

PROCEEDINGS
15TH CONFERENCE ON MILITARY MEDICINE
UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES

Editors: COLONEL Clifford C. Cloonan, USA and Colonel Joseph M. Palma, USAF
Department of Military and Emergency Medicine
4301 Jones Bridge Road
Uniformed Services University
Bethesda, Maryland 20814
Phone: 301-295-3720
e-Mail: ccloonan@usuhs.mil or jpalma@usuhs.mil

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EXECUTIVE SUMMARY

The Uniformed Services University of the Health Sciences (USHUS) is proud to offer this report of the 15th Conference on Military Medicine, “A Challenge to Readiness: Maintaining Currency in Military Medical Education.” These proceedings serve as a record of the Service’s Surgeons General nominees' contributions toward predicting the changes that will affect military medical practice over the next twenty to thirty years and of their recommendations regarding the changes needed in military health care education to prepare today’s students to practice in the future.

The Uniformed Services University, as the nation’s pre-eminent center of military medical education, is committed to ensuring that its students are prepared to practice in our rapidly changing world. To this end, Dr. Val Hemming, Dean of the School of Medicine (SOM), directed that this conference be conducted and its proceedings be published. The specific focus of this conference was to identify the anticipated changes in military health care practice and the new educational objectives needed to properly prepare military health care practitioners for the next twenty to thirty years. Changes in

both the content and structure of medical education and military medical education within the SOM are already underway.

Process

Experts in military and contingency medicine contributed their expertise, experience, knowledge, opinions, predictions and, most importantly, their recommendations for the planning and implementation of military medical education and training by the Department of Defense in the next twenty to thirty years. The conference began with a plenary session in which selected experts reviewed current military medicine educational and training programs and offered their “best guess” predictions in four principal topic areas: (1) new technologies, both medical and non-medical, that are likely to significantly influence the practice of military medicine over the next twenty to thirty years; (2) changes in the Services’ missions and doctrines that will affect future health care delivery and the practice of military medicine; (3) emerging threats – new emerging or re-emerging diseases, and new weapons or new weapon technologies; (4) changes in ethics, mores, and societal expectations that will affect the future practice of military medicine.

The opening plenary session, which was designed to “set the stage,” provided background information and defined the “deliverables” for each of the working panels. Presenters included: (1) Rear Admiral (Ret.) William Rowley, M.D., a prominent futurist, speaking on “The Potential Future”; (2) Colonel (Ret.) Craig H. Llewellyn, M.D., M.P.H., M.S., Professor and former Chair of the Department of Military and Emergency Medicine, USUHS, speaking on “Military Medicine: Yesterday, Today, and Tomorrow”; (3) David P. Stevens, M.D., Vice President for Medical School Standards and Assessment, Association of American Medical Colleges (AAMC), speaking on “Educating Physicians for Unpredictable Change”; and (4) Rear Admiral Richard A. Mayo, USN, Director, J4-MRD, speaking on “Joint Vision 2020.” Each of the individual Services’ medical departments also provided overview briefings.

In the following three days, each of the four working panels developed and presented to the Dean of the USUHS SOM their predictions for how medical practice will change and recommendations for educational objectives that, if met, could would prepare today’s students for medical practice in the next twenty to thirty years. The complete list of these predictions and recommendations is provided in the full text. A consolidated summary of these predications and recommendations follows.

While no one can predict the future with any degree of certainty, there are aspects of the future that can be reasonably determined and, because human nature remains fairly constant, there are some things that will remain unchanged regardless of how technology evolves. Although there has been unprecedented change in the technology of war, most of the issues related to the delivery of medicine in war remain unchanged; therefore, most of the current military medicine educational objectives will remain relevant for the foreseeable future.

Working Panel Core Concepts

The following core concepts emerged from the working panels:

(1) Technology, by itself, is not nearly as significant a factor in altering the practice of medicine in general, and military medicine specifically, as is the way technology is integrated into a new way of doing business.

(2) Information technology and the Internet will fundamentally shift the relationship between physician and patient. The role of physician will increasingly shift from that of impersonal expert who is assumed to know best, to that of listener, teacher, and guide working with the patient to achieve health goals set out by the patient. Physicians and other health care providers will have to be able to interpret medical information and help patients weigh decisions regarding risks and benefits.

(3) The reorganization of the military toward smaller, more flexible, multi-functional and highly dispersed units, made up of more educated and more highly trained individuals, will have a profound influence on military medicine. As each warrior will represent a more significant proportion of the assets of the organization, it will be increasingly important to keep him or her healthy, fit and productive. Preventive medicine's role in maintaining the health of the military population will, therefore, become even more important. Finally, warriors are likely to be more remote from a central medical facility when deployed, and deployment will occur more often than in the past. This means that they will have to be more medically self-reliant or that each relatively small unit will need to have a highly trained medic/corpsman who can independently provide fairly sophisticated medical care. Physicians will need to take on the roles of educator, supervisor, mentor, and consultant to these sophisticated medics/corpsmen. Current civilian "HMO" medical planning, and the education and training of health care providers emphasize the need to optimize efficiency. Due to the need to support increasingly more dispersed forces in an increasingly complex, fluid, and unpredictable combat environment, military health care providers will also need to be taught the value of excess capacity in insuring the appropriate level of care when and where needed.

(4) Changing missions and concepts for the use of military force is having, and will continue to have, a significant influence on military medical practice. Defeat of an enemy's armed forces is only one aspect of achieving national strategic goals. In the realm of accomplishing national strategic objectives without the use of force, military medicine will play an increasingly important role. More than ever, health care providers need to learn foreign languages (or at least how to use a "universal translator"), understand foreign cultures, and be familiar with how medicine can most effectively facilitate national strategy.

(5) Violent military confrontations, when they do occur, will increasingly occur in urban, suburban, and mostly coastal, environments. This has implications for combat casualty care because urban warfare presents unique medical support challenges, in particular in the areas of far forward care and casualty evacuation (CASEVAC), and is associated with unique injury patterns, such as crush injuries and related problems. Future wars will be

“come as you are,” with no time to prepare and little time to deploy. Preparing health care providers for these unique conditions presents a challenge to military medical educators at all levels.

(6) Changing global and national demographics will affect military missions, medical support for those missions, and even the military organization itself. The pool of young military recruits for developed countries is shrinking and increasingly comprised of more immigrants. For the United States, its troops will be older, come more often from another culture, and frequently speak English as a second language. All of this has significant military medical implications, and much of it has strategic military implications.

(7) Although it is not possible to predict all of the different diseases or toxic threats that might arise in the next twenty to thirty years, it is fairly certain that such threats will emerge and may cause a large number of civilian and/or military casualties. These threats may be old diseases that have become resistant to current therapies, diseases that have been modified to produce new symptomatology, or new diseases that have either arisen spontaneously or are the result of genetic engineering. Toxic threats may come from chemical or biologic toxins that have been intentionally produced and released for the purpose of causing casualties or they may come from the inadvertent or intentional release of industrial toxins. Health care providers should be taught a toxidrome or syndrome-based approach to the initial management of casualties sustaining an unknown exposure. They should also be taught a general approach to gathering incident or outbreak information, and they should be able to safely manage patients suffering from unknown diseases or toxins.

(8) Despite the emergence, or potential for emergence, of several new weapons systems which have novel methods of injury or incapacitation (anti-materiel pulsed lasers, for example), ballistic threats (penetrating injury) will continue to be the most common casualty-producing mechanism. Patterns of wounding and types of wounds are, however, changing and will continue to change. Two recent trends in mechanisms of combat injury are an increased incidence of burns and eye injuries. These are best attributed to changes in types of combat and to a range of weapons types, rather than to the development of particular individual weapons. Enhanced blast weapons, such as thermobaric weapons and fuel-air explosives, are likely to increase the incidence of primary blast injury as they are used with increasing frequency. Other changes in wounding patterns and type are likely to arise from a wide array of improved and new weapons, including “non-lethal” weapons. These weapons will produce an alteration in both the current epidemiology and distribution of wounding and will create entirely new forms of pathology.

