Pre Post Deployment Spirometry

NASEM Roundtable

Michael J. Morris, M.D.
COL (Ret), MC, USA
Pulmonary/Critical Care
Brooke Army Medical Center

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- Speaker’s Bureau – Janssen/GSK

Studies

- Screening spirometry in military personnel – Anderson DF et al, *Mil Med* 2018; 183; e562–e569.
- Air Force firefighters – unpublished
- Asthma - unpublished
- Pre/post deployment spirometry (STAMPEDE II) – Morris MJ et al, *Respir Care* 2019; 64 (5) 536-544

Screening Spirometry

- 900 patients enrolled (80% male)
- Mean age = 21.6; BMI = 24.3
- Abnormal studies (10.9%)
  - Obstructive = 4.0%
  - Restrictive = 4.9%
  - Mixed = 0.3%
  - Flow volume loop = 2.0%
- Logistic regression analysis
  - Did not correlate with gender, smoking, symptoms, asthma history, or failed APFT
  - Correlated only with elevated BMI

Screening Spirometry

	FVC	FEV_1	FEV_1/FVC	Smoking	APFT Failure	Cough	Dyspnea	Asthma
Normal (n = 802)	97.4%	96.6%	0.84	317 (39.5%)	181 (22.6%)	78 (9.7%)	54 (6.7%)	43 (5.4%)
Abnormal (n = 98)	88.1%*	81.7%*	0.79*	41 (41.8%)	26 (26.5%)	6 (6.1%)	5 (5.1%)	4 (4.1%)
Obstructive (n = 33)	100.8%	80.7%*	0.67*	13 (39.4%)	8 (24.2%)	0	0	0
Restrictive (n = 44)	75.1%*	77.1%*	0.87*	19 (43.2%)	14 (31.8%)	6 (13.6%)	4 (9.1%)	2 (4.5%)

No effect on the probability of an abnormal spirometry result (p=0.56).

Firefighter – Single Deployment

Spirometry (n = 58)	Pre-Deploy	% Change Post-Deploy
FEV_1	101 ± 12%	+ 1.3%
FVC	102% ± 11%	+ 1.5%
FEF_{25-75}	93 ± 22%	+ 3.2%

