Overall Study Objective

➢ To prospectively evaluate the impact of military experiences, including deployment, on long-term health outcomes of US service members

• To provide strategic policy recommendations that inform leadership and guide interventions
Study Oversight and Management

- **Naval Health Research Center**
  - Provides operational and scientific quality oversight
  - Oversees the conduct of the study
  - Institutional review board (IRB)
  - Public affairs correspondence, BUMED approval as appropriate

- **Military Operational Medicine Research Program (MOMRP)**
  - Provides core program funding
  - Provides programmatic scientific oversight and tracks program objectives twice yearly through status reports and annual Task Area M Review and Analysis (R&A) meeting
  - Provides feedback regarding study topics of highest relevance to the Department of Defense
Collaborations

- Collaborator guidelines established and posted on website
  - FY10-FY13
    - > 35 collaborative projects with Military experts
    - >20 collaborative projects with VA experts
    - > 30 collaborative projects with academic experts

- Veteran’s Affairs, Washington, DC
  - Finalized agreement and secured funding for 3 positions at NHRC to conduct projects linking VA and Millennium Cohort data

- Veteran’s Affairs, Seattle, WA
  - Continuing work on 5 year grant to examine risk factors related to smoking and alcohol use in the military

- USUHS, Bethesda, MD
  - Data use agreement in place to share data. One project is complete and in journal review, 2 others are underway
Study Methodology

- Study began in July of 2001 (pre 9/11)
- Questionnaire measures physical, behavioral, and mental health
- Includes questions on military experiences (combat, deployment) and other metrics (alcohol and tobacco use)
- Participants respond via secure website or traditional paper survey
- Participants are re-surveyed every ~3 years through at least 2022 (extension for 75 years)
- Link to other data to complement subjective measures with objective measures of exposures and health outcomes
Millennium Cohort Enrollment and Follow-up

1st enrollment
N = 77,047

2nd enrollment
N = 31,110

3rd enrollment
N = 43,439

4th enrollment
N = 50,564

2001 Cohort: Panel 1
2004 Cohort: Panel 2
2007 Cohort: Panel 3
2011 Cohort: Panel 4
## Panel Composition

<table>
<thead>
<tr>
<th>Panel</th>
<th>Dates Enrolled</th>
<th>Years of Service at Enrollment</th>
<th>Oversampled Groups</th>
<th>Roster Size (Date)</th>
<th>Number Contacted**</th>
<th>Total Enrolled (% of contacted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jul 2001-Jun 2003</td>
<td>All durations (cross-section of military population)</td>
<td>Females, National Guard/Reserves, and prior deployers*</td>
<td>256,400 (Oct 2000)</td>
<td>214,388</td>
<td>77,047 (35.9%)</td>
</tr>
<tr>
<td>2</td>
<td>Jun 2004-Feb 2006</td>
<td>1-2 years</td>
<td>Females and Marine Corps</td>
<td>150,000 (Oct 2003)</td>
<td>123,001</td>
<td>31,110 (25.3%)</td>
</tr>
<tr>
<td>3</td>
<td>Jun 2007-Dec 2008</td>
<td>1-3 years</td>
<td>Females and Marine Corps</td>
<td>200,000 (Oct 2006)</td>
<td>154,270</td>
<td>43,439 (28.2%)</td>
</tr>
<tr>
<td>4</td>
<td>Apr 2011-Apr 2013</td>
<td>2-5 years</td>
<td>Females and Married</td>
<td>250,000 invited (Oct 2010)</td>
<td>250,000 invited</td>
<td>50,564 (20.2%)</td>
</tr>
</tbody>
</table>

*Deployment to Southwest Asia, Bosnia, and/or Kosovo after August of 1997

**Invalid names/addresses and duplicates were excluded
### 2011-2013 Survey Cycle Update

<table>
<thead>
<tr>
<th>Panel</th>
<th>Response Rate to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel 1, Wave 4</td>
<td>51,199/77,047 (67% follow-up rate)</td>
</tr>
<tr>
<td>Panel 2, Wave 3</td>
<td>14,893/31,110 (48% follow-up rate)</td>
</tr>
<tr>
<td>Panel 3, Wave 2</td>
<td>21,672/43,440 (50% follow-up rate)</td>
</tr>
<tr>
<td>Panel 4, Wave 1</td>
<td>50,564/250,000 (20% response rate)</td>
</tr>
</tbody>
</table>
Status of Panels 1-3

