Providing Medical Care on the 21st Century Battlefield

During urban warfare training, young Marines learn to provide humanitarian assistance in a hostile environment, respond to threats from chemical and biological weapons, and restore order in the aftermath of civil unrest. Training side by side with the Marines are the FMF hospital corpsmen, honing their traditional combat casualty care skills and learning new computer skills to assess injuries, administer treatment and transport casualties. During Project Metropolis (ProMet), an experimental tactical project conducted by the Marine Corps Warfighting Laboratory (MCWL) and First Marine Expeditionary Force, a research team from the Naval Aerospace Medical Research Laboratory (NAMRL) field-tested the Tactical Medical Coordination System (TacMedCS). TacMedCS is a prototype system used to identify and track casualty locations. TacMedCS relies on radio-frequency technology, electronics, and global-positioning systems to quickly locate an injured Marine and record, store, and transmit medical information and request a casualty evacuation.

Urban warfare operations are often planned and executed in a matter of hours or days. This is different from traditional military operations that may take weeks or months in order to achieve the mission. CAPT Chris Schuyler, MSC, Head of Advanced Technology and the bioscience/expeditionary medicine officer at MCWL pointed out, “In an urban warfare environment there is no front line, there is only a moving “bubble.” A bubble of Marines who control an area with the enemy potentially all around. One of the difficulties of urban warfare is finding people. Knowing you have a casualty and locating a casualty are two very separate issues.”

Three functions of medical support during urban warfare operations are preventive medicine, trauma treatment, and casualty evacuation. TacMedCS supports timely communication of casualty-related information in order to facilitate casualty evacuation. TacMedCS will eventually include three components: a small electronic tag for each Marine, a palm-size computer for the hospital corpsman, and a medical and map display system for medical personnel at the command center.

HM1 Michael E. Stiney, a cardiovascular technologist and FMF corpsman, is the TacMedCS project manager. He said, “TacMedCS is like FedEx for casualties. In No-

NAMRL photo

During Project Metropolis, conducted by the Marine Corps Warfighting Laboratory and the First Marine Expeditionary Force, the research team from the Naval Aerospace Medical Research Laboratory successfully evaluated TacMedCS. TacMedCS allowed medical personnel to make faster, better informed decisions with minimum resources.

vember 2000 and February 2001, we took TacMedCS and 300 tags into the field during Project Metropolis to look at how we could track casualties on the battlefield and beam information to a control center away from the battlefield. With TacMedCS there is the potential to increase survival in combat by getting a casualty to definitive care sooner, reducing the mythical golden hour."

In future conflicts, each Marine will wear an individual plastic tag, similar to a dog tag, with an imbedded computer chip to store general personal identification and medical and treatment details. The tactical information on the tag will include name, rank, SSN, organization, and location. The medical information will include items like injury type, coma score, treatment, triage, and blood type—information relevant to the combat environment.

As hospital corpsmen identify casualties, they scan the tag with a palm-size computer and enter appropriate information about the casualty (i.e. triage category, treatment given, and possible injury type and location). The casualty information, along with GPS coordinates, will be transmitted via RF model to a command center.

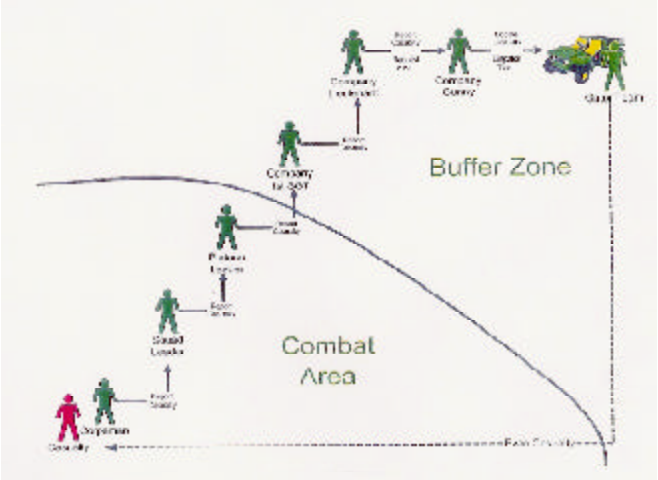
A central server will maintain a database and digital map display of the operational area at the command center. Each casualty will appear on the map as a colored icon corresponding to a triage category. Red icons represent priority status, yellow icons represent urgent status, and green icons represent delayed status. Medical support personnel will see the location of each casualty on the digital map and respond with needed evacuation resources and begin planning for incoming casualties. One click on a colored icon and a drop down window will show individual casualty details. As the casualty moves through the medical evacuation system the tag will be repeatedly scanned and updated and at the same time the medical status and new location will appear on the regional map.

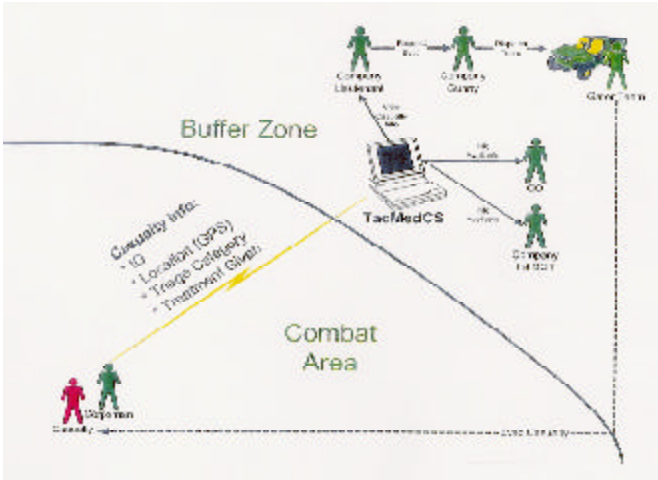
The situational awareness provided by the TacMedCS system will allow medical and command personnel to make faster, better informed decisions in order to achieve the mission with minimum resources, as efficiently and effectively as possible.

The NAMRL team has been working for 3 years with other federal laboratories like DOD's Defense Advanced Research Projects Agency and the Department of Energy's Pacific Northwest National Laboratory, and industry partners to make TacMedCS compatible with other technologies being designed for the battlespaces of the future.

CAPT Schuyler points out the value of TacMedCS, "The benefit to the Marine Corps is twofold. First we can locate and move a casualty into the medical system faster than before and second, we can provide an electronic treatment record that can be accessed from a variety of sources to improve casualty management. As the casualty progresses through the evacuation system we know where he is at any given time." ❑

—Story by Doris M. Ryan, Medical Research and Development Division (MED-26), Bureau of Medicine and Surgery, Washington, DC.





The current casualty notification path that takes place in an urban warfare environment (left) — all communications are made via radio or face-to-face. The TacMedCS casualty notification path (right) was demonstrated during ProMet. TacMedCS was used inside the combat zone to scan casualty tags then transmit the location (GPS) and other essential medical information via RF signal to the command center medical support team.

Looking Beyond the Obvious: A Case Report

LT Michelle M. Boyance, MC, USNR
LCDR Gary Raffel, MC, USNR

TABLE 1						
VARIABLES/DATES						NORMAL RANGE
	Oct 98	Nov 98	Dec 98	Feb 99	Apr 99	
T3	21.7	21.4	21.2	21.6	22.1	27.4-40.7
T4	12.54	21.25	17.19	15.21	14.67	4.5-12.0
T7/FTI	2.7	4.5	3.6	3.3	3.2	1.2-4.9
TSH	21.69	0.03	0.04	0.27	1.14	0.25-5.00

A 30-year-old woman presented to the Primary Care Clinic for a routine gynecological exam. She had just transferred to the area with her active duty husband, and it had been just over a year since her last pap smear and breast exam.

She had multiple complaints which developed over the past several months. These included fatigue, hair loss, weight loss of approximately 10 pounds without trying, increased flatulence, and amenorrhea for 3 months. She denied constipation, diarrhea, nausea, vomiting, fever, night sweats, breast tenderness, or discharge.

Her past medical history was pertinent for a miscarriage, which occurred 11 years earlier. Her family history included a grandmother with type II diabetes. There was no history of thyroid, heart, lung, or bowel disease. There was no recurrent hospital admissions or blood transfusions. She denied tobacco and illicit drug use and rarely imbibed alcohol. She had been married for 3 years, was monogamous and had no children.

On physical examination, she was a well-developed, well-nourished female. Her HEENT exam was within normal limits without evidence of thyromegaly or lymphadenopathy. The heart was normal rate and rhythm without murmur. The lungs were clear and abdomen showed neither hepatosplenomegaly nor masses. Extremities had full range of motion and

TABLE 2		
VARIABLE		NORMAL RANGE
Follicle Stimulating Hormone (mIU/mL)	4.26	2-22
Luteinizing Hormone (mIU/mL)	0.71	0.4-105
Prolactin (ng/mL)	10.75	1.39-24.2

TABLE 3		
VARIABLE		**NORMAL RANGE**
White-cell Count (mm3)	1,800	4,800-10,800
Red-cell Count (mm3)	3,780	4,200-5,400
Hemoglobin (g/dL)	11.2	12-16
Hematocrit (%)	32.4	37-47
Mean Corpuscular Volume (fL)	85.7	81.0-99.0
Platelet count (mm3)	141,000	130,000-400,000
Differential Count (%)		
Neutrophils	51.6	42.2-75.2
Lymphocytes	36.7	20.5-51.1
Monocytes	9.4	1.7-9.3
Eosinophils	2.0	0.0-7.0
Basophils	0.3	0.0-0.2
Morphology Review		
Normocytic/Normochromic		
Erythrocyte Sedimentation Rate (mm/hr)	72	0-20
Glucose (mg/dL)	94	65-105
BUN (mg/dL)	11.0	7-17
Creatine (mg/dL)	0.8	0.7-1.2
Sodium (mmol/L)	143	137-145
Potassium (mmol/L)	3.7	3.5-5.3
Chloride (mmol/L)	105	98-107
Carbon Dioxide (mmol/L)	25	22-30
Phosphorus (mg/dL)	4.1	2.5-4.5
Calcium (mg/dL)	9.9	8.4-10.2
Protein Total (g/dL)	9.0	6.3-8.2
Albumin (g/dL)	4.1	3.2-5.2
Alkaline Phosphatase (U/L)	95	38-126
Aspartate aminotransferase (U/L)	70	14-36
Alanine aminotransferase (U/L)	67	9-52
Lactate Dehydrogenase (U/L)	569	313-618
Bilirubin (mg/dL)	0.7	0.2-1.3
Globulin (mg/dL)	4.9	2.3-3.5
Cortisol (mcg/dL)	13	4-22

a neurological exam was within normal limits with 2 + DTRs at all stations. The skin appeared free from rashes, petechiae, and purpura.

