



# Millennium Cohort Study Update

## Defense Health Board Meeting

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# 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



Photo source: <http://www.defenselink.mil/multimedia>



# 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

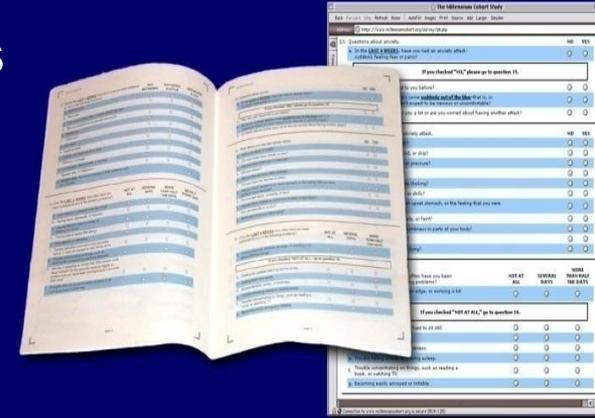


- **Collaborator guidelines established and posted on website**
  - **FY10-FY13**
    - > 35 collaborative projects with Military experts
    - >20 collaborative projects with VA experts
    - > 30 collaborative projects with academic experts
- **Veteran's Affairs, Washington, DC**
  - Finalized agreement 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

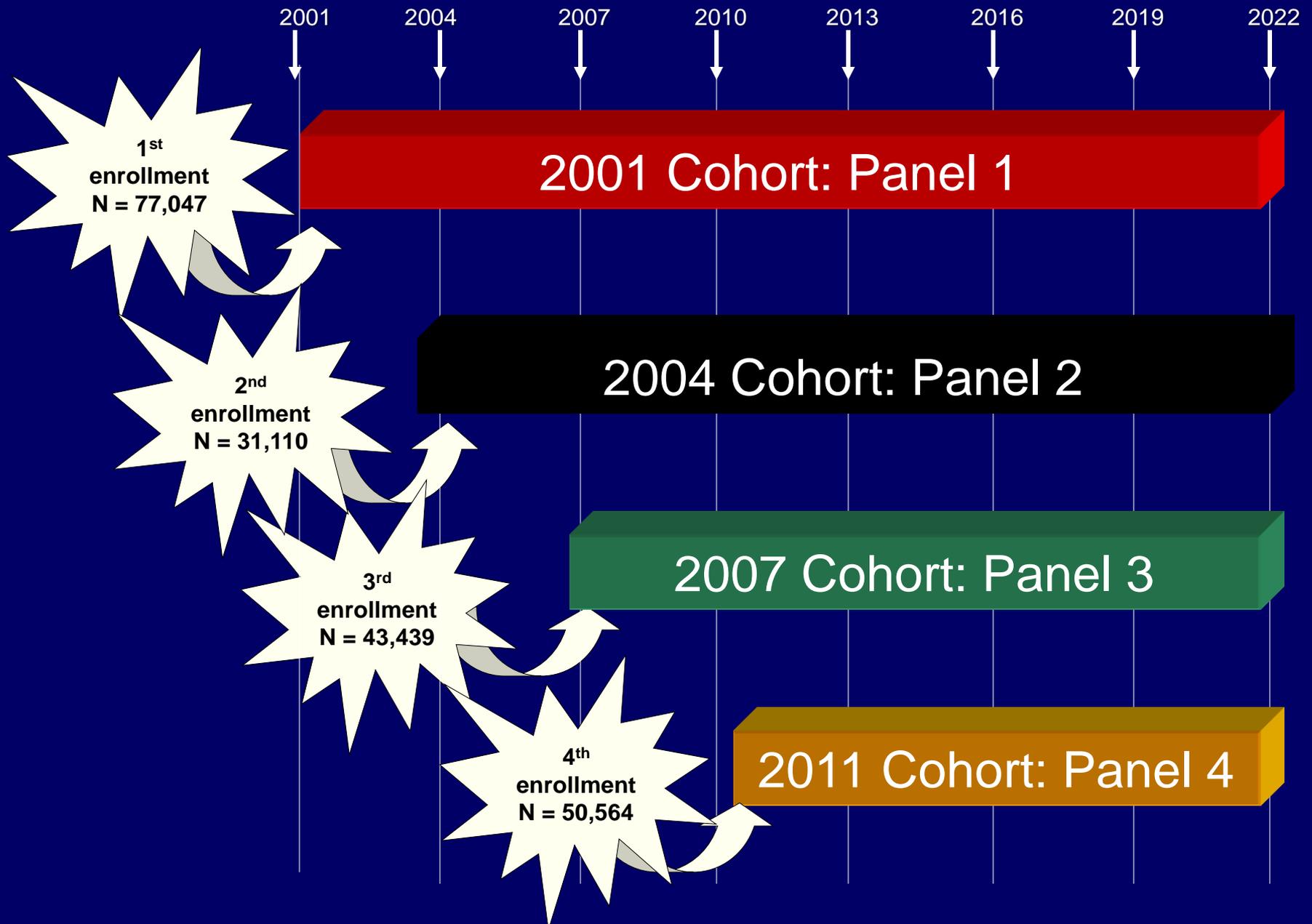


# Study Methodology

- 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



# Panel Composition



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

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

\*\*Invalid names/addresses and duplicates were excluded



# 2011-2013 Survey Cycle Update

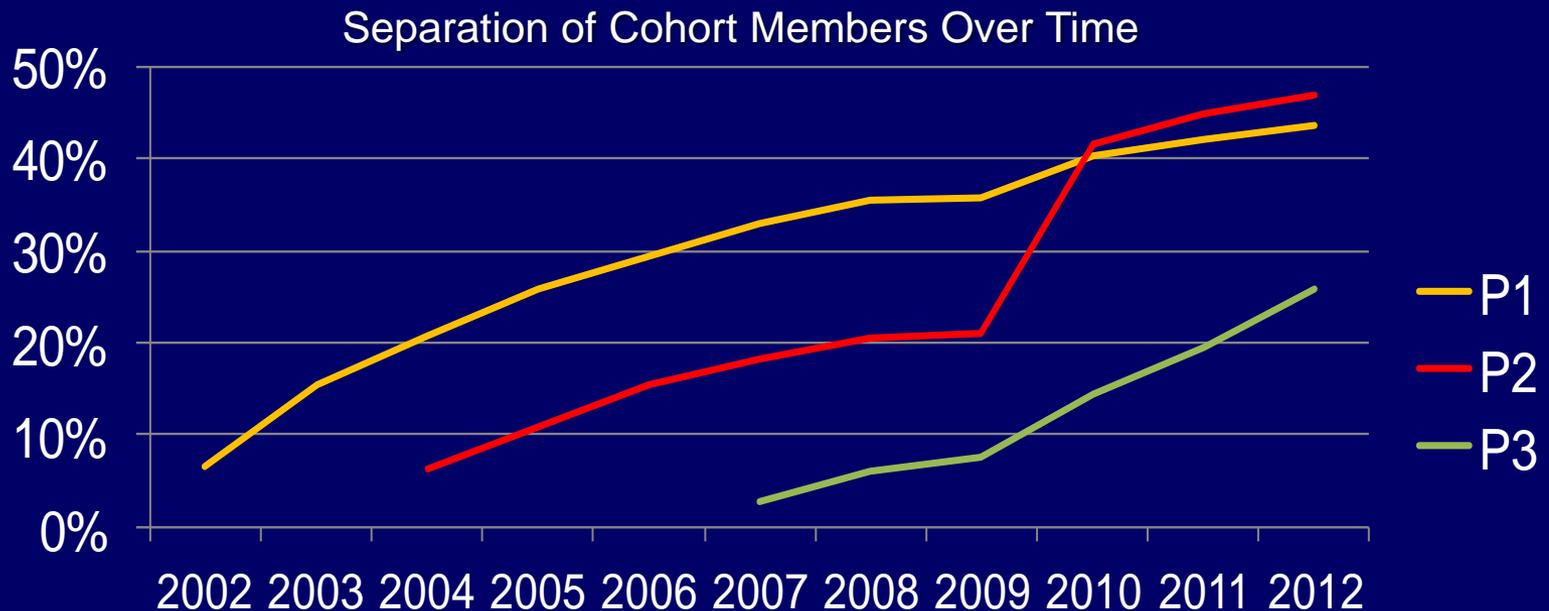


Panel	Response Rate to Date
Panel 1, Wave 4	51,199/77,047 (67% follow-up rate)
Panel 2, Wave 3	14,893/31,110 (48% follow-up rate)
Panel 3, Wave 2	21,672/43,440 (50% follow-up rate)
Panel 4, Wave 1	50,564/250,000 (20% response rate)

