

# Effects of Deployment Exposures on Cardiopulmonary and Autonomic Function

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# Disclosure

- No disclosures
- Contents of this presentation do not represent the views of the U.S. Department of Veterans Affairs or the United States Government



# VA Pilot Award

- Scope of Award:
  - *“This RFA is specifically directed at **pilot projects** to establish feasibility or to develop data, a technique, concept or procedure, which is preliminary to undertaking a full Merit Review project”*
- VA RRD I21RX001079 (NCT01754922)
  - 2-year observational, cross-sectional study



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## Primary Outcomes



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# OEF/OIF Veterans

(n = 25)



# Non-Deployed

(n = 25)



## Visit 1 – Cardiopulmonary

- Questionnaires
- Spirometry (BD, DLCO, FOT)
- Exercise challenge testing

## Visit 2 – Autonomic

- Heart rate variability (HRV)
- Cerebrovascular reactivity (CVRT)
- Flow-mediated dilation
- Blood markers



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# OEF/OIF Veterans

(n = 32)



# Non-Deployed

(n = 18)



	OEF/OIF Vets	Non-Deployed*
<b>Sex (% male)</b>	81.3%	72.2%
<b>Age (years)</b>	35.4 (8.2)	33.22 (9.7)
<b>Body Fat (%)</b>	20.8 (4.5)	16.7 (7.1)
<b>Smoking (Pack Years)</b>	1.5 (3.4)	1.7 (5.2)
<b>Deploy Length (mo)</b>	15.8 (6.8)	-
<b>Post-Deploy Length (yrs)</b>	6.5 (2.8)	-
<b>St. George Qx (Total %)</b>	18.3 (12.3)	3.8 (3.9)

\*Civilians (n = 13) included in non-deployed group

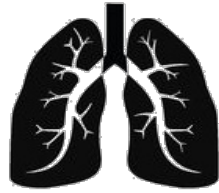


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	Deployed OEF/OIF Mean (SD)	Non Deployed Mean (SD)	Effect Size Hedges g (95% CI)
<b>VO<sub>2</sub> Peak (ml/kg/min)</b>	33.7 (8.3)	34.5 (10.4)	-0.1 (-0.7, 0.5)
<b>VAT (% Peak VO<sub>2</sub>)</b>	64.2 (9.6)	67.5 (13.3)	-0.3 (-0.9, 0.3)
<b>VE/VCO<sub>2</sub> Slope</b>	27.8 (3.2)	27.3 (2.2)	0.2 (-0.4, 0.8)
<b>VE/MVV</b>	0.85 (0.2)	0.74 (0.2)	<b>0.5 (-0.1, 1.1)</b>
<b>Borg Breathlessness*</b>	5.1 (1.8)	3.4 (1.4)	<b>1.1 (0.4, 1.7)</b>

VAT = ventilatory anaerobic threshold; VE = minute ventilation; MVV = maximal voluntary ventilation

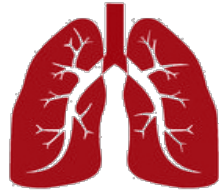


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	Deployed OEF/OIF Mean (SD)	Non Deployed Mean (SD)	Effect Size Hedges g (95% CI)
<b>FEV<sub>1</sub> (% Predicted)</b>	94.5 (16.5)	108.3 (16.4)	<b>-0.9 (-1.5, -0.2)</b>
<b>FVC (% Predicted)</b>	99.5 (14.5)	111.2 (14.1)	<b>-0.8 (-1.4, -0.2)</b>
<b>FEV<sub>1</sub>/FVC (%)</b>	77.7 (7.0)	81.8 (4.9)	<b>-0.6 (-1.3, -0.3)</b>
<b>DL<sub>CO</sub> (% Predicted)</b>	84.0 (7.2)	86.4 (12.8)	-0.2 (-0.8, 0.4)
<b>FEV<sub>1</sub> (% BDR)</b>	6.8 (6.7)	6.6 (5.5)	0.0 (-0.6, 0.7)
<b>FVC (% BDR)</b>	2.8 (3.9)	1.4 (3.2)	0.3 (-0.3, 1.0)

BDR = bronchodilator response



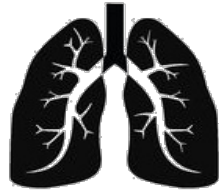
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	Deployed OEF/OIF Mean (SD)	Non Deployed Mean (SD)	Effect Size Hedges g (95% CI)
HR Recovery (bpm)	42.9 (13.7)	53.3 (18.5)	<b>-0.7 (-1.3, -0.1)</b>
HRV SDNN (ms)	74.9 (46.1)	83.6 (37.0)	-0.2 (-0.8, 0.4)
HRV RMSSD (ms)	70.6 (80.5)	82.9 (56.3)	-0.2 (-0.8, 0.4)
HRV LF/HF Ratio	2.0 (1.7)	1.1 (1.1)	<b>0.6 (-0.0, 1.2)</b>
RSA (bpm)	9.5 (4.9)	14.1 (6.8)	<b>-0.8 (-1.4, -0.2)</b>
CVRT (%·mmHg <sup>-1</sup> )	1.7 (0.6)	1.4 (0.6)	0.4 (-0.1, 1.1)

