Office of Public Health

Presentation to the Research Advisory Committee on Gulf War Veterans’ Illnesses

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Outline

• Introductions
• Epidemiology Program
• Overview of data model
• Overview of Veterans from the Gulf War (GW) Roster and assessment of diagnostic data
• Results from GW Surveys
• Mortality among GW & GW Era Veterans
• Proposed studies
• Development of common data elements
• Institute of Medicine (IOM) study of multiple sclerosis (MS) and other neurologic conditions
• Discussion and recommendations
Epidemiology Program

- Epidemiology is the study of the distribution and determinants of disease frequency and health related states and a contributor to the rationale for public health policies, services and their evaluation.
- The Epidemiology Program seeks to provide nationally-recognized leadership in the epidemiology of Veterans’ health.
- VA’s Office of Public Health (OPH) defines public health as the science and practice of promoting health and preventing disease among Veterans and VA staff populations.
- OPH’s Epidemiology Program conducts descriptive, observational and analytic studies of cohorts defined by period of service.
  - Studies are informed by the observations and concerns of the Veteran community, results from internal and external research, clinical observation and direction from VA leadership with the goal of promoting health and preventing disease.

Data Model
Gulf War Veteran Roster

- Computerized data file of 746,247 non-deployed Veterans - comparison population who served during the same period.
- Data elements include demographic variables and military service characteristics.
- Historically served as the basis for mortality and morbidity studies.
- Vital status and cause of death data through 2012 is currently being collected.

Characteristics of Gulf War Veterans & Gulf War Veterans Who Used VHA Services

1. Results from analyses of VHA administrative data are preliminary and presented for discussion of potential research applications.
2. Results from analyses of administrative data should not be used to test for differences.
3. Different results may be obtained using alternate algorithms for identifying diagnoses.
Prevalence of ICD-9 Diagnostic Categories among GW and GW Era Veterans with History of VHA Service Use, FY 2002 – FY 2013 (1,2)

1. Veterans are only counted once in each diagnostic category. However, an individual may have more than one diagnosis.
2. The total number of GW Veterans (n=286,995) and GW Era Veterans (n=269,635) who used VHA services was used to calculate percentages.

Prevalence of ICD-9 Diagnostic Categories among GW and GW Era Veterans with History of VHA Service Use, FY 2002 – FY 2013 (1,2)

1. Veterans are only counted once in each diagnostic category. However, an individual may have more than one diagnosis.
2. The total number of GW Veterans (n=286,995) and GW Era Veterans (n=269,635) who used VHA services was used to calculate percentages.
Most Common Diagnoses among Gulf War and Gulf War Era Veterans Diagnosed With A Malignant Neoplasm, FY 2002- FY 2013

GW Veterans (Diagnosis, Within Category Percentage)  | GW Era Veterans (Diagnosis, Within Category Percentage)
---|---
1. Other malignant neoplasm of skin, 23.6% | 1. Malignant neoplasm of prostate, 24.4%  
2. Malignant neoplasm of prostate, 22.1% | 2. Other malignant neoplasm of skin, 23.8%  
3. Malignant neoplasm of the colon, 6.2% | 3. Malignant neoplasm of the trachea, bronchus, and lung, 6.3%  
4. Malignant neoplasm of the trachea, bronchus and lung, 6.0% | 4. Malignant neoplasm of the female breast, 5.9%  
5. Malignant neoplasm of the skin, 5.3% | 5. Malignant neoplasm of the colon, 5.7%  
6. Other malignant neoplasms of lymphoid, histiocytic tissue, 5.2% | 6. Malignant neoplasm of the skin, 5.1%  
7. Secondary malignant neoplasm of other specified sites, 4.4% | 7. Other malignant neoplasms of lymphoid, histiocytic tissue, 5.0%  
8. Malignant neoplasm of kidney and other unspecified urinary organs, 4.1% | 8. Secondary malignant neoplasm of other specified sites, 4.1%  
9. Malignant neoplasm – no site specified, 4.0% | 9. Malignant neoplasm of kidney and other unspecified urinary organs, 3.8%  
10. Malignant neoplasm of the female breast, 3.8% | 10. Malignant neoplasm – no site specified, 3.8% 

GW Veterans n=14,752, GW Era Veterans n=17,105

Most Common Diagnoses among Gulf War and Gulf War Era Veterans Diagnosed With Disease of the Nervous System and Sense Organs, FY 2002- FY 2013