# 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)



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

\*Some initial participants were withdrawn from the study population

# Population Characteristics (Panels 1-3)



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

\*Some initial participants were withdrawn from the study population

# Population Characteristics (Panels 1-3)



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

\*Some initial participants were withdrawn from the study population

‡ Data reflected as of January 2011

# Standardized Instruments Embedded within the Survey

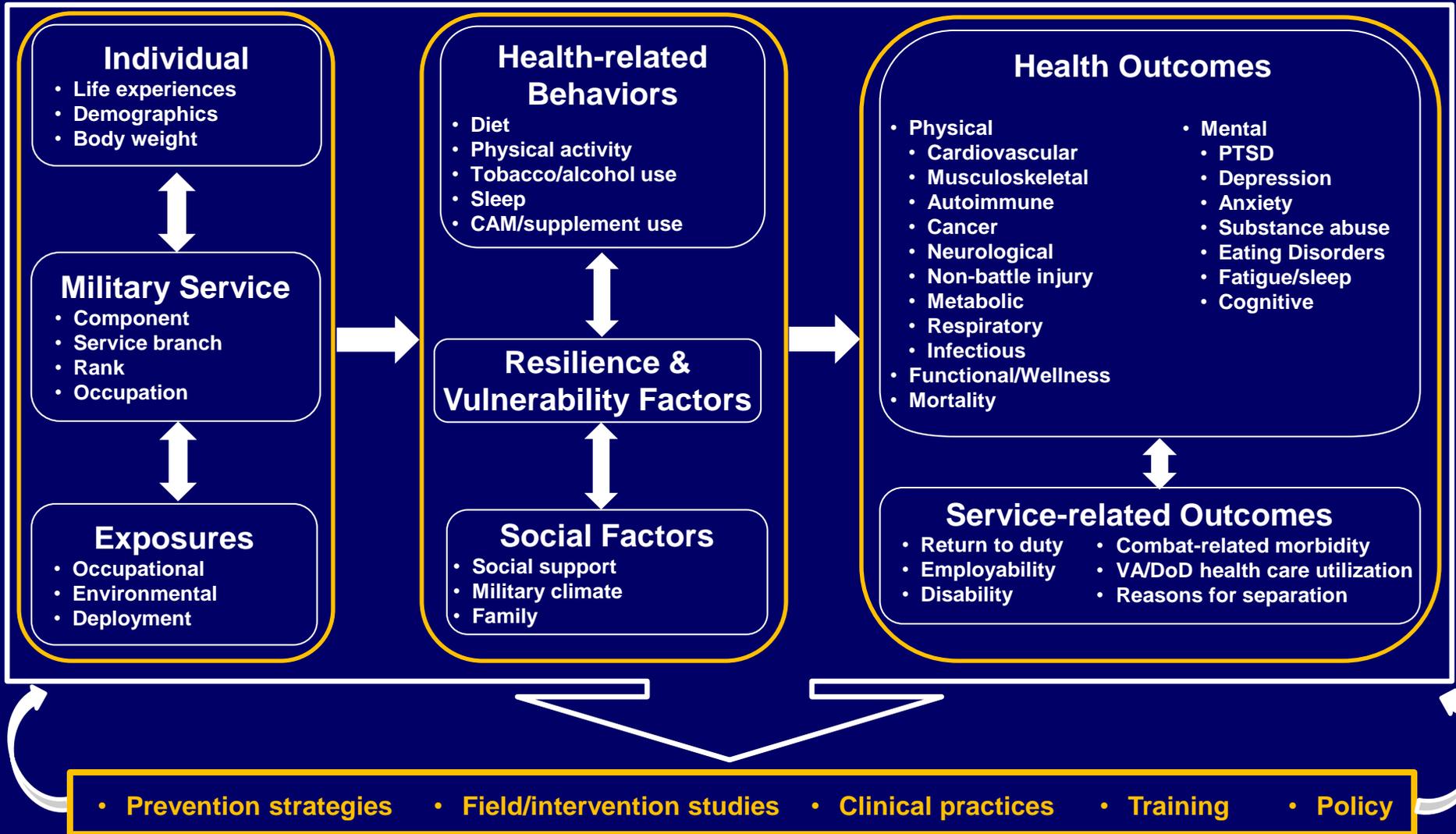


Construct	Inventory
Physical, mental, and functional health	Short-Form 36
Psychological assessment including symptoms of depression, anxiety, panic syndrome, binge-eating, bulimia nervosa, and alcohol abuse	Patient Health Questionnaire (PHQ)
Post-traumatic stress disorder	Posttraumatic Stress Disorder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