- 57% have deployed to current operations
- 39% separated from the military
- <1% are deceased

*Data were provided by the DMDC and reflect separation as of March 2012*
### Population Characteristics (Panels 1-3)

<table>
<thead>
<tr>
<th>Characteristics at Enrollment</th>
<th>Panel 1 n 77,019*</th>
<th>Panel 2 n 31,110</th>
<th>Panel 3 n 43,439</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>26.8</td>
<td>38.4</td>
<td>35.7</td>
</tr>
<tr>
<td><strong>Birth year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre - 1960</td>
<td>21.6</td>
<td>0.7</td>
<td>0.2</td>
</tr>
<tr>
<td>1960 - 1969</td>
<td>37.9</td>
<td>5.4</td>
<td>1.7</td>
</tr>
<tr>
<td>1970 - 1979</td>
<td>34.6</td>
<td>31.9</td>
<td>15.7</td>
</tr>
<tr>
<td>1980 - later</td>
<td>5.9</td>
<td>62.0</td>
<td>82.4</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White, non-Hispanic</td>
<td>69.6</td>
<td>71.4</td>
<td>72.2</td>
</tr>
<tr>
<td>Black, non-Hispanic</td>
<td>13.8</td>
<td>11.6</td>
<td>11.3</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>7.9</td>
<td>4.9</td>
<td>5.6</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.4</td>
<td>10.1</td>
<td>7.8</td>
</tr>
<tr>
<td>Other</td>
<td>2.3</td>
<td>2.0</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*Some initial participants were withdrawn from the study population
## Population Characteristics (Panels 1-3)

*Some initial participants were withdrawn from the study population

| Characteristics at Enrollment | Panel 1  
n 77,019* | Panel 2  
n 31,110 | Panel 3  
n 43,439 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>74.4</td>
<td>84.6</td>
<td>84.8</td>
</tr>
<tr>
<td>Some college or more</td>
<td>25.6</td>
<td>15.4</td>
<td>15.2</td>
</tr>
<tr>
<td><strong>Service branch</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army</td>
<td>47.3</td>
<td>48.2</td>
<td>36.4</td>
</tr>
<tr>
<td>Air Force</td>
<td>29.0</td>
<td>26.6</td>
<td>29.7</td>
</tr>
<tr>
<td>Navy/Coast Guard</td>
<td>19.0</td>
<td>16.9</td>
<td>18.2</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>5.1</td>
<td>8.3</td>
<td>15.7</td>
</tr>
<tr>
<td><strong>Service component</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active duty</td>
<td>57.0</td>
<td>59.9</td>
<td>79.3</td>
</tr>
<tr>
<td>Reserve/National Guard</td>
<td>43.0</td>
<td>40.0</td>
<td>20.7</td>
</tr>
<tr>
<td><strong>Military pay grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enlisted</td>
<td>77.0</td>
<td>88.3</td>
<td>88.5</td>
</tr>
<tr>
<td>Officer</td>
<td>23.0</td>
<td>11.7</td>
<td>11.5</td>
</tr>
</tbody>
</table>
### Population Characteristics (Panels 1-3)

<table>
<thead>
<tr>
<th>Characteristics at Follow Up</th>
<th>Panel 1 (n=77,019*)</th>
<th>Panel 2 (n=31,110)</th>
<th>Panel 3 (n=43,439)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployed to current operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>47.2</td>
<td>64.5</td>
<td>67.4</td>
</tr>
<tr>
<td>No</td>
<td>52.8</td>
<td>35.5</td>
<td>32.6</td>
</tr>
<tr>
<td>Number of deployments‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two or more</td>
<td>23.7</td>
<td>31.9</td>
<td>31.9</td>
</tr>
<tr>
<td>One</td>
<td>23.5</td>
<td>32.6</td>
<td>35.5</td>
</tr>
<tr>
<td>None</td>
<td>52.8</td>
<td>35.5</td>
<td>32.6</td>
</tr>
<tr>
<td>% Separated‡</td>
<td>40.4</td>
<td>41.5</td>
<td>14.4</td>
</tr>
<tr>
<td>% Deceased‡</td>
<td>0.9</td>
<td>0.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Some initial participants were withdrawn from the study population
‡ Data reflected as of January 2011
## Standardized Instruments Embedded within the Survey

