

# **Military Occupational Codes: Uses and limitations in estimating inhalational exposures in deployed military populations**

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## **Overseas deployments create unique exposures for military “deployers”**

- Variety of inhalational exposures
  - Particulate matter, burn-pit emissions, exhaust, debris from combat related detonations, etc
- Enhanced Particulate Matter Survey
  - Air sampling from 15 locations across Southwest Asia
    - Six from Iraq and two from Afghanistan
  - All sites exceeding PM<sub>2.5</sub> exposure guidelines
  - Three main pollutants
    - Geological dusts, burn-pit smoke and heavy metals

*Background*

# Airborne Hazards



## **Increasing number of articles showing respiratory illness in military deployers**

- Several studies show association between deployment exposures and respiratory symptoms and illness
  - Respiratory symptoms (cough, dyspnea, exercise intolerance) with little abnormalities on noninvasive testing
  - Respiratory diseases (ie asthma, bronchiolitis)
- Symptoms often debilitating and career impacting

Krefft et al, Curr Opin Pulm Med, 2015, Smith et al, Am Journal of Epid, 2012, Falvo et al, Oxford Univ Press, 2015

Is there an epidemiological tool that can be utilized to characterize risk of hazardous exposures in soldiers deployed to regions of Southwest Asia?

Can Military Occupational Codes Serve as that tool?



## **Dept of Defense occupational classification**

- Military Occupational Specialty Codes (MOS)
  - Alpha-numeric coding system
  - Identifies specific job duties
- US Army/Marine Corps
- 11B (Bravo)
  - Standard infantry soldier
- 68W (Whiskey)
  - Combat Medic

## **Study Population and Design**

- Target population
  - Soldiers previously deployed to primarily Iraq and Afghanistan
- Study design
  - Expert MD panel consisting of six physicians
    - Three physicians with deployment experience
    - Three occupational pulmonologists with clinical experience

# **Research Hypothesis #1**

- Combat related MOS codes will have the highest rated exposure intensity
- Administrative related MOS codes will have the lowest.



- Panel independently ranked 228 US Army MOS using exposure matrix
  - Six common inhalational exposures ranked
  - Job descriptions based on US Army human resource websites
- Intensity defined as low (score of 1), medium (score of 2) and high (score of 3) based on:
  - Frequency
  - Proximity
  - Likelihood

# Exposure Variables

		Low	Medium	High
<b>Sandstorm Exposure</b>	Frequency	<2 times/month	weekly	<weekly
<b>Exhaust Fumes</b>		<2 times/month	weekly	<weekly
<b>Time Outdoors</b>		<25% of the time	25-50%	>50%
<b>Combat Dust</b>	Likelihood	Unlikely	Somewhat likely	Very likely
<b>VDGF Exposure</b>		Unlikely	Somewhat likely	Very likely
<b>Burn Pit Exposure</b>	Proximity	>2 km away	1-2 km	<1 km away