GW Veterans (Diagnosis, Within Category Percentage)  | GW Era Veterans (Diagnosis, Within Category Percentage)
---|---
1. Disorders of refraction, accommodation, 48.3% | 1. Disorders of refraction, accommodation, 50.6%  
2. Hearing loss, 33.5% | 2. Hearing loss, 35.0%  
3. Other disorders of the ear, 25.0% | 3. Other disorders of the ear, 24.5%  
4. Organic sleep disorders, 15.9% | 4. Cataract, 19.3%  
5. Cataract, 15.5% | 5. Organic sleep disorders, 13.4%  
6. Migraine, 12.3% | 6. Visual disturbances, 12.5%  
7. Visual disturbances, 12.2% | 7. Glaucoma, 12.4%  
8. Mononeuritis of upper limb, mononeuritis multiplex, 11.9% | 8. Mononeuritis of upper limb, mononeuritis multiplex, 11.9%  
9. Glaucoma, 11.5% | 9. Migraine, 11.2%  
10. Disorders of the external ear, 9.6% | 10. Diabetic retinopathy, 10.3% 

GW Veterans n=166,396, GW Era Veterans n=156,772
**Most Common Diagnoses among Gulf War and Gulf War Era Veterans Diagnosed With Symptoms, Signs and Ill-Defined Conditions, FY 2002- FY 2013**

**GW Veterans (Diagnosis, Within Category Percentage)**
1. General symptoms, 53.7%
2. Symptoms involving respiratory system and other chest symptoms, 39.1%
3. Symptoms involving skin, integumentary tissue, 26.7%
4. Symptoms involving head, neck, 24.8%
5. Nonspecific findings on examination of blood, 24.1%
6. Other symptoms involving abdomen, pelvis, 17.7%
7. Symptoms involving digestive system, 17.6%
8. Nonspecific abnormal results of function studies, 15.1%
9. Other nonspecific abnormal findings, 12.8%
10. Other ill-defined, unknown causes of morbidity, 10.9%

**GW Era Veterans (Diagnosis, Within Category Percentage)**
1. General symptoms, 50.5%
2. Symptoms involving respiratory system, other chest symptoms, 39.5%
3. Symptoms involving skin, integumentary tissue, 27.1%
4. Nonspecific findings on examination of blood, 24.8%
5. Symptoms involving head, neck, 22.9%
6. Other symptoms involving abdomen, pelvis, 18.3%
7. Symptoms involving digestive system, 16.8%
8. Nonspecific abnormal results of function studies, 14.8%
9. Other nonspecific abnormal findings, 12.7%
10. Renal colic, 11.3%

GW Veterans n=176,541, GW Era Veterans n=157,051

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**Follow Up Study of a National Cohort of Gulf War and Gulf War Era Veterans**

Erin K. Dursa, PhD, MPH  
Principal Investigator  
Post-Deployment Health Epidemiology Program  
Office of Public Health
Background

- Overarching research question: Is the health of Veterans who deployed to the 1991 Gulf War better, worse or the same as those who did not deploy?
  - Health includes several domains: physical (such as neurologic, immunologic and respiratory), mental, women’s health, functional, and social

- Provide a population-level assessment of overall health and wellness of this group almost 20 years after the Gulf War.

- Describe the natural histories of disease and other health conditions in this Veteran population over time.

<table>
<thead>
<tr>
<th>Unit Component</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>4,800</td>
<td>1,200</td>
<td>6,000</td>
</tr>
<tr>
<td>Reserve</td>
<td>4,000</td>
<td>1,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Guard</td>
<td>3,200</td>
<td>800</td>
<td>4,000</td>
</tr>
<tr>
<td>Total</td>
<td>12,000</td>
<td>3,000</td>
<td>15,000</td>
</tr>
</tbody>
</table>
Background


- Health Findings: Gulf War Veterans reported higher prevalence of
  - Functional Impairment
  - Healthcare utilization
  - Wide variety of symptoms
  - Serious chronic health conditions
  - Lower perception of general health
  - Miscarriage (female Veterans and female partners of male Veterans)
  - Birth defects among live born infants (female Veterans and female partners of male Veterans)

