U.S. Department of Veterans Affairs

Brain Cancer Mortality in Gulf War Veterans: Findings, Challenges, and Next Steps

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Erin K. Dursa, PhD, MPH
Post Deployment Health Services

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"I CARE" Values: Integrity, Commitment, Advocacy, Respect, Excellence

FINDINGS

Since the war, evidence suggests that Gulf War Veterans that were possibly exposed to nerve agents (sarin, cyclosarin, and unknown environmental contaminants) at Khamisiyah had a higher risk of brain cancer mortality compared to those who were not possibly exposed

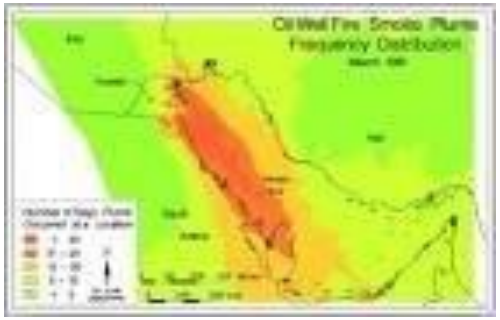
The Gulf War

August 1990 to March 1991

- Remember:
  - The First Gulf War?
  - Persian Gulf War?
  - Desert Storm/Desert Shield (ODSS)?
    - It's all the same war
  - Iraq, Saudi Arabia, Kuwait, UAE, Qatar, Bahrain, Oman
- At the time, it was the largest in scale/scope since Vietnam
  - The "Mother of all Battles," as Saddam Hussein described it
  - ~ 700,000 US military service members were deployed to the combat theater
  - No official figures for the Iraqi military
    - Estimates for Iraqi troops range from 180,000 - 630,000

Smoke-Oil Exposure and Possible Nerve Gas Exposure

- The troops were “hunkered down” as the air war began on 17 January 1991
- The ground war began 24 February 1991
  - Companies and Battalions reported locations
  - Oil well fires set 17 January 1991
    - Produced large amounts of smoke
    - Issues for
      - Marines near Kuwait
      - Navy sailors patrolling the Persian Gulf
    - Cease-fire April of 1991
- Khamisiyah, a weapons depot
  - Contained sarin nerve agent canisters
  - Destroyed on 10 March 1991
  - Some Service Members were in the path of the projected cloud



FINDINGS

Bullman, et al (2005)

- Compared risk of brain cancer mortality from 1991-2000 among US Army Gulf War Veterans possibly exposed to contaminants at Khamisiyah (n=100,487) to Army Gulf War Veterans not possibly exposed (n=224,980)

- Vital status was ascertained using the VA Beneficiary Identification and Records Locator System (BIRLS) and the Social Security Administration Master File

- Cause of death data was obtained using the National Death Index (NDI) VA Regional Office, or Federal Records Center

FINDINGS

Bullman, et al (2005) cont.

- Data on possible Khamisiyah exposure comes from a model that the Department of Defense (DoD) and Central Intelligence Agency (CIA) developed to estimate the plume area and identify military units possibly exposed

- Follow up began on the date that the Veteran left the Gulf Theatre (alive) and ended on December 31, 2000, or the date of death, which ever came first

- Cox proportional hazard models were used to produce adjusted relative risks
  - Covariates included: exposure, age at entry to follow up, gender, race, rank, unit component

FINDINGS

Bullman, et al (2005)

- Adjusted risk ratio for Army Gulf War Veterans possibly exposed at Khamisiyah for one day was 1.72 (95% CI=0.95, 3.10)

- Adjusted risk ratio for Army Gulf War Veterans possibly exposed at Khamisiyah for two or more days was 3.26 (95% CI= 1.33, 7.96)

FINDINGS

Barth, et al (2009)

- Expanded analysis to include ALL Gulf War Veterans (n= 621,902) and a stratified random sample of those who served during the Gulf War but did not deploy to theatre (n= 746,248)
  - Extended follow up period through 2005
  - Performed subgroup analysis of Khamisiyah cohort
- Cox proportional hazard models were used to calculate adjusted rate ratios (aRR) and 95% confidence intervals (95% CI) for cause-specific mortality while controlling for potential confounding variables:
  - Date of birth, race, marital status during war, gender, military rank, branch of service, deployment date, unit component

FINDINGS

Barth, et al (2009)

- No overall increased risk of brain cancer mortality among Gulf War deployed compared to non-deployed (adjusted risk ratio=0.90, 95% CI=0.73, 1.11)

- Increased risk of brain cancer mortality among Army Gulf War Veterans potentially exposed at Khamisiyah for **two or more days** (adjusted risk ratio=2.71, 95% CI=1.25, 5.87)

FINDINGS

In 2014, a workgroup of experts in oncology, neurology, epidemiology, biostatistics and toxicology was formed to determine a more comprehensive analysis that could be performed with the mortality data through 2011

Manuscript accepted to Cancer Epidemiology

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Challenges in the study of exposure at Khamisiyah

CHALLENGES IN THE STUDY OF EXPOSURE AT KHAMISIYAH

- Dispersion models were used to predict the transport and spread of the chemical agents according to simulated meteorological conditions. The models simulated the potential hazard area (plume) that varied in size and shape from March 10-14, 1991