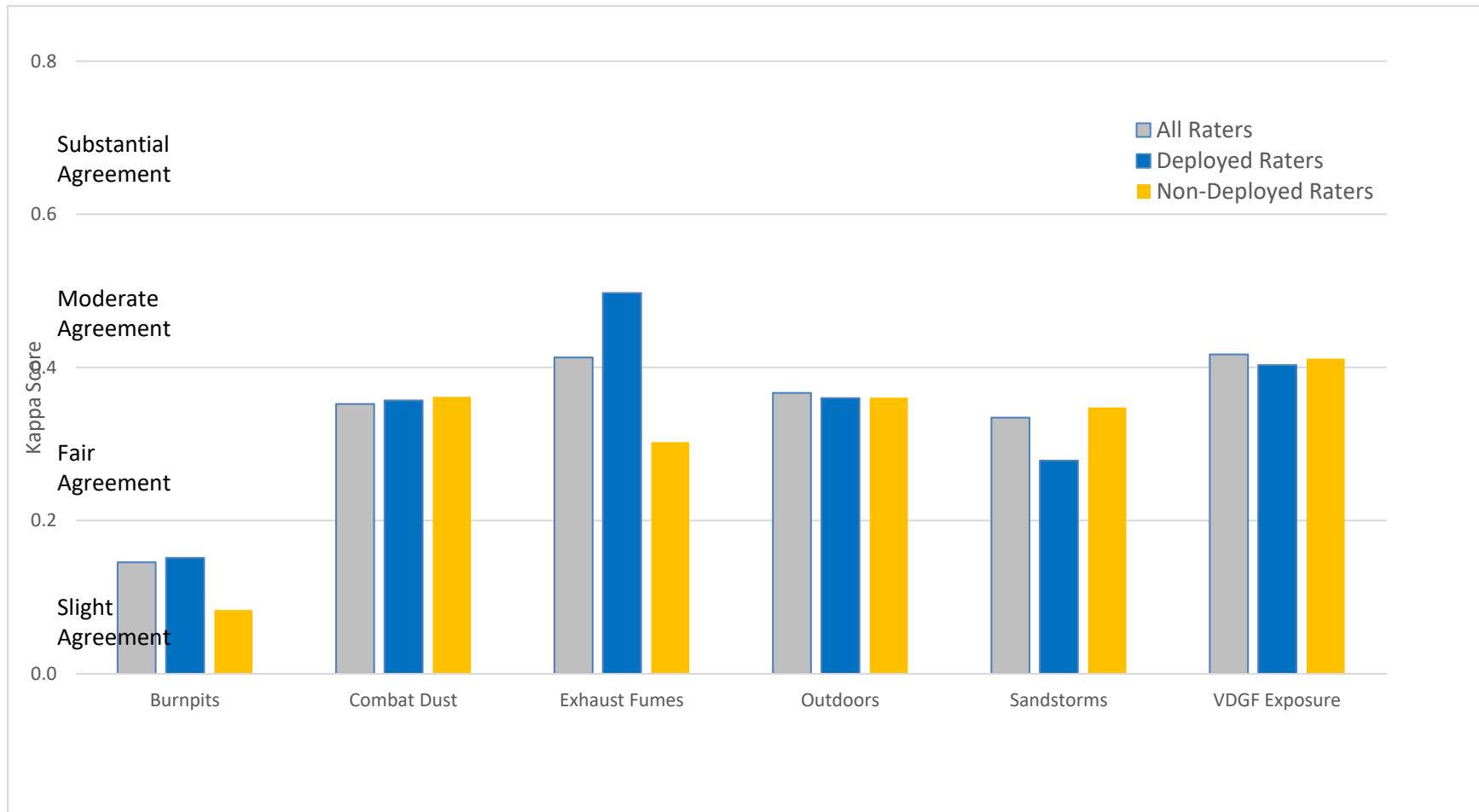
## **Statistical Analysis**

- Inter-rater agreement assessed using Cohen's Kappa
  - 0.21-0.4: fair agreement
  - 0.41-0.60: moderate agreement
  - 0.61-0.80: substantial agreement
  - 0.81-0.99: almost perfect agreement

## **Statistical Analysis**

- 228 MOS codes clustered into 4 groups
  - Combat/Intelligence
  - Mechanics/engineering/IT
  - Admin/arts/media
  - Other
    - Law enforcement, legal, medical and transportation/aviation

## Higher agreement for deployed vs non-deployed raters



How do these expert panel rankings compare to exposures being reported by symptomatic deployers?