Kang et al, 2000


- Panel of 30,000 Gulf War and Gulf War Era Veterans were recontacted
- 14 years after deployment, Gulf War Veterans continued to report significantly higher rates of many adverse health including:
  - Unexplained multi-symptom illness
  - Chronic fatigue-like illness
  - Posttraumatic stress disorder
  - Functional impairment
  - Health care utilization
  - Majority of selected physical and mental conditions

Kang et al, 2009

Methods

Follow-Up Study of a National Cohort of Gulf War and Gulf Era Veterans

- Data Collection (May 2012-December 2013)
  - Multimodal health survey - mail, Web, and Computer Assisted Telephone Interview (CATI)
    - Phase I: Veterans mailed a letter inviting them to take the survey on the Web using a unique personal identification number
    - Phase II: Veterans who did not respond to the Web survey were mailed a paper survey, 2 copies of the consent form, a benefits and healthcare information sheet, Veterans Crisis Line information sheet, and pre-addressed postage paid return envelope
    - Phase III: Veterans who did not respond to the Web or paper survey were called and invited to participate in a Computer Assisted Telephone Interview
Methods

• Medical records validation
  – Conducted to verify and validate selected responses provided by mail and Web respondents in the main study. All Veterans who provided a valid verbatim response to either Question 5 (reason for clinic or doctor visit in the past 12 months) or Question 6 on the survey (reason for hospitalization in the past 12 months) were eligible to have these responses coded using the ICD-9 coding scheme

  – 2,500 Veterans were invited to participate in the medical records validation study

  – 86% of records were verified; validity of self-report is high

Results

• Weights were applied to produce estimates that reflect what we would expect in entire population of Gulf War and Gulf Era veterans
  – Reflect the stratified sampling design used to draw the original sample in the baseline study
  – Adjust for non-response encountered in the field
  – Correct known inconsistencies in the original frame information

• Weighting is performed in all large population based surveys so that prevalence estimates in the entire population can be determined from a sample
  – National Health and Examination Survey (NHANES)
  – National Health Interview Survey (NHIS)
  – Behavioral Risk Factor Surveillance System (BRFSS)
Results

- 50% response rate (N=14,252)
  - 68% (n=9,643) responded by mail survey
  - 26% (n=3,808) responded by Web
  - 6% (n=801) responded by CATI

- Non-response analyses indicated that the following groups were over-represented in the 2012 follow up
  - Air Force and Army vs. Marines and Navy
  - Deployed vs. Non-deployed
  - Older vs. Younger
  - Officer vs. Enlisted
  - White vs. African American

<table>
<thead>
<tr>
<th>Sample Frame Characteristic</th>
<th>Web</th>
<th>Mail</th>
<th>CATI</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>3,072</td>
<td>80.7</td>
<td>7,783</td>
<td>79.7</td>
</tr>
<tr>
<td>Female</td>
<td>736</td>
<td>19.3</td>
<td>1,960</td>
<td>20.3</td>
</tr>
<tr>
<td>Deployment Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deployed</td>
<td>2,209</td>
<td>58.0</td>
<td>5,443</td>
<td>56.4</td>
</tr>
<tr>
<td>Not Deployed</td>
<td>1,599</td>
<td>42.0</td>
<td>4,200</td>
<td>43.6</td>
</tr>
<tr>
<td>Service Branch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Force</td>
<td>582</td>
<td>15.3</td>
<td>1,161</td>
<td>12.0</td>
</tr>
<tr>
<td>Army</td>
<td>2,236</td>
<td>58.7</td>
<td>6,394</td>
<td>66.3</td>
</tr>
<tr>
<td>Marine</td>
<td>421</td>
<td>11.1</td>
<td>941</td>
<td>9.8</td>
</tr>
<tr>
<td>Navy</td>
<td>569</td>
<td>14.9</td>
<td>1,147</td>
<td>11.9</td>
</tr>
<tr>
<td>Service Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Duty</td>
<td>1,705</td>
<td>44.8</td>
<td>3,551</td>
<td>36.8</td>
</tr>
<tr>
<td>Reserve</td>
<td>1,244</td>
<td>32.7</td>
<td>3,284</td>
<td>34.1</td>
</tr>
<tr>
<td>National Guard</td>
<td>859</td>
<td>22.6</td>
<td>2,808</td>
<td>29.1</td>
</tr>
</tbody>
</table>
### Results