A urine pregnancy test was negative and a thyroid function test (TFT) was ordered. Her pap smear showed atypical squamous cells of undetermined significance (ASCUS). The patient was notified of these results and Synthroid, at a dose of 0.1 mg daily, was initiated. Thyroid peroxidase and antithyroglobulin antibody assays were normal. TFT at 7 and 10 weeks into therapy were obtained. (See Table 1)

During a followup appointment, she indicated an improvement in symptoms Including diminished fatigue and hair loss. Overall she stated feeling better. There was a new complaint of occasional cramping in her hands and feet. A physical exam revealed no thyroid nodules or goiter, DTRs were 2+ and symmetrical throughout. The synthroid dose was decreased to 0.075 mg per day. The plan was to return in 4 to 6 weeks for follow up or sooner if new symptoms developed.

Blood work obtained about 8 weeks after starting the new dose of synthroid showed minimal improvement. (See Table 1)

A repeat pap smear was done on a followup visit; by this time she had not menstruated in 9 months. TFT, follicle stimulating hormone (FSH), lutenizing hormone (LH), and prolactin levels were within the normal range (Tables 1 and 2). Thyroid disease can disrupt the menstrual cycle; however, the TSH had been normal for several months so further work up was warranted. A review of systems was positive for fatigue, headaches, and muscle cramps involving the lower extremities. OB/GYN was then consulted after a trial of

TABLE 4		
VARIABLE		**NORMAL RANGE**
HIV-1 antibody screen	reactive	non-reactive
HIV-1 antibody confirmation by Western Blot		
P24	reactive	non-reactive
GP41	reactive	non-reactive
GP120/160	reactive	non-reactive
Hepatitis C Antibody	reactive	non-reactive

medroxyprovera, which failed to produce withdrawal bleeding. Endometrial biopsy showed an atrophic endometrium.

Lab work including a complete blood count, erythrocyte sedimentation rate (ESR), chemistry panel and cortisol level (Table 3).

Symptoms including fevers, night sweats, bleeding gums, and increasing fatigue. A review of travel history revealed no foreign travels. There was no heavy metal or animal exposures, no illicit drug use, or transfusion exposure.

An internal medicine specialist was consulted. After perusal of the history and laboratory data, it was felt this patient was most likely suffering from anemia of chronic disease and neutropenia. Given the constellation of symptoms, it was recommended that a differential diagnosis should include collagen vascular disease, occult neoplastic process, and infectious etiologies such as HIV and viral hepatitis (Table 4). Informed consent was obtained.

A diagnosis of human immunodeficiency virus and hepatitis C was confirmed. An infectious disease specialist was consulted who then requested HIV-1 RNA and hepatitis C RNA viral load as well as CD4 helper count (Table 5). Based on these results it was determined that she should begin, stavudine (Zerit), lamivudine (Epivir) and nelfinavir (Viracept) (HAART Protocol). In addition she agreed to become a part of a support group for persons with HIV.

This case points out the following important points. A diagnosis of hypothyroidism in the face of anemia and neutropenia should alert the clinician to a broad differential. The human immunodeficiency virus has a myriad of faces and can often elude the practitioner. Finally, appropriate consultation with specialists can aid the general practitioner in reaching a diagnosis and treatment plan. ❑

When this article was written LT Boyance was a general medical officer at the Primary Care Clinic, Naval Ambulatory Care Center, Groton, CT.

LCDR Raffel was a general internist at the same activity.

TABLE 5		
VARIABLE		**NORMAL RANGE**
HIV-1 RNA Quantitative by bDNA Ultrasensitive (copies/mL)	170,000	None
Hepatitis C Virus RNA by PCR Quantitative (copies/mL)	160,000	None
CD4 Helper T-cell Count CD4 (Helper Cells) (%)	15	30-61
Absolute CD4+ Cells (per cm)	83	490-1740

Seeking Treatments for Gulf War Veterans' Illnesses

Jamie McKeehan, BS
Suzanne Clark, BA
LCDR Margaret Ryan, MC, USN

Gulf War veterans in the San Diego area were recently given an important opportunity to help researchers learn how to treat chronic multi-symptom illnesses. The Department of Defense (DOD) Center for Deployment Health Research at the Naval Health Research Center, San Diego, is participating in two large clinical trials to treat nonspecific illnesses among Gulf War veterans. One of more than 30 sites nationwide, the Naval Health Research Center is the only Navy site involved in these Department of Veterans Affairs (VA)-DOD cooperative studies. Other sites include the Walter Reed Army Medical Center, Washington, DC, and 28 VA medical centers across the country.

What Is "Gulf War Illness?"

Nearly 700,000 U.S. service members deployed to the Persian Gulf region for Operations Desert Shield and Desert Storm in 1990-91.

Although the conflict was brief and extraordinarily successful for the U.S. and allied forces, our troops were still exposed to the hazards of war and the environment. Concerning exposures included sand, insects, temperature fluctuations, jet fuel, smoke from burning oil wells, chemical munitions, medical chemoprophylactic agents, vaccines, insect repellants, and the general stressors of war.(*1*)

In the years following the Gulf War, many service members reported health concerns. Although the appearance of post-deployment medical problems was not unique to this conflict,(*2*) registries were developed to chronicle the veterans' concerns,(*3*) and tremendous resources have been spent to investigate the nature and causes of Gulf War veterans' health problems. A recent bibliography comprises more than 5,000 articles published on Gulf War health issues,(*4*) and details almost $150 million spent on research.

The results of epidemiological research have been reassuring for an absence of severe morbidity associated with Gulf War deployment. Compared with their non-deployed colleagues, veterans of the conflict appear no more likely to have experienced hospitalizations, cancer, children with birth defects, or mortality.(*5-10*) Ongoing

Photos by Robb Reed, Naval Health Research Center

Current staff of the Clinical Trials Center in San Diego includes (back, left to right) Jamie McKeehan, LCDR Margaret Ryan, LCDR Julie Stenger; (front, left to right) Dr. Bill Matulich, Debbie Kamens, Deena Friedlander, and Esther Hudson.

research continues to explore these important health outcomes.

In contrast to severe problems, Gulf War veterans have reported more ill-defined, symptom-based conditions than their non-deployed peers.(*11-14*) Chronic fatigue, chronic pain, memory and concentration problems in the absence of other known medical conditions have been especially frustrating for some Gulf War veterans. With causes of their symptoms still unknown almost 10 years after deployment, many veterans have sought relief from unproven remedies. VA and DOD investigators, recognizing the needs of these veterans, are now exploring ways to help treat the chronic, multi-symptom disorders that are sometimes called Gulf War illnesses.

VA-DOD Cooperative Study # 470: Exercise and Cognitive Behavioral Therapy Trial

Chronic multi-symptom conditions have long been experienced by the general population, causing similar diagnostic frustration in the medical community. In recent years, such symptom conditions have been given various names, including chronic fatigue syndrome, irritable bowel syndrome, multiple chemical sensitivities, fibromyalgia, and post traumatic stress disorder. While the nature and diagnostic criteria for these conditions are not always agreed upon, some empirical treatments have proved promising in relieving the suffering of those affected.

Cognitive behavioral therapy (CBT) is one such treatment. The theory behind CBT recognizes the experience of pain as a complex integration of pathophysiology, cognition, affect, and behavior. Relaxation training, activity pacing, pleasant activity scheduling, goal setting, and visual imagery techniques are skills commonly associated with CBT treatments for chronic pain. Several randomized, controlled trials have suggested that CBT is effective in the management of fibromyalgia and chronic fatigue syndrome, as well as the better-defined disorders of rheumatoid arthritis, multiple sclerosis, and coronary artery disease.(*15-17*)

Another type of therapy that seems to be effective for treating a wide range of chronic illness is aerobic exercise. Many studies indicate that involvement in an aerobic exercise program can improve cardiovascular fitness as well as symptoms associated with fibromyalgia, chronic fatigue syndrome, rheumatoid arthritis, and mood disorders.(*18,19*) Researchers have found that adherence to a lifelong program of exercise that gradually increases in intensity is most effective.(*20*)

The goal of VA-DOD Cooperative Study #470 is to assess the value of exercise and cognitive behavioral therapy in Gulf War veterans who have experienced at least two of the following three symptoms: (1) fatigue that limits their usual activities, (2) pain in at least two regions of the body, and (3) problems with memory or concentration. Volunteers with these symptoms were randomized to receive either CBT, exercise therapy, both, or usual care. They have been followed with assessments of their symptoms, general functioning, pain tolerance, and exercise tolerance over the course of 1 year.

Nationally, nearly 1,100 veterans are participating in this study. The San Diego site has contributed an important part of this number. Naval Health Research Center professionals involved in the exercise and cognitive behavioral therapy study include Esther Hudson, study coordinator; Dr. Bill Matulich, clinical psychologist; Deena Friedlander, exercise physiologist; Jamie McKeehan and Lesley Henry, research assistants; and LCDR Julie

Stenger, LCDR Margaret Ryan, and CAPT Greg Gray, physician investigators. The study began enrollment in the summer of 1999 and will conclude in late 2001.

VA-DOD Cooperative Study # 475: Antibiotic Treatment Trial

One of the most interesting theories about chronic multi-symptom illnesses is that infections might play a role in their development. Some civilian researchers in California have popularized the theory that occult *Mycoplasma fermentens* infection causes chronic fatigue syndrome in Gulf War veterans and civilians alike.(*21,22*) In the absence of rigorous clinical trials, Internet-driven marketing of this idea has drawn thousands of fatigue sufferers to seek long-term antibiotic treatment.

Recognizing that more extensive research was necessary before antibiotic treatment could be recommended for symptomatic veterans, the VA and DOD developed Cooperative Study #475. Patient-volunteers for this study are similar to those participating in Study #470 in that they are Gulf War veterans suffering from chronic fatigue, chronic pain, and/or memory and concentration problems. However, those participating in Study #475 have met the additional criterion of having a blood test showing evidence of mycoplasma infection. Blood drawn at local study sites was sent to a central laboratory for mycoplasma testing; a very sensitive molecular detection method was used that is not available in most clinical laboratories.