<table>
<thead>
<tr>
<th>Construct</th>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical, mental, and functional health</td>
<td>Short-Form 36</td>
</tr>
<tr>
<td>Psychological assessment including symptoms of depression, anxiety, panic syndrome, binge-eating, bulimia nervosa, and alcohol abuse</td>
<td>Patient Health Questionnaire (PHQ)</td>
</tr>
<tr>
<td>Post-traumatic stress disorder</td>
<td>Posttraumatic Stress Disorder (PTSD) Checklist-Civilian Version</td>
</tr>
<tr>
<td>Alcohol problems</td>
<td>CAGE questionnaire</td>
</tr>
<tr>
<td>Specific war-time exposures – depleted uranium, chemical or biological warfare agents</td>
<td>Department of Veterans Affairs Gulf War Survey</td>
</tr>
<tr>
<td>Sleep</td>
<td>Insomnia Severity Index</td>
</tr>
</tbody>
</table>
Complementary Data Sources

- Immunization Data
- Recruit Assessment Program
- Medical History
- Induction
- Demographic Data
- DoD Serum Repository
- Pharmacologic Data
- Environmental Exposure Data
- Deployment Data
- Mortality Data
- Family Data e.g., DoD Birth and Infant Health Registry
- Civilian Inpatient and Outpatient Care
- Military Inpatient and Outpatient Care
- Survey Data e.g., Millennium Cohort and Family Studies

Department of Veterans Affairs

MOMRP
Science to Soldier
Study’s Contribution to a Healthy and Fit Force

Individual
- Life experiences
- Demographics
- Body weight

Military Service
- Component
- Service branch
- Rank
- Occupation

Exposures
- Occupational
- Environmental
- Deployment

Health related Behaviors
- Diet
- Physical activity
- Tobacco/alcohol use
- Sleep
- CAM/supplement use

Resilience & Vulnerability Factors

Social Factors
- Social support
- Military climate
- Family

Health Outcomes
- Physical
- Cardiovascular
- Musculoskeletal
- Autoimmune
- Cancer
- Neurological
- Non battle injury
- Metabolic
- Respiratory
- Infectious
- Functional/Wellness
- Mortality

Service related Outcomes
- Return to duty
- Employability
- Disability
- Combat related morbidity
- VA/DoD health care utilization
- Reasons for separation

- Mental
- PTSD
- Depression
- Anxiety
- Substance abuse
- Eating Disorders
- Fatigue/sleep
- Cognitive

Prevention strategies • Field/intervention studies • Clinical practices • Training • Policy
Summary of Methodology Work

- Linking exposures and health outcomes to large study (Mil Med, 2011)
- Overview of the study (BMC Pub Health, 2011)
- Profile of two cohorts: US and UK military studies (Int J Epidemiol, 2011)
- Early mortality (Pop Health Metr, 2010)
- Veterans Day and Memorial Day post card analysis (Epidemiol, 2009)
- Little to no response influence to prior health (Eur J Epidemiol, 2008)
- Cohort representative of the invited sample and military (J Clin Epidemiol, 2007)
- Reliable data through test-retest & internal consistency (Ann Epidemiol, 2007)
- Web vs. paper based survey comparison (Am J Epidemiol, 2007)
- Examine reliability of:
  - Occupation reporting (Int J Env Hlth Res, 2007)
  - Deployment reporting (Ann Epidemiol, 2007)
- Overview (Mil Med, 2002)
Key Findings: PTSD

- New-onset and persistent PTSD (BMJ, 2008)
  - Combat deployers were about 3-fold more likely to screen positive for PTSD compared with non-deployed
  - Deployment was not associated with PTSD persistence

- Prior assault and new-onset PTSD (Epidemiol, 2008)
  - The risk of new-onset PTSD was more than 2-fold higher in women and men who reported assault prior to combat experience