# Research Hypothesis #2

- Expert ratings of exposure intensity will be similar to those reported by deployers by MOS
  - Combat related MOS would report the highest
  - Administrative related MOS would report the lowest



- Questionnaire data from 74 symptomatic deployers used to determine clustering based on reported exposure intensity
  - Informed consent/IRB approval obtained
  - Detailed exposure questionnaire administered by research coordinator
  - Findings maintained in REDCap database
- Responses to corresponding exposure variables were ranked according to intensity
  - 1-low; 2-medium; 3-high



## **Statistical Analysis**

- Mean sum panel rankings calculated for each MOS group
- Mean sum reported rankings calculated for each of the 4 groups
  - Panel vs deployer reported
  - Rankings ranged from 5-15
  - Higher scores equal higher intensity of exposure

## Deployers reported higher exposure intensity across all groups

Category	Panel		Deployers		# deployers
	n	mean	n	mean	
Combat, Intelligence	67	9.6	20	11.3	36
Mechanics, IT, Construction/Engineering	76	8.9	14	11.3	20
Other (legal, law enforcement, Medical, Transportation/Aviation)	63	7.6	8	11.2	17
Admin, Arts & Media	22	6.4	4	10.9	5

## Mean scores for each exposure

range: 1.0 (lowest) to 3.0 (highest)

Exposure	Panel	Deployers
Exhaust	1.83	2.94
Outdoors	1.99	2.71
Burn Pits	1.47	2.58
Combat	1.60	1.54
Sandstorms	1.61	1.53

# Conclusions

- MOS utilization substantially limited in predicting exposure risk in deployers
  - Symptomatic deployers reported higher intensity of exposures to all hazards than expected based on expert panel ratings, irrespective of MOS category
- Burn pit exposure reported as a higher intensity than rated by our panel
  - Possibly due to MOS code/deployment duty discrepancies
- Variability among expert raters across all MOS codes
  - Fair/moderate Kappa agreement

# Study Strengths

- Study expanded on prior research
  - 228 Army MOS codes scored vs only 38 Marine MOS codes scored in pilot study
- Rigor in panel scoring process: MOS descriptions provided to expert panel
- Validation step: use of reported exposure data from symptomatic deployers to assess utility of deployment exposure matrix

# Study Limitations

- Incomplete MOS descriptions available to panel
- Potential for recall bias among symptomatic deployers
- Lack of industrial hygiene expertise on scoring panel



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# Questions?





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## **Previous Findings**

- Prior research developed and assessed use of exposure matrix in characterizing likelihood of exposure by 38 Marine MOS codes.
- MOS-exposure matrix consisted of six major deployment inhalational exposures:
  - Sandstorms, burn pits, exhaust fumes, combat dusts, occupational VDGF (vapors, dusts, gases and fumes) and work outdoors
- MOS codes ranked by exposure intensity
  - 1-low; 2-medium; 3-high
  - Combat ranked highest
  - Administrative ranked lowest