(9) There is an increasing societal expectation that future wars will be “bloodless,” and that U.S. casualties will be minimized. America expects that, even during times of war, the U.S. military will provide state-of-the-art health care, adhere to Food and Drug Administration regulations, and do everything possible to reduce troop exposures to hazardous materials, or at least know precisely when such exposures have occurred and be able to track exposed patients. These expectations have significant implications for military medicine. Not only must military health care providers be taught how to deliver

high-quality medical care in an austere environment, but they must also be taught how to recognize disease patterns that suggest toxic exposure and how to collect data for epidemiological studies.

(10) One global change that seems to be affecting all aspects of society is the progressive elimination of boundaries and a growing realization that, at some level, almost everything is inter-related. This has led to a breaking down of formerly “stove-piped” organizational charts into more functional groupings. The implication of this for medicine is that, increasingly, health care delivery will be accomplished through an overall system made of teams, and patient care will be approached holistically. This will create a demand for increased training in how to function as a team and in leadership and communications skills.

(11) A pervasive theme throughout most of the working groups was the increased importance of communication skills. The ability to effectively communicate medical, military medical, and medical-related information to patients, the public, and the news media will be highly valued in almost every possible future world that was envisioned.

If one thing is clear from this conference it is that the focus of military health care educators now needs to be on teaching future health care providers to be flexible thinkers and problem solvers. These health care providers must be skilled at accessing databases and understanding health care systems; become teachers who can educate patients, commanders, and the general public; and be capable of initially managing a wide-range of acute medical problems and properly "dispositioning" an even wider array of diseases and injuries. Another area in which future health care providers will have to become expert is that of expectation management. As noted earlier, society expects “bloodless war” and patients have come to expect perfect or near perfect medical outcomes. Being able to work with society and individuals to bring their expectations more in line with reality will be a highly valued skill. Because of the highly dispersed and highly mobile nature of the modern battlefield, professional health care clinicians must be educated not only to be teachers but also to be consultants. They must be skilled in the use of telemedicine and able to mentor or supervise highly-skilled but nonprofessional independent health care practitioners who will, by necessity, be providing care for most of the troops in dispersed, relatively small, units. Finally, there remains the educational challenge of teaching health care providers not only how to practice state-of-the-art medicine in fixed modern facilities but also how to deliver high quality medical care in austere and often hostile environments.

Summary of Educational Recommendations

In the context of an evolving future that is difficult to predict, the following captures the educational changes recommended by our conference participants for the future. These are developed in more detail in the text of these proceedings. Students of medicine should demonstrate the following:

1. Competency in the principles of justice and confidentiality and the ability to properly allocate limited resources to diverse populations in ambiguous clinical situations and diverse environments while involving patients in managing their health
2. Ability to develop and appropriately apply customized therapies that can be used both in high and low technology environments
3. Ability to keep patient expectations in line with probable outcomes, while involving the patient in medical decision-making
4. Team work and decision making skills in changing environments that include individuals with differing skill-sets, medical and non-medical, with diverse, even international, backgrounds and organizations
5. Ability to simultaneously address or provide force protection, life-saving and life-sustaining medical care, and force enhancement for a dispersed military force across the spectrum of prevention, and physical, social, and spiritual interventions with sensitivity to cultural, demographic, economic, and political differences
6. Expertise in the application of both medical and medically-related information technologies
7. Working knowledge of simulated tactical situations that require the simultaneous application and integration of force protection, population health, varied medical capabilities, and people, and multiple evacuation options in both a networked high-technology and low-technology battlefield, often in a high tempo environment
8. Ability to provide leadership in complex and changing strategic and tactical scenarios
9. Expertise in managing emerging diseases and injuries deriving from new and emerging weapons technologies
10. Ability to apply systems-critical thinking to the conduct of military medical planning and medical logistics with special emphasis on functioning in diverse, joint, coalition, and non-government agency medical organizations
11. A basic understanding of modern finance and business models that may be applicable to the future military medical environment
12. Acquisition of life-long learning skills through self-initiated education via a wide range of educational modalities
13. An understanding of society's view of military medicine and its expectations of the military and medicine in the overall U.S. health care environment

14. Comprehensive understanding of the full range of force protection threats, both medical and non-medical
15. Ability to take advantage of medical informatics, both in peace and in war, including the use of biosensors and automated tools of intervention
16. Familiarity with all of the advances in militarily-relevant medical technologies in genomics and proteomics, particularly those that may apply to selection and force enhancement
17. Ability to perform integrated medical decision-making that combines the scope of basic and advanced informatics from biosensors, genomics, artificial intelligence, digitization, virtual reality, and nano- and biotechnologies
18. A basic understanding of applied neuroscience as a tool for education
19. Ability to help develop and use military medical mission-support systems in response to differing military options
20. Ability to make sound decisions during the “fog of war” and in the absence of complete and/or accurate information
21. A high level of competence in emergency and operational medical skills, as the likelihood is good that military medicine will be provided from dispersed or isolated medical treatment facilities on the modern battlefield
22. Ability to function in multiservice, multinational, and non-governmental organizations, often in changing operational settings
23. Ability to recognize and treat emerging diseases and other threats, and to demonstrate an understanding of the battlefield force-protection issues related to these new threats; also the ability to recognize syndromes and symptom “sets” and to utilize advances in immunology, molecular biology, vaccinology, and genetics to diagnose and treat these “new” or re-emerging disease threats and emerging weapons technologies
24. Ability to clearly communicate risk and benefit information to patients and assist them in making appropriate medical decisions that are consistent with and complementary to the other aspects of their life; also, to support a patient's decision-making process, more than a superficial understanding of statistics, disease risk, and population health
25. Ability to demonstrate consequence-management skills (ability to deal with environmental and population needs and risks as a consequence of a toxic exposure) as well as medical intervention in toxic events and environments, including pertinent physiological events, molecular biology, genetics, and risk communication

26. Working knowledge of basic public health skills in outbreak investigation and associated immunology, molecular biology, vaccinology, genetics, and risk communication

27. Competence in disaster planning and medical “consequence” management in diverse and evolving tactical environments, including military support of adverse civil events

PREFACE

The Uniformed Services University of the Health Sciences (USUHS) is proud to offer this report of the 15th Conference on Military Medicine. These proceedings serve as a record of the Service’s Surgeons General nominees’ contributions toward predicting the changes that will affect military medical practice over the next twenty to thirty years and of their recommendations regarding the changes needed in military health care education to prepare today’s students to practice in the future.

The world, military organizations, and health care are all undergoing change at an unprecedented rate. A measure of this change is the number of conferences being held internationally and within the United States addressing the implications of advances in information science, biology, health care, and engineering, and the rapidly changing demographics of the world. Many governments, businesses, and educational organizations have recognized the need to identify the impact these and other changes will have. They have also recognized the need to implement changes in their structure and practice to take advantage of these changes and to minimize any adverse consequences they might bring about.

The Uniformed Services University, as the nation’s pre-eminent center of military medical education, is committed to ensuring that its students are optimally prepared to practice in this rapidly changing world. To this end, Dr. Val Hemming, Dean of the School of Medicine (SOM), directed that this conference be conducted and its proceedings published. The specific focus of this conference was to identify the anticipated changes in military health care practice and the new educational objectives needed to prepare military health care practitioners for the next twenty to thirty years. The conference intentionally did not address how these changes would be accomplished; that will be left to the 16th Military Medicine Conference in the summer of 2002. Changes in both the content and structure of medical education and military medical education within the SOM are already underway. A future conference is planned to help determine which metrics can be used to measure whether these changes have achieved their desired effect.