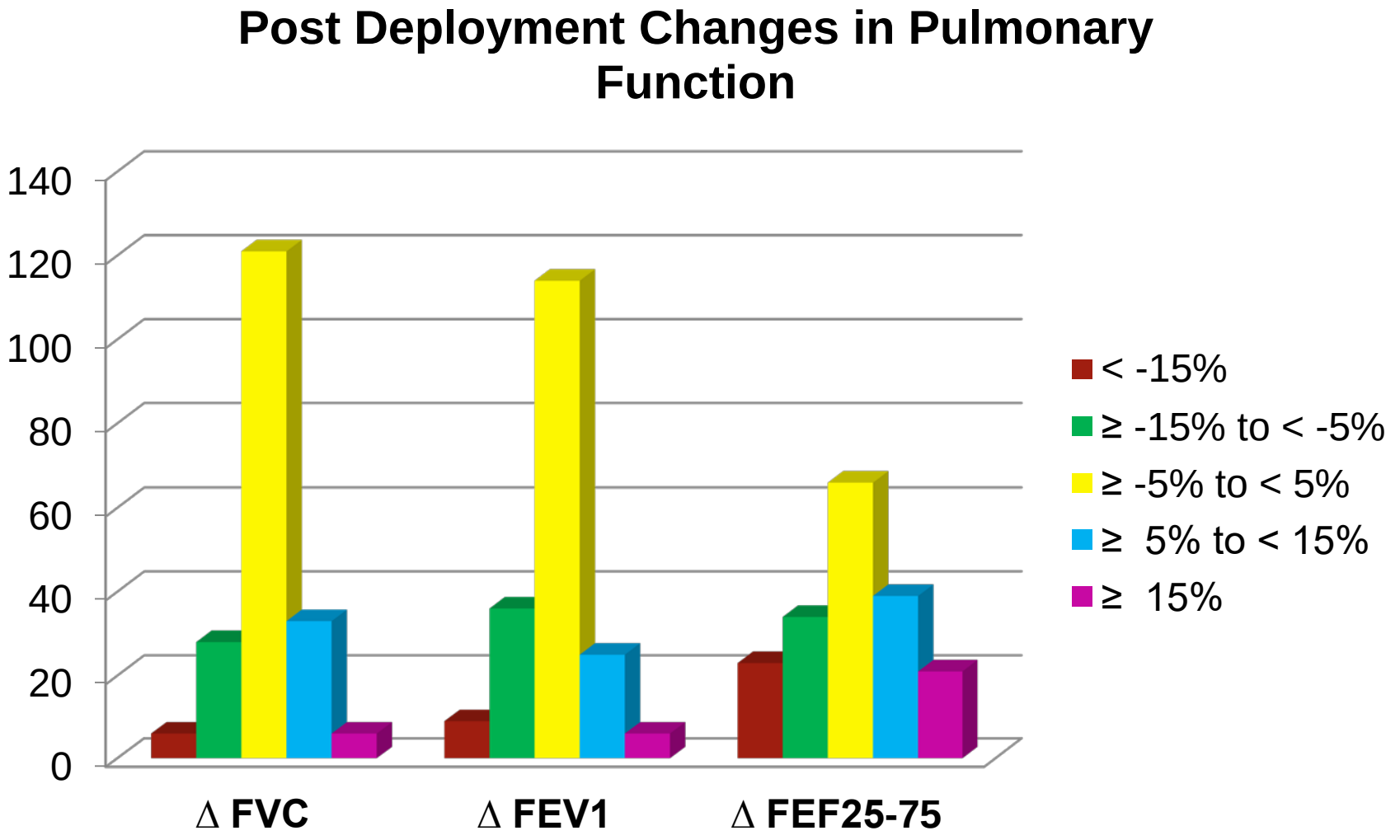
- 3 subjects with decrease in both FVC and FEV_1 > 10%
- 1 subject with decrease in FEV_1/FVC suggesting new onset obstruction
- 2 subjects with > 20% isolated decrease in mid-flows without significant change in FEV_1/FVC ratio.

Firefighter – Five Years

Spirometry (n = 100)	Pre-Deploy	Post-Deploy
FEV_1 (% pred)	98.4 ± 12.8	99.3 ± 14.5
FVC (% pred)	98.6 ± 13.1	101.5 ± 14.3
FEV_1/FVC	83.4 ± 6.4	80.3 ± 5.4
FEF_{25-75}	95.0 ± 23.2	95.1 ± 24.3

- Mean time between spirometry = 5.74 years

Firefighter – 5 Years



Asthma

- 642 AD military with ICD-9 diagnosis of asthma
- 2009 - 2015
- Documented spirometry and SWA deployment
- 71 individuals identified with pre- and post-deployment spirometry
  - Mean interval: 1181 days
- 35 identified with pre- and post-deployment spirometry with post-bronchodilator values
  - Mean interval: 1382 days

Asthma

	Pre/Post FEV_1	Post-BD FEV_1
N	71	34
Age (yrs)	31.9	32.2
Male	51 (71.8%)	25 (70.6%)
Female	20 (28.2%)	10 (29.4%)
Deployments	1.69	1.71
Deployment Length (days)	201	227

Asthma Spirometry

Value	Pre-Deployment	Post-Deployment	Difference	P-value
FEV_1 (L)	3.34 (86%)	3.29 (87%)	-0.05 L	0.43
FVC (L)	4.44 (94%)	4.41 (95%)	-0.03 L	0.59
FEV_1/FVC	0.75	0.75	0	0.60

Asthma Post-BD

Value	Pre-Deployment	Post-Deployment	Difference	P-value
FEV_1	80%	84%	+4%	0.16
FVC	92%	97%	+5%	0.04
Post-BD FEV_1	90%	89%	-1%	0.74
Post-BD ΔFEV_1	+12%	+7%	-5%	0.03