- Functional status and new-onset PTSD (BMJ, 2009)
  - Combat deployers who scored below the 15th percentile for mental and physical health functioning had 2 to 3 times the risk of new-onset PTSD compared with those who scored in the middle 70th percentile

- PTSD and physical activity (Public Health Rep, 2011)
  - Those who reported at least 20 minutes of vigorous physical activity twice weekly had decreased odds for new-onset and persistent PTSD

- Preinjury psychiatric status, injury, PTSD (Arch Gen Psychiatry, 2011)
  - After controlling for injury, baseline psychiatric disorders were significantly associated with new-onset PTSD
Key Findings: Mental and Behavioral Health

- Risk factors associated with suicide (JAMA, 2013)
  - Suicide risk was independently associated with depression, manic-depressive disorder, alcohol-related problems, and male gender. None of the deployment or military-related factors were associated with an increased risk for suicide.

  - Combat-deployed personnel were 32% and more than twice as likely to screen positive for new-onset depression compared with nondeployed, while deployment without combat was associated with a decreased risk for new-onset depression.

- Alcohol use and deployment (JAMA, 2008)
  - Reserve/National Guard combat deployers were 63%, 46%, and 63% more likely to experience new-onset heavy weekly drinking, binge drinking, and alcohol-related problems compared with nondeployed.
  - Active duty combat deployers were 31% more likely to experience binge drinking compared with nondeployed.

  - Deployment with combat, multiple deployments, and prolonged deployments were associated with increased odds of initiating and resuming smoking.
Key Findings: Physical Health

- Predeployment sleep and postdeployment mental health (Sleep, 2013)
  - Combat-related trauma and predeployment insomnia symptoms were significantly associated with developing posttraumatic stress disorder, depression, and anxiety following deployment.

- Combat deployment and sexual harassment and assault (Women’s Health Issues, 2013)
  - Significant risk factors for sexual trauma included prior deployment with combat experience, serving as a Marine, younger age, recent marital separation or divorce, positive screen for a prior mental health condition, moderate/severe life stress, and prior sexual trauma experiences.

- Diabetes, deployment and mental health (Diabetes Care, 2010)
  - Those who screened positive for baseline PTSD, but not other mental disorders, had a 2-fold increase in type 2 diabetes risk.

- New-onset respiratory symptoms and conditions (Am J Epidemiol, 2009)
  - Deployers had a higher rate of newly reported respiratory symptoms than nondeployers (14% vs. 10%), while similar rates of chronic bronchitis or emphysema (1% vs. 1%) and asthma (1% vs. 1%) were observed. Land-based deployers had the highest rates (Army, Marine Corps).
Summary

- The Millennium Cohort Study has successfully enrolled over >200,000 US service members as well as military spouses (n=~10,000)
- The study has prospectively evaluated the impact of military experiences, including deployment, on mental and physical long-term health outcomes of US service members
  - Future work adding family component and possible clinically-relevant sub-studies
- With a 21-year follow-up period (and possibly 75-year), the Millennium Cohort Study will continue to provide ongoing militarily-relevant data on health outcomes of interest to help inform DoD leaders and policies
Objective: Address health and well-being questions about service members and their families in the context of military deployment and other occupational exposures

- Critical information on the service member – spouse dyad
Study Methodology

- Study began in June of 2011
- Participants are spouses of married Panel 4 service members
- Questionnaire measures physical, behavioral, and mental health of spouse
  - Also includes questions on marital relationship, life stressors, deployment experiences, support and resilience, and children’s health and well-being
- Respond via secure website or paper survey
- Participants are re-surveyed every ~3 years for 21+ years
  - Even if the service member separates from the military, or the spouse and service member divorce, separate, or no longer co-reside
- Link to other data including service member’s survey data and military/medical records
Spouse Categories

- **With referral**
  - Email available
  - Rolling enrollment

- **Without referral**
  - No email addresses provided
  - Three groups created from “newly” eligible spouses
    - (July 17, 2012)
    - Push to Web
    - Push to Paper
    - Push to Web with change in last mailing
Overall Response Rates