Patient-volunteers who tested positive for mycoplasma infection agreed to be randomized to treatment with either an antibiotic (doxycycline) or placebo (inactive pill) for the next 12 months. Follow-up visits were required monthly throughout the year, and again 6 months after the treatment trial was complete. Participants were assessed for their symptoms, general functioning, and blood test results at regular intervals.

Nationwide, 491 veterans were randomized in this study, and many were from the San Diego area. Naval Health Research Center professionals involved in the antibiotic treatment trial include Debbie Kamens, study coordinator; Jamie McKeehan, research assistant; and LCDR Stenger, LCDR Ryan, and CAPT Gray, physician investigators.

Results of the Treatment Trials

Both treatment trials began in the summer of 1999 and are ongoing. The strict research protocols require that investigators are "blinded" to results before the nationwide efforts are complete, so it is still too early to know exactly how well the treatments may have worked.

Even at this stage, however, some information from the Naval Health Research Center is extremely positive. The team in San Diego, led by CAPT Gray, has worked hard to recruit all interested Gulf War veterans, and these efforts have been very well received. Coverage from the local television and newspapers in San Diego has prompted praise for the team's caring efforts. Quotes from patient-volunteers include: "The staff is probably the most professional medical staff I have encountered … they genuinely care about all aspects of treatment … it is a pleasure to be in this program!" and "Extremely customer oriented … I was treated like royalty, efficiently, expeditiously, and courteously." Further validating this work, rigorous VA audits revealed that San Diego was a top-performing site for best clinical research practices.

Deena Friedlander, exercise physiologist, displays some of the equipment used by patient-volunteers at the Clinical Trials Center.

Although it may be some time before the research results are fully available, the team at the Naval Health Research Center will continue to provide quality investigative care for all service members. The researchers in San Diego are quick to credit their patient-volunteers for the commitment and sacrifice that make clinical research possible. The efforts of these veterans are likely to benefit not only their fellow service members, but all people with chronic multi-symptom illnesses.

VA-DOD Cooperative Study Information

VA-DOD Cooperative Studies #470 and #475 are led nationally by Dr. John Feussner, Chief Research and Development Officer, Department of Veteran Affairs; Dr. Sam Donta, Professor of Medicine, Boston VA Medical Center; COL Charles Engel, MC, USA, of Walter Reed Army Medical Center, Washington, DC, and Dr. Daniel Clauw, Professor of Medicine, Georgetown Medical Center, Washington, DC.

For more information on research performed by the DOD Center for Deployment Health Research at the Naval Health Research Center, visit http://www.nhrc.navy.mil/rsch/code25/program5.htm

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Feature

Vision 2005: Forecast of Executive Leadership Competencies Required by Navy Dental Corps Officers

CAPT Andrew D. Peters, DC, USN
CDR Daniel G. Dominguez, MSC, USN
K. Finstuen, M.Sc., M.Ed., Ph.D.

Introduction

This is a time of dramatic change for all facets of our nation's military to include the U.S. Navy Dental Corps. From streamlining to increase efficiency, to a fundamental redefinition of strategy, the Navy Dental Corps is responding to the exponentially increasing challenges of the 21st century. Changes in the methods of dental health care delivery and dental readiness are placing unprecedented demands on those who lead and manage it. To meet these challenges, dental health planning, as an integral part of Naval force health protection and health promotion training, requires a sound balance of performance-oriented management and imaginative leadership.(*1,2*)

In the context of rapid change, health training programs must maintain a strong process of external surveillance and internal assessment to ensure the continued relevance of its curricula to the skill, knowledge, and ability (SKA) requirements needed to cope effectively with emerging leadership and managerial challenges in such an environment. Consequently, numerous graduate programs in business, health care administration, and management are offering executive skills courses to prepare their graduates for leadership positions.(*3*)

Analytical skills and functional abilities are critically important ingredients for managerial success in health care organizations. In the civilian sector, health care industry observers agree that business-related abilities and analytical skills will remain key elements of success for the leaders of health care organizations. Key trends and indicators suggest that during this time of turbulent transition, successful healthcare managers and leaders must be visionary and possess strong interpersonal, communication and integrative skills.(*4*)

In response to the Department of Defense (DOD) Appropriations Act of 1992, the military services were required to determine the professional administrative skills that medical and dental treatment facility commanders must demonstrate.(*5*) In compliance with this mandate, competencies were identified by a Tri-Service Task Force. The Navy and Army developed executive management education programs to ensure that medical department leaders gained the necessary executive skills to effectively lead within military health care system. Competencies reflected SKAs commonly accepted in the civilian sector, as well as those unique to the military. The competencies defined were intended to become the standard against which professional development programs within the DOD could be evaluated.(*6*) From the mid-1990s, the U.S. Army-Baylor University Graduate Program in Health Care Administration has conducted an active, ongoing program of research to study health care executive competencies.(*7*) Similar work has also been done by the Navy Post Graduate School.(*8*)

There has been agreement among military and civilian administrators regarding the skills needed in the changing health care environment. In a 1993 study in the civilian sector, Fellows in the American College of

Healthcare Executives identified issues using a Delphi study to content-analyze domains into nine areas of importance to future administrators. In order of ranked importance, domains were: cost/finance, leadership, professional staff interactions, health care delivery concepts, accessibility, ethics, quality, risk management, technology and marketing. Among the executive SKAs judged by respondents as most important to manage future issues, nearly 64 percent were associated with the domains of leadership and professional staff relations, strategic vision, physician motivation, conflict management and knowledge of hospital finance and cost accounting.(*7*) Two other civilian studies, one in 1997 with Medical Group Management Association executives and another in 1998 with physicians of the American College of Medical Practice Executives, found comparable trends.(*7*)

Five similar Delphi studies have been conducted in military health care facilities. In the first study of Army hospital commanders and administrators in 1994, emphasis on financial and technical skills, in conjunction with interpersonal and communication skills, were found to be most important. A second study in 1995 assessed executive concerns among senior federal nurses.(*7*) In 1998, researchers assessed leadership competencies required by senior naval hospital administrators. Commanders and deputy commanders for administration within the medical treatment facilities believed that cost/finance, health care delivery and access to care were critical competencies required for success in their jobs. They concluded that while a business orientation is needed for organizational survival, an emphasis on person-oriented SKAs is necessary for future success as a health care administrator in the Navy health care system. These expert respondents represented the Navy's Medical Corps, Medical Service Corps, and Nurse Corps; however, *no respondents represented the Navy Dental Corps*.(*7*) A fourth executive study, also in 1998, examined behaviors required by Army Dental Corps leadership defined by commanders, residency directors and senior staff officers. The findings suggested that behaviors of honesty, acting with integrity, accountability for actions, and dedication to mission accomplishment have strong similarities to Army values.(*9*) A recently published fifth study identified important domains in Coast Guard health care administration. SKAs fell into 15 rank-ordered domains, of which the top five were: managed care, cost/finance, personnel, technology, and leadership. Results indicated that leadership skills were key elements, but advanced education was seen to be of lesser importance.(*10*)

In light of the many changes in the federal and military health care system, a need to delineate the skills needed for successful senior Navy Dental Corps officers is imperative. The purpose of this study was to develop a consensus among senior dental corps officers about the specific competencies required by Dental Corps officers to perform at the senior executive level. This Delphi study was the first empirical assessment of future Navy Dental Corps issues; and adds to the growing body of literature concerning health care executive competency.

Methods

The Delphi Network for the study was comprised of 67 senior Navy Dental Corps officers in executive positions who were identified to participate in two rounds of a Delphi group exercise. These current commanding officers, executive officers, specialty leaders and executive staff officers were chosen as study respondents because of their level of experience in the Navy dental health care arena and demonstrated expertise in managing complex organizations, world wide, for Navy dentistry. In addition, they were considered the best source to estimate future Navy Dental Corps senior officer job requirements and identify issues based on competencies and required skills, knowledge and abilities (SKAs).

The method used consisted of two iterations of the Delphi technique for executive decision-making separated by an expert panel content analysis. The Delphi technique, developed by the RAND Corporation(*11,12*), has been used in a variety of health care settings to establish priorities and predict future trends.(*13-15*)

Ethical Concerns. Anonymity of respondents was an essential concern. Electronic responses received via the Internet, were collated as electronic files without retaining names or addresses. Original electronic messages were deleted; no record of individual participation was retained. Participation in the study remained strictly voluntary.

Delphi Iteration One Issues. During the first round of forecasting, Delphi members who were identified as a pool of executive participants, were asked to identify the five major issues believed to be the cornerstones of success for senior Navy Dental Corps leaders now and 5 years into the 21st century. The response format was open-ended. Members were asked to articulate specific SKAs needed to meet the needs created by the major identified issues. The SKAs were derived directly from the responses contained in all of the questionnaires in the first phase of the Delphi process. Capturing the "job language" of the SKA statements served to reflect the perceptions and state of mind of the respondents. Electronic mail via Internet was the method used for instrument delivery and for expert participants to return

their responses.

Content Analysis of Issues. Phase one responses, including issues and associated SKAs identified by the Delphi participants, were entered into a computer spreadsheet. Key phrases were designated and assigned according to their main theme or content of each issue. Statements for SKAs were also tracked by the specific key phrases. The frequency of responses for each key phrase was determined for each issue.

An expert panel of four senior Navy dental health care executives was assembled to review and sort the collected issues into a set of meaningful domain categories. This panel used the initial lists as a starting point to examine and modify the key phrases. Based on the panel's review and modification, the collected issues and key phrases were then sorted into meaningful sets of domain categories. The expert panel discussed issues and made modifications until all members achieved consensus. Once the domain categories were agreed upon, they were given appropriate titles and then rank ordered by the issue's reported frequency.

Delphi Iteration Two, SKA Ratings. The results of phase one were provided in two formats to the executive respondents during the second phase of the Delphi process. First, the data obtained were prioritized and returned to all participants as feedback. Second, from the SKAs identified within each domain, a structured rating questionnaire was developed. The intent of collecting SKAs was to form a standard pool of job requirements for each domain. The SKAs were derived directly from the responses obtained. During this second round of the Delphi process, respondents were asked to review the feedback materials and provide ratings based on a 7-point relative importance rating scale. The 7-point scale was anchored at the extremes ranging from 1 = extremely unimportant to 7 = extremely important for each of the SKA items within each of the domains. In completing the questionnaire, respondents based their decisions on what they believed were the most important SKAs to their profession in the future. Rating reliabilities and descriptive statistics were computed for each of the SKA items.