#### Table I: Weighted prevalence and adjusted odds ratios for self-reported medical conditions in Gulf War and Gulf Era Veterans

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gulf (n=8,104) (%)</th>
<th>Gulf Era (n=6,148) (%)</th>
<th>aOR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Multisymptom Illness</td>
<td>43.9</td>
<td>20.3</td>
<td>3.06 (2.78, 3.83)</td>
</tr>
<tr>
<td>Migraine Headache</td>
<td>20.3</td>
<td>16.1</td>
<td>1.30 (1.15, 1.47)</td>
</tr>
<tr>
<td>Gastritis</td>
<td>20.2</td>
<td>14.3</td>
<td>1.59 (1.35, 1.73)</td>
</tr>
<tr>
<td>Irritable Bowel Syndrome</td>
<td>13.8</td>
<td>9.1</td>
<td>1.65 (1.41, 1.94)</td>
</tr>
<tr>
<td>Chronic Fatigue Syndrome</td>
<td>11.8</td>
<td>5.3</td>
<td>2.36 (1.94, 2.86)</td>
</tr>
<tr>
<td>Asthma</td>
<td>10.2</td>
<td>9.0</td>
<td>1.22 (1.04, 1.44)</td>
</tr>
<tr>
<td>Neuralgia</td>
<td>9.4</td>
<td>6.3</td>
<td>1.65 (1.40, 1.95)</td>
</tr>
<tr>
<td>Chronic Obstructive Pulmonary Disorder</td>
<td>8.4</td>
<td>6.3</td>
<td>1.48 (1.23, 1.78)</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>8.1</td>
<td>5.9</td>
<td>1.47 (1.20, 1.79)</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>3.7</td>
<td>2.9</td>
<td>1.48 (1.15, 1.91)</td>
</tr>
<tr>
<td>Multiple Sclerosis</td>
<td>0.6</td>
<td>0.5</td>
<td>1.35 (0.72, 2.51)</td>
</tr>
<tr>
<td>Brain Cancer</td>
<td>0.3</td>
<td>0.3</td>
<td>1.02 (0.47, 2.21)</td>
</tr>
<tr>
<td>Amyotrophic lateral sclerosis</td>
<td>0.1</td>
<td>0.05</td>
<td>4.32 (0.82, 21.74)</td>
</tr>
</tbody>
</table>

Models adjust for age, race, gender, BMI, smoking, service branch, and unit component.

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### Results

#### Table II: Weighted prevalence and adjusted odds ratios for a positive screen of mental health conditions in Gulf and Gulf Era Veterans

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gulf (n=8,104) n (%)</th>
<th>Gulf Era (n=6,148) n (%)</th>
<th>aOR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD</td>
<td>20.9</td>
<td>11.5</td>
<td>1.93 (1.67, 2.24)</td>
</tr>
<tr>
<td>Major Depressive Disorder</td>
<td>33.5</td>
<td>21.3</td>
<td>1.75 (1.54, 2.00)</td>
</tr>
<tr>
<td>Other Depressive Disorder</td>
<td>48.2</td>
<td>40.3</td>
<td>1.32 (1.19, 1.46)</td>
</tr>
<tr>
<td>Anxiety Disorder</td>
<td>18.6</td>
<td>14.4</td>
<td>1.34 (1.17, 1.54)</td>
</tr>
</tbody>
</table>

Adjusted models control for age, race, gender, service branch and unit component.
# Results

Table III. Weighted prevalence of selected symptoms in past 12 months by Gulf and Gulf Era Veterans with self-reported lifetime CMI

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Gulf (%)</th>
<th>Gulf Era (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint aching/pain</td>
<td>88.0</td>
<td>87.4</td>
</tr>
<tr>
<td>Unrefreshing sleep</td>
<td>86.3</td>
<td>80.3</td>
</tr>
<tr>
<td>Stiffness in joints</td>
<td>82.1</td>
<td>80.9</td>
</tr>
<tr>
<td>Generalized muscle aching</td>
<td>79.6</td>
<td>74.9</td>
</tr>
<tr>
<td>Headaches</td>
<td>73.1</td>
<td>65.9</td>
</tr>
<tr>
<td>Trouble finding words</td>
<td>64.8</td>
<td>58.0</td>
</tr>
<tr>
<td>Problems with coughing</td>
<td>39.9</td>
<td>38.5</td>
</tr>
<tr>
<td>Wheezing in chest</td>
<td>38.7</td>
<td>34.4</td>
</tr>
<tr>
<td>Fever/chills</td>
<td>35.4</td>
<td>32.0</td>
</tr>
</tbody>
</table>