BACKGROUND AND METHODOLOGY

Dr. Val Hemming
Dean, School of Medicine
Uniformed Services University of the Health Sciences

Early in the fall of 2000, the Dean of the F. Edward Hébert School of Medicine (SOM) of the Uniformed Services University of the Health Sciences (USUHS) dedicated the 15th Conference on Military Medicine to an examination by military medical experts of the knowledge and technical skills required by military undergraduate and graduate military medical trainees in preparation for the optimal practice of military and contingency medicine in the next twenty to thirty years. The experts' predictions were to be translated into training and curriculum objectives for incorporation into military medical education and training programs to ensure that graduates were prepared for the most likely military and contingency environments of the future. To accomplish this, the 15th Conference on Military Medicine was planned under the title "A Challenge to Readiness: Maintaining Currency in Military Medical Education." The Department of Military and Emergency Medicine, under the leadership of Dr. Craig Llewellyn, Colonel Clifford Cloonan, and Colonel Joseph Palma, planned, organized, and conducted this very successful conference. The conference permitted invited and volunteer experts in military and contingency medicine to contribute their expertise, experience, knowledge, opinions, predictions, and most importantly, their recommendations for planning and implementing military medical education and training by the Department of Defense (DoD) during the next twenty to thirty years. The recommendations from the conference's working panels will be used to update the undergraduate military medicine curriculum for the SOM. They will also be use to make changes in the specialty-specific military medicine educational objectives of the Military Unique Medicine Curriculum portion of the DoD-sponsored graduate medical education programs.

For the first plenary session, selected experts reviewed current military medicine educational and training programs and offered their "best guess" predictions in four principal topic areas: (1) new technologies, both medical and non-medical, that are likely to significantly affect the practice of military medicine over the next twenty to thirty years; (2) changes in the Services' missions and doctrines that will affect future health care delivery and the practice of military medicine; (3) emerging threats—new emerging or re-emerging diseases, and new weapons or new weapon technologies; (4) changes in ethics, mores, and societal expectations that will affect the future practice of military medicine. Four working panels comprised of experts in military and contingency medicine each addressed one of these four topic areas. Each panel explored and predicted likely future changes in military health care and recommended the changes needed to keep military health care education current and relevant over the coming years.

Membership for each of the panels was solicited from the Surgeons General of the Air Force, Army, and Navy. Further solicitations for panel members were made to other important military medicine constituencies. The meeting was publicly announced and many military medical volunteers also came forward to participate in the discussion,

including physicians, nurses, bioscience, veterinary science, and medical service corps officers.

Substantial funding for the conference and for the publication of these proceedings was provided from non-appropriated technology transfer funds from the office of the SOM. The Defense Advanced Research Projects Agency (DARPA) provided additional funding.

The first day's plenary presentations were designed to "set the stage," provide background information, and define the "deliverables" for each of the panels. The background information included a "State of the Future" address by Rear Admiral (Ret.) William Rowley, M.D., a prominent futurist. This was followed by presentations and discussions on "Military Medicine" and "Educating Physicians for Unpredictable Change." The medical departments of each of the Services then provided an update of current progress in the organization and delivery of DoD health care and provision of contingency medicine for the next twenty to thirty years.

Beginning with the first afternoon of the conference and throughout the next two days, each of the four panels discussed and debated prospective changes in technology, health care, military doctrine, and contingency medicine and military medicine environments. The panels prioritized those future changes they identified, for both importance and probability of occurrence. The panels also developed learning objectives for each item for the military medical curriculum. Each group then prepared a report for presentation to conference participants and a written report for the Dean.

It is the intention of the conference planners, following publication of these proceedings, to use the concepts and learning objectives produced during this conference as a basis for the 16th Conference on Military Medicine. During this conference, military medical educators will develop plans for integrating the newly identified learning objectives into existing and future military medical undergraduate and graduate medical curricula for the SOM, DoD graduate medical education programs, and continuing health educational programs.

SECTION I: THE ENVIRONMENT OF MILITARY MEDICINE

1. The Potential Future

Comments by Bill Rowley, M.D., RADM, MC,USN (Ret.)

Dr. Bill Rowley, a futurist with the Institute of Alternative Futures, opened the conference with a presentation addressing the technologies being developed today and how they might affect medical practice and health care in the future.

How the Advancement of Computer Technology May Affect Medical Care

Computer power is doubling about every eighteen months. By the year 2020, people will have a computer in their home, for a moderate price, that can calculate at the rate of twenty million billion computations per second. The more users connected to a network, the more powerful is that network. In the next five years, possibly sooner, about one billion people will be connected with each other either through computers or cell phones—and that number should also include the various home appliances, for example, that will probably also be online. Computing will offer a tremendous amount of power, thanks to all of the virtual connections made, providing humans with access to a huge amount of computing power.

This power will likely be used to manage an enormous amount of paperwork, especially in health care, saving millions of dollars each year. Computer chips are not just going into computers but also into everyday items. Cars already contain microelectronic mechanical systems that work like very small factories. Radio frequency chips are currently placed inside merchandise to make sure the customer pays for it before leaving the store.

Radio frequency chips are proving to be very important, and many expect that they will be used in health care in the very near future. These chips will be used to track patients' health, their whereabouts, and their compliance with drug and other regimens, and they will transmit this information to remote stationary main frames and desk top computers. Thanks to radio frequency chips, health care workers will be able to secure a patient's records and immediately deliver the records anywhere around the world—a huge asset, especially in emergencies.

Issues that beg to be solved through advanced chip technology include: (1) reducing the seventeen years it takes approved clinical trial results to achieve widespread acceptance in the American marketplace; (2) the unacceptable number of medical errors, many resulting from the failure of health care providers to keep up with continuing medical education; (3) reducing the 280 billion dollars spent annually on medical transactions and records and, (4) monitoring patient compliance, a valuable feature in an age of skyrocketing pharmaceutical costs.

Consumers are already using the Internet to search for health plans with reasonable prices and customized features. Women can now arrange to deliver their babies in a tropical

setting such as Aruba, with the help of U.S.-trained and board-certified obstetricians. The price even includes five recovery days in a beach condominium. Thanks to the Internet, consumers can demand and receive products and services tailored to their precise needs and desires.

The Impact of Biotechnology and Other Advances on the Practice of Medicine

Biotechnology will also reveal the odds of an individual developing particular diseases, given their genetic profile, environment, and behavior. As our ability to identify the genes involved in disease improves, we will be able to create diagnostic tools that predict diseases and allow us to focus on prevention. When we understand the basic biologic defect involved in a disease, we can create a drug therapy specifically for that disease, or use gene therapy to modify the abnormal gene and prevent the disease from occurring in the first place.

Biotechnology and micro-electromechanical sensors will allow us to create devices such as an artificial pancreas. A watch-like prototype that is able to monitor blood glucose non-invasively already exists, and the ability to administer insulin non-invasively through this device is very close at hand. Numerous other devices will emerge that can monitor patients' health. There will also be household devices that will monitor health status and store health information accessible to health care providers and institutions if the patient so desires.

This kind of monitoring technology may be immensely helpful to the five million Americans experiencing congestive heart failure, or to the millions who require monitoring of their diabetes, high blood pressure, and high cholesterol. The computers that collect this information could not only keep track of a patient's vital signs, but they could also coach them in exercise and eating habits, and answer certain questions they may have regarding their disease.

These developments indicate that the focus of health care is shifting. As in the recent past when health care shifted from the hospital to the ambulatory care site, the focus of health care is now shifting into individuals' homes, encouraging and allowing patients to take an increased responsibility for their health. This has tremendous implications for the practice of medicine in the next twenty to thirty years and should, therefore, change how health care providers are schooled.

Another biotechnological advancement is pharmacoeconomics. People respond differently to drugs. Physicians in the future will be able to use genetic testing to determine whether a treatment course will work before therapy is started, thus creating efficiencies and potentially reducing health care costs. Pharmacoeconomics will also reduce costs by minimizing adverse reactions. This may save the lives of thousands who die each year from adverse drug reactions.