- **Family Study**
  - Overall: 10,065/22,617 (45%)
  - Referred: 5,469/8,345 (65%)
  - Non-Referred: 4,596/14,272 (32%)
Study Products

Near

Foundation Studies

Methodology, Non-response Analyses, Baseline Characteristics, Instrument Reliability And Validity

Service Member Deployment

Non-deployed
Non-combat Deployed
Combat Deployed

Spouse and Child Health & Well-being

Service Member Readjustment

Mental Health Issues
Alcohol Abuse/Misuse

Spouse and Child Health & Well-being

Mid

Service Member Factors
Support Factors
Employment Factors

Marital Quality and Family Functioning

Far

Service Member Deployment and Readjustment

Resiliency and Vulnerability Factors
Spouse and Child Health & Well-being
2014-2015 Survey Cycle

- Design of the next survey cycle is complete based on successes of the current cycle
- Cohort is now “defined” so spouses will be asked to complete the follow-up at the same time at Panel 4
- OMB/RCS package with 2014-2015 survey questions submitted 24 months in advance and approval is pending
Successes

- Successful enrollment of a large cohort of spouses (~10,000)
- Ability to link spouse data with service member surveys and DoD health records
  - Unprecedented ability to understand the impact of military life on families
- Development of a highly effective survey strategy to reach and engage spouses in this study
- Expansion of study team with several additional members to conduct the study and perform data analyses
Challenges

- Study is longitudinal – funding decrements in DoD research is a concern
  - Budget submitted for the continuation of the current cohort
  - Funding is unclear regarding the possibility of a 2nd panel of spouses during the next cycle
- Engagement of spouses even after their service member separates from the military
  - A challenge which is already being addressed in the Millennium Cohort Study
  - Methods to leverage the service member-spouse connection
- Engagement of spouses even after separation, divorce, or becoming widowed
- Additional data on the children, especially as they age
The Family Study is the only prospective service-wide military study that collects information on the service member-spouse dyad

- Determines the impact of service member’s military experiences on family outcomes

Ability to explore important subpopulations

- Reserve and National Guard families, dual military families, and male military spouses

Upcoming analyses will provide critical data for DoD leaders and policymakers to more fully understand the impact of military service on families, and provide information for the development of preventive and interventional programs
Millennium Cohort Pulmonary Research Review
The Effects of Exposure to Documented Open-Air Burn Pits on Respiratory Health Among Deployers of the Millennium Cohort Study

Methods

- Study Population and Data Sources
  - Millennium Cohort Study Panels 1 and 2 members with surveys during 2004-2006 and 2007-2008
    * Deployed to Iraq or Afghanistan during 2003-2008
    * Restricted to Army and Air Force members
  - Defense Manpower Data Center provided deployment data (location, dates), and military and demographic characteristics
  - Questionnaire utilized for respiratory outcome data

- Respiratory Outcomes
  - Persistent or recurring cough or shortness of breath
  - New-onset* chronic bronchitis or emphysema
  - New-onset* asthma

*Reported on 2007-2008 survey with no previous endorsements
**Methods**

- **Potential Burn Pit Exposures**
  - Deployment within a 3-mile radii of a burn pit at three different camps in Iraq (Joint Base Balad, Camp Taji, Camp Speicher) compared to deployment to other areas in Iraq or Afghanistan
  - Cumulative time near burn pit (days): 1-56, 57-131, 132-209, >210
  - Specific camp compared to other locations
    - Also utilized Camp Arifjan as an alternate comparator group

- **Statistical Analyses**
  - Separate multivariable logistic regression models were created to examine each respiratory outcome with each proxy measure of potential burn pit exposure
  - Models adjusted for sex, birth year, marital status, race/ethnicity, education, smoking, aerobic exercise, service branch, service component, military rank, and occupation
Results

- 22,844 Army and Air Force members were evaluated
- Similar proportions of exposed and nonexposed groups had respiratory outcomes
  - 1.5% vs. 1.6% chronic bronchitis or emphysema
  - 1.7% vs. 1.6% asthma
  - 21.3% vs. 20.6% respiratory symptoms (new onset: 14.9%)
- In the adjusted model, no significant increase in any outcome
  - Newly-reported chronic bronchitis/emphysema: AOR 0.91, 95% CI 0.67-1.24
  - Asthma: AOR 0.94, 95% CI 0.70-1.27
  - Respiratory symptoms: AOR 1.03, 95% CI 0.94-1.13
# Results