A demographic questionnaire was included to evaluate and validate the experiences of the Delphi Network. Participants were asked to provide background information such as age, gender, education, current and past health care experience, and affiliation with professional organizations.

Results

In the first iteration of the Delphi, 41 of 67 participants responded for a return rate of 61.2 percent. This response rate was considered adequate for the study.(*7,14*) A total of 77 unique issues were identified.

A four-member expert panel was convened and asked to sort the collected issues into a set of meaningful domain categories. On average, panel members were 53 years old. Collectively, the experts had a total of 99 years of experience in a dental health care setting and a total of 38 years in dental health care administration. Group members held four doctorate degrees in dentistry and two master's degrees. After the expert panelists examined the issue key phrases and determined domain titles, the experts were asked to make ratings of their individual judgments in terms of accuracy and confidence. The experts expressed high levels of perceived accuracy and confidence in relation to the finalized ordered list of issues within domains. Seven domain categories emerged. Response frequencies of the key issue phrases were summed to arrive at a total domain frequency. Domains were then rank ordered by total response frequencies and percentages as shown in the right column of Table 1.

The issues sorted by the expert panel were used to operationally define the particular domains for the respondents during the second round of the decision making process. During the second round of the Delphi, SKAs within each domain were rated in terms of their importance as future job requirements by the same pool of executive respondents that participated in the first iteration. The response rate for this round was 76.1 percent (51/67).

The rating scale data were analyzed using the Statistical Package for the Social Sciences (SPSS) computer software. On the 7-point rating scale used, average ratings ranged from 4.28 to 6.63. Next, SKA item ratings were assessed for the degree of overall agreement. The inter-rater reliability was determined by the use of Cronbach's coefficient alpha.(SPSS). Overall, reliability indices ranged from a low of .78 for marketing to a high of .92 for leadership issues. These findings indicated: obtained ratings of SKAs were internally consistent, average values computed for the SKAs within specific domain categories were stable, and participants agreed on the values to a high degree. Table 2 displays the top two highest average SKAs within each of the seven competency domain categories.

Demographic and background data collected during the second phase of the Delphi showed the dental executives to be 94 percent male with an average age of 49.78 (SD 4.24) years. The average experience in dental health care settings was 23.38 (SD 4.47) years with 8.00 (SD 6.07) years of executive administrative experience. All 51 respondents reported obtaining a doctorate degree in dentistry. Membership in a professional dental organization was reported by 98 percent of the respondents; only three respondents (5.9 percent) were

members of a healthcare or management professional organization.

Discussion

Predicted Future Issues. The results of this study identified seven primary domains that senior dental health care executives must master in order to be successful. The most important issues that appear to confront senior Navy Dental Corps officers are in the areas of personnel management and leadership. These two domains alone account for over 49 percent of the issues (98 /177) identified by the respondents (see Table 1). Given the changes associated with the military draw-down and the difficulties associated with recruiting and retaining dentists in the Navy, the concerns of military dental health care senior executives are consistent with the changes and the challenges faced by all officers in the military over the past 5 years. Other areas that executive leaders felt were critical for success were dental health care management (18.59 percent of the issues) and resources management (15.58 percent of the issues). These are directly linked to the executive leader's ability "to think outside the box" and to develop new and innovative ways to reduce cost and improve the quality and access to dental health care.

Comparing these results with the previous Delphi studies discussed above that utilized both civilian and military health care executives as respondents, some interesting similarities and differences were observed. In nearly all the referenced studies, cost/finance was ranked as one of the top domains. The results of this study indicate that concerns of cost/finance are still important, however, they no longer stand alone as domains and are now considered SKAs as part of a systems approach in resources management. This difference in perspective is probably due to the familiarity and experience of senior Dental Corps executives with regard to managing budgets and policies. With respect to 'leadership' issues, the results of this study differ somewhat with those previously published. The difficulties in recruiting and retention for the all volunteer military force, and the continued evaluation of Navy medicine by Congress and the Navy "line" has likely resulted in the issues of personnel management and leadership being elevated by senior Dental Corps executives to the top two issues.

Skill, Knowledge, and Ability Requirements. Table 2 lists the top two SKAs per domain and appropriate descriptive statistics. The results are reflective of the most critical SKAs within each domain. A review at this level indicates senior Dental Corps executives must embrace strategic management as a philosophy that is inseparable from leadership. In addition, senior executives must be able to clearly communicate a shared mission, vision and values, verbally and in writing, not only to leaders of Navy dentistry but to Navy medicine as well. They must also utilize multifunctional teams to embrace the organization's vision and goals while employing creative and innovative methods to meet and exceed the patients' needs in the delivery of dental health care. Senior executives must be vigilant in monitoring the organization by collecting data and using statistical analysis to interpret validated data.

Conclusions

In this study, the results of research forecast the future. Experienced senior Dental Corps executives provided a consensus of opinion to identify and forecast critical issues associated with executive leadership competencies that will confront future Dental Corps officers in the new millennium. This research also renders an empirical basis for identifying the skills, knowledge, and abilities that will be needed for program planning and successful executive performance in tomorrow's dental health care environment. To meet these challenges, Dental Corps leaders must require senior executives to commit to developing and mentoring SKA requirements identified in this study. In addition, results from this study may: 1) be incorporated in the strategic plans of the institutions of higher federal education as they plan future curriculum development; 2) be used to make comparisons of various service health care executives; 3) be used to judge and compare various educational styles; 4) provide criteria for selection and promotion to higher rank; and 5) guide assignment officers (detailers) in the assignment of Dental Corps officers to leadership and executive staff positions.

Specifically, senior Dental Corps executives will need to focus their development around personnel management and leadership issues. In addition, they will need an understanding of strategic management as a philosophy that is inseparable from leadership. Even though these are essential for their success, senior dental corps executive leaders must maintain a balanced and well-rounded base of SKAs associated with the technical aspects of dental health care such as administrative functions, information systems, dental health care delivery and resources management. By integrating technical and well-communicated strategic leadership, future senior Dental Corps executives will lead their organizations in the new millennium.

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Table 2: Descriptive Statistics for the Top Two Rated SKA Requirements in Each Domain

Domain	SKA Item	Mean (SD)
Personnel Management	Ability to communicate through speaking Ability to develop a shared vision and values	6.37 (.87) 6.26 (.97)
Leadership Issues	Ability to accomplish mission Ability to communicate effectively	6.63 (.56) 6.57 (.64)
Dental Health Care	Skill in developing a dental health care management delivery system to increase access to care Ability to work and plan credibly with multi-disciplinary medical and dental executive leadership	6.20 (.87) 5.98 (1.10)
Resources Management	Ability to apply systems thinking to solve Knowledge of financial management	5.98 (1.10) 5.96 (.87)
Information Technology	Ability to collect data, use statistical analysis Ability to validate data (data integrity)	6.05 (.90) 5.94 (1.14)
Quality of Dental Health Care	Ability to maintain high standards of care Ability to maintain and elevate customer	6.49 (.85) 6.30 (.90)
Marketing	Ability to prove value of Navy Dentistry Skill in championing dental health	6.49 (.77) 6.30 (.85)

Note: Ratings were made on a relative rating scale from 1 = 'unimportant' to 7 = 'important'.

Navy Hearing Conservation in Action: Mitigating Risk

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Occupational or noise-induced hearing loss has a significant economic impact on both the Department of Defense and Veterans Administration. In 1998, disability-payments for all veterans whose primary disability was hearing loss approached $282 million (Navy and Marine Corps veterans were paid $62 million). Hearing loss disability payments have been consistently on the rise the past 20 years with a cumulative amount greater than $3.6 billion. In addition, medical costs and worker's compensation payments for civilian employees in 1998 totaled $21.8 million for the Department of Defense (9.8 million for the Navy).

Some military hearing-conservation programs have been shown to be effective (Ohlin, 1996; Sack et al., 1998); however, many military and civil service individuals still suffer from the effects of occupational noise induced hearing loss. Navy investigators (Wolgemuth, Luttrell, Kamhi, and Wark, 1995) found that 29 percent of 12,492 Navy fleet personnel (surface ships and submarines) exhibited a significant hearing decrease on their most recent audiogram. For high-noise enlisted job specialties, the incidence ranged from 48 percent to 70 percent. Research data has also suggested that noise exposure from live-fire M16 rifle training can cause noise-induced hearing loss over a short exposure period. Wolgemuth and Wester (1998, unpublished data) found significant threshold shifts in 11 percent of Marine Corps infantrymen using hearing protection after firing 300 M16 rounds during training.

However, economic considerations are only part of the cost associated with occupational hearing loss. This type of hearing loss, which primarily effects the ability to hear higher frequency sounds, results in problems understanding conversational speech in background noise, detection of auditory warning signals, and localizing sound sources (Hetu, Getty, and Quoc, 1995). Hearing loss also can restrict a person's social activities and disturb family interactions (Hetu et al. 1995). Since occupational hearing loss involves economic, readiness, safety, and quality of life issues it can be detrimental to mission accomplishment, can endanger the hearing impaired Sailor or Marine and their shipmates, and reduce enjoyment of social and recreational activities. In an effort to protect Navy personnel from these effects, hearing conservation

Photo by Ms. Ivonne Dawson

Sailor needle-gunning the deck aboard the USS *Dwight D. Eisenhower* (CVN 69).

instructions for forces afloat (OPNAVINST 5100.19C, Change 2) and ashore (OPNAVINST 5100.23E) mandate that when high-frequency hearing levels in both ears exceed 270 decibels individuals will undergo a special type of audiological evaluation. An occupational or hearing conservation audiologist working in conjunction with other occupational health professionals as members of a review panel (i.e., occupational medical officer, occupational health nurse, industrial hygienist) jointly make a recommendation as to whether or not the member should continue to work routinely in a high-noise environment. Unfortunately, until a few years ago, these safeguards were not being used consistently.