- Individuals' location was determined by the company's location as this is considered to be more precise than location at the battalion level

- Unit locations based on 855,000 recorded daily locations in the Gulf Theatre

GAO STUDY

- At the request of Congress, the General Accountability Office (GAO) conducted a study between 2002-2004 to determine the validity of the DoD/CIA plume model

- In 2004 GAO released their final report report entitled “Gulf War Illnesses: DoD Conclusions about US Troops Exposure Cannot Adequately Be Supported”

GAO METHODS

- GAO examined the meteorological and dispersion used to model chemical agent releases from demolition
- Evaluated the basis for technical and operational assumptions DOD made in the models
- Evaluated the efforts of the CIA and DOD to collect and develop data that was used for the modeling
- Interviewed DOD, CIA, and Department of Energy modelers and officials involved with the modeling

GAO METHODS

- Interviewed officials from U.S. Army Dugway Proving Ground in Utah to determine how the chemical agents at Khamisiyah could have been released
- Interviewed U.S. Army Center for Health Promotion and Preventive Medicine to determine how units were identified as being exposed
- Interviewed United Nations Monitoring, Verification, and Inspection Commission (UNMOVIC)

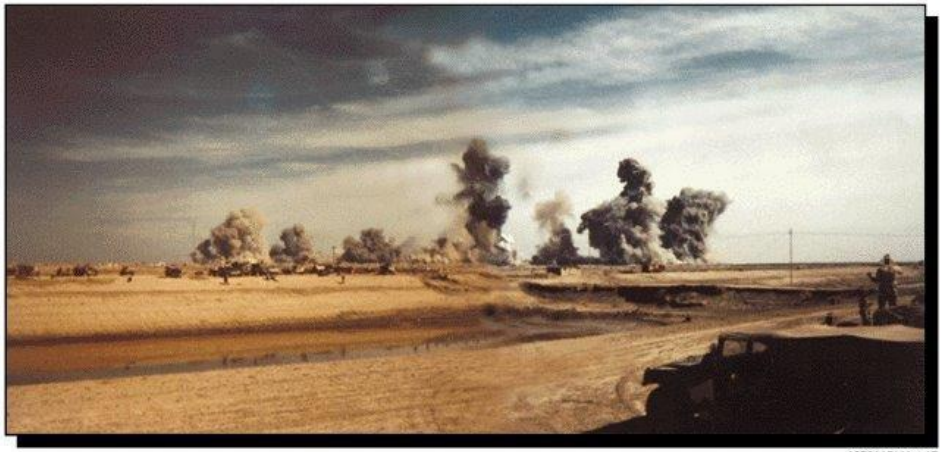

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Figure 5. Demolition of bunkers at Khamisiyah, 4 March 1991.

GAO FINDINGS

1. The models were not fully developed for analyzing long range dispersion of agents as an environmental hazard
2. Assumptions regarding the source data used in the modeling were inaccurate
3. The plume heights were under-estimated
4. Postwar field testing at the U.S. Army Dugway Proving Ground to estimate the source data did not reliably simulate the actual conditions of either the bombings or the demolition at Khamisiyah
5. Wide variance in results among the individual models DoD selected, as well as in the DoD and non-DoD models, with regard to the size and path of the plume and the extent to which troops were exposed

GAO RECOMMENDATIONS

1. Recommended that the Khamisiyah plume model not be used for any more epidemiological studies of Gulf War Veterans

   VA concurred with this recommendation- DoD and CIA did not concur

2. Recommended that Secretary of Defense require no additional plume modeling of Khamisiyah and other sites

   DoD concurred with this recommendation

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Next Steps

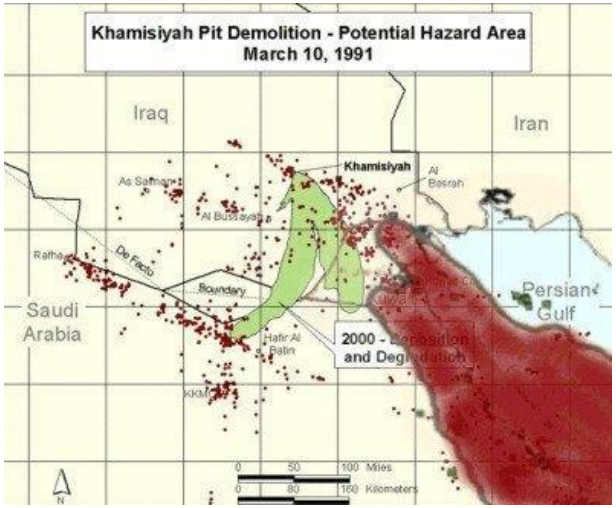
NEXT STEPS

- IOM has referred to the GAO's report of the Khamisiyah plume model in two recent reports when making a determination about the relationship between deployment to the Gulf War and brain cancer

- Use of the Khamisiyah model may limit the strength of the findings

NEXT STEPS

- The Khamisiyah plume model is the only source of information on exposure available from DoD to researchers and clinicians
- Self-report?
- Future using Khamisiyah plume model?
- Future brain cancer analyses?



NEXT STEPS

http://www.gulflink.osd.mil/

NEXT STEPS


Delta Company 6th/6th Infantry, 1st Armored Division


City View, NC; 2015