## TABLE 3. Adjusted Odds of Reported Respiratory Outcomes Among Army and Air Force Personnel in Relation to Cumulative Days Deployed Within 3 Miles of a Documented Open-Air Burn Pit, the Millennium Cohort Study

<table>
<thead>
<tr>
<th></th>
<th>Chronic Bronchitis or Emphysema° (N = 20,676)</th>
<th>Asthma° (N = 20,077)</th>
<th>Respiratory Symptoms† (N = 22,297)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AOR (95% CI)</td>
<td>AOR (95% CI)</td>
<td>AOR (95% CI)</td>
</tr>
<tr>
<td>Exposed days‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0§</td>
<td>17,348 (83.9)</td>
<td>1.00</td>
<td>0.76</td>
</tr>
<tr>
<td>1–56</td>
<td>850 (4.1)</td>
<td>1.00 (0.59–1.69)</td>
<td>826 (4.1)</td>
</tr>
<tr>
<td>57–131</td>
<td>829 (4.0)</td>
<td>0.63 (0.31–1.28)</td>
<td>799 (4.0)</td>
</tr>
<tr>
<td>132–209</td>
<td>820 (4.0)</td>
<td>1.10 (0.64–1.90)</td>
<td>795 (3.9)</td>
</tr>
<tr>
<td>≥210</td>
<td>829 (4.0)</td>
<td>0.90 (0.51–1.59)</td>
<td>800 (4.0)</td>
</tr>
</tbody>
</table>

Models were adjusted for sex, birth year, marital status, race/ethnicity, education, smoking status, aerobic activity, service branch, service component, military rank, and occupation. For respiratory symptoms outcome, adjustment for prevalence of respiratory symptoms reported at 2004–2006 was included. AOR, adjusted odds ratio; CI, confidence interval.

°All participants in respective models were disease free prior to 2007–2008.

†Respiratory symptoms were defined as persistent or recurring cough or shortness of breath self-reported at 2007–2008.

‡Categories found by computing quartiles of days exposed among those with identified deployments within a 3-mile radius of the burn pit sites.

§Indicates reference category.

## TABLE 4. Adjusted Odds of Reported Respiratory Outcomes Among Army and Air Force Personnel Deployed Within 3 Miles of a Documented Open-Air Burn Pit, by Campsite, the Millennium Cohort Study

<table>
<thead>
<tr>
<th></th>
<th>Chronic Bronchitis or Emphysema° (N = 20,676)</th>
<th>Asthma° (N = 20,077)</th>
<th>Respiratory Symptoms† (N = 22,297)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AOR (95% CI)</td>
<td>AOR (95% CI)</td>
<td>AOR (95% CI)</td>
</tr>
<tr>
<td>Campsite‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other deployment§‖</td>
<td>17,348 (83.9)</td>
<td>1.00</td>
<td>18,712 (83.9)</td>
</tr>
<tr>
<td>Joint Base Balad</td>
<td>2,022 (9.8)</td>
<td>1.07 (0.74–1.54)</td>
<td>1,957 (9.7)</td>
</tr>
<tr>
<td>Taji</td>
<td>543 (2.6)</td>
<td>1.05 (0.55–2.01)</td>
<td>523 (2.6)</td>
</tr>
<tr>
<td>Speicher</td>
<td>763 (3.7)</td>
<td>0.48 (0.22–1.02)</td>
<td>740 (3.7)</td>
</tr>
</tbody>
</table>

Models adjusted for sex, birth year, marital status, race/ethnicity, education, smoking status, aerobic activity, service branch, service component, military rank, and occupation. For the respiratory symptoms outcome, adjustment for prevalence of respiratory symptoms reported at 2004–2006 was included. AOR, adjusted odds ratio; CI, confidence interval.
Results

- Alternate radii were examined
  - No significant findings at a 5-mile radius
  - 2-mile radius: Air Force personnel at JBB had an increased risk for symptoms (AOR 1.24, 95% CI 1.01-1.52), but not for other respiratory outcomes