Asthma

- Limited number of AD military with both pre- and post- deployment spirometry (n = 71, only 10% of study patients)
- 82.3% of asthma diagnosis supported by confirmatory testing
- No differences in pre- and post-deployment ACT scores, ICS dosing, or LABA use

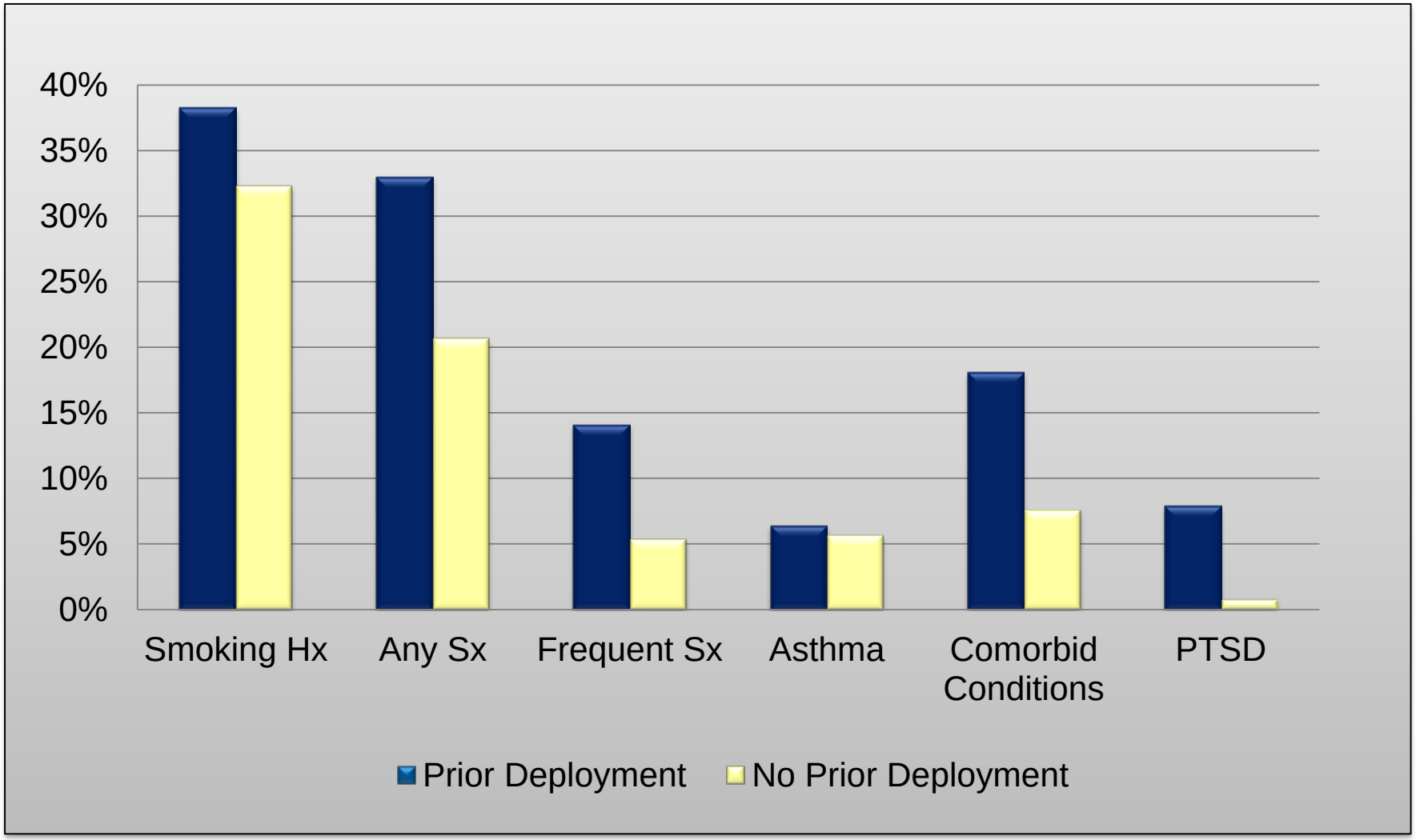
STAMPEDE II

- Deploying soldiers from Ft. Hood, Texas
- Primarily tasked to Afghanistan
- Pre-deployment evaluation – SRP site
  - Spirometry
  - Impulse oscillometry
  - Respiratory questionnaire
- Enrollment of 1693 soldiers
- 83% male
- Age = 32.2 ± 9.1 years
- BMI = 27.1 ± 3.7
- Never smokers = 64%

