



# Effects of Combined Upper and Lower Respiratory Symptoms on Pulmonary Function and Exercise Tolerance Among Dyspneic Veterans



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## Background

- The unified airway model underscores the interdependence of the upper and lower respiratory tracts and has been described in the context of occupational exposure.
- Upper and lower airway conditions appear to be increasing in prevalence among military veterans of our most recent conflicts [Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND)] post-deployment.

## Purpose

- We aimed to explore the impact of combined upper (URS) and lower respiratory symptoms (LRS) on pulmonary function and exercise tolerance among veterans referred for chronic dyspnea.

## Methods

- Eighty-one deployed veterans referred to our War Related Illness and Injury Study Center within the Department of Veterans Affairs, presented with URS or LRS (URS/LRS; n= 41) or both (URS+LRS; n = 40).
- The presence of URS was determined via the Sino-Nasal Outcome Test (SNOT-20) (average score  $\geq 2$ )
- LRS diagnosis was via standardized questionnaire: (cough, wheeze or shortness of breath  $\geq 2$  days $\cdot$ wk<sup>1</sup>)
- All veterans completed complete pulmonary function testing (PFT).
- Exercise tolerance and physical health-related functioning was assessed via maximal cardiopulmonary exercise testing and questionnaire (VR-36 PCS).
- SPSS was used for data analysis. Between-group differences and effect sizes were assessed via unpaired t-tests and Hedges' *d*, respectively.

## Results

**Table 1. Patient Demographics**

	Either URS or LRS (n = 41)	Combined URS and LRS (n = 40)
Male (n = 68)	33	35
Female (n = 13)	8	5
Age (Years)	42.5 $\pm$ 10.7	44.9 $\pm$ 8.3
Body Mass Index (kg/m <sup>2</sup> )	32.5 $\pm$ 5.2	32.3 $\pm$ 7.0
Tobacco History (Years)	13.7 $\pm$ 7.8	12.7 $\pm$ 11.0
Deployment Length (Months)	13.7 $\pm$ 7.8	12.7 $\pm$ 11.0
Time from Deployment to Evaluation in the Clinic (Months)	10.7 $\pm$ 6.8	14.5 $\pm$ 8.6

Table 1. (Above) LRS = Lower Respiratory Symptoms, URS = Upper Respiratory Symptoms.