History

In the summer of 1995 the Senior Member, Navy Propulsion Examining Board (PEB) in the Norfolk, VA, area found poor compliance with the Navy Hearing Conservation Program in surface combatant ships. Specifically, the following OPNAV Instruction 5100.19C hearing conservation requirement was of concern: "In the absence of a statement to the contrary from an audiologist, otologist, or occupational medicine physician any individual who has hearing loss in both ears in which the sum of thresholds at the frequencies of 3000, 4000 and 6000 Hertz (Hz) exceeds a total of 270 decibels (dB) will not be assigned to duties involving exposure to hazardous noise." These criteria eventually became known as the "270 dB rule" and represent a substantial amount of high-frequency hearing loss. Individuals exhibiting significant high frequency, noise-induced hearing loss were not being evaluated to make appropriate job placement decisions.

Shortly thereafter, Commander, Navy Surface Force, U.S. Atlantic Fleet (SURFLANT) convened a Quality Management Board (QMB) to address the "auditory fitness for duty" concerns raised by the PEB. The QMB consisted of a Navy occupational medical officer, two industrial hygiene officers, a Navy otolaryngologist, a senior Navy occupational audiologist, and the SURFLANT force medical administrative officer. For 7 months prior to the convening of the QMB, approximately 80 SURFLANT fleet Sailors with hearing loss that exceeded the 270 dB criteria were evaluated. In an effort to prevent on-the-job mishaps due to the hearing loss and limit further deterioration of hearing, 31 of the Sailors with more severe and progressive losses were recommended to be medically disqualified from further prolonged exposure to noise hazardous environments. Generally, the recommendations were either a change in rating to a low noise rating or retaining the member's current rating and deployability status but with a restriction against future prolonged hazardous noise exposures. This meant that an engineman may not be able to work or stand duty in the main spaces or a machinist's mate may not be able to work in the machine shop during hazardous noise operations. Shipboard administrative type positions such as 3M Coordinator (if qualified) were recommended. The effect was significant on the manning of fleet units and could have a negative impact on the career of the restricted sailor. These were two concerns of the QMB.

On 4 January 1996, a point paper addressing the findings of the QMB was forwarded by the SURFLANT Commander to the Chief, Bureau of Medicine and Surgery (MED-02) via the Commander-in-Chief, U.S. Atlantic Fleet and the Chief, Bureau of Naval Personnel (BUPERS). The point paper raised four issues concerning the Navy's Hearing Conservation Program (HCP) and the fitness for duty evaluations of Sailors and Marines with significant hearing loss: 1) As a result of no standardized system, the evaluation and disposition of patients varies between otolaryngologists and occupational audiologists; 2) The findings of the QMB, based on a 7-month retrospective review in a specific local area, may not have been representative of Navy-wide conditions; 3) Since no medical standard for this type of disposition exists, personnel with significant hearing loss who are subsequently fitted for hearing aids and found fit for full duty may pose a potential danger to themselves or others when they remove the aids and are then required to apply double hearing protection in a noise hazardous environment; and 4) Personnel were not being screened for fitness for sea duty which resulted in disqualified personnel being transferred to sea duty billets involving exposure to noise hazardous environments.

After obtaining further input from the Navy audiology community, the Bureau of Medicine and Surgery (BUMED) distributed "guidelines for evaluation and disposition of active duty and civilian employees with hearing loss" to Navy medical treatment facilities in February of 1998. The guidelines specified individuals exhibiting the greater than 270 decibel (dB) hearing loss would be evaluated by an audiologist, occupational medicine physician, or otolaryngologist prior to being exposed to further noise hazardous duties. In addition, individuals who had baseline audiograms (reference for annual hearing test comparisons) re-established three or more times due to worsening hearing would also undergo evaluation. A thorough medical and noise exposure history, com-

plete audiological evaluation looking at the pattern and progression of hearing loss, the opinion of the member's medical and safety personnel, current career status, and the assessment of communication impairment with specific reference to probable work environments were also recommended to be used in making a recommendation. These "auditory fitness for duty evaluations" were to be made on a case-by-case basis considering all of these relevant factors. For the first time, guidelines were provided to assist specialists in making decisions and recommendations that could prevent the occurrence of further occupational hearing loss in Navy members. All Navy occupational (hearing conservation) audiologists were instructed to implement programs using these guidelines and submit fitness for noise duty recommendations and supporting documentation to the Specialty Leader for Audiology for an 18-month trial period. During this period, the specialty leader would provide supervision to monitor consistency among occupational audiologists in applying these guidelines. The goal was to have occupational audiologists, who have significant experience in evaluating the impact of noise-induced hearing loss, or board certified occupational medicine physicians serving as case managers for evaluation of members with hearing loss.

The first "auditory fitness for duty" or "270 dB" program was established where this issue was first raised, in the Norfolk, VA, area in 1996**.** The goal of the program was to address and resolve these issues at the lowest level thus precluding a formal medical board. The senior occupational audiologists at Naval Medical Center, Portsmouth, VA, developed a multidisciplinary "Hearing Conservation Review Panel" to work as a team in making these occupational recommendations. The panel, consisting of two occupational audiologists, an occupational medicine physician, and an industrial hygienist, worked closely to make appropriate and fair recommendations. On each case, the patient's medical officer or representative was asked to sit on the panel and the patient was invited to address the panel, along with any personnel that the patient felt could provide input to the recommendations. The environment in which the panel met was comfortable and open so as to put everyone at ease. The panel developed important criteria that should be used in making clinically valid and fair recommendations for what are really "personnel" (job placement, fitness for duty) as well as a "clinical" (prevention of further hearing loss) decisions. They also developed standard (SF-600) overprint forms to document the recommendations in member's medical records along with a system for follow-up with the member's command to assist in interpretation of the recommendation and job placement if necessary.

In October of 1998, the Occupational Audiology, Occupational Medicine, Occupational Health, and Industrial Hygiene Departments of Naval Medical Center, San Diego began creating their own "270 dB" or "Auditory Fitness for Duty Program." In many ways the program was modeled after the initial one created at Naval Medical Center, Portsmouth. Meetings were held between all of the above departments using Total Quality Leadership principles. All departments "bought into" the program and agreed on how it should be managed in the San Diego area. Next, a standard operating procedures manual describing the details of the program and the review panel were developed. Prior to initiating 270 dB evaluations and review panel meetings, a point paper and references were sent to all local type commands and the regional Human Resources Office (Civilian Personnel) so no one was surprised by this expansion of hearing conservation services. Another naval hospital and its three branch medical clinics supported by Naval Medical Center, San Diego, were also briefed on the program and the potential impact it would have on their personnel. Separate meetings were also held with the Military Sealift Command, Pacific. Every attempt was made to get the word out regarding the clinical and administrative decisions that could result from these evaluations. A Hearing Conservation Review Panel was then stood up. Meetings were held on a monthly basis, with ad hoc meetings held in instances where a quick decision was required (i.e., impending orders or deployment).

Results

To date, the panel has reviewed 132 cases (20 military, 112 civil service). Table 1 displays mean ages, years of service, mean high frequency hearing thresholds, and average high-frequency hearing loss (3K-6K Hz, both ears) for two types of military and civil service patients (recommended for retention in rate or job, recommended for removal from rate or job). Table 2 presents results of two-sample Wilcoxon rank-sum tests examining differences between the military and civil service groups en total and broken down into the two retention and removal categories for each group. There was no significant difference between the military and civil service groups as a whole in terms of mean age, mean high-frequency hearing threshold, or mean average high-frequency hearing

Table 1: Means and standard deviations for age, years of service, high-frequency hearing threshold, and high-frequency average hearing loss among military (Mil) and civil service (C/S) '270 dB' board patients for Naval Medical Center, San Diego: Nov 1998-Nov 1999.

	Group			
	Mil Retain (n=14)	**Mil Remove (n=6)**	**C/S Retain (n=96)**	**C/S Remove (n=6)**
Age (in years)	37.78 (6.11)	39.5 (7.89)	54.55 (7.22)	47.5 (21.26)
Years of Service	15.29 (4.90)	11.5 (7.47)	26.52 (10.16)	30.58 (12.39)
High-frequency Hearing loss (dB HL)	57.5 (8.89)	60.27 (10.35)	56.84 (9.52)	73.75 (16.60)
High-frequency average hearing loss 3K-6K Hz both ears (dB HL)	345 (53.34)	362 (62.10)	341 (57.17)	443 (99.63)

loss at 3K-6K Hz for both ears. A significant difference did exist, however, on years of service. The civil service employees on average had significantly more years on the job. When examining the four categories, there was significantly greater high frequency hearing loss at 3K-6K Hz for the civilian employees who received a job removal recommendation as compared to those civilians who received a retention with continued monitoring recommendation. Among the military 270 patients, the mean high frequency hearing loss was not significantly different among the retention/removal categories. Recommendations for job removal were higher among the military population (6/14 or 43 percent) as compared to the civilian population (6/112 or 5 percent). As shown in Table 3, age was not significantly correlated with mean high-frequency hearing threshold.

Table 3: Pearson product-moment correlation coefficients for military and civilian employees between mean high-frequency hearing threshold, age, and years of service.

	Age	**Years of Service**
Mean high-frequency Hearing Loss	-0.01	-0.02
Age	---	0.27*
*p<.05		

Discussion

As a whole, the overall high-frequency hearing loss is similar between the military and civil service 270 dB patients. The military personnel have less time in government service and are younger overall even though there was not a statistically significant difference between the two groups on mean age. A question the San Diego Hearing Conservation Review Panel has had to ask itself is why we appeared to be recommending more job removals/changes for military personnel. The results above at least partially answer that question. Although average high-frequency hearing loss is similar, the military population has significantly fewer years on the job and is younger. Within the civil service group, the six employees recommended for a non-

Table 2: Results of Wilcoxon rank-sum (Mann-Whitney) test for age, years of service, high-frequency hearing threshold, and high-frequency average hearing loss between and among groups.

Source	**Z**	**p**
	Age	
Military & civilian	6.31	.000*
Military removal & civilian removal	1.76	.078
	Years of service	
Military & civilian	5.02	.000*
Military removal & civilian removal	2.41	.016*
	Mean high-frequency hearing loss 3K-6K Hz (both ears)	
Military & civilian	.367	.713
Civilian removal & civilian retain	2.46	.014*
*p<.05		

noise hazardous job had significantly greater average high-frequency hearing loss as compared to the 110 civilian employees who received a “stay in the current position” recommendation. The statistical results do not tell the whole story, however, as to how this new program is managed and the effects it has had on the San Diego Area Hearing Conservation Program.