Biotechnology will also reveal the odds of an individual developing particular diseases, given their genetic profile, environment, and behavior. But problems exist as far as whether or not patients will want to be given that kind of information, and whether

adequately trained health care counselors who could effectively and compassionately transmit such information will be available. This is just one example of how health care providers will need to change to provide optimal patient care in the environment created by these new technologies.

Despite the tremendous potential of all of these new technologies, it is likely that not all of our health issues will be explained in our genes. It is unlikely, even with these tremendous advances, that we will be able to completely understand every aspect of what makes up a person's health. Convincing people to change their behavior for the sake of their health is often very difficult. Technology may be able to help with this by showing young people, through simulations, the actual impact their behaviors will have on their future health.

These new technologies also raise new ethical issues. Right now we are creating the technology much faster than we can solve these ethical problems. We must think of all the ramifications to individuals and society if genetic profiles are widely known and the ability to clone humans proceeds at its current pace.

By 2030, robots may be conducting much of the surgery, and they will do it better than humans. The field of nanotechnology, in which scientists build laboratories or machines at the molecular level, is evolving quickly. Physicians may one day be able to conduct a physical examination by injecting a tiny "machine" into patients. These "nanomachines" will not only be able to report on the patient's health status but also "repair" a few cells to improve their health.

Changes in Population and Economic Status, and the Impact on Health

The rate of population growth in developing countries is a primary driver for future events. Ninety-five percent of the world's population growth is occurring in the developing world. In addition, the global economy is surging, and is today worth about 40 trillion dollars. Players other than the United States are affecting the global economy in a large way, in particular China and India, which respectively have the second and fourth largest economies in the world.

On the other hand, extreme poverty is still the norm. About half of the world's population lives on \$3 a day, while twenty of the world's wealthiest people have assets equal to the entire worth of about 60 percent of all nations. This discrepancy in wealth is bound to create instability, especially when many around the world can see the apparent wealth of America on television.

Disease statistics in the developing countries are dramatically different from those in the developed countries. While infectious diseases and intentional and unintentional injuries continue to dominate health status in most developing countries, in the United States 27 percent of all disabilities come from neuropsychiatric conditions. AIDS in Africa is currently defining the headlines, but other infectious diseases are not going away; indeed diseases such as tuberculosis and malaria are getting worse. On top of re-emerging old diseases come such illnesses as Mad Cow Disease. Unfortunately, the wonders of modern

pharmacology may not focus on these more serious problems when pharmaceutical companies can make more money selling anti-obesity and other lifestyle drugs in the United States than by developing drugs to treat infectious diseases in developing countries.

How Does Technology and Biotechnology Affect Military Medicine?

Concern about unrest across various nations has replaced worry about the Cold War, and civilians often comprise the largest portion of casualties in the engagements that result from such unrest. "High-tech war" and military intervention in humanitarian situations has changed how medical care will be provided in such conflicts; for example, a large, 500-bed field hospital is too big and too immobile to support such operations. How to best medically support a "high-tech war" remains an open question. Medicine will certainly play a significant role in operations-other-than-war and in dealing with the effects of Weapons of Mass Destruction (WMD).

The Status of the Health Care System in the United States

As opposed to most industrial nations, the population of the United States is growing—primarily due to immigration. In some areas of the country, immigrants may form the majority. This will have an increasingly significant influence on the practice of medicine within the United States over the next twenty to thirty years.

The aging of the baby boomer generation will also make a huge difference in how medicine is practiced. They are an educated and informed population, and are used to getting what they want immediately. As they age, and as they see their parents age, they are becoming increasingly interested in health care. They will have a tremendous influence on how health care is delivered and how health care resources are allocated. In addition, their own aging will have a huge impact on the cost of medical care and prescription drugs.

Despite this, Americans will not opt for a single payer health care system any time soon, nor will the government take over the system. Today, and in the foreseeable near future, there is simply not enough dissatisfaction with the current health care system to overcome the resistance to change. Americans love technology and believe that health insurance is a matter of individual responsibility—unless that individual happens to be a child. Currently, the challenge is to control costs and create a future health care system that is consistent with our current values, or we must change our values.

From the viewpoint of the rest of the world, the American health care system doesn't look very good. On top of the 106,000 annual deaths from adverse drug reactions, about 98,000 people die in hospitals due to medical errors. And according to a United Nations survey, the United States is thirty-seventh in the world in terms of the quality of our health care system.

Spending more money on the treatment of disease is not the best way to improve health care. Disease prevention, including behavior modification, is the key to better health. About 50 percent of the changes needed to live a healthy life have to do with behavior

and lifestyle; 20 percent relates to the environment; another 20 percent depends upon a person's genes. Access to health care influences only the remaining 10 percent. Despite this, only about 10 percent of health care dollars are spent on prevention.

Because healthy individuals cannot exist in an unhealthy society, the problem of health care should be looked at in a more holistic way. This new viewpoint should include eliminating poverty, encouraging people to take more responsibility for their health, addressing not just physical but mental health, and considering health care options outside the mainstream.

Finally, a word of caution—just because a new technology or idea is on the "radar screen" today does not mean it will be part of our future. Experts in 1893 predicted that in 1993 people would travel in trains and balloons; there would be three hour workdays; all houses would be made of aluminum because the forests would be gone; there would be little need for lawyers because laws would be simplified; poverty would fade; crime would be rare; and we would all be healthier, handsomer, and happier. Well, they missed a few. The bottom line is that there are many things that are unforeseeable. While many of these wonderful technological ideas, such as the computerized medical record, are “no-brainers” and are within our reach, if people (specifically, in this case, physicians) do not want to make the changes needed to make them a reality, these changes simply will not happen. If you want to know how medicine will change, look outside of medicine, for how the world changes, medicine will change.

2. Military Medicine: Yesterday, Today, and Tomorrow

**Comments by Craig H. Llewellyn, M.D., M.P.H., M.S., COL, MC USA (Ret.)
Professor and Chair of the Department of Military and Emergency Medicine—
USUHS**

This briefing provided a look at three eras of military medicine—pre-modern, before World War II; modern, World War II through the present day; and the future, or post-modern period—and it also looked at how military medicine interacts with civilian medicine. Additionally, the briefing presented concerns about what and when military physicians should be taught.

Pre-Modern Medicine

The relationship between military and civilian medicine is cyclical, and each has contributed to the practice of the other. Civilian practice is the basis for military medical practice, but during times of war and deployment civilians begin serving in military medical capacities. After the war, these individuals, now with military medicine experience, move back out into the civilian community and use this experience to inform their practice of medicine.

The focus of military medicine in this period was primarily on infectious diseases, tropical and non-tropical, and on emerging efforts in both prevention and treatment. During periods of combat, the care of war casualties assumes a primary focus. How

military and civilian medicine handled infectious diseases during this period was quite similar. How they handled trauma was much less similar.

Pre-modern medicine (before WWII) is characterized by the period's concern about infection and infectious diseases, and by the lack of antibiotics. During this period, in the surgical area, there was no focus on trauma, and there were severe limitations in the knowledge-base and efficacy of peri- and post-operative care. Hospitals were not the center of practice during the pre-modern era; they were simply where patients went to die. Just before WWII the very beginnings of group practice were emerging, but most physicians performed under a fee-for-service model in their practice.

In this era, medical education was hampered by a significantly limited knowledge base that also restricted physicians' diagnostic and therapeutic capabilities. The bulk of medical education centered on medical students learning the basic sciences from a research rather than a clinical perspective, with minimal thought as to how this might relate to their practice of medicine. During this period, specialty-focused graduate medical education was just beginning, and was thus not a major element of military medicine. Medical students and physicians were taught many basic technical skills—slide preparation, blood chemistry tests, culture of microorganisms, urine analysis—which are now managed by a wide array of medical technicians and advanced diagnostic, analytic, and imaging technology and equipment.