Table IV: Weighted cases of self-reported brain cancer by service branch and deployment status

<table>
<thead>
<tr>
<th>Service Branch</th>
<th>Cases in Gulf Veterans</th>
<th>Cases in Gulf Era Veterans</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Force</td>
<td>124</td>
<td>0</td>
<td>124</td>
</tr>
<tr>
<td>Army</td>
<td>1073</td>
<td>1035</td>
<td>2108</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>278</td>
<td>1014</td>
<td>1292</td>
</tr>
<tr>
<td>Navy</td>
<td>534</td>
<td>449</td>
<td>983</td>
</tr>
<tr>
<td>Total</td>
<td>2009</td>
<td>2498</td>
<td>4507</td>
</tr>
</tbody>
</table>

Table V: Weighted cases of self reported brain cancer in Gulf War Army Veterans with and without exposure to Khamisiyah*

<table>
<thead>
<tr>
<th></th>
<th>Khamisiyah Exposed</th>
<th>Khamisiyah Unexposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain Cancer</td>
<td>27 (0.027)</td>
<td>984 (.47)</td>
</tr>
</tbody>
</table>
Neurological and all-cause mortality among U.S. Veterans of the Gulf War: 20-year follow-up
Shannon K. Barth, MPH
Principal Investigator
Post-Deployment Health Epidemiology Program
Office of Public Health

Objectives

• To determine the vital status of a cohort of Gulf War (GW) and GW Era Veterans through 2011.

• To determine cause of death among GW and GW Era Veterans.

• To compare mortality rates between GW and GW Era Veterans.

• To determine the association between neurological and other cause-specific deaths and military, exposure, and demographic characteristics.
Background

- 20-year follow up of mortality among GW Veterans compared to GW Era Veterans
  - All-cause mortality
  - Focus on neurological deaths
    - ALS (amyotrophic lateral sclerosis)
    - MS (multiple sclerosis)
    - Parkinson’s disease
    - Brain cancer
- This cohort was previously followed-up at 2, 7, and 13 years

Measures

- Dependent variables:
  - All causes of death
  - Disease-related causes (infectious and parasitic diseases, all cancers, diseases of circulatory system, respiratory system, digestive system, neurological diseases)
  - External causes (motor vehicle accidents, suicide, homicide)
- Independent variables:
  - Demographic and military characteristics (date of birth, race, sex, branch of service, unit component)
  - Potential nerve gas exposure at Khamisiyah among Army GW veterans (1 day, 2 or more days, not exposed)
  - Potential oil well fire smoke exposure among Army GW veterans (considered exposed if at least 0.26 mg/m³ of total suspended particulate)
Methods

• Update vital status through December 31, 2011 using National Death Index (NDI) data.

• Determine ICD-9 or ICD-10 cause of death using NDI data.

• Crude mortality rates calculated per 10,000 person years.

• Cox proportional hazard models used to calculate adjusted rate ratios (aRR) and 95% confidence intervals (95% CI) for cause-specific mortality while controlling for potential confounding variables.

Results- All Causes

<table>
<thead>
<tr>
<th>Underlying cause of death</th>
<th>GW (n=621,901)</th>
<th>GW Era (n=746,247)</th>
<th>aRRb</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>ratea</td>
<td>n</td>
<td>ratea</td>
</tr>
<tr>
<td>Total</td>
<td>21,163</td>
<td>16.65</td>
<td>29,396</td>
<td>19.36</td>
</tr>
<tr>
<td>Disease related</td>
<td>12,903</td>
<td>10.15</td>
<td>20,299</td>
<td>13.37</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>728</td>
<td>0.57</td>
<td>1,196</td>
<td>0.79</td>
</tr>
<tr>
<td>Cancers</td>
<td>3,955</td>
<td>3.11</td>
<td>6,422</td>
<td>4.23</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>556</td>
<td>0.44</td>
<td>970</td>
<td>0.64</td>
</tr>
<tr>
<td>Digestive diseases</td>
<td>822</td>
<td>0.65</td>
<td>1,160</td>
<td>0.76</td>
</tr>
<tr>
<td>Circulatory system diseases</td>
<td>4,407</td>
<td>3.47</td>
<td>6,640</td>
<td>4.37</td>
</tr>
<tr>
<td>External</td>
<td>8,050</td>
<td>6.33</td>
<td>8,883</td>
<td>5.85</td>
</tr>
<tr>
<td>Motor vehicle</td>
<td>2,708</td>
<td>2.13</td>
<td>2,800</td>
<td>1.84</td>
</tr>
<tr>
<td>Suicide</td>
<td>2,477</td>
<td>1.95</td>
<td>2,844</td>
<td>1.87</td>
</tr>
<tr>
<td>Homicide</td>
<td>880</td>
<td>0.69</td>
<td>959</td>
<td>0.63</td>
</tr>
</tbody>
</table>