RSA = respiratory sinus arrhythmia; CVRT = cerebrovascular reactivity test



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Preliminary Data to Inform Current and  
Future Work at the Airborne Hazards  
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(AHBPCE)



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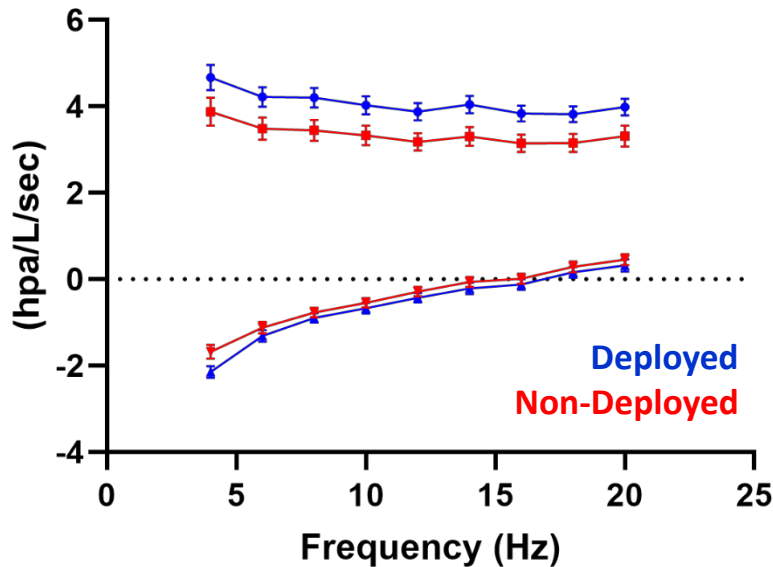


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- Small airway dysfunction observed in deployed Veterans with preserved spirometry

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**Respiratory Physiology & Neurobiology**

Journal homepage: [www.elsevier.com/locate/resphysiol](http://www.elsevier.com/locate/resphysiol)

**Forced oscillation technique in veterans with preserved spirometry and chronic respiratory symptoms**

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**ARTICLE INFO**

**Keywords:** Forced oscillation technique; Small airways; Environmental exposure; Veterans health; Signs and symptoms; Respiratory

**ABSTRACT**

**Purpose:** To evaluate the utility of the forced oscillation technique (FOT) among military veterans with preserved spirometry and chronic unexplained respiratory symptoms.

**Methods:** 178 veterans referred for evaluation of unexplained respiratory symptoms completed pulmonary function testing and FOT. Preserved spirometry was defined as FEV<sub>1</sub>/FVC, FEV<sub>1</sub> and FVC ≥ 5th percentile. Frequency dependence of resistance (R4-R20) and reactance area (AX) were assessed via FOT, and R4-R20 ≥ 20% and AX ≥ 95th percentile were considered abnormal.

**Results:** Spirometry was preserved in 71.3%, of whom 124 had acceptable FOT data. 93 of 124 (75.0%) veterans with preserved spirometry had one or more abnormal findings on FOT. Veterans with abnormal R4-R20 and/or AX had reduced FVC, FEV<sub>1</sub>, FEF<sub>25-75</sub>, and diffusing capacity (% predicted) in comparison to those with Normal FOT ( $p = 0.030$  to  $p < 0.001$ ).

**Conclusions:** In our referral sample, distal airway dysfunction in the presence of preserved spirometry appears common and may represent an at-risk group requiring closer surveillance.

- 75% of clinical sample small airway dysfunction and preserved spirometry



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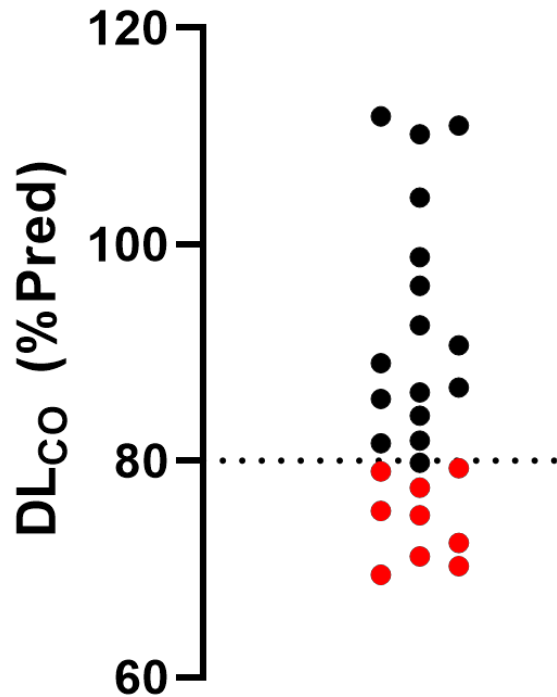