The bilateral high-frequency hearing loss that exceeds 270 dB and the employee who has had their baseline audiogram re-established three times are “trigger points”

signaling the need for evaluation as to whether or not this individual needs to be removed from hazardous noise. The BUMED guidelines, although helpful in ensuring fairness in making these clinical/personnel decisions, do not provide guidance necessarily for every situation encountered. A few case studies will demonstrate how the board evaluates the "270 dB patients" on an individual basis and the results of some of these recommendations.

Case Study #1 is a 35-year-old, male, machinist mate who was referred to Occupational Audiology meeting the >270 dB criteria. He had 18 years naval service and possessed orders to report to the engineering spaces of an aircraft carrier 3 weeks after his audiology appointment. Audiological evaluation revealed a significant sensorineural (permanent) hearing loss in both ears over two-thirds of the speech frequency range and beyond. His total high-frequency hearing loss was 370 dB. It was a hearing loss severe enough to necessitate an in-the-ear bilateral hearing aid fitting in 1996 and one that made the individual a safety risk working in noise-hazardous spaces. Importantly, one cannot wear hearing aids while working in a high noise area without the risk of suffering even greater hearing damage due to noise amplification. His previous 3-year tour was shore-based working in a non-noise hazardous environment at a shore command. The panel met post-haste and recommended he not be assigned to any future duties in hazardous noise. The occupational audiologist serving as the case manager (second author) contacted the ship and explained the extent of the hearing loss to the senior medical officer (SMO). It was determined that the petty officer's future assignment was definitely noise-hazardous. The SMO notified the audiologist that the ship did not desire to have this individual PCS onboard with such a significant hearing loss. The audiologist contacted BUPERS, explained the recommendation, and the orders were cancelled approximately 10 days prior to his reporting date to the ship. He would serve his remaining 2 years on active duty at a shore facility in a non-noise hazardous working environment.

Case Study #2 was a 46-year-old, male, aviation electronics mate with 18 years service referred for audiological re-evaluation due to the presence of a severe sensorineural hearing loss in both ears across the entire test frequency range (335 dB). This member had less overall high-frequency hearing loss than in Case Study #1, but his hearing loss affected all measured frequencies. He had been previously fitted with in-the-ear hearing aids due to a significant hearing loss across the speech frequency range and was a potential safety risk while working in a high noise workspace. He had a long-standing hearing loss, had been wearing hearing aids for approximately 10 years, but had never been referred to an audiologist before to assess job placement. He was currently working in a non-noise hazardous environment and due for orders. The panel recommended no assignments to noise-hazardous areas. A few months after the board's recommendation, the member's command decided to send him to work at another command (squadron). The Industrial Hygiene Department took noise measurements at the member's work locations within the squadron and determined which were safe "non-noise" areas. The command supported the work space restriction recommendations. This is an excellent example of medical and line commands partnering to protect the health and safety of Navy personnel.

Case Study #3 was a 72-year-old male civil service sheet metal worker exhibiting a profound sensorineural hearing loss across half of the speech frequency range. He was referred to the panel. He exhibited an average speech recognition score in the right ear and a very poor score in the left ear. This individual exhibited a significant decrease in hearing for both ears compared to his 1992 re-established baseline audiogram and was fit with two hearing aids by the VA in 1993. Because of the poor speech recognition score in one ear, he was referred to Otorhinolaryngology (ENT) for evaluation. All "270 dB patients" exhibiting any medical pathology or an asymmetrical hearing loss is automatically referred to ENT as part of their review panel work up. The commanding officer and civilian personnel office of the large industrial facility where this employee worked were notified that the panel recommended removing this individual from

Photo by PH3 Laine Altshuler

Gunnery Sgt. Crady wears a protective hearing device on the pistol range in Sicily.

Photo provided by authors

Protective hearing devices should always be worn by military and civilian maintenance workers around aircraft, including during refueling stages.

noise-hazardous duties. At the request of the command, a meeting was held with the case manager (second author), civilian personnel, the union, and the employee's supervisor to discuss options for the employee. This allowed occupational audiology and industrial hygiene the opportunity to explain the rationale and goals of the 270 dB program and this particular recommendation. It was decided that civilian personnel would attempt to find another position for the employee free of hazardous noise. In this case, however, no other position could be found. Fortunately, the sheet metal worker was eligible for retirement benefits. Occupational audiology and industrial hygiene are in the process of scheduling hearing conservation training for supervisors and shop employees at this command as a result of the disposition of this patient.

Case Study #4 was a 31-year-old, male, boatswain's mate with only 8 years of naval service exhibited a sharply sloping bilateral sensorineural hearing loss. This member did exhibit some high-frequency hearing loss at time of enlistment, but did meet entrance standards. In 9 years his high-frequency hearing had decreased significantly in both ears. According to the 1987 enlistment standards for hearing, this Sailor with pre-existing hearing loss should never have been assigned to an identified noise-hazardous rate. The panel recommended removal from duties in noise and a rate change.

Conclusions and Recommendations

Occupational hearing loss continues to be costly for the Navy fiscally with negative impacts on the quality of life. The implementation of this program, although time consuming for Navy occupational health professionals, appears to be having positive effects in generating more support for the hearing conservation program. This program has improved collaboration between different occupational health disciplines (audiologists, physicians, nurses, and industrial hygienists) to work in a more coordinated fashion. It has also resulted in more face-to-face contact with the line and supported commands served and taking hearing conservation to the deckplates more frequently than ever before. More importantly, recommendations are being implemented that will preserve the hearing of members who cannot afford to lose more auditory functioning. Historically, the degree of hearing loss has been largely unintentionally ignored for noise hazardous ratings that do not have specific hearing criteria as identified in the aviation communities. One of the incidental benefits of the "270 dB rule" is that sailors are counseled early in their careers that they must maintain relatively normal hearing or their rating and subsequent career may be put at risk. DOD hearing conservation programs are moving forward in technology allowing for more accurate trending and data collection. This is evidenced by the implementation of the Defense Occupational Health Readiness System—Hearing Conservation (DOHRS-HC) which allows for more in-depth data analysis of the effectiveness of the program. This is a major centrally funded project being implemented now across the Navy. Future efforts in hearing conservation will also focus on the training of supervisory personnel, as these are the individuals that will enforce the consistent use of hearing protection. Occupational hearing loss is largely preventable. The majority of noise induced hearing loss in the Navy today is a result of the failure of exposed personnel to use appropriate hearing protective devices. Commands are encouraged to place greater emphasis on their programs. Hearing conservation practices enhance the military readiness, safety, and quality of life for our military and civilian employees. If there are high noise work areas where the use of hearing protection is a problem or concern, commands need to contact their local occupational audiologist or occupational health professionals. Let's continue to partner with the line community to accomplish the Navy's mission without jeopardizing the health of our civilian employees, service members, and the fighting forces they support. ❑

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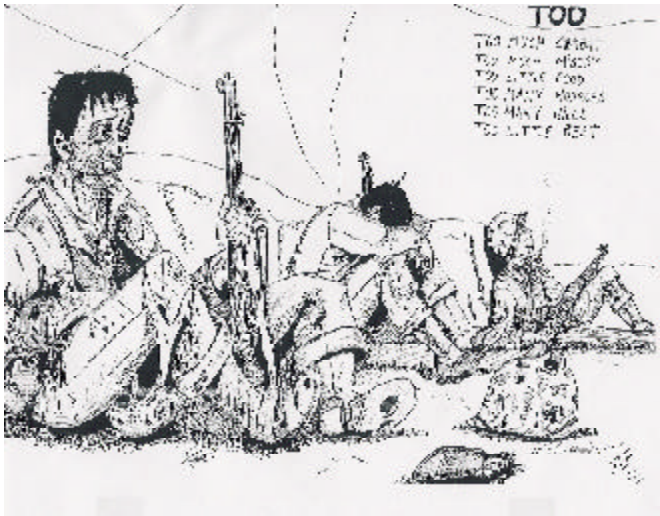
Combat Fatigue in the Navy and Marine Corps During World War II

CDR Lee R. Mandel, MC, USNR



Sketch by SGT John F. Fenwick, Jr., USMC, Korean War veteran.

Descriptions of what is now known as combat stress appear in the literature as far back as the Civil War.(*1*) At various times in history, it was known by different names: "irritable heart," "nostalgia," "shell shock" in World War I, and "combat fatigue" in World War II.

It was during World War I that many advances were made in the understanding of the etiology and treatment of combat stress. It was at that time that the etiology was determined to be psychological, and not due to concussions caused by the explosions of modern weaponry.

The work of Salmon (*2*) described the most important concepts of the effective treatment of shell shock. It was based on the principles of "PIE": **P**roximity—treatment near the front lines, **I**mmediacy—immediate initiation of short-term treatment once the problem was identified, and **E**xpectancy—treatment with the expectancy of a prompt return to duty. The concept of shell shock treatment near the front lines was rapidly embraced by the French, the Germans, and also the Americans when they entered the war. Initially, the British evacuated all their shell shock cases to the rear, with disastrous results on manning and readiness. By the end of the war, they, too, embraced the concepts of "PIE."

During the inter-war period, the lessons learned concerning the treatment of shell shock were largely ignored. The U.S. Army doctrine at the beginning of World War II was that only weak neurotic men succumbed to what was now called "combat fatigue" or "combat exhaustion;" normal soldiers did not break down.

This led to the Army's reliance on screening psychiatric interviews. The policy was to routinely hospitalize and then discharge anyone screened with the diagnosis of "psychoneurosis."(*3*) This led to an unacceptably high discharge rate, and it was not until late 1943 that the Army began considering each individual on a case-by-case basis.

John W. Appel, M.D. joined the Army in 1941, and quickly realized the futility of the Army's screening pro-

cess. He championed the concept of preventive psychiatry and began using an epidemiological approach to combat psychiatry. He also noted the importance of motivation and morale in preventing psychiatric combat casualties.

Appel and his team studied the length of combat effectiveness for a soldier in a combat zone and ultimately recommended an infantryman combat tour of 180 aggregate days. Appel also stressed the importance of psychiatric support at the front lines and gradually the concepts developed in World War I were re-instituted. By the end of the war, it was readily acknowledged that every man can have a breaking point during combat exposure.(*4*)

During World War II, the Navy also initially ignored the World War I lessons of "PIE." Despite this, the Navy and Marine Corps had a much lower rate of combat fatigue casualties than the Army. There were several factors to account for this. During most of the war, Navy and Marine Corps personnel were volunteers, unlike the Army. Hence they were more motivated and the Navy and Marine Corps were able to set higher physical and mental standards. The Navy also had psychologists in place at naval training centers before the war started, and hence had a more sophisticated and effective screening program.(*5*)

Most of the literature on combat fatigue from World War II is from the Army Medical Department. It, of course, mainly deals with the infantryman in combat. There is considerably less literature on combat fatigue dealing specifically with the Navy and Marine Corps. However, there is literature available that provides an insight into the character of combat fatigue aboard Navy combatant vessels, as well as information on the combat fatigue suffered by the Marines during their amphibious campaigns in the Pacific.