- Using the referent group of Camp Arifjan (Kuwait) did not change the results
Limitations and Conclusion

- **Limitations**
  - Respiratory outcomes were self-reported
  - Follow-up time was short (mean of 2.9 years)
  - No direct quantitative or individual-level exposure data available

- **Conclusion**
  - Study did not show an elevated risk for respiratory outcomes among service members deployed within proximity of a documented open-air burn pit in Iraq
Newly Reported Respiratory Symptoms and Conditions among Military Personnel Deployed to Iraq and Afghanistan: A Prospective Population-Based Study

Am J Epidemiol. 2009 Dec 1;170(11):1433-42
Methods

- **Study Population and Data Sources**
  - Millennium Cohort Study Panel 1 members with complete baseline (2001-2003) and follow-up (2004-2006) data
  - Millennium Cohort questionnaire collects self-reported data on respiratory health and behavioral data including smoking status
  - Defense Manpower Data Center provided deployment data and military and demographic characteristics

- **Newly-Reported Respiratory Outcomes**
  - Persistent or recurring cough or shortness of breath
  - Chronic bronchitis or emphysema
  - Asthma
Methods

- Deployment Exposures
  - Deployment status of deployed versus nondeployed
  - Cumulative deployment length (days): 0, 1-180, 181-270, >270
  - Deployment locations examined among deployed personnel

- Statistical Analyses
  - Univariate and chi-square statistics, and unadjusted odds ratios
  - Multivariable logistic regression with adjusted odds ratios stratified by service branch
  - Models adjusted for sex, tobacco use, birth year, marital status, race/ethnicity, education, service component, military rank, and occupation
Results

- 46,077 participants
  - 10,753 (23%) deployed between baseline and follow-up
    * Prior deployers and persons with history of respiratory conditions or symptoms were excluded
- Deployers were more likely to have new-onset respiratory symptoms vs. nondeployers (14% vs. 10%)
- Similar rates of chronic bronchitis or emphysema (1% vs. 1%) and asthma (1% vs. 1%)
  - Incidence rate of 3.3 per 1,000/year
Results

- No significant increase in newly reported asthma, or chronic bronchitis or emphysema

- Independent of smoking, demographic, and military characteristics, deployment was associated with respiratory symptoms in:
  - Army personnel (OR: 1.73, 95% CI: 1.57, 1.91)
  - Marines (OR: 1.49, 95% CI: 1.06, 2.08)

- Deployment length was linearly associated with increased symptom reporting among Army personnel (p < 0.0001)

- Among deployers, elevated odds of respiratory symptoms were associated with land-based deployments
Conclusion and Future Directions

- Findings suggest specific exposures rather than deployment itself, as a determinant for post-deployment respiratory illness (persistent and recurring cough and shortness of breath)

- Future Directions
  - Continued research necessary to understand impact of deployment on respiratory health particularly chronic conditions
  - Explore associations of particulate matter exposure and respiratory illness
Cigarette Smoking and Military Deployment: A Prospective Evaluation

Methods

- **Study Population and Data Sources**
  - Millennium Cohort Study Panel 1 members with complete baseline (2001-2003) and follow-up (2004-2006) data
  - Millennium Cohort questionnaire collects self-reported data on lifetime smoking habits and other behaviors
  - Defense Manpower Data Center provided deployment data and military and demographic characteristics

- **Smoking outcomes at follow-up**
  - Nonsmoker
  - Past smoker
  - Current smoker
Methods

- **Deployment Exposures**
  - No deployments, 1 deployment, > 1 deployment
  - Extreme deployments: > 9 months or < 1 month
  - Combat deployment experience ascertained by affirmative responses to questions about witnessing death, trauma, injuries, prisoners of war, or refugees

- **Statistical Analyses**
  - Incidence rates for new-smoking among nonsmokers. Univariate and chi-square statistics, and unadjusted odds ratios
  - Multivariable logistic regression with adjusted odds ratios
  - Models adjusted for sex, birth year, marital status, race/ethnicity, prior mental health issues, pay grade, service component, service branch, military rank, and previous deployment history
Results