# Study's Contribution to a Healthy and Fit Force



# Summary of Methodology Work



- Latent semantic analysis of open-ended question (BMC Med Res Method, 2011)
- 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)
- Nonresponse to first follow-up (BMC Med Res Method, 2010)
- Factor analysis of symptoms (BMC Med Res Method, 2010)
- 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)
- Self-report and medical condition comparison (BMC Med Res Method, 2008)
- Cohort representative of the invited sample and military (J Clin Epidemiol, 2007)
- Characteristics of early responders (BMC Med Res Method, 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)
  - Anthrax and smallpox vaccine reporting (Am J Prev Med, 2007 and Hum Vaccin, 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 15<sup>th</sup> 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 70<sup>th</sup> 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

## ➤ New-onset depression and deployment (Am J Pub Health, 2010)

- 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

## ➤ Tobacco use and deployment (Am J Prev Med, 2008)

- 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**





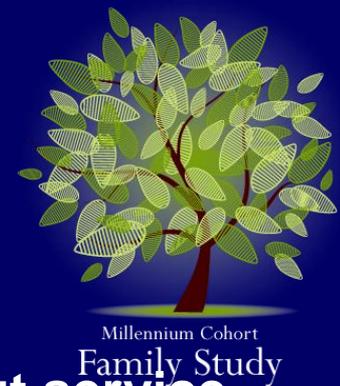
**MOMRP**  
*Science to Soldier*



Millennium Cohort  
Family Study



# Millennium Cohort Family Study



**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**



Millennium Cohort Family Study

*Because Families Serve Too*

HOME ABOUT THE STUDY FREE GIFT SAMPLE SURVEY PAGES ABOUT US F.A.Q. START SURVEY

*"Thank you for your selfless service and dedication to these important health issues."*

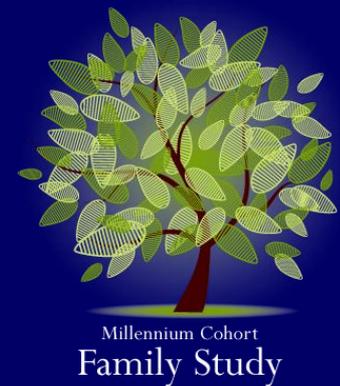
endorsed by  
**GENERAL MARTIN E. DEMPSEY**,  
Chairman of the Joint Chiefs of Staff  
and his wife **DEANIE DEMPSEY**

READ THE  
DEMPSEY'S  
LETTERS TO  
PARTICIPANTS

[CLICK HERE](#)

# 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



Millennium Cohort Family Survey

Please login by entering your Subject ID and the last four digits of the Social Security Number of the person who referred you to the Millennium Cohort Family Study.

Subject ID:

Verify your identity:  
Last 4 digits of your referer's SSN  
(Having trouble logging in? Click here)

Login

More Information  
Click here

Questions?  
Click here to contact us

The Millennium Cohort Family Study is a Department of Defense research project of the Department Health Research, Department, located in San Diego, California. Host: OHSU. Reference Number: 000101. NCI Number: CCRN040120. OHSU Approval Number: 0701-0075. AUCR/AMTRM Approval Number: CCR-04-204, and Primary IRB Protocol Number: HREC-2001-0007 © 2010, Millennium Cohort Family Study. All rights reserved.

THE FAMILY STUDY SURVEY

Military spouses who participate in the study are given an opportunity to make a real difference

**MARITAL RELATIONSHIP**  
Taking all things together, please rate the following statements about your relationship with your spouse