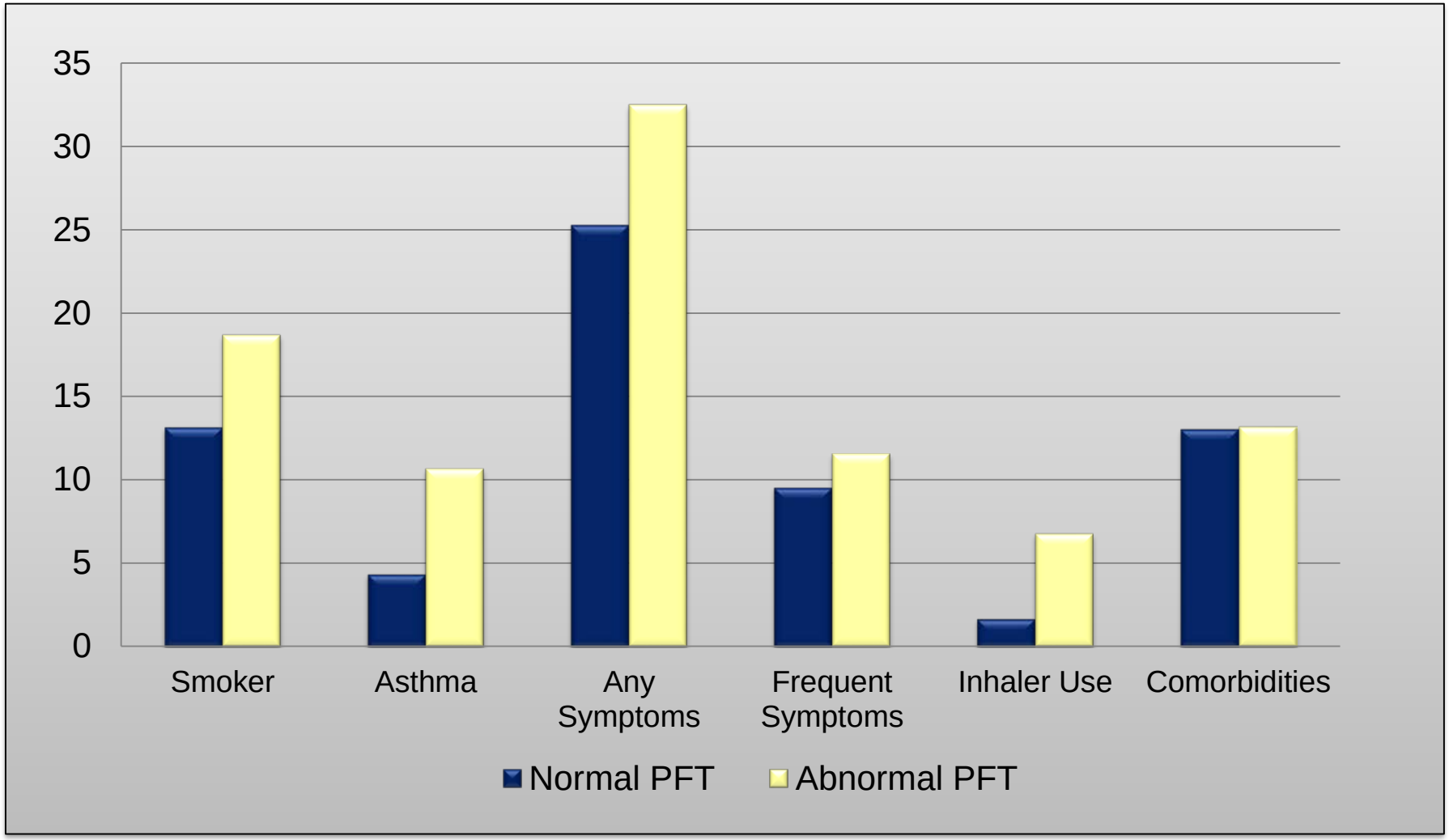
STAMPEDE II Pre

	All (n=1693)	Non-Deploy (n=809)	Prior Deploy (n = 884)
FEV_1 (% pred)	94.8 ± 12.7	92.7 ± 12.3	95.6 ± 12.7
FVC (% pred)	95.5 ± 11.9	93.6 ± 11.3	98.4 ± 12.8
FEV_1/FVC	81.7 ± 6.4	80.9 ± 6.5	82.2 ± 6.9
FEF_{25-75} (% pred)	96.6 ± 25.9	94.1 ± 25.3	93.5 ± 26.9
Obstructed (LLN)	190 (11.2%)	89 (11.0%)	101 (11.4%)
Supranormal (FEV_1)	64 (33.7%)	33 (37.1%)	31 (30.7%)