Modern Medicine

One of the greatest changes that appeared during and after World War II was the introduction of antibiotics. They fundamentally changed how physicians and other health care workers managed infectious diseases.

Enormous changes began to emerge in the areas of laboratory testing and imaging, and separate testing and imaging centers were created. However, despite many of these changes, for years most medical schools still expected students to understand everything about how to do these tests themselves, such as learning staining techniques and the use of various blood chemistry tests. Imaging technology advanced considerably, but during the first half of this period, medical students were taught little about these new techniques. Instruction in x-ray interpretation was relatively rare. Currently, most second-year medical students receive some training in reading and interpreting diagnostic images.

Because peri- and post-operative care, as well as life support systems, improved greatly during the modern era, surgery could become more invasive than was ever imagined prior to World War II. Civilian surgery began to focus more on trauma care, and this was aided immensely by the experiences of surgeons who had served during World War II. These developments encouraged more specialization and sub-specialty training in medical education.

During most of this period, civilian medical education continued to focus on detailed instruction and laboratory experience in the basic sciences, principally from a research

rather than a clinical perspective. Topics relevant or unique to military medicine were generally absent from the curriculum, in spite of almost total conscription of graduate physicians during World War II. It was not until the opening of USUHS in 1976 that there was a major departure in undergraduate medical education with the integration of militarily unique or relevant medical material throughout the four-year curriculum. In this curriculum, special emphasis was given to tropical medicine, emergency medicine, preventive medicine, community psychiatry, medical aspects of chemical, biological and radiation weapons, and practice under austere conditions in an echeloned patient care system. The separate knowledge basis, which supports the practice of military medicine, is made clear to USUHS students.

Military Medicine in the Modern Era

World War II

During World War II, faculty from the best medical schools in the United States were brought into the military, including, in addition to general practitioners, a number of the few specialists that existed. This group included some of the "best and the brightest" in the medical world; physicians such as Michael DeBakey, esteemed chiefs of surgery, and leaders in internal medicine and infectious disease who became involved in the war effort. This work in the military also provided many practitioners their first introduction into group and hospital-based practice.

Thanks to the experience gained in providing troop medical care and in dealing with the health of large military populations, American medicine realized that it must place the same emphasis on disease prevention as on the treatment of disease. This ultimately led to an increase in the number of schools of public health, and to the eventual creation of the Center for Disease Control to battle malaria and sexually transmitted diseases. Military medicine and the World War II experience produced a great push toward specialization and the development of residency programs at medical schools.

World War II through the Korean War

After World War II a tremendous number of military medicine practitioners and faculty returned to civilian life. In an effort to maintain contact with civilian medicine, the military organized medical ROTC units, and military medical residencies and fellowships. The idea was for these organizations to be "civilian friendly" so the focus in these training programs was on general studies and on medicine with, unfortunately, little training in anything that was of military medical relevance.

As a result, when the Korean War broke out in 1950, those civilians assigned to reserve hospitals and ROTC units, even those in residency training, were thrust into military situations for which they had little training or preparation. Stories of the enemy overrunning medical units were not uncommon. Physicians who were in the middle of their residency training might, in two weeks time, become a medical battalion commander, without ever having attended any basic training. An excellent book that covers this experience is Albert Cowdrey's 1987 book, *The Medic's War: The History of the Korean War*.

Eventually, the U.S. Army Medical Service Postgraduate School at the Walter Reed Army Institute of Research started a company grade medical officer's course. A number of WWII-experienced Army and Navy physicians were called back to teach this course. In addition, many of these experienced military physicians were made consultants to the Surgeon General. At this point, the Air Force was still small enough that it could not spare any medical officers to be faculty in this course.

Although initially ill prepared at the outset of the Korean War, medical units did ultimately succeed. They became highly mobile through the development of MASH units conducting far-forward surgery and evacuating post-operative patients on small aircraft to Japan. This concept was so successful that the Israelis copied it in 1978.

Eventually the warfront in Korea stabilized and these highly mobile field hospitals became fixed. These units were extremely "high-tech" for the times. Those doing planning for operations Desert Storm and Desert Shield would have been well advised to look at how these hospitals were quickly put into place.

Vietnam War

Because of advances in peri- and post-operative care, military medicine made huge strides in the areas of resuscitation and stabilization during the Vietnam War. During the war, the military used fixed hospitals, equipped with monitors, plenty of blood, and various kinds of fluid resuscitation. In fact, the argument about whether or not patients with penetrating abdominal wounds benefited from attempts to restore normal blood pressure using crystalloids, was alive and well during the Vietnam War.

The pre-hospital medical facilities in Vietnam were mostly ignored, such that by 1967 the military provided hardly any medical staffing at the battalion level. Army units, in particular, relied heavily on helicopters for medical evacuation. Evacuation times were rapid, but not really as rapid as they have often been described because, while it is true that most hospitals during the war were usually no further than a twenty-minute helicopter flight away, this figure underestimates the actual length of time for an evacuation by at least one-half. In other words, if flying to the hospital takes twenty minutes, then it should also take another twenty minutes to fly out and pick up the casualty, thus the delay in transport by helicopter had to be, at least, forty minutes. This model of advanced pre-hospital stabilization, as exemplified by Special Forces medics in Vietnam, followed by rapid evacuation, is the model from which current civilian emergency medical services (EMS) has evolved.

Gulf War

The military experienced unopposed entry and buildup at the start of the Gulf War, so at the beginning of combatant operations the theater was mature with multiple levels of hospitals. Troops incurred brief combat and few casualties, but high speed movement over large distances challenged medical facilities. Medical treatment facilities had to be improvised on the ground in a very short period of time. The ability to adopt a more mobile medical capability relied heavily on advances in rapid laboratory and high tech imaging technology.

Military and Civilian Medicine in the 1990s

During the 1990s, there was a paradigm shift in the clinical practice of medicine, in both the civilian and military arenas. There is now a decreased focus on inpatient hospital-based practices and an increased focus on ambulatory care.

As a result of managed care's efforts to use gatekeepers to prevent "excessive" direct patient access to specialists, there has been a reduction in the role of the specialist. This rationing, however, has paradoxically only increased society's demand for the newest in medical technology, often before the medical profession completely understands how to use the newest techniques. The medical knowledge base has increased so dramatically that no one is completely confident about what portion of this new knowledge really needs to be taught to medical students and officers, or when it should be taught. As an example, Dr. Llewellyn cites the rise of minimal or non-invasive surgery, which has prompted deliberations about who should receive initial training in this area, and when.

Changes in Education and Practice: 1960s to the Present

Much has changed in medical education in the area of laboratory technology since World War II. Microbiology and infectious disease classes include more immunology than in the past. Many graduate medical educators are reconsidering the roles played by clerks and house staff in assisting with laboratory tests. The types and availability of laboratory tests have changed. Now it is possible to remotely monitor real-time biochemical parameters that previously could only be evaluated in a laboratory. In the past, physicians were taught mostly how to do laboratory tests. Today, physicians must understand the basis of these tests and how to use them appropriately.

Additionally, huge progress has been made in developing portable and field deployable imaging technology. X-rays, contrast studies, tomography, CAT, and MRI are being made field deployable and easier to use. In fact, a new hand-held ultrasound today requires only about ten minutes of training to operate. As in the case of emerging laboratory technologies, many also wonder whether the person conducting the study must understand not only how to perform the study but also how to interpret the results and how the imaging works.

In the area of blood, fluids, and parenteral nutrition, much has changed since the publication of the classic *Metabolic Care of the Surgical Patient*, for example, advances in homeostasis and engineered fluids. But, as with laboratory tests and imaging, there is ongoing discussion about what knowledge medical students and physicians actually need in biochemistry, physiology, and pathophysiology in order to use these interventions appropriately.