**Figure 1. Pulmonary Function Test Comparison**

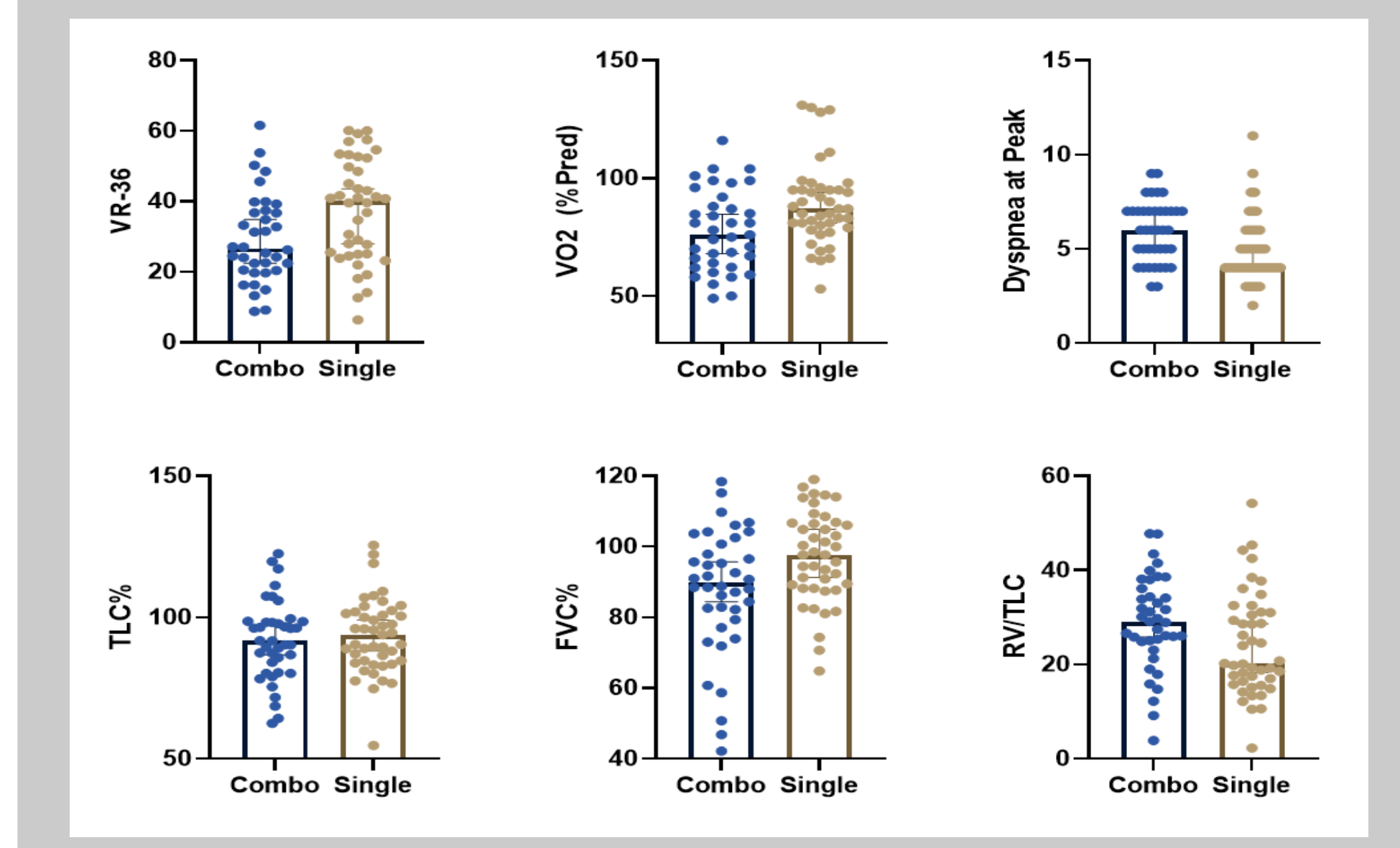


Figure 2. (Above) Lower Respiratory Symptoms = Combo, Upper Respiratory Symptoms = Single, VR-36 = Cardiopulmonary Exercise Testing and Questionnaire, Residual volume/total lung capacity ratio = RV/TLC, Forced Vital Capacity = FVC%, Forced Expiratory Volume = FEV<sub>1</sub>%, Peak exercise capacity = VO<sub>2</sub>%

**Table 2. Pulmonary Function and Quality of Life Comparison**

	Either URS or LRS	Both URS and LRS	p Value	d	95% CI
Residual Volume/Total Lung Capacity Ratio (RV/TLC)	23.4 $\pm$ 9.4	28.9 $\pm$ 9.9	0.01	-0.56	[-1.01, -0.11]
Forced Vital Capacity (FVC%)	97.9 $\pm$ 12.7	88.4 $\pm$ 18.5	< 0.01	0.59	[0.15, 1.04]
Forced Expiratory Volume (FEV <sub>1</sub> %)	95.0 $\pm$ 15.3	86.5 $\pm$ 20.5	0.04	0.47	[0.03, 0.91]
Peak exercise capacity (VO <sub>2</sub> %)	88.8 $\pm$ 18.2	77.6 $\pm$ 17.0	< 0.01	0.63	[0.46, 1.43]
Physical-Health Related Functioning (PCS Score)	34.2 $\pm$ 9.2	25.9 $\pm$ 7.9	-	0.95	[0.46, 1.43]

## Discussion/Conclusion

- Combined URS and LRS represent a major cause of morbidity in OEF/OIF/OND veterans. Those with combined URS+LRS were found to have higher RV/TLC and lower FVC% and FEV<sub>1</sub>%.
- Those with URS+LRS also had worse exercise tolerance and overall quality of life than those with only LRS/URS, indicative of significant disease burden. Although this may be due to increased air trapping or decreased physical health, further studies are needed in order to further explore the interdependence of the upper and lower respiratory tracts.

## References

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