- New smoking among nonsmokers
  - 1.3% of nondeployed
  - 2.3% of those deployed once
  - 2.2% of those deployed multiple times

- Smoking resumption among past smokers
  - 28.7% of nondeployed
  - 39.4% of those deployed once
  - 40.3% of those deployed multiple times
# Smoking Uptake Among Never and Past Smokers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Smoking Initiation among Never Smokers</th>
<th>Smoking Recidivism among Past Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>OIF/OEF deployment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deployed once <em>(ref: nondeployed)</em></td>
<td>1.03</td>
<td>0.75, 1.44</td>
</tr>
<tr>
<td>Deployed multiple times <em>(ref: nondeployed)</em></td>
<td>1.36</td>
<td>0.86, 2.15</td>
</tr>
<tr>
<td>Extreme deployment &lt; 1 month</td>
<td>0.90</td>
<td>0.56, 1.47</td>
</tr>
<tr>
<td>Extreme deployment &gt; 9 months continuously</td>
<td>1.29</td>
<td>0.88, 1.89</td>
</tr>
<tr>
<td>Minimal time home before deploying again (&lt; 1 month)</td>
<td>0.52</td>
<td>1.12, 2.21</td>
</tr>
<tr>
<td>Deployed with combat exposures</td>
<td>1.63</td>
<td>1.15, 2.32</td>
</tr>
</tbody>
</table>
Conclusions and Future Directions

- Smoking increased in this population; increase was greater among deployers.
- Deploying longer than 9 months, multiple times, and experiencing combat exposures increases the risk for smoking uptake and resumption.
- Programs should focus on preventing smoking relapse during and after deployment.
- Analyses in progress to examine other military and behavioral risk factors associated with smoking initiation and relapse.
Specific exposures, rather than deployment itself, may be determinants for post-deployment respiratory symptoms

- To date, no significant associations between deployment and respiratory diseases (chronic bronchitis or emphysema, or asthma) have been found.

Potential exposure (within 3-mile radii) to open-air burn pits was not associated with respiratory outcomes to date.

Additional studies are underway to clarify the role of deployment experiences and respiratory outcomes.
Future Respiratory Work and Collaborations
Particulate Matter and Respiratory Outcomes

- **Objective**
  - To evaluate the potential association of increasing levels of particulate matter (PM) exposure and risk of newly reported respiratory symptoms
  - To characterize the relationship between PM levels and cumulative time deployed, by respiratory symptom status

- **Method**
  - Collaboration between Millennium Cohort and the United States Army Public Health Command
  - Link Millennium Cohort questionnaire data on respiratory health with particulate matter data collected by the DoD Enhanced Particulate Matter Surveillance Program as well as deployment data to the PM sampling sites
    - Examine Army personnel who deployed to the particulate matter (PM) sampling sites in Southwest Asia
    - Behavioral data including smoking status from Millennium Cohort would be also be examined
  - Initial collaboration explored, more data needed to thoroughly examine the specified outcomes
Respiratory Symptoms and Conditions among Service Members and Veterans

- Additional follow-up surveys have been administered since the initial study examining respiratory outcomes and deployment
  - Extended longitudinal study of Panel 1 with 10 years of follow-up
  - Novel analysis of Panels 2 & 3 will allow for evaluation of deployment in later years of conflicts (after 2006)
  - Sub-study in active duty members to investigate respiratory encounters using the medical data repository (ICD-9 codes)

- Objectives
  - Evaluate the risk of new-onset self-reported respiratory symptoms and provider diagnosed conditions associated with military experiences among service members and veterans
  - Evaluate the risk of new-onset respiratory encounters, as determined by medical records, associated with military experiences among active duty service members

- Analysis
  - Survival analyses with adjustment for potential confounders, including tobacco use, physical and mental health, and life stressors
The Millennium Cohort Study Team includes:
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The views expressed in this research are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of the Army, Department of the Air Force, Department of Veterans Affairs, Department of Defense, or the U.S. Government. Human subjects participated in this study after giving their free and informed consent. This research has been conducted in compliance with all applicable Federal Regulations governing the Protection of Human Subjects in Research.

We are indebted to the Millennium Cohort Study members for their continued participation!