Basic genetics should probably be required of all medical students, as the time is very near when health care providers will have the ability to make diagnoses using genetic material. They will also be able to use genetic information to provide patient counseling in the area of risk assessment. Faculty and others involved in medical education must

make decisions soon about the degree and type of human genome knowledge required for practicing physicians in the near future.

As advances in knowledge, skills, and technology increasingly influence surgical practice, some have expressed concern about what topics should be taught in this area and how to teach them. For example, in the case of teaching advanced cardiac life support or advanced trauma life support to all fourth year medical students, it is not clear whether anyone has actually looked closely at how and when it is best to teach these courses, or even whether all of the skills and knowledge taught are demonstrably efficacious.

The Difference Between "Medicine in the Military" and "Military Medicine"

Medicine in the military will continue to be driven by civilian practice models for the foreseeable future, but this has and will continue to create some significant problems. These practice models include:

- ~~✍~~ Managed care models
- ~~✍~~ Cost-containment in the form of ambulatory and short-stay care
- ~~✍~~ Emphasis on productivity and no redundancy

In the future military medicine will be driven by such features as:

- ~~✍~~ A small medical foot print to match the fighter footprint—it must be light, mobile, and flexible
- ~~✍~~ More pre-hospital capabilities for all providers
- ~~✍~~ Small, austere hospitals, such as forward surgical units
- ~~✍~~ The ability to rapidly stabilize, package, and evacuate patients to a higher level of medical care
- ~~✍~~ A continuing requirement to maintain the capability to support large deployments

At present and in the near future, civilian medicine and the peacetime military health care system (“medicine in the military” rather than military medicine) will continue to be very similar in both organization and practice, with the managed care model (health maintenance organizations, or HMOs) being dominant. Simultaneously, however, changes in military doctrine, tactics, weapons systems and organization, and the rapid change in nature of both combat and non-combat operations, have led to a requirement for military medical support that is increasingly divergent from the contemporary civilian model. The medical support for operational deployments cannot be “the HMO that goes to war.” The mobilization time for these operations is now measured in hours rather than months, meaning that all military medical personnel must be educated and trained for their operational deployment roles and practice at all times. No longer can these personnel be conscripted from the civilian community and then educated and trained prior to operational deployment—there simply won't be enough time.

In summary, the cycle of transferring medical knowledge and skills between civilian and military practice, and military to civilian practice, will continue so long as there is a flow

of health care providers in and out of the military. Medicine, military medicine and medical education will continue to evolve although not always in synch. There is an intellectual, ethical, and moral imperative on military medical educators to insure that the on-going and future evolutionary and revolutionary changes in medical practice and in military medicine are taught, and taught well, to today's and tomorrow's military health care providers.

3. Educating Physicians for Unpredictable Change

Comments by David P. Stevens, M.D.

Vice President, Medical School Standards and Assessments

Association of American Medical Schools (AAMC)

The challenge here today is how can educators prepare their learners for the next thirty years if they don't know what the future of medicine will bring? And how good are we at predicting change and its implications?

First, we are good at the new biology, for example, the new genetics. It is familiar ground. On the other hand, the new territory of information sciences is less familiar ground. We can guess at where this may take us, but it is fundamentally unfamiliar. And finally, new non-science territory, like health systems, is totally new territory and we are pretty unclear about how to deal with it.

There was a recent project called "Better Health 2010," developed at the AAMC in conjunction with the National Library of Medicine. A Delphi process was used to try to predict what might be the role for information sciences in health care ten years from now. What you would recognize right away, if you were to read this report, is that most of what is described will not take ten years; half of it is already here.

With everything that is between our ears now available to our patients by way of the Internet, we have to begin to think totally differently about how patients and health care providers interact. This leads to the physician as an information manager. We all have to figure out how this will work because we are conditioned to being more in control.

What does this mean for education and its accreditation? I think it means that our students must think of themselves differently from the way their teachers were taught. The patient becomes a learning partner with the physician.

What about systems? We can only speculate at how we as professionals have to begin to accommodate the concept of "system-ness" in what we do. From the education perspective, our students must learn about the physiology of the health system as much as they do about the physiology of the human body. For example, the physiology of the health system is about effectively linking the emergency department with the intensive care unit, or how to line patients up, whether they are coming through the door for an ambulatory visit or whether they are going into the operating room. This is knowledge that can better inform all of these areas. The focus on safety that the Institute of Medicine (IOM) has created has a lot to do with better systems of care.

Now, if you haven't had a chance to look at it, look at the last IOM study called "Crossing the Quality Chasm," which discusses the concept of complex adaptive systems. If you look at Appendix B of that report, you will find an excellent discussion of the relevance of complex adaptive thinking to health systems.

I propose there are at least three ways accreditation might provide a more adaptive response to rapid change in medicine and education. One approach is to think much more effectively about outcomes rather than processes. A second is to consider not just specific components of a physician's education, but rather the entire educational continuum throughout a physician's career. And a third is to think more systematically about the stages of a learner's knowledge across that continuum.

To help guide the first approach, the Accreditation Council for Graduate Medical Education (ACGME) has developed a set of six competencies as a way of focusing on outcomes. I want to point out that in the late 1980s the Canadians were looking at this issue from a public point of view. This effort grew to become CanMEDS 2000, the project that drives all of medical education in Canada at this point. In Canada, the public decided they wanted their physicians to be (1) medical experts; (2) decision-makers; (3) communicators; (4) professionals; (5) health advocates; and (6) managers.

The result of the ACGME process has been to set forth the following physician competencies: (1) patient care; (2) medical knowledge; (3) communication; (4) professionalism; (5) practice-based learning and improvement; and (6) knowledge of systems. Comparison of the two lists of competencies leads one to conclude that the two are close to the bedrock definition of a physician.

The accreditation of residency programs and certification of specialists will be based on these six general competencies. This will take physician assessment beyond examinations of memorized knowledge to assessment of communication, professionalism, and the ability to improve what one does based on being able to learn systematically from experience.

The second approach is to think about learning across the continuum. Until recently, accreditation of each of the components of a physician's education—medical school, residency, and continuing medical education—was accredited as though the others did not exist. The Liaison Committee on Medical Education (LCME), ACGME, and Accreditation Council for Continuing Medical Education (ACCME) have begun to look for ways to link our processes. We have developed a loosely coupled organization called the Broadband Group to pursue such links.

The third, and final, approach to creating a more adaptive response to rapid change in medicine and education is defined by work the Dreyfus brothers did with Rand in the 1970s that examined the stages of learning for pilots. They came up with five: novice, advanced beginner, competent, proficient, and expert. Paul Batalden added a sixth, master. Paul distinguishes between the expert and master in a number of ways. The most meaningful is that while the expert knows what he or she knows, the master knows what he or she doesn't know.

Approaching medical education and its accreditation from a focus on outcomes and on the continuum and stages of learning provides several opportunities. First, this approach brings greater coherence to the process of a physician's learning. Second, it places greater

emphasis on the physician as a life-long scholar. Third, it focuses on where the learner is in his or her stage of learning and relieves the pressure on any particular stage to “do it all.” Fourth, it places the medical school in an integrative role as the principal institution for all medical education. And finally, it provides a framework for the fulfillment of the social contract that is implicit in the public support provided to medical education at every stage of the continuum. It begins to address the professional role that we all have and the responsibility that we have for making this work.

I don't know what the future holds, but I think we can—with the right commitment and a little reflection—come at it in a better way.

4. Joint Vision 2020

Comments by Richard A. Mayo, M.D., RADM, USN Director, J4-MRD

Admiral Mayo's briefing outlined how the military medicine community will support planned and emerging military operations in the near future, as informed by Joint Vision 2020. The Chairman's Joint Vision 2020 is a conceptual template for how the U.S. military will conduct warfare in the year 2020 and beyond.