On 15 September 1942, CDR Bartholomew W. Hogan, MC, was serving as the senior medical officer aboard the aircraft carrier USS *Wasp* (CV-7) when it was hit by two Japanese torpedoes. Multiple subsequent explosions from fuel and ordnance soon occurred, and the order was passed to abandon ship just prior to her sinking. Hogan, a psychiatrist, reported his observations at the May 1943 meeting of the American Psychiatric Association.(*6*)

The majority of casualties were burn patients, as well as sailors suffering from long bone fractures and shrapnel wounds. Hogan was impressed by the incredible coolness under fire displayed by the crew. "I saw no panic and there were no reports of any." Despite the carnage, he noted no panic or hysterical reactions, and noted that the abandon ship procedure proceeded in an orderly manner. Hogan interviewed all the survivors and recorded their reactions. An officer from the engineering spaces noted the great mental strain the men were under, but reported that the men showed no fright and worked efficiently showing little or no excitement. Two junior officers interviewed also noted no hysteria, as the crew was entirely focused on saving the ship and taking care of their injured shipmates.

Hogan submitted questionnaires to the *Wasp*'s survivors to assess their reactions at three distinctive times: a) immediately after the torpedoes struck the ship, b) 12 hours later, and c) 3 weeks later. Immediately after the torpedoes struck, 38 percent of the respondents reported that they were calm with little change, 33 percent reported that they were excited, nervous, tense, or shocked, and 9 percent reported that they were very fearful. Twelve hours later, 46 percent reported that they were fearful, apprehensive, or nervous. Three weeks later, 80 percent reported that they were unaware of any physical change, 53 percent were unaware of any emotional change, and 37 percent reported that they were nervous, apprehensive, or jumpy.

CDR Hogan, who received a Silver Star and a Navy and Marine Corps Medal for his heroic actions aboard the *Wasp*, would eventually rise to the position of Surgeon General of the Navy.

The Solomons campaign first demonstrated the effect of combat fatigue on the Marine Corps. A large percentage of Disease/Non Battle Injury (DNBI) cases proved to be from combat fatigue. It was on Guadalcanal that medicinal brandy was first used by the Medical Department to treat combat fatigue. Brandy was supplied to each aid station and field hospital so that it could be administered by medical officers to men who showed early signs of fear or combat fatigue. Four ounces of brandy were added to each canteen of water, and 2 to 3 swallows were given on an empty stomach to induce sleep. After this treatment, men were often ready for frontline duty again, with the treatment being repeated two or three times for an occasional patient. It was noted that "in no instance did a patient try to take improper advantage of the medication."(*7*)

Following Guadalcanal, in the New Georgia operation, the most serious medical problem was the relatively high risk of combat fatigue, exhaustion, and "war-weariness." From 30 June to 30 September 1943, 2,500 men were

admitted to field hospitals for anxiety reactions. On Bougainville, the largest of the Solomon Islands, the Marines had 749 cases of combat fatigue and 140 cases of psychoneurosis out of a total of 1,380 cases of DNBI.

After the experiences on Guadalcanal and Tarawa, the need became apparent for improved psychiatric support to handle the combat fatigue cases that could be anticipated in any further combat actions. Accordingly, a psychiatrist was added to the headquarters company of each medical battalion. This proved to be highly effective during the battle for Iwo Jima. It allowed for the segregation and controlled evacuation of combat fatigue casualties, while freeing up other medical officers to care for the wounded.

During the Saipan campaign, DNBI (including combat fatigue) accounted for one-third of all hospital admissions. The 4th Marine Division had 414 combat fatigue cases and 169 cases of psychoneurosis, out of a total of 1,698 cases of DNBI. The high incidence of neuropsychiatric casualties was felt to be due to a number of factors, primarily a) instances of poor leadership at the small unit level, b) lack of proper orientation as a result of keeping troops poorly informed on the battle situation, and providing poorly defined objectives, and c) the loss of physical fitness that contributed to a high incidence of anxiety.(*8*) In many of the combat fatigue cases, providing 3 or 4 days of rest, a bath, and nourishing food resulted in complete recovery with return to duty in 75-80 percent of the cases.

A new and unique combat stressor appeared during the Okinawa campaign in April, 1945—the kamikaze. These suicide aircraft attacks added a new dimension of terror to an already extremely dangerous, stressful environment. This experience was exemplified by the battleship USS *New Mexico* (BB-40). Struck by a kamikaze in the superstructure, she suffered 30 killed and 129 wounded. Medical evacuation was not possible for 13 days. For 4 days following the attack, the ship was nearly continuously at general quarters and subject to repeated air attacks. The critically injured were placed in an air-conditioned ward, but other seriously injured patients, and neuropsychiatric patients, were put in poorly ventilated compartments. The constant shelling and repeated air attacks produced a state of anxiety and panic among the wounded and DNBI patients, and their continued presence aboard soon became a negative morale factor for the rest of the crew. The senior medical officer, in his after-action report, stressed the importance of early evacuation of the wounded, considering it as essential to the ship's mission as rearming or refueling.(*9*)

As a result of continual kamikaze attacks, nervous tension was high in personnel aboard the ships involved in the Okinawa campaign. As the battle progressed, increasing numbers of men had "vague mental complaints", exhibiting irritability, depression, anxiety, and fatigue. The senior medical officer aboard the aircraft carrier USS *Cabot* (CVL-28) noted that the time required to complete various tasks increased by as much as 50 percent.(*10*) The continuous action, kamikaze attacks, lack of recreation and rest, and the lack of replacement personnel were all contributing factors in the development of "nervous fatigue." The commanding officer of the USS *Southard* (DD-207) cited these factors, noting that as a result, a few crewmembers "cracked up." He also noted that these were not green, inexperienced sailors, but were veterans who had been aboard ship a long time. This added further credence to John Appel's observation that every man in combat has his breaking point.

Despite the overwhelming stress of the campaign, there were numerous reports of extraordinary calm under kamikaze attack by naval personnel at Okinawa. After-action reports by the medical officers of the USS *Maryland* (BB-46), USS *Pensacola* (CA-24), and USS *Terry* (DD-513) documented the absence of panic or hysterical reactions among the crew of these stricken ships. Each cited both the tireless efforts of the medical department to treat casualties, as well as the steadfastness of injured crewmembers, who often refused to leave their battle stations despite serious injuries. These reports mirror the observations of CDR Hogan, who also noted the lack of panic among the men of the *Wasp*, despite carnage of the torpedo attack that led to the ship's sinking.

Overall, the Okinawa campaign was one of the deadliest in the history of the United States Navy. The Navy suffered 9,973 casualties out of a total of 38,420 casualties for all United States military forces. The ratio of Marines killed to wounded was 1 to 5; Army, 1 to 4.25; and the Navy 1 to 1. Probably for the first time in naval history the number of killed and missing exceeded the number of wounded.(*11*)

The unique environment of submarine warfare was studied in detail by the Navy. U.S. submarines made 1,520 war patrols, from which 1,489 were available for analysis.(*12*) It was concluded that the psychic trauma sometimes experienced by submariners was as great, if not greater, than that experienced by any other group in the

war. World War II logs of surviving boats describe the mental strain of not only hearing depth charges explode nearby but also of leaky bulkheads, loss of lighting and power, and working under temperatures ranging as high as 130 degrees. Compared to other branches of the Navy, losses were high. About 18 percent of all boats that saw combat were lost.(*13*)

Prior to the war, there were no unique physical requirements required by the Manual of the Medical Department for assignment to submarine duty. It was quickly noted that intelligence quotient and psychological fitness needed to be added to the screening process for submarine duty. The screening procedure resulted in a submarine force that was extremely motivated and with a very high degree of esprit de corps. The Submarine Service had only a minimal number of men expelled for infractions of discipline or incompatibility with their shipmates.(*14*) An indicator of the high quality of leadership of the commanding officers was the fact that there were only three instances where the crew lost confidence in the commanding officer.(*15*)

Despite the hazards under which submarine crews existed, the rate of psychiatric casualties was extremely low.(*16*),(*17*) Out of 126,160 man patrols, there were 62 psychiatric casualties, an incidence rate of 0.00041 cases per man patrol.(*18*) The actual rate was probably lower, an analysis of the reported cases include such diagnoses as epilepsy, migraine, vertigo, and neuritis. The Navy attributed this low rate to 1) careful screening and selection of personnel, 2) thorough and specialized training, 3) high morale associated with success of combat submarines, 4) adequate rest and rehabilitation facilities and frequent rotation of duty, and 5) medical examinations before and after patrol duty.(*19*)

In summary, during World War II, it was found that regardless of branch of service, potentially every man had a breaking point when exposed to the rigors of combat. Combat fatigue became a major cause of DNBI, and as the war progressed, the need for additional health care personnel skilled in the treatment of this condition became apparent.

The Navy Medical Department relearned the principles of Salmon and successfully applied them. These lessons were not forgotten, but were very successfully applied during the Korean War, where front line psychiatric aid stations were rapidly established. These psychiatric aid stations were highly effective, returning about 70 percent of their patients to combat within 10 days. At the same time, the relapse rate for the Marine Corps was only about 6 percent.(*20*)

Despite the unique environment of Naval/Marine Corps combat (including kamikaze attacks, submarine warfare, and continual amphibious assault), where the possibility of combat stress was always present, the overall record documents incredible heroism and coolness under fire. The magnificent performance of U.S. service men during World War II can best be summed up by quoting Fleet Admiral Chester Nimitz when he described the Marines at Iwo Jima: "Uncommon valor was a common virtue."

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Rota Finds Way to Celebrate Women, Making Health Promotions Effective

Heather King Navarrete

With all of the health awareness issues that Americans encounter on a daily basis, it is becoming harder and harder for health promoters to call the public's attention toward important health-related issues. One group of health promoters at Naval Hospital, Rota, was able to capture the attention of 200 women and leave a lasting impression. The opportunity came about when a private, non-profit organization, spear headed by Naval Audiologist LT Mari Schulz, hosted a 1 day women's forum.