*a Crude death rate per 10,000 person years
*b Models control for race, sex, age, branch of service, unit component
Results - Neurological Causes

<table>
<thead>
<tr>
<th>Underlying cause of death</th>
<th>GW (n=621,901)</th>
<th>GW Era (n=746,247)</th>
<th>aRR&lt;sup&gt;b&lt;/sup&gt;</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain cancer</td>
<td>306</td>
<td>0.24</td>
<td>458</td>
<td>0.3</td>
</tr>
<tr>
<td>ALS</td>
<td>88</td>
<td>0.07</td>
<td>141</td>
<td>0.09</td>
</tr>
<tr>
<td>MS</td>
<td>31</td>
<td>0.02</td>
<td>48</td>
<td>0.03</td>
</tr>
<tr>
<td>Parkinson's Disease</td>
<td>15</td>
<td>0.01</td>
<td>38</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<sup>a</sup> Crude death rate per 10,000 person years

<sup>b</sup> Models control for race, sex, age, branch of service, unit component

Oil well fire smoke and nerve gas at Khamisiyah exposures among Army Gulf War veterans

- 322,249 Army GW Veterans total
- Exposure to nerve gas at Khamisiyah
  - 84,328 exposed for 1 day
  - 14,078 exposed for 2 or more days
- Oil well fire smoke exposure
  - 123,478 exposed
- Approximately 13% of Army GW Veterans were exposed to both oil well fire smoke and nerve agents at Khamisiyah
Results – Neurological Deaths among Army Gulf War Exposed Groups

Adjusted rate ratios (aRR) estimated from the proportional hazard models relating various combinations of variables of potential risk factors to brain cancer among Army Gulf War Veterans

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimated model, aRR, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil well fire smoke exposure vs. not exposed</td>
<td>1.36 (0.96, 1.91) b 1.65 (0.86, 3.18)</td>
</tr>
<tr>
<td>Khamisiyah, 1 day of exposure vs. not exposed</td>
<td>b 1.22 (0.86, 1.73) b 1.60 (0.80, 3.20)</td>
</tr>
<tr>
<td>Khamisiyah, 2 days + of exposure vs. not exposed</td>
<td>b 1.35 (0.95, 1.92) b 1.42 (0.93, 2.19)</td>
</tr>
</tbody>
</table>

* All models control for sex, race, type of unit, and age
b Indicates variable not included in the model

Summary

- No difference in mortality risk among GW and GW Era Veterans at 20 year follow up.
- GW Veterans had statistically significantly lower risk of death due to all disease related causes and infectious diseases compared to GW Era Veterans.
- GW Veterans had statistically significantly high risk of death due to motor vehicle accidents compared to GW Era Veterans.
- No increased relative risk of neurological diseases among GW vs GW Era Veterans.
- The findings from the 13-year follow up (2004) that Army Gulf War Veterans who were exposed to nerve agents at Khamisiyah (2+ days) or oil well fire smoke had greater risk of brain cancer are no longer statistically significant at the 20-year follow up
  - Increased number of brain cancer deaths among non-exposed groups
  - Increased number of person-years in the denominator
Future Planned Analyses

Robert Bossarte, PhD
Director, Epidemiology Program

September 22, 2014

Future Planned Analyses – Clinical and Administrative Data

- Routine reporting on patterns of health care utilization and diagnoses among Gulf War (GW) and GW Era Veterans.
- Characterization of patients with multiple poorly defined symptoms/illnesses and high service utilization.
- Incidence of cancer among GW and GW Era Veterans using data from VA and state tumor registries.
- Patterns of morbidity among Veterans exposed to Khamisiyah or smoke from oil well fires.
- Patterns of morbidity among Veterans with self-report of CMI.
Future Planned Analyses – GW Survey