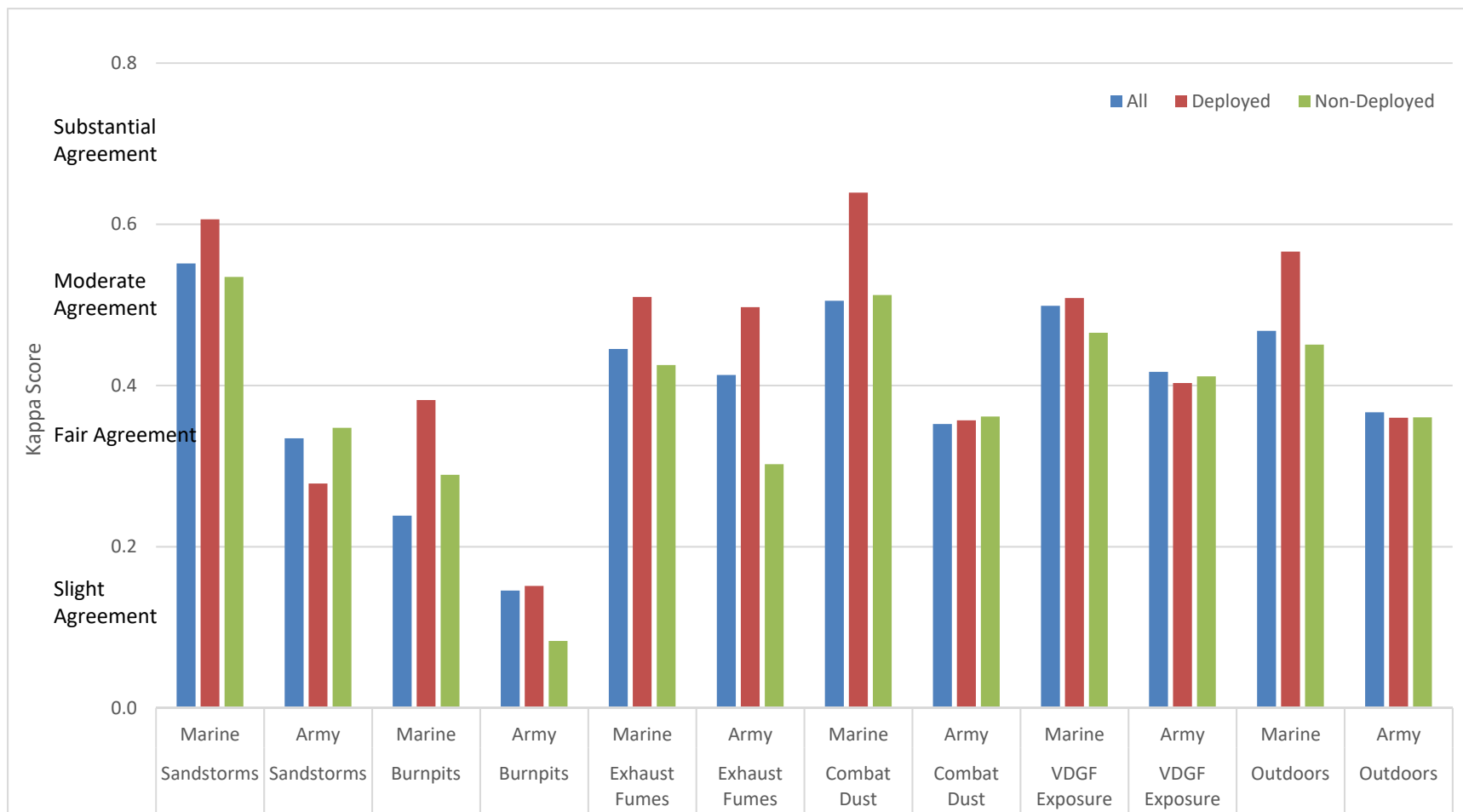
# Two major questions

- How do expert panel assessments of Army MOS-specific exposures compare to MOS codes of symptomatic deployers?
- Are military occupational specialty codes useful tools to identify those at risk for respiratory illness?

# Scored vs Reported rankings *Results*

Category	Scored Hazard <sup>1</sup>				Reported Hazard <sup>2</sup>			# of Deployers
	For all Army MOS		For only Paired Army MOS		n	Mean (Min - Max)		
	n	Mean (Min - Max)	n	Mean (Min - Max)				
Administrative Support + Arts & Media	22	6.4 (5.2 - 10.0)	4	6.0 (5.2 - 10.0)	4	10.9 (9.7 - 12.3)	5	6%
Combat + Intelligence & Combat Support	67	9.6 (5.2 - 14.3)	20	10.7 (5.5 - 14.3)	20	11.3 (9.7 - 14.3)	36	46%
Mechanics + Computers & Technology + Construction & Engineering	76	8.9 (5.2 - 13.8)	14	9.3 (5.3 - 13.8)	14	11.3 (8.0 - 13.2)	20	26%
All others (Legal & Law Enforcement, Medical & Emergency, Transport & Aviation)	63	7.6 (5.2 - 13.0)	8	10.4 (5.3 - 13.0)	8	11.2 (9.9 - 12.4)	17	22%
Overall	228	8.5 (5.2 - 14.3)	46	9.8 (5.2 - 14.3)	46	11.3 (8.0 - 14.3)	74*	

# Kappa agreement: Higher for deployed; fair-moderate *Results*



# Future Directions

- Investigate effects of deployment duration and frequency on reported exposure intensity
- Assess correlations between panel ratings and deployer reported exposures
- Evaluate MOS-specific deployer reported exposures for potential targeted prevention

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