Excerpted text from the publication "Joint Vision 2020":

"This vision is centered on the joint force in 2020. The date defines a general analytical focus rather than serving as a definitive estimate or deadline. The document does not describe counters to specific threats, nor does it enumerate weapon, communication, or other systems we will develop or purchase. Rather, its purpose is to describe in broad terms the human talent—the professional, well trained, and ready force—and operational capabilities that will be required for the joint force to succeed across the full range of military operations and accomplish its mission in 2020 and beyond. In describing those capabilities, the vision provides a vector for the wide-ranging program of exercises and experimentation being conducted by the Services and combatant commands and the continuing evolution of the joint force. Based on the joint vision implementation program, many capabilities will be operational well before 2020, while others will continue to be explored and developed through exercises and experimentation.

The overarching focus of this vision is full spectrum dominance—achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection. Attaining that goal requires the steady infusion of new technology and modernization and replacement of equipment. However, material superiority alone is not sufficient. Of greater importance is the development of doctrine, organizations, training and education, leaders, and people that can effectively take advantage of the technology.

The evolution of these elements over the next two decades will be strongly influenced by two factors. First, the continued development and proliferation of information technologies will substantially change the conduct of military operations. These changes in the information environment make information superiority a key enabler of the transformation of the operational capabilities of the joint force and the evolution of joint command and control. Second, the U.S. Armed Forces will continue to rely on a capacity for intellectual and technical innovation. The pace of technological change, especially as it fuels changes in the strategic environment, will place a premium on our ability to foster innovation in our people and organizations across the entire range of joint operations. The

overall vision of the capabilities we will require in 2020, as introduced above, rests on our assessment of the strategic context in which our forces will operate."

The Role of the Military

Military roles are expanding beyond traditional expectations to include humanitarian assistance, disaster relief, peacekeeping, drug trafficking intervention, and firefighting. But the U.S. military should not sway from its primary mission of deterring conflict and fighting to win.

Prior to Joint Vision 2020, planning and thinking about operations was only in terms of two Major Theater Wars (MTW). Planning can now cover ambiguous situations such as peacekeeping, regional and civil wars, and working with international partners across the full range of military operations.

Three critical aspects affect how the military will respond in the near future. First, the United States will continue to have global interests and be engaged with a number of regional actors. Second, potential adversaries will have access to the same international commercial and industrial sources and technology as the U.S. military. Third, and probably the most serious, is that potential adversaries will adapt to the military's evolving capabilities. This includes the development and deployment of long-range ballistic missiles and other direct threats to U.S. citizens and territories.

Those in military medicine must be capable of supporting military forces through a full spectrum of operations. This will require innovation and forward thinking in strategy, policy, and technology. Military medicine must be able to provide the right personnel, the right equipment, and the right information at the right place and time to support the soldiers and maintain military preparedness and superiority.

Dominant Maneuver

Dominant maneuver means the U.S. military will control the depth, width, and height of the battlefield under all conditions, denying the enemy an advantageous position. The military's deployment time will be reduced, its footprint will be smaller, and troops will be more widely dispersed. This increases the speed and agility of operations and makes it more difficult for the enemy to find and attack U.S. military forces. The use of dominant maneuver will make a significant and lasting impression in the minds of the enemy.

Information superiority will support the conduct of dominant maneuver by enabling the coordination of widely dispersed troops and the collection of timely feedback on the status, location, and activities of separate units. This will happen through the use of improved sensors, near real-time evaluation, and simultaneous distribution of information.

The use of dominant maneuver demands that those in military medicine rethink the way health care is provided on the battlefield.

Precision Engagement

Precision engagement is the ability of joint forces to locate, surveil, discern, and track objectives and targets. The current concept of precision engagement extends beyond precisely hitting a target and includes the use of information technology to enhance the capability of the joint forces commander to understand the battlefield situation, generate the desired results, select the course of action, assess that action, and re-engage as necessary while minimizing damage and casualties.

All these actions will be done in a very brief period of time, which should mean fewer casualties.

Focused Logistics

Focused logistics is the ability to provide joint forces with the right personnel, equipment, and supplies at the right place and right time across the full range of military operations. No longer will there exist the "iron mountain" of logistics and supplies. A web-based information system will keep track of supplies and equipment. Medical facilities also will no longer have an "iron mountain," but will be serviced through just-in-time deliveries. Focused logistics will effectively link all logistical functions and units to advanced information systems to integrate data in real-time and provide total access to a common operational picture.

Although the technology exists today to create a focused logistics system, such a system has yet to be put into place across the force. In Kosovo, for example, the logistics system was not set up with the focused logistics concept in mind. A helicopter in Albania needed a part that was sitting offshore on a Navy ship, but despite their relative proximity, it ended up taking weeks for the piece of equipment to arrive from a source outside the theater rather than the few hours it could have taken had focused logistics been incorporated. Many problems of this type can be traced back to the fact that the military still does not operate jointly.

Force health protection is one of the tenets of focused logistics and one of the primary areas of concentration in Joint Vision 2020. The other tenets of focused logistics include:

- ~~///~~ Multinational logistics
- ~~///~~ Joint theater logistics command and control
- ~~///~~ Information fusion
- ~~///~~ Joint deployment and rapid distribution
- ~~///~~ Agile infrastructure

The result of focused logistics will be increasingly capable forces and an eventual boost in resource efficiency.

Full-Dimensional Protection

Full-dimensional protection is the ability of joint forces to protect the personnel and other assets required to execute any assigned tasks through the selection and application of multi-layered passive and active measures in the air, on land and sea, in space, and

through information management across the spectrum of military operations with an acceptable level of risk. Providing this protection is very complex and will include not only air and missile defense systems but also protective clothing and chemical and biological sensors—whether on the battlefield or in the continental United States.

For an example of how full-dimensional protection might work, look at the detection and engagement of Scud missiles during the Gulf War. Soon, combining current technology with expected future technology should make it possible to detect Scuds before or immediately after they have been launched. These Scuds could then be targeted immediately—not after launch.

Coalition and Interagency Interoperability

Not only must the military be capable of efficient and effective joint operations, it must also be able to work effectively with different coalitions and international partners, such as the North Atlantic Treaty Organization (NATO). Including such groups in planning and executing operations will take advantage of their strengths and, in the end, save resources and manpower.

Recent events in Kosovo have provided important instruction in this area. For example, previously both the U.S. and British militaries had a level three facility on the ground in Kosovo, creating many redundant activities and services. After a year of working on an agreement, the two units were combined into a single level three facility in the American sector. The plan is for the Americans to command the facility; other elements will be under British command. Physicians from both countries will be integrated as well.

Ultimately, the vision for health care delivery in similar circumstances has the U.S. military providing its own health care upon first entering a theater then, as the theater matures, the U.S. military will work with other nations and groups to eliminate any in-country redundancy.

Issues will arise within this vision, such as ensuring that all parties to the agreements have the same understanding of all of the terms used in those agreements. For example, when the U.S. and British militaries put together a memorandum of understanding (MOU) about integrating the level three facility in Kosovo, language became critical. The British asked that "sisters" develop the health care, meaning the nursing staff. The Americans, of course, interpreted the word "sisters" as having a completely different meaning. An understanding of a partner's language and culture is critical when conducting any collaborative planning of this type.

Medical Information Management System

Collaborative efforts have also proved fruitful in the area of medical information management. The Medical Information Management System (MIMS) hopes to improve the exchange of medical information between NATO partners. The Army has set up a Web page for NATO to help with this effort.

Building successful coalitions is the future direction for the U.S. military. These coalitions and relationships leverage military capabilities and enhance allied defensive options.

The Forces Driving Force Health Protection

No matter how sophisticated weapons systems become, the primary weapon system is the human weapon system. It should be treated as any weapon system, receiving full preventive maintenance and life cycle management. Force health protection helps accomplish this.