STAMPEDE II Pre



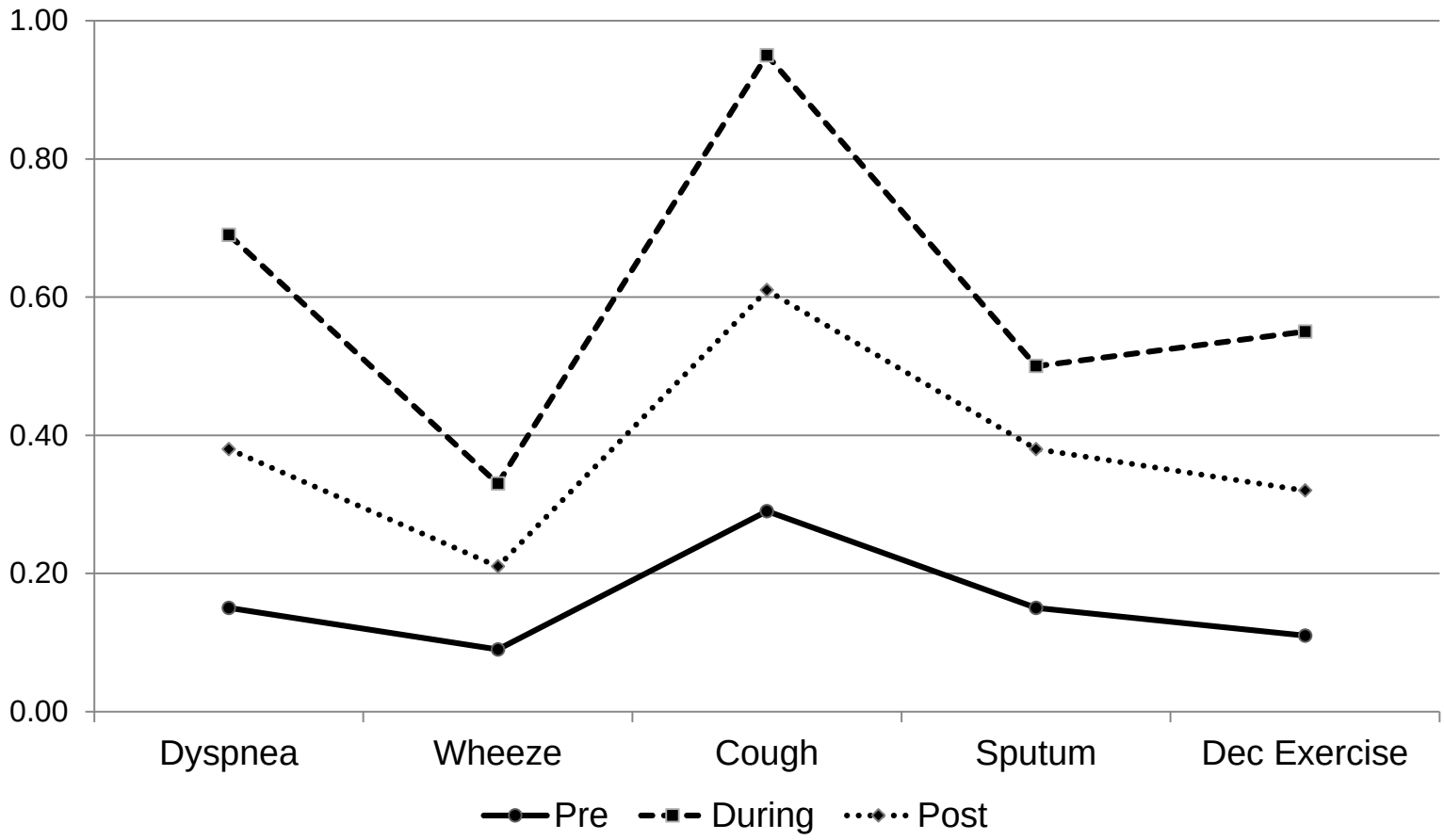
STAMPEDE II Pre



STAMPEDE II

- More than one third of surveyed solders had a smoking history
- 73% were overweight or obese
- 6.2% reported a history of asthma.
- Abnormal spirometry was found in 22.3% of participants.
  - More asthma (10.1% vs 5.1%, $P < .001$)
  - Failed physical fitness tests (9.0% vs 4.6%, $P < 0.02$)
  - Respiratory symptoms (32.8% vs 24.3%, $P < 0.001$).

Deployment Symptoms



0 = never, 1 = <2x weekly, 2 = 2-5x weekly, 3 = daily

Post-Deployment PFTs

	Pre-Deploy (n = 1693)	Pre-Deploy (n = 843)	Post-Deploy (n = 843)	P value
FEV_1	94.8 ± 12.7	95.2 ± 12.6	96.1 ± 12.4	0.14
FVC	95.5 ± 11.9	95.9 ± 11.8	96.4 ± 11.9	0.32
FEV_1/FVC	81.7 ± 6.4	81.5 ± 5.9	81.8 ± 6.1	0.29
R_5 (IOS)	4.39 ± 1.48	4.34 ± 1.47	4.12 ± 1.37	0.002
R_{20} (IOS)	3.53 ± 1.06	3.49 ± 1.08	3.33 ± 0.92	< 0.001
X5 (IOS)	-1.49 ± 0.71	-1.48 ± 0.74	-1.37 ± 0.73	< 0.001

STAMPEDE II Post

Table 6. Subgroup Analysis of Spirometry Based on Post-Deployment Symptoms

Symptom	Level	Results, mean ± SD	*P*, Wilcoxon Test