- Cross-sectional
  - Symptom characterization of Veterans with CMI
  - Comparison of health with Operation Enduring Freedom/Operation Iraqi Freedom Veteran cohort (New Generation Study)
  - Complementary and Alternative Medicine for CMI
- Longitudinal
  - Gulf War environmental/chemical exposures and disease incidence
    - CMI
    - Neurological Illness (ALS, brain cancer, migraines, Parkinson’s, MS)
  - Longitudinal course of PTSD as predictor of chronic health conditions
  - Disease incidence and persistence over time
  - CMI symptom reporting over time

Future Planned Analyses – Mortality

- Annual updates for leading causes of death among GW and GW Era Veterans by age group and sex.
- Continued updates of analyses of mortality among GW and GW Era Veterans.
- Medical records validation of neurological mortality.
- Continued analyses for populations with indication of increased risk including Veterans exposed at Khamisiyah.
- Time dependent models of cancer risk.
Summary and Discussion

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Director, Epidemiology Program

September 22, 2014

Development of Common Data Elements

- The Epidemiology Program has proposed to convene an expert panel to develop recommendations for a common core of elements for sponsored studies.
- The goal of this effort is to identify essential measures of exposures encountered during military service and health.
- When implemented, a common core of measures would:
  - Allow for comparability across time and population on key indicators of exposure and health.
  - Provide a mechanism for standardized measurement across studies.
- The proposal requests support to convene a panel of experts and an external review of recommendations by an objective third party with documented expertise in Veterans health and measurement.
IOM Study of MS and Other Neurologic Disorders

- The Office of Public Health (OPH) has continued efforts to identify a mechanism that would satisfy legislative requirements for a study of MS and other neurologic disorders among Gulf War Veterans.
- OPH has been working with IOM to inventory data and other resources that could be made available to a study committee if requested.
- IOM has proposed a study designed to assess risk for MS and other neurological disorders among Gulf War Veterans.
- The anticipated cost of the proposed effort is ~3 million with a project duration of ~3 years.

Questions

- Would a quarterly report of GW Veteran Diagnoses and Healthcare Utilization contribute to research?
  - If so, are there other elements that should be added?
- Are there other research priorities that can be addressed using clinical or administrative data?
- Are there other studies of CMI that should be prioritized using available data?
- Are there other studies of cancer (particularly brain cancer) that should be considered?
  - Should VA studies of cancer incidence include data from available state registries or should they be limited to information available from VA?
- Should there be a fourth wave of the GW Survey?
Gulf War Roster Service Use Summary

- A large proportion of Veterans included in the Gulf War and Gulf War Era Roster have a history of VHA service use (46% & 36% respectively).
- Gulf War Veterans who used VHA services were more likely to be younger (age 59 years or less), have served in the Army and have been enlisted than all Veterans included in the larger Gulf War Veteran Roster.
- Gulf War Era Veterans who used VHA services were also more likely to be younger (age 59 years or less), have served in the Army and have been enlisted than all Veterans included in the Gulf War Roster.
VHA Administrative Data

- Administrative data provide a mechanism for assessing the prevalence and incidence of diagnoses and service utilization among Veterans who use Veterans Health Administration (VHA) services.
- The following results from analyses of VHA administrative data are preliminary and presented for discussion of potential research applications.
- These data cannot be used to test for differences and different results may be obtained using alternate algorithms for identifying diagnoses.

GW Roster Veterans With Use of VHA Services by Year (N=286,993)
GW Era Roster Veterans With Use of VHA Services by Year (N=269,635)

Characteristics of Gulf War Era Veterans & Gulf War Era Veterans Who Used VHA Services
Most Common Diagnoses among Gulf War and Gulf War Era Veterans Diagnosed With A Mental Disorder, FY 2002- FY 2013

GW Veterans (Diagnosis, Within Category Percentage)
1. Adjustment disorder, 52.4%
2. Non-dependent abuse of drugs, 51.0%
3. Depressive disorder NOS, 48.5%
4. Anxiety, dissociative, somatofom disorders, 37.9%
5. Episodic mood disorders, 30.6%
6. Alcohol dependence syndrome, 16.8%
7. Sexual, gender identity disorders, 15.5%
8. Drug dependence, 9.8%
9. Special symptoms or syndromes NOS, 8.9%
10. Personality disorders, 5.3%