**YOUR FAMILY**  
Family members discuss their ideas and beliefs with each other

**YOUR SPOUSE**  
I really feel like part of a team with my spouse

# Spouse Categories

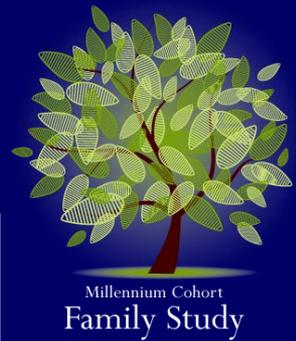
## ➤ With referral

- Email available
- Rolling enrollment

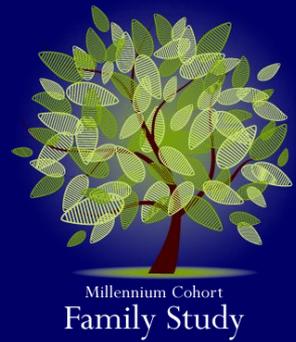


## ➤ Without referral

- 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**



**Mid**



**Far**

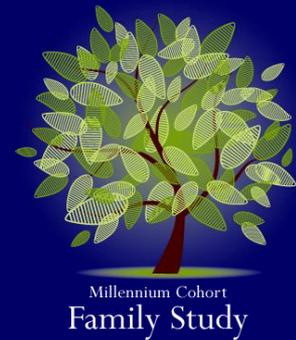


# 2014-2015 Survey Cycle

- 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

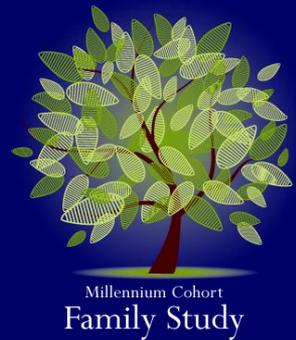


# Successes



- **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**



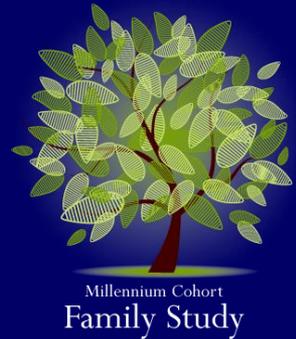


# Challenges

- **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 2<sup>nd</sup> 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**



# Summary



- **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

J Occup Environ Med. 2012 Jun;54(6):708-716



# 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,  $\geq 210$
- 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

	Chronic Bronchitis or Emphysema* (N = 20,676)		Asthma* (N = 20,077)		Respiratory Symptoms† (N = 22,297)	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Exposed days‡		<i>P</i> = 0.76		<i>P</i> = 0.63		<i>P</i> = 0.94
0§	17,348 (83.9)	1.00	16,857 (84.0)	1.00	18,712 (83.9)	1.00
1–56	850 (4.1)	1.00 (0.59–1.69)	826 (4.1)	0.71 (0.38–1.30)	908 (4.1)	0.98 (0.83–1.17)
57–131	829 (4.0)	0.63 (0.31–1.28)	799 (4.0)	0.77 (0.41–1.45)	897 (4.0)	1.05 (0.88–1.25)
132–209	820 (4.0)	1.10 (0.64–1.90)	795 (3.9)	1.15 (0.68–1.96)	899 (4.0)	1.05 (0.88–1.26)
≥210	829 (4.0)	0.90 (0.51–1.59)	800 (4.0)	1.14 (0.41–1.45)	881 (4.0)	1.03 (0.87–1.23)

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

	Chronic Bronchitis or Emphysema* (N = 20,676)		Asthma* (N = 20,077)		Respiratory Symptoms† (N = 22,297)	
	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)	n (%)	AOR (95% CI)
Campsite‡		<i>P</i> = 0.27		<i>P</i> = 0.22		<i>P</i> = 0.82
Other deployment§	17,348 (83.9)	1.00	16,857 (84.0)	1.00	18,712 (83.9)	1.00
Joint Base Balad	2,022 (9.8)	1.07 (0.74–1.54)	1,957 (9.7)	0.84 (0.56–1.25)	2,206 (9.9)	1.01 (0.90–1.14)
Taji	543 (2.6)	1.05 (0.55–2.01)	523 (2.6)	1.53 (0.91–2.58)	568 (2.5)	1.10 (0.90–1.36)
Speicher	763 (3.7)	0.48 (0.22–1.02)	740 (3.7)	0.76 (0.42–1.38)	811 (3.6)	1.01 (0.85–1.21)

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 a 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

Am J Prev Med. 2008 Dec;35(6):539-46.



# 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



Characteristic	Smoking Initiation among Never-Smokers		Smoking Recidivism among Past Smokers	
	OR	95% CI	OR	95% CI
<b>OIF/OEF deployment</b>				
Deployed once ( <i>ref: nondeployed</i> )	1.03	0.75, 1.44	<b>1.23</b>	<b>1.06, 1.41</b>
Deployed multiple times ( <i>ref: nondeployed</i> )	1.36	0.86, 2.15	<b>1.55</b>	<b>1.24, 1.93</b>
<b>Extreme deployment &lt; 1 month</b>	0.90	0.56, 1.47	0.93	0.73, 1.17
<b>Extreme deployment &gt; 9 months continuously</b>	1.29	0.88, 1.89	<b>1.28</b>	<b>1.03, 1.59</b>
<b>Minimal time home before deploying again (&lt; 1 month)</b>	0.52	1.12, 2.21	1.29	0.71, 2.34
<b>Deployed with combat exposures</b>	<b>1.63</b>	<b>1.15, 2.32</b>	<b>1.27</b>	<b>1.07, 1.51</b>



# 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**



# Summary of Findings to Date



- **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



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





# MILLENNIUM COHORT STUDY

<http://www.millenniumcohort.org>



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