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FORUM WILEY

### Isolated diffusing capacity reduction is a common clinical presentation in deployed Iraq and Afghanistan veterans with deployment-related environmental exposures

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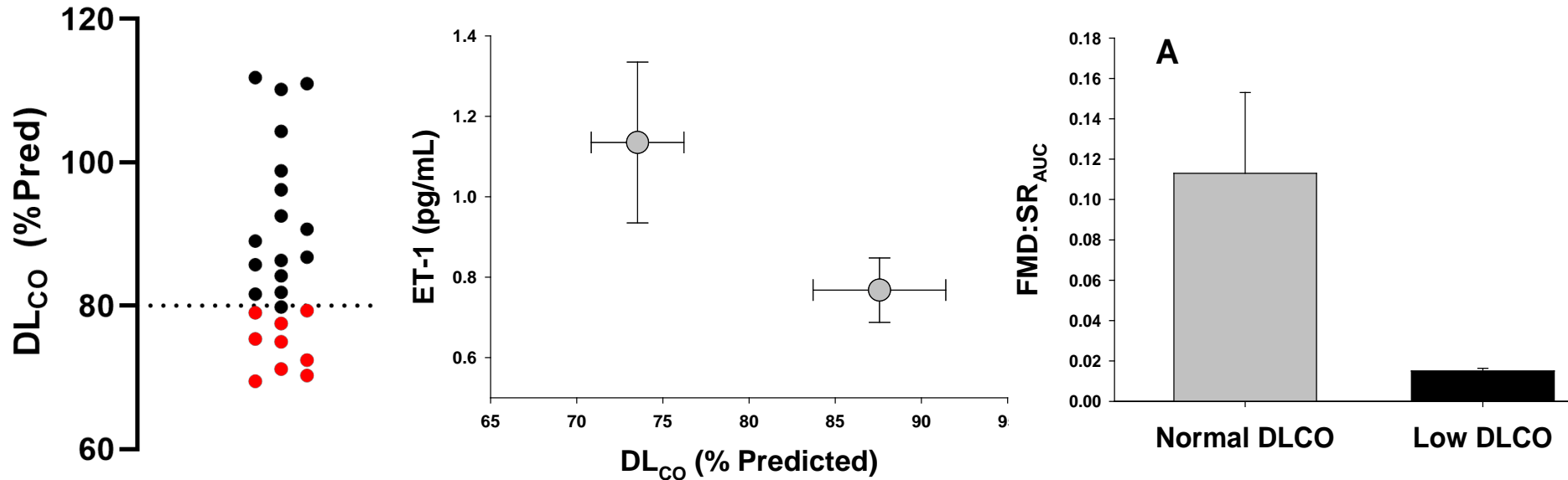
**Abstract**  
 Following deployment to Iraq and Afghanistan (“post-9/11”), a spectrum of respiratory conditions has been reported; however, there are few published reports of objective physiologic data or later experience of symptoms and function. To better understand the post-deployment clinical presentation, we conducted a retrospective review of pulmonary function testing in 143 veterans referred to our tertiary care clinic for post-deployment health concerns. More than 75% of our sample had normal lung volumes and spirometry on pulmonary function testing; however, an isolated reduction in lung diffusing capacity (DLCO) was observed in 30% of our sample of post-9/11 veterans. An isolated reduction in DLCO is a rare pattern in primary-care seeking dyspneic patients, but is commonly associated with underlying pulmonary disease. Post-9/11 veterans with respiratory complaints and an isolated reduction in DLCO should undergo further evaluation.

**KEYWORDS**  
 air pollution, particulate matter, pulmonary diffusing capacity, respiratory function tests, veterans health

- 36% of deployed Veterans – isolated reduction in DL<sub>CO</sub>

- 30% of clinical sample

# VA Pilot Award → VA Merit Award



- Exploratory analysis → ↑ET-1 and ↓FMD of brachial artery
- Pulmonary vascular phenotype?
- **VA CSR&D (I01 CX001515-01)**

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  - Anays Sotolongo, MD; Drew Helmer, MD; Omowunmi Osinubi, MD; Helena Chandler, PhD; Nisha Jani, PhD
  - NJ WRIISC Leadership
  - CPL Team



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  - Cardiopulmonary results under revision;
  - Autonomic results under review
- Conference Proceedings (4)
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