The forum, "Womanhood: The Basics and Beyond," included 68 workshops that ranged in a variety of topics from health and finances to beauty and crafts, and provided a chance for women to network in the morning and in the afternoon over a continental breakfast and lunch. The keynote speaker, psychologist CAPT Elizabeth Holmes, spoke about gender differences in communication.

"It was an event that meshed contributions from all base resources into one beautifully packaged educational and fun day," said Schulz.

During opening remarks, Breast Care Initiative Facilitator LT Elizabeth Escalera and Mammography Technologist Kimberly Plourde seized the opportunity to educate 200 women on breast cancer and the importance of early detection. Escalera and Health Promoter Betty Murphy set up a station in the banquet hall, which provided participants a chance to speak with health experts individually and to collect literature on the subject. There, Escalera completed nearly 100 breast cancer risk assessments and taught one of the 45-minute seminars offered.

A table was also set up in honor of breast cancer survivors and victims. A pink candle was lit in their memory and two posters were provided where participants were invited to remember their loved ones by name, by writing a remembrance in their honor.

The marketing opportunity the conference provided was invaluable, said Escalera. Nearly 3 months after the event, Escalera is still seeing a response.

"I still have women that were at the conference coming to the clinic, seeking guidance and information regarding breast cancer prevention and detection," she said.

The information was well received, said Murphy, because it was provided in a forum where women would be open to the information.

"When you have a big forum like that, it is helpful because it gives you a chance to get the message out in a different way," she said. "[As a health promoter], you are always looking for ways to get the message out, and so the more innovative way makes for a larger impact."

The event proved that careful marketing really does make a difference, said Schulz. ❑

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In Memoriam

CAPT Lewis L. Haynes, MC, USN, (Ret.), died on 11 March 2001, in Naples, FL, 1 month shy of his 89th birthday. Born in Manistee, MI, he graduated from the University of Michigan in 1934 before attending Northwestern University Medical School in Chicago. During his internship at Cook County Hospital, he applied to the Navy. "There were 400 of us who took an exam for 23 internships. In those depression days, anybody that could get in the Navy or Army did so. It was very competitive." Dr. Haynes did well on the exam and received a temporary grade of lieutenant (j.g.) and a 1-year internship in 1938.

With war looming in Europe the following year, Dr. Haynes' naval service was extended and he was reassigned to the dispensary at the Naval Base, Norfolk, VA. In February 1940 the novice Navy physician became division medical officer of Destroyer Division 62 which comprised the *Overton* (DD-239), *Bainbridge* (DD-246), *Sturtivant* (DD-240), and *Reuben James* (DD-245), obsolescent "four-pipers" from the World War I era. With the *Reuben James* as his headquarters, Dr. Haynes patrolled the Atlantic shadowing German submarines and assuming other duties usually not given to medical officers. Because the division was undermanned, Haynes took his turn as officer of the deck and stood the 4 to 8 watch every morning and the 4 to 8 watch every night on the bridge. Just days after Dr. Haynes transferred to another destroyer of the division, the *Reuben James* was torpedoed and sunk on 31 October off Greenland by a German U-boat.

As the as yet undeclared war with Germany heated up, DESDIV 62 escorted British convoys across the Atlantic to what was called Mid-Ocean Meeting Point. That was right off the tip of Ireland—about 200 miles north of Ireland—halfway to Murmansk. There the division turned the convoy over to the British. "Our orders were to consider any German submarine or plane that came within 50 miles of us as hostile and we were to retaliate. Every time we picked up a sonar contact on a submarine we made a run on it."

On one patrol the division encountered a near fatal hurricane and there were a lot of injuries. As Dr. Haynes recalled, "Our sick bay was nothing more than a small closet. If I wanted to examine a patient, I took him out of sick bay and laid him down in one of the crewman's bunks. Sometimes it was very rough up forward. Men would complain of seasickness and even I had my big bucket right alongside of me. A crewman would say, "Doc, I'm seasick." And I'd reply, "I am too. Go on back to work." During the 19 months Dr. Haynes was medical officer, DESDIV 62 made six round trips in the North Atlantic.

His most memorable World War II assignment was as **senior medical officer aboard USS** *Indianapolis* (CA-35), best known as the vessel that carried the essential components for "Little Boy," the Hiroshima atomic bomb. Having delivered its deadly cargo, the *Indianapolis* had another distinction as well. She was the last U.S. warship sunk in World War II. Traveling alone, on 29 July, the Indy was torpedoed by a Japanese submarine. Although some 800 members of her 1,199 man crew got into the water, 4 1/2 days passed before rescuers arrived. Only 316 were pulled from the ocean. The pathetic story of the *Indianapolis* and her crew has been told and retold many times, yet the horror of the tragedy which cost the lives of 880 men lives on over a half-century later. For the precious few fished alive from the shark-infested Philippine Sea, memories are still vivid. They certainly were for Dr. Haynes. During an interview with *Navy Medicine* in 1995, Dr. Haynes shared his recollections of the tragedy. "Normally, I don't have the nightmares. Last night, I didn't sleep well. And I won't sleep well tonight. But eventually my mind will turn off and I'll be all right. It's like when I try to say The Lord's Prayer. I cry, or I sit down and try to talk to somebody about it. As long as I stay away from talking about individuals—my friends... I was on that ship over a year and a half and we were all close friends and we'd been through a lot together and I knew their wives and their families. As a doctor you get more intimate than normal." —JKH

CDR Eugene Owen, MC, USN, examines Dr. Haynes' dressings at the hospital in Guam. *Indianapolis* skipper, CAPT Charles B. McVay, stands at right.

Book Review

Newcomb, Richard F. *Abandon Ship! The Saga of the* USS Indianapolis, *the Navy's Greatest Sea Disaster.* HarperCollins. New York. 326 pages, 2000.

Peter Maas, author of *The Terrible Hours*, the story of the USS *Squalus*, disaster, has revived a work that remained forgotten for over four decades. In 1958, the book *Abandon Ship!* was a bestseller that told the story of the sinking and terrifying ordeal of the crew of the USS *Indianapolis* (CA-35) near the end of World War II. Ironically, the cruiser, which had just delivered the components of the atomic bomb that would be dropped on Hiroshima to hasten the ending of the war, would be the last warship sunk by the enemy during that war. Questions surrounding that last voyage have been the subject of heated debate for over half a century. Why wasn't the vessel's skipper, CAPT Charles McVay, warned of enemy submarine activity? Why didn't he pursue a zig zag course to help minimize a successful torpedo attack? Why wasn't the *Indianapolis* reported overdue and a search begun? Was McVay made a scapegoat for the tragedy?

What is painful to read is not the actual sinking of the ship but the 4 1/2 days the survivors spent floating in the vastness of the Pacific Ocean. One by one, survivors succumbed to delirium, despair, the elements, hopelessness, and sharks. Of 1,199 sailors only 316 survived. As with so many campaigns, Navy medical personnel would be present bringing comfort and sharing the pain of their fellow shipmates.

This review focuses on the hospital corpsmen, physician, and the medical evacuation of the *Indianapolis*' survivors. LCDR Lewis L. Haynes, MC, was the ship's doctor, and the book devotes several pages to his routine at ship's sick call and his warm relationship with the crew and his corpsmen. Dr. Haynes was stretching out in his bunk when the first torpedo struck; the second impacted directly beneath his stateroom, causing the compartment to burst into flames.

With the warship now listing, Haynes dashed with his life-vest toward the wardroom and onto the quarterdeck, where he fell and burned his hands on the now red-hot deck. When he arrived he found Chief Pharmacist Mate John A. Schmuech administering morphine. The doctor quickly began organizing the injured for what became a very hasty departure, as the ship, still underway, buried itself beneath the waves within minutes. One Marine, wearing a cast for broken toes, slipped from sight, weighed down by his cast. Dr. Haynes was unable to save him.

When the *Indianapolis* sank at 14 minutes past midnight on Monday 30 July 1945, the survivors' horror had just begun.The book describes how fate brought Dr. Haynes, his assistant LTJG Melvin Modisher, MC, and Chaplain T.M. Conway together floating with the largest group of survivors. In such bleak circumstances, Haynes, with burned hands and without medicine, could do little but encourage the men to hold on until rescuers arrived, or to pronounce dead the less fortunate. Screams of "Doctor," "Doc" penetrated the night, as oil-covered men cried for assistance.

In perhaps the largest group—some 300 men that first day—LCDR Haynes was the senior surviving officer and, by virtue of rank, training, and force of personality, he took charge. The story continues with a blistering daytime equatorial sun and cold temperatures at night. Wednesday 1 August was a day of horror as men swam away never to return. Others dived beneath the waves thinking their ship was just beneath them and never resurfaced. Father Conway and other officers expended their last ounce of energy preventing such suicidal actions and in turn collapsed in delirium, the chaplain dying in Dr. Haynes' arms. The doctor would be attacked that night by sailors who succumbed to hallucinations that the Japanese were around them. Of the original 300 in Haynes' group only 100 remained by Thursday morning.

When rescue finally came, the lucky few were taken to Base Hospital No. 114 off the tip of Leyte, and Base Hospital No. 20 in Peleliu, where they were treated for dehydration, shark bites, salt-water ulcers, exposure, shock, and burns. Eventually, the most severe casualties were medically evacuated to Peleliu where the hospital ship USS *Tranquillity* (AH-14) took aboard survivors for transfer to Guam. Commanding the hospital ship's medical facility was CAPT Bartholomew W. Hogan, MC, who would later become Surgeon General of the Navy. From his bed aboard the *Tranquillity*, and at Hogan's suggestion, Dr. Haynes dictated his recollections of the disaster. This record would later be used by the board of inquiry investigating the disaster.

For nearly 56 years, there has been controversy surrounding this greatest sea disaster in U.S. Navy history. What is not controversial is the fortitude displayed by those medical personnel as they tried to relieve the suffering of their comrades. *Abandon Ship!* provides the details to this epic story.

—LT Youssef H. Aboul-Enein, MSC, USN, is Plans Operations and Medical Intelligence Officer, Naval Hospital Great Lakes, Il.

Navy Medicine 1936

BUMED Archives

Students at the Naval Medical School, Washington, DC, learn gross anatomy in the basement dissection room. This space now houses the gym in BUMED's Building 2.