

APPENDIX B

B-1 - APA Abstracts

AMERICAN PSYCHOLOGICAL ASSOCIATION ABSTRACTS

PERSIAN GULF WAR VETERANS HEALTH COMPLAINTS: PSYCHOLOGICAL STUDIES

White RF.

Since the return of military personnel from the Persian Gulf War, there have been consistent reports that PGW veterans suffer from a variety of symptoms. In many cases, physical examinations reveal no explanations for these self-reported symptoms. No case definition of any syndrome or specific constellation of symptoms has been agreed upon among scientists or clinicians working with this population to date. However, the phenomenon has become known in the popular press as "Gulf War Syndrome". In order to pursue scientific research exploring this phenomenon, the Department of Veterans Affairs established three Environmental Hazards Centers. This symposium focuses on the work and findings of psychologists in the three Centers.

Fatiguing Illness and the Gulf War Veteran: The New Jersey Environmental Hazards Research Center

Felder N, Lange G, Tiersky L, Deluca J, Policastro T, Kelly-McNeil K, Natelson B.

Preliminary surveys of Persian Gulf veterans revealed a significant prevalence of self-reported fatiguing illness and chemical sensitivities. Sixty-one veterans completed questionnaires of negative affect, life stressors, repression, war-related trauma, self-reports of exposure (e.g. oil-well fires, pesticides), and coping resources. Other medical conditions to account for the fatiguing illness were ruled out. Questionnaire variables are used in a regression model to predict fatigue scores. No significant differences in fatigue scores are noted for veterans with and without Axis I psychiatric disorders. However, measures of combat-related stress show significant relationships with fatigue scores.

GULF WAR ILLNESS IS A HETEROGENEOUS DISORDER

Lange G, Tiersky L, Scharer J, Fielder N, Pollet C, Morgan J, Deluca J, Natelson B.

Gulf War Illness (GWI) is a collection of explained physical, psychological, and cognitive symptoms often attributed to post-war psychological sequelae. In an effort to reduce the psychiatric heterogeneity of Gulf Veterans (GV) we attempted to stratify them along number, type, and onset of DSM-III-R disorder. Twenty-one Gulf Veterans without (NoSx) and 40 subjects with GWI (Sx) as defined within our study, were administered a psychiatric interview. Overall, the general frequency of Axis I disorder, number of multiple diagnoses, and number of diagnoses since return from the Gulf Wars was greater in the Sx than the NoSx GV group.

HEALTH STATUS OF PERSIAN GULF WAR VETERANS: SELF-REPORTED HEALTH SYMPTOMS

Proctor SP, White RF, Wolfe J, Heeren T, Sullivan M, Davis JD, Vasterling J, Sutker P.

Persian Gulf War (PGW) veterans have experienced adverse post-war changes in health. Few studies have compared the prevalence of PGW veterans' symptoms to that of a non-Gulf-deployed cohort. The Boston Environmental Hazards Center's research on PGW veterans' health status involves two cohorts of Persian Gulf-deployed (PG_D) and a group of Germany-deployed (G_D) veterans recruited to complete two types of questionnaires, neuropsychological test battery, environmental interview, and psychological diagnostic interviews. This presentation focuses on self-reported health symptom data obtained from a 52 symptom checklist. Overall, the prevalence of reported symptoms in the PG-D groups exceeded reporting by the G-D cohort. The two PG-D veterans' cohorts displayed similar rates of symptom reporting, with

muscle twitching, skin rashes, and difficulty learning new material exhibiting some of the highest prevalence ratios (PRs). The effects of psychological/psychiatric disorders and stress on symptom reporting will be discussed.

HEALTH STATUS OF PERSIAN GULF WAR VETERANS: NEUROPSYCHOLOGICAL TEST FINDINGS

Krengel M, White RF, Proctor SP, Wolfe J, Heeren T, Sullivan M, Davis JD, Vasterling J, Stucker P.

Substantial numbers of Persian Gulf War (PGW) veterans report memory impairment, difficulty maintaining attention, and fatigue. Given these symptoms and reports of potential low level exposure to neurotoxicants, it is hypothesized that PGW veterans would demonstrate neurobehavioral impairments on neuropsychological tests compared to a non-Gulf deployed cohort. The Boston Environmental Hazards Centers; research on PGW veterans' health status involves two cohorts of Persian Gulf-deployed (PG_D) veterans and a group of Germany-deployed (G_D) veterans recruited to compete a study protocol which included health symptom questionnaires, a neuropsychological test battery, and environmental and psychodiagnostic interviews. A group of treatment-seeking PG-D veterans were also studied with the same protocol. This presentation focuses on the neuropsychological test battery results. Comparisons of mean test scores (after adjusting for age, education, and gender differences) between the P-D, G-D, and treatment-seeking groups will be presented. The effect of having a psychological diagnosis and the impact of low-level psychological stress on neuropsychological test performance will be discussed.