GW Era Veterans (Diagnosis, Within Category Percentage)
1. Nondependent abuse of drugs, 49.5%
2. Depressive disorder NOS, 46.1%
3. Adjustment disorder, 39.5%
4. Anxiety, dissociative, somatofom disorders, 35.3%
5. Episodic mood disorders, 29.6%
6. Sexual, gender identity disorders, 16.7%
7. Alcohol dependence syndrome, 14.7%
8. Drug dependence, 8.8%
9. Special symptoms or syndromes NOS, 8.1%
10. Delirium due to conditions classified elsewhere, 5.3%

GW Veterans n=157,277, GW Era Veterans n=156,772

Most Common Diagnoses among Gulf War and Gulf War Era Veterans Diagnosed Infectious and Parasitic Disease, FY 2002- FY 2013

GW Veterans (Diagnosis, Within Category Percentage)
1. Dermatophytosis, 46.9%
2. Other diseases due to virus, Chlamydia, 13.0%
3. Herpes simplex, 9.2%
4. Viral hepatitis, 8.9%
5. Bacterial infection in conditions classified elsewhere, unspecified site, 8.8%
6. Dermatomyositis NOS, 6.5%
7. Viral, chlamydial infection in conditions classified elsewhere, unspecified site, 6.0%
8. Candidiasis, 5.1%
9. Herpes zoster, 4.5%
10. Other venereal diseases, 3.4%

GW Era Veterans (Diagnosis, Within Category Percentage)
1. Dermatophytosis, 46.0%
2. Other diseases due to virus, Chlamydia, 12.6%
3. Herpes simplex, 9.8%
4. Viral hepatitis, 9.4%
5. Streptococcus infection in conditions NOS and of unspecified site, 8.6%
6. Candidiasis, 7.0%
7. Viral, chlamydial infection in conditions classified elsewhere, unspecified site, 6.1%
8. Dermatomyositis NOS, 5.4%
9. Herpes zoster, 5.1%
10. Other venereal diseases, 3.0%

GW Veterans n=63,096, GW Era Veterans n=58,721
Background

- Health Findings: Gulf War Veterans reported higher prevalence of
  - Functional Impairment
  - Healthcare utilization
  - Wide variety of symptoms
  - Serious chronic health conditions
  - Lower perception of general health
  - Miscarriage (female Veterans and female partners of male Veterans)
  - Birth defects among live born infants (female Veterans and female partners of male Veterans)

*Kang et al, 2000 (JOEM)*
Background

• Longitudinal Health Study of Persian Gulf War Era Veterans (2003-2005)
  – Panel of 30,000 Gulf War and Gulf War Era Veterans were recontacted
  – 14 years after deployment, Gulf War Veterans continued to report significantly higher rates of many adverse health outcomes compared with Gulf War Era Veterans including:
    • Unexplained multi-symptom illness
    • Chronic fatigue-like illness
    • Posttraumatic stress disorder
    • Functional impairment
    • Health care utilization
    • Majority of selected physical and mental conditions

Kang et al, 2009 (JOEM)

Domains

• Survey Instrument
  – Military service
  – General health
  – Chronic multisymptom illness
  – Cancers
  – Liver dysfunction
  – GI disturbance
  – Endocrine disorders
  – Autoimmune conditions
  – Neurological conditions
  – Amyotrophic lateral sclerosis
  – Functional health
  – Post traumatic stress disorder
  – Exercise
  – Alcohol use
  – Tobacco Use
  – Complementary and alternative medicine (CAM)
  – Women’s health
  – Demographics
  – Health care utilization
  – Medication use
Cohort description

• GW: 621,902 U.S. Veterans who were in the Persian Gulf during the time period of the armed conflict (August 1, 1990 - March 1, 1991)

• GW Era Veterans: 746,248 veterans from a stratified random sample of all military personnel (active duty, reserves or National Guard) who served during the GW but were not in theater.

Results

• 21,163 deaths among GW Veterans.

• 29,396 deaths among GW Era Veterans.

• GW Veterans are more likely to be male, slightly younger, and not Reserve or National Guard.

• GW and GW Era Veterans similar in race, branch of service, marital status at deployment.