The driving forces behind force health protection, as it has evolved over the past two years, have been:

- ✍ The President of the United States
- ✍ National Military Strategy
- ✍ The United States Congress
- ✍ Joint Vision 2020
- ✍ Lessons from the Gulf War
- ✍ The current revolution in American medicine
- ✍ Quality people
- ✍ Advancing technologies

Emerging Technologies

The emerging technologies key to providing longitudinal health care include:

- ✍ Theater medical information systems
- ✍ Computer-based patient record
- ✍ Telemedicine
- ✍ Common access card/Patient Information Card (PIC) encoded with health information
- ✍ Global combat support system
- ✍ Fibrin bandage—stops bleeding
- ✍ Biological sensors
- ✍ Advanced transport capability
- ✍ Diagnostic glove
- ✍ Telecommunications

Force health protection is a unified strategy that seeks to protect service members from all health and environmental hazards associated with military service. It also stresses a healthy and fit force.

Where We Have Been and Where We Are Now

Then

In the past, military medicine focused primarily on hospital-centric curative medicine, based in the continental United States (CONUS). Health care was managed in a stovepipe manner along the lines of the four Services, including DoD Health Affairs, each with its

own set of regulations. There was plenty of money, and much of what was accomplished was world-class, including pioneering work in casualty care management.

Now

Currently, three pillars support force health protection: (1) a healthy and fit force; (2) casualty prevention; and (3) casualty care and management. Some may argue that in the past two years of work on Joint Vision 2020 undue emphasis has been placed on casualty prevention and a healthy force, rather than an equal balance between all three. But once the National Military Strategy is pulled together, the Joint Staff will propose working with the Uniformed Services University School of Medicine (USUHS) to host a conference to determine the next steps for casualty care and management.

Healthy and Fit Force

Military medicine's goal is to be a war-efficient health care delivery system. Creating a healthy and fit force starts at members' entry into service and continues past retirement throughout the rest of their lives. Service members must work with the military health care system taking responsibility for their own health status. The goal is to fill a pair of boots with a hyper-fit soldier, one who can resist disease, not be prone to injury, and able to withstand the rigors of an unfamiliar and hazardous environment. These warriors would know who their primary health care provider is, they would not smoke or drink to excess, and they would have attended health promotion classes and received nutritional counseling. Dental health is a critical feature of the fit soldier, as is mental wellness. Commander involvement in reaching this level of a healthy, fit force is essential.

Casualty Prevention

This is an area in which most would say the military has excelled. Although military health care providers may have conducted medical threat briefings and food and water inspections, this type of information has often failed to move past the medical staff and on to the soldiers.

The Gulf War taught the military a lot about industrial and environmental surveillance. Stories from that war include one about a medical facility set up near an ammunition dump and a chemical plant. These experiences, however, made the military very conscious of industrial and occupational dangers when facilities were established in Bosnia and Kosovo. Tests there were run on the soil, water, air, and food. The U.S. military probably knew more about the environment in Kosovo than the environment in one of its own buildings in the United States.

More remains to be done to reduce or eliminate mental health casualties.

Casualty Care

Advances in casualty care and management include efforts underway to develop cutting edge technologies for treating patients in the field, in theater hospitals, and during evacuation. The focus is on providing medical treatment with a small footprint. Emerging technologies include the fibrin bandage and a hand-held ultrasound that can not only detect bleeding but can also stop it until the patient is transported.

The Continuum of Care

Creating a continuum of health care is critically important; from the moment a member enters the service, throughout his or her career, and after retirement or separation. There must also be a seamless longitudinal medical record for each member documenting that continuum of care. This should include medical data for each member documenting health care status during recruit training, pre-deployment assessments, deployment and redeployment, and all intervening cycles.

Currently none of this data is linked, however, the TRICARE system and computerized patient record are poised to make this happen in the near future. No matter where service members are stationed, military health care providers will have access to their full medical record. These linkage efforts will also extend to making data connections with civilian health care and non-duty agencies such as the Veterans Administration and Health and Human Services. In addition, communication and exchange of medical information with NATO and other coalition partners must be enhanced.

Force health protection in Joint Vision 2020 is not a destination, but a journey.

SERVICE BRIEFINGS

Each of the Services' medical departments—the U.S. Army, Navy, Air Force, and Marine Corps—provided presentations on the environment in which each operates and their plans for modernizing their twenty-first century medical support operations. Colonel Dave Nolan presented the U.S. Army's plans to implement a "skip policy" in a theater of war. Colonel Rick Hersack presented the Air Force Medical Service's doctrinal initiatives for the twenty-first century. Captain (USN) Brian G. Brannman presented the Navy's plans to right size its medical forces and provide the right tools, personnel, and training for the changing operational environment. Rear Admiral James Johnson presented the Marine Corps' doctrinal changes being developed to deal with emerging twenty-first century threats. The full text of these presentations is not available in the printed copy, but is presented here at www.usuhs.mil, following the section on "EXPERT PANEL INTRODUCTIONS" below.

EXPERT PANEL INTRODUCTIONS

The panel leaders, Brigadier General Klaus Shafer, USAF, MC (Emerging Technologies panel); Colonel Naomi Aronson, MC, USA (Emerging Threats panel); Colonel Martha Turner, USAF, NC (Societal Expectations and Ethics panel); and Lieutenant Colonel Julia Lynch, MC, USA (Changing Missions and Doctrine panel), used the afternoon session to set forth the methods their groups would use, within their subject area, to describe the changes that the next twenty to thirty years will bring. They also examined how those changes will affect the practice of military medicine and what changes will be needed in military medical education to prepare military health care providers to practice in this changed environment. Each of these panel leaders also presented an example, from their own perspective, of how the military and civilian worlds are changing and how those changes will affect the practice of medicine.

Emerging Threats

Colonel Aronson discussed the issues of emerging and re-emerging diseases and highlighted the potential for mass epidemics (including those caused by Weapons of Mass Destruction, or WMD). For example, Colonel Aronson used the case of Hong Kong avian flu in 1997 to demonstrate how an emerging infectious disease could, even today, cause a massive number of casualties similar to that of the 1918 Spanish Flu pandemic that killed between twenty and fifty million people worldwide. Colonel Aronson pointed out that, while this pandemic occurred before the development of intensive care units (ICUs) and antibiotics, today's health care system might have just as much trouble with a large-scale influenza outbreak as did the health care system eighty years ago. Perhaps such an outbreak would have even worse consequences today. The frequency of air travel and the rise in the number and size of large urban population centers portend an even more rapid spread of contagious diseases, such as influenza. Such rapidly spreading diseases could easily overwhelm already overcrowded hospitals and ICUs, and the need to institute quarantine measures could create social and ethical dilemmas in a health care system that has already shifted its focus from hospital-based to home-based health care. A rapidly spreading deadly disease will inevitably give rise to speculation about the possibility of biological warfare, regardless of whether or not the origin of the disease was natural or not. The consequences of such an outbreak on military medicine is hard to overstate. Old methods for disease control would have to be combined with new information technologies, and military and civilian health care workers would be forced to adopt a new pragmatic and austere health care paradigm that focuses primarily on population health, as opposed to the health of individuals. To combat such a threat, health care workers must be trained in public health measures, how to perform mass triage of patients with infectious diseases, rapid diagnosis and treatment, and be familiar with those methods used to control similar epidemics in the past.

Changing Missions and Operations

Lieutenant Colonel Julia Lynch discussed the diversity of environments and missions within which the U.S. military is currently operating and the challenges this creates for educating physicians to practice in these environments and during such missions. These missions span a spectrum of operations, from humanitarian-peace keeping to full-scale

war involving the use of WMD. These operations may involve a spectrum of environments ranging from the poorly infrastructured third world to the mature medical environments found in fully developed theaters.

The doctrinal changes necessary to allow U.S