EVIDENCE FROM A POPULATION-BASED STUDY OF NEUROBEHAVIORAL AND PSYCHOLOGICAL EFFECTS IN PERSIAN GULF VETERANS WITH UNEXPLAINED SYMPTOMS

Storzbach D, Campbell K, Anger HW, Binder LM, Rohlman DS, McCauley L, Kovera CA, Davis KL.

Randomly-selected veterans of the 1991 Persian Gulf War were sent questionnaires regarding symptoms associated with Persian Gulf service. Following extensive medical evaluation, veterans with persistent cognitive/psychological, gastrointestinal, dermatologic, fatigue, or muscle and joint-pain symptoms beginning during or after Gulf services were classified as symptomatic "Cases" or asymptomatic "Controls". In this ongoing study, Cases studied to date differ significantly from Controls on a broad range of psychological tests indicative of increased distress, including measures of PTSD. Health symptoms, personality, and psychopathology, and on neurobehavioral tests of memory, attention, and response speed.

LINKED BEHAVIORAL AND PSYCHOLOGICAL ASSESSMENTS OF PERSIAN GULF VETERANS: DEVELOPMENT AND RELIABILITY OF THE COMPUTERIZED BARS AND HSS TESTING SYSTEM

Rohlman DS, Anger KA, Campbell LM, Binder LM, Kovera CA, Storzbach D, Davis KL, Faring-Grund L.

A series of 12 psychosocial and 6 behavioral performance tests is being administered to veterans of the 1991 Gulf War at the Portland Environmental Health Research Center. The are administered during a 4-hr session by two computerized test systems, the Health Screening System (HSS) and the Behavioral Assessment and Research system (BARS). This battery of tests is administered to up to 8 people at a time by a single Research Assistant. The test-retest reliability of the 18 test administered in the 4-hr battery described here was determined in 30 people. Reliability coefficients were comparable to published values.

APPENDIX B

B-2 - APHA Abstracts

AMERICAN PUBLIC HEALTH ASSOCIATION ABSTRACTS

DEMOGRAPHIC CHARACTERISTICS ASSOCIATED WITH PARTICIPATION IN PERSIAN GULF WAR HEALTH REGISTRIES

Gregory C. Gray¹, Anthony W. Hawskworth¹, Tyler C. Smith¹, Han K. Kang², and James D. Knoke¹.

¹Naval Health Research Center, San Diego, CA; ²The Department of Veterans Affairs, Washington, DC.

The Department of Veterans Affairs (VA) and the Department of Defense (DoD) established Persian Gulf War health registries to document, diagnose, and treat the symptoms of Gulf War veterans (GWVs). Using traditional univariate procedures and multiple logistic regression analyses, we examined demographic and operational characteristics associated with participation in these registries. GWVs who were registry participants as of mid-1996 (n=62,246) were compared with GWVs who had not participated in either registry (n=575,989). Service branch and type were strongly related to registry participation with Army [adjusted odd ratio (OR)=4.6; 95% confidence interval (CI)=4.4-4.8] and guard personnel (OR=2.1; 95% CI=2.0-2.2) most likely to participate compared to reference category personnel. Registry participants were also more likely to be older, married, female, to have been hospitalized before the war, to have been medical workers, to have separated from the military, and to have served in the Gulf for more than 90 days. If registry participation is viewed as a surrogate for Gulf War related illnesses, these characteristics may be valuable in investigating etiologic hypotheses.

HOSPITALIZATION RISK AFTER POSSIBLE EXPOSURES TO IRAQI CHEMICAL MUNITIONS DESTRUCTION DURING THE PERSIAN GULF WAR

Gregory C. Gray, Tyler C. Smith, Anthony W. Hawskworth, James D. Knoke. Naval Health Research Center, San Diego, CA.

It has been postulated that subclinical exposures to nerve agents may later cause chronic disease. We compared the postwar hospitalization experience of 19,852 regular active-duty Army Gulf War veterans (GWVs) who were within 50 km of the destruction of nerve agent munitions at Khamisiyah, Iraq (Kh+), during the period 2-14 March 1991, with that of 239,812 regular active-duty Army Gulf War veterans who were outside of the 50-km radius of Khamisiyah (Kh-). Using univariate and multivariate Cox proportional hazards modeling, Department of Defense hospital data from 1 February 1991 to 30 September 1995 were examined for these veterans. Adjusting for gender, age, occupational category, race/ethnicity, paygrade, marital status, length of service, and prewar hospitalization, Kh+ veterans had significantly higher relative risk (RR) of hospitalization for any cause (RR = 1.11; 95% Confidence Interval [CI] 1.08-1.15) compared with Kh- veterans. Kh+ veterans were also at higher risk of being hospitalized for 6 of 16 major ICD-9-CM categories, compared with their peers. A number of frequent specific diagnosis in these 6 categories may be attributed to the occupational hazards of Kh+ veterans (e.g. Airborne service), however, other most frequent specific diagnosis are unexplained.

CROSS-SECTIONAL STUDY OF GULF WAR VETERANS WITH NEUROLOGICAL DIAGNOSES

Barbra L. Eaton, PhD; MAJ Erik J. Kobylarz, MD, PhD; MAJ Charles D. Magruder, MD, MPH. Deployment Surveillance Team, Office of the Assistant Secretary of Defense for Health Affairs and Neurology Service, Darnall Army Hospital, Ft. Hood, Texas.

During the Gulf War, U.S. Armed Forces experienced remarkably low morbidity and mortality. Some veterans have, however, reported persistent post-war symptoms which they believe are related to their wartime experiences. DoD provides prioritized access to an in-depth medical examination in which one to seven diagnoses are assigned to such veterans eligible for care through the Military Health Services System. In this cross-sectional study, 16,496 veterans who completed the evaluation and were assigned at

least one diagnosis other than “normal exam” were divided into two analysis groups: (1) 3,197 participants who had been assigned at least one diagnosis of a disease of the nervous system or sense organs (ICD-9-CM range 320-389), and (2) 13,299 participants who had been assigned no diagnoses in that category. When odds ratios (OR) are calculated to compare the first group to the second, there are small but statistically significant positive associations with concurrent diagnoses in the following categories: neoplasms (OR=1.42), mental disorders (1.08), circulatory system diseases (1.22), respiratory system diseases (1.12), digestive system diseases (1.10) and musculoskeletal system and connective tissue diseases (1.18). Statistically significant negative associations are found for concurrent diagnoses in skin and subcutaneous tissue diseases (0.87); symptoms, signs, and ill-defined conditions (0.78); and a normal exam V65.5 (0.33). There are also small demographic differences between the two groups. These findings and their implications as well as those of on-going additional analyses will be presented.

EXAMINATION OF VA OUTPATIENT VISITS AMONG PERSIAN GULF VETERANS AND SELECTED CONTROLS

N.A. Dalager, H.K. Kang. Department of Veterans Affairs, Washington, DC.

Among the 700,000 troops deployed to the Persian Gulf (PG) theater from August 1990 through July 1991, nearly 192,000 (27%) veterans have made almost 1.8 million outpatient visits to VA medical facilities through the end of fiscal year 1996. While the VA PG Health Examination Program can account for some 60,000 of those veterans who have been seen in VA as outpatients, the reasons for the balance of those veterans' use of VA facilities has not been available. The Environmental Epidemiology Service has been routinely reviewing computerized inpatient files for patterns of hospitalization among PG War veterans. However, computerization of diagnostic information related to outpatient visits has only recently been initiated in VA. To examine the health complaints of PG veterans which are not serious enough to require hospitalization, we have developed an alternative approach. The computerized outpatient record does capture up to 15 different clinics where the veteran is scheduled for appointments. These analyses will examine the patterns of clinic visits (type and frequency) among PG veterans compared to those of a cohort of PB era veterans previously identified as controls for our PG Mortality Study. A sample of clinics of interest would include the pain clinic, alcohol treatment and/or counseling, dermatology, nuclear medicine (oncology), various psychiatric clinics, neurology, and the rheum/arthritis clinic which would target the patterns of symptoms frequently reported by PG veterans.

RESPIRATORY DIAGNOSES (RD) AND EXPOSURE TO OIL WELL FIRES (OWF) AMONG GULF WAR VETERANS (GWV)

David N. Cowan, Greg Anders, Jack Heller, Warren Wortman, Chris Weir, Jeff Kirkpatrick, Jackie Howard, Jeff McQueen, Roland Draxler. Department of Defense Deployment Surveillance Team; Brooke Army Medical Center; US Army Center for Health Promotional Preventive Medicine (CHPPM); National Oceanic and Atmospheric Agency, Atmospheric Research Laboratory (ARL).

Background: In February 1991 Iraqi forces torched hundreds of oil wells, creating a super-plume of smoke passing over many US units. Since then, many GWVs have complained of illnesses which they relate to their war exposures, including OWFs. **Methods:** Nearly 30,000 GWVs have participated in the Comprehensive Clinic Evaluation Program (CCEP), providing health data. Exposure to OWF will be estimated from unit locations and dispersion modeling. Location of the unit of assignment is tracked on a daily basis. Dispersion modeling is being conducted by ARL and CHPPM. GWVs (cases) with specified RD were selected from the CCEP population. One control group was selected from the population of GWVs who did not participate in the CCEP. Separate analyses will be conducted for each set of controls. **Results:** Among cases and CCEP controls there is a statistically significant association between self-reported OWF exposure and RD, with odds ratio = 2. **Discussion:** Analysis indicates a significant association between RD and OWF exposure. Since the exposure was self-reported and not quantified the

association is difficult to interpret. Multivariate evaluation of unit location and dispersion modeling will permit a more objective assessment. Findings to date will be presented.

GOLDENHAR SYNDROME AMONG INFANTS OF GULF WAR VETERANS

Maria Rosario G. Araneta¹, Cynthia A. Moore², Richard S. Onley², Larry D. Edmonds², Jennifer Karcher¹, Colleen McDonough¹, Katia Hiliopoulos¹, Karen Schlangen¹, Gregory Gray¹. ¹Naval health Research Center, San Diego, CA; ²Birth Defects and Genetic Diseases Branch, Centers for Disease Control and Prevention, Atlanta, GA.

Reports in the popular press described the occurrence of Goldenhar syndrome (GS) among children of Gulf War veterans (GWVs). The objective of this investigation was to compare GS rates among infants of GWVs born in military hospitals with rates among infants of nondeployed veterans (NDVs). Infants in the study were limited to those conceived after the GW and born prior to October 1, 1993. Computerized hospital discharge data were reviewed and medical records were evaluated for newborns diagnosed with an abnormality that might be related to GS. Two pediatricians, blinded to the GW status of the infants' parents, reviewed records. An estimated 75,414 infants were conceived after the GW and born in military hospitals during the study period (34,069 infants of GWVs and 41,345 infants of NDVs). Seven infants fulfilled the case criteria (5 infants of GWVs and 2 infants of NDVs). The GS birth prevalence was 14.7 per 100,000 live births (95% CI: 5.4-36.4 per 100,000) among infants of NDVs. However, the difference was not statistically significant (RR: 3.03; 95% CI: 0.63-20.57; p-value: (2-tailed) = 0.26, (1-tailed) = 0.160. The few affected cases and the broad confidence intervals surrounding the relative risk require that these results be interpreted with caution and do not exclude chance as an explanation for these findings.

STRATEGIES TO ACCESS VALIDITY OF SELF-REPORTED EXPOSURES DURING THE PERSIAN GULF WAR

P. Spencer, L. McCauley, S. Joos, M. Lassarev, D. Bourdette.

Research to date in the area of Persian Gulf War Unexplained Illnesses (PGWUI) is heavily dependent on self-reports of exposures in the theater of operations. The Portland Environmental Hazards Research Center (PEHRC) is conducting a population-based case control; study utilizing three specific techniques to measure the magnitude of potential error in self-reports of exposure. While it is impossible to verify many exposures in the Persian Gulf (PG), we are conducting a study utilizing a stratified random sample with purposeful over-sampling of veterans who served in distinct deployment periods associated with specific exposures (i.e. anti-nerve gas pills and anthrax vaccines were only given to troops serving during the combat period; troops serving during the Desert Shield period were exposed to desert conditions and heat, but were not exposed to combat stress). Results of our survey to date will be presented with information on the degree of over-reporting of exposures that can be verified based on the time period served in the PG. We will also report the reliability of self-reported exposures obtained at two points in time (on a survey questionnaire and at the time of clinical evaluation). PGWUI have received much political and scientific attention. Our study design allows the comparison of self-reported exposures in those time periods preceding and following extensive media or particular exposures such as nerve gas or pesticides. These results are useful in the interpretation of findings related to the PGWUI and in the decision of future investigations.

BOSTON ENVIRONMENTAL HAZARDS CENTER: EVALUATION OF ENVIRONMENTAL EXPOSURES AND COGNITIVE FUNCTIONING IN PERSIAN GULF WAR VETERANS

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In light of symptomatology being reported by Persian Gulf War (PGW) veterans (e.g., problems with memory and maintaining attention, difficulty concentrating, fatigue) and the reports of potential low level exposure to neurotoxicant agent exposure, it is hypothesized that PGW veterans would demonstrate neurobehavioral impairments on clinical neuropsychological tests compared to a non-deployed cohort. As part of research being conducted at the Boston Environmental Hazards Center on the health status of Persian Gulf War veterans, two cohorts of Persian gulf-deployed (PG-D) veterans (one group of veterans from the New England area and one from the New Orleans area) and a group of Germany-deployed (G-D) veterans were recruited to complete a study protocol which included two types of questionnaires, a neuropsychological test battery, a structured environmental interview, and psychological diagnostic interview (SCID, CAPS). The neuropsychological test battery was designed to assess abilities across all functional domains (e.g., general academic ability, motor function, visual and verbal memory, visual spatial skills, attention, executive function, mood) and to be completed within w hours. This presentation focuses on the neuropsychological test results, in which we will test several specific a priori hypotheses regarding the specific behavioral effects associated with suspected environmental exposures. Exposure assessment was based on self-reported information of Gulf exposures and of individual troop locations. Comparisons of mean test scores (adjusting for age, education, and gender differences) between the P-D and G-D groups, and results of regression analyses examining certain exposure-effect relationships will be presented. The effect of a psychological diagnosis and the impact of low-level psychological stress on neuropsychological test performance in the study groups will also be evaluated in examining exposure-outcome relationships.

PERSIAN GULF WAR ILLNESSES: VALIDATION OF SELF-REPORTED SYMPTOMS BY CLINICAL EXAMINATION

L. McCauley, S. Joos, D. Bourdette, W. Johnston, A. Barkhuizen, M. Wynn N. Redmond.

Most published reports of health symptoms among Persian Gulf War (PGW) veterans are based upon self reports. Validation of the presence or unexplained nature of symptoms in a standardized manner has rarely been done. We report the results of an ongoing population based case-control study of unexplained illnesses in PGW veterans. Self-reported symptoms from a questionnaire are verified by a comprehensive, standardized clinical examination with examiners blinded to exposure status. A random sample of PGW veterans who listed Oregon or Washington as their home state of record at the time of deployment have been surveyed by questionnaire for the presence of cognitive, fatigue, gastrointestinal, muscle/joint and skin problems. Findings from the first 100 subjects who have completed the clinical examination indicate significant differences between self-reported symptoms and those validated by clinical exam. The positive predictive value of self-report by questionnaire varies across the symptom groups. While in 78% of subjects self-report of cognitive symptoms was confirmed by clinical exam, self-reported gastrointestinal symptoms were confirmed by clinical exam in only 35% of subjects. Differences in self-reported and clinically confirmed symptoms due to finding a clinical explanation for the symptom, resolution of symptom(s) between time of questionnaire and clinical exam, and inadvertent endorsement of the symptom on the questionnaire. Our findings suggest that inappropriate conclusions may be drawn about effects of exposures on health status from data based solely on self-report.

GULF WAR DEPLOYMENT AND SPOUSE ABUSE (SA) AMONG ARMY PERSONNEL

Charley Magruder, David Cowan, Phuong Colquett. Deployment Surveillance Team, US DoD, Office of the Assistant Secretary of Defense for Health Affairs.

Background: A preliminary review indicates that Gulf War deployment may be a risk factor for SA. The goal of this study is to measure the impact of Gulf War deployment on the rates of SA among Army families. Methods: Data have been collected on SA events occurring in military families for nearly 10 years. For the period 1989-1995 these records will be matched with deployment and personnel databases, families of deployed members during a baseline period, during the pre-deployment phase, and post-deployment; and comparisons of rates between deployed and non-deployed persons. Results: Between 1989 and 1995 about 50,000 substantiated cases of SA were identified. Over 60% of cases involved husbands and abusers. 38% of abusers were white, 49% black, and 8% Hispanic. Groupings were similar for men and women, and for victims. Among events where the husband was the abuser, 97% involved physical abuse, and 8% emotional abuse, and drugs were involved in 28%. Findings were similar when wives were the abusers, except that fewer events involved drugs. Analyses utilizing population data will be completed during the summer of 1997 and findings presented at the APHA. Discussion: SA has been recognized as an important public health concern in the US. The unique nature of the military personnel and medical systems permits analyses and insights not possible in the civilian community.

RESEARCH CHALLENGES IN EVALUATING HEALTH EFFECTS OF POTENTIAL CHEMICAL AGENT (CA) EXPOSURE

Patricia A. Koslowe, PhD; Samar DeBakey, MD, MPH; David N. Cowan, PhD, MPH; Barbra L. Eaton, PhD; Roz Tartaglione, MA; Robert Atanda, PhD; MAJ Charles D. Magruder, MD, USA. Deployment Surveillance Team, Office of the Assistant Secretary of Defense for Health Affairs Department of Defense.

In March of 1991, shortly after the cease fire in the Gulf War, US troops in southern Iraq conducted bunker and pit demolitions in a facility know as Khamisiyah. Khamisiyah contained nearly 100 ammunition storage bunkers and covered a 25-square km area. There is evidence that CA weapons were in the pit area and one of the bunkers, though the presence of these was not suspected at the time of the demolition. While there is no evidence of acute illness at the time of the demolition, considerable concern has been raised about the possible long-term effects from this potential exposure. Units that were involved with the actual demolition have been identified as well as other military units that were within a 50 km radius. Preliminary investigations were conducted in which symptoms and diagnoses in participants in the Comprehensive Clinical Evaluation Program (CCEP) who were with demolition units were compared with those in participants from other units. Methodologic challenges related to the identification of an exposed population, identification of an unexposed population, and appropriate health indicators for follow-up will be discussed, as will findings to date.

TESTICULAR CANCER AMONG US PERSIAN GULF WAR VETERANS

James D. Knoke, Gregory C. Gray. Naval Health Research Center, San Diego, CA.

A recent epidemiological study of the postwar hospitalization experience of regular, active-duty male Persian Gulf War veterans (GWVs) found them to have a significantly elevated risk of testicular cancer, compared to nondeployed veterans of the same era (NDVs), during the first five months after the war. The diagnosis of testicular cancer was only one of many diagnoses studied, however, and the significance of the elevated risk was not adjusted for multiple comparisons. We evaluated the hospitalization records of all GWVs (n=514,269) and all NDVs (n=1,204,474) for the first admissions for testicular cancer, from the Gulf War deployment period through March 31, 1996. Using the Cox proportional hazards model for survival with covariates, we found that age and race were significant predictors of hospitalization with testicular cancer, that occupational status was of borderline significance, and deployment status was not

significant, for the 4^{2/3} year period following the conclusion of the war. The survival curves for the two cohorts indicated an increase in risk for GWVs immediately after the war ended, but the cumulative risks 4 years after the conflict for the two groups were not significantly different. Male GWVs who remained on active duty after the war are not at increased risk of hospitalization for testicular cancer.

HOSPITALIZATIONS FOR EMERGING ILLNESS DIAGNOSES AMONG US PERSIAN GULF WAR VETERANS

James D. Knoke, Gregory C. Gray. Naval Health Research Center, San Diego, CA.

It has been suggested that some veterans of the Persian Gulf War may be experiencing chronic symptoms due to a new illness. Using 77 ICD-9 diagnoses thought most likely to capture an emerging illness, we screened Department of Defense (DoD) hospitalization data for 546,195 regular active-duty Gulf War veterans (GWVs) and 1,337,875 non-deployed veterans (NDVs) of the same era. Subjects were followed from August 1991 until October 1995 or until separation from the military. Using the Cox proportional hazards survival analysis model to adjust for numerous demographic covariates, GWVs were found to be at increased risk for hospitalization with an emerging illness diagnosis; however, the results were affected by admissions for evaluations under the Comprehensive Clinical Evaluation Program. Once admissions for evaluation only were eliminated, there was no difference in risk between the two cohorts. DoD hospitalization data do not suggest the GWVs have experienced an emerging illness since the war ended.

THE PERSIAN GULF WOMEN'S HEALTH LINKAGE STUDY: A LONGITUDINAL STUDY DESIGNED TO ASSESS SHORT-TERM AND LONG-TERM EFFECTS OF GULF WAR SERVICE

Rebecca J. Klemm, PhD, MS; Luann Rhodes, MPA, MPH; Lynda Ugwu, PhD, MS, Nancy LaVerda, MPH.

The US military is undergoing a rapid change in its demographic character with an increasing number of women joining the institution and expanding into non-traditional occupations within the service. These changes underscore the need for primary investigations of the impact of deployment on all aspects of women's health. This population-based study of women in the military is designed to provide baseline health and risk factor information to estimate the incidence and prevalence of selected health conditions, including reproductive and other medical outcomes. The study population consists of women deployed to the Persian Gulf theater and Persian Gulf-era military women (control-population) not deployed to the theater. This presentation will provide an overview of the study, and a discussion of the sampling frame and methods used to track women identified for study. Results of a pilot study to test research design, procedures, and systems will be presented.

SELF-REPORTED HEALTH STATUS AND EXPOSURE AMONG GULF WAR REGISTRY VETERANS

Howard Kipen, William Hallman, Michael Diefenback, Han Kang, Nancy Fiedler, Benjamin Natelson.

Of US troops deployed to the Persian Gulf, approximately 10% have volunteered for the VA and DoD registries. This study, based on the VA Registry, examines in detail the level and type symptomatology among a random group of registry members, and further seeks to elucidate an underlying structure of symptom, illness, and exposure reports. Domains evaluated include physical health (e.g., symptom onset and care seeking behavior); psychological health (e.g., depression, anxiety, PTSD, negative affect); as well as pre and post deployment life events, exposures, and perceptions of their military experience. A mail survey of 1935 registry-enrolled veterans from 10 states yielded 1161 (60%) questionnaires returned. Response rates were not significantly more than active or reserve. 41.5% indicated overall fair/poor health, while 19.9% indicated very good/excellent health. Validity checks revealed a high correlation

between registry enrollment symptoms and current symptoms. A factor analysis of symptoms revealed 6 factors which explained 59% of the variance, similar to those reported previously. We will report on the relationship between symptoms and various predictors as above, including proximity to the Khamisiyah explosion.

ANALYSIS OF POTENTIAL RISK FACTORS FOR THE EXCESS ACCIDENTAL DEATHS AMONG PERSIAN GULF VETERANS

H.K. Kang, C.A. Magee, T.A. Bullman. Department of Veterans Affairs, Washington DC.

Among veterans of the Persian Gulf War, there was a significantly higher mortality rate than among veterans deployed elsewhere. However, most of the increase was due to accidents rather than disease, a finding consistent with patterns of postwar mortality among veterans of previous wars. In an effort to evaluate the possible reasons for the excess deaths, 549 Gulf veterans and 398 non-Gulf veterans who died from motor vehicle accidents (ICD E810-E825) were identified from the VA Persian Gulf veterans mortality study. They will be compared on the numerous host and external factors including age, race, sex, marital status, driver status (driver vs. passenger), vehicle types, speed, alcohol and drug measures, seat belt use, nature of collision (fixed object, moving vehicle), etc. Data for the evaluation will be obtained from a standardized nationwide database, Fatal Accident Reporting System (FARS), maintained by the Department of Transportation. The FARS collects information on over 100 variables from police crash reports, emergency medical transport records, and medical examiner/coroner/autopsy reports. The results of the study will help us improve understanding of the reasons for the excess mortality from accidents among Gulf War veterans and suggest remediable causes.

MORTALITY AMONG U.S. VETERANS OF THE PERSIAN GULF WAR: FIRST UPDATE THROUGH DECEMBER 1995

H.K. Kang, T.A. Bullman. Department of Veterans Affairs, Washington, DC.

A retrospective cohort mortality study which compares the overall mortality rate and cause-specific mortality rates of 695,516 Gulf War veterans and 746,291 other Persian Gulf War era veterans through September 1993 has been completed and published in a medical journal. For this update, vital status was followed for the study subjects through December 31, 1995, adding additional 2 years and 3 months to the observation period.

By the end of 1995, 4,027 additional deaths were observed resulting in a total of 7,521 deaths to be analyzed and compared by the Persian Gulf deployment status using univariate and multivariate statistical model. Analyses will focus on the reported excess mortality from accidental deaths and other external causes, as well as mortality from several specific illnesses. The study will be periodically updated to ascertain any long-term consequences of Persian Gulf service on mortality outcomes.

PYRIDOSTIGMINE BROMIDE INTAKE DURING THE PERSIAN GULF WAR AND HAND GRIP STRENGTH IN 1994-95

Kevin Scott Kaiser, Anthony Hawksworth, Larry Dlugosz, Gregory C. Gray, James Knoke. Naval Health Research Center, San Diego, CA.

Results of experiments on humans and laboratory animals suggest that pyridostigmine bromide (PB) might affect body strength. Thousands of US Gulf War veterans took PB tablets to protect against a possible chemical nerve gas attack during the Gulf War. Relationships between PB intake in 1990-91 and hand grip strength in 1994-95 were examined in a clinical-epidemiological study of members of Naval Construction Battalions ("Seabees") who remained on active duty at Navy bases in Port Hueneme, CA, and Gulfport, MS, following the Gulf War. The study population consisted of 527 Gulf War veterans (GWVs) (521 males, 6 females) and 969 non-deployed veterans (NDVs) (926 males, 43 females).

Seventy percent of GWVs reported taking PB. Dominant had grip strength measurements (in pounds) were as follows: NDVs (120.6 ± 18.5), GWVs who did not take PB (118.5 ± 18.4), and GWVs who took PB (118.3 ± 20.0). In linear regression analysis, mean handgrip strength (pounds) was associated with height, and negatively associated with female sex and age. PB intake during the Persian Gulf War was not associated with handgrip strength in male Seabees who remained on active duty through 1994-1995.

HEALTH SERVICES UTILIZATION AMONG PERSIAN GULF WAR AND ACTIVATED NON-DEPLOYED VETERANS

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It has recently been shown (NEJM, 1996) that there were no differences in hospitalization rates among military personnel remaining on active duty during the 2.5 years after Operation Desert Shield/Desert Storm (PGW). We recently completed a population-based, cross-sectional telephone survey of 3,695 PGW and PGW-era veterans originally from Iowa to assess the current prevalence of self-reported symptoms and illnesses 5 years later (JAMA, 1997). The sample was equally divided by active duty versus Guard/Reserve and deployed (Exposed = E) versus activated but not deployed (Unexposed = U), and further stratified by age, gender, race service branch, and rank. A total of 76% of eligible and 91% of located subjects participated. In order to evaluate whether the illnesses and symptoms reported were related to medical care utilization, we assessed self-reported data on health services utilization in the year prior to the survey. Data was categorized by any reported hospitalization (2 cats), any reported emergency room (ER) visit (2 categories), and number of outpatient visits (log of # visits + 1). In logistic models adjusting for service type, age, sex, race, rank and branch, there were no significant differences by deployment with regards to either hospitalization (E 135/1896=7.1%, U 115/1799, 6.4%; RR = 1.17, p=0.24) or ER visit (E 455/1896, 24%; U 385/1799, 21.4%; RR = 1.12, p=0.167). However, PGW veterans had significantly more outpatient visits than era veterans (adjusted mean = 1.32, vs. 1.12, p=0.0025). Analyses of rates and determinants of utilization will be presented by study strata and by active duty status at the time of the survey. These results suggest that the illnesses reported by PGW veterans in our survey are positively and significantly related to outpatient physician visit utilization five years after the conflict.

SELF-REPORTED ILLNESS FOLLOWING SERVICE IN THE PERSIAN GULF: MULTIPLE MEDICAL CONDITIONS

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It has been suggested that the problems reported by military personnel returning from the Persian Gulf War (PGW) represent anew syndrome or possibly 3 new syndromes (Haley et al, JAMA, 1997). We recently completed a population-based, cross-sectional telephone survey of 3,695 PGW and comparable non-deployed veterans to assess the current prevalence of self-reported symptoms among those originally from Iowa five years after the conflict (JAMA<. 1997). A stratified random sample of approximately equal numbers of Active Duty vs. Guard/Reserve, and deployed vs. activated by not deployed was selected, that further included stratification by age, gender, race, service branch, and rank; 76% of eligible and 91% of located subjects participated. Validated questions, instruments were used wherever possible, with development of outcome definitions prior to data analysis. Importantly, we found considerable overlap among these predefined, medical conditions. The majority (52%) of PGW veterans did not met criteria for any of the conditions. However, 24% met criteria for one and 24% met criteria for tow or more. In contrast, 68% of non-PGW veterans met criteria for none of these conditions, 20% met for a single condition, and 12% met criteria for tow or more. We have taken a variety of approaches to these data, including exploratory and confirmatory factor analyses, cluster analysis, and examination of models developed by others. Implicit in these approaches is independent development and validation of the

models in separate derivation and validation samples among both the deployed and non-deployed samples. The relative value and limitations of each statistical and epidemiological approach will be discussed. Further, the validity of these findings will be compared with health services utilization, employment, disability, and MOS SF-36 scores.