Dyspnea	Normal	1.37 ± 0.66	.37
	Obstruction	1.49 ± 0.80	
Wheezing	Normal	1.21 ± 0.55	.03
	Obstruction	1.41 ± 0.79	
Cough	Normal	1.65 ± 0.89	.74
	Obstruction	1.59 ± 0.83	
Sputum	Normal	1.38 ± 0.80	.73
	Obstruction	1.42 ± 0.86	
Exercise tolerance	Norm	1.33 ± 0.67	.25
	Obstruction	1.38 ± 0.65	

Post-Deployment

- Improvement in spirometry and IOS values
- Analysis of obstructed spirometry
  - 33 (3.9%) with pre obstruction
  - 54 (6.4%) with pre/post obstruction
  - 29 (3.4%) with post obstruction
- Pre-deployment obstruction, asthma, smoking, or increased BMI did not demonstrate a reduction in spirometry values post-deployment.
- Frequent wheezing post-deployment was only symptom associated with airways obstruction during deployment ($p = 0.026$)

STAMPEDE III Abnormal PFTs

PFT Value	% Abnormal
Reduced FEV_1/FVC (below 95th CI)	25.0%
Post-BD FEV_1 > 12% ↑	11.6%
Total lung capacity (TLC) < 80% pred	7.4%
RV/TLC > 35	13.2%
Diffusing capacity (DLCO) < 70%	9.7%

Majority of patients with normal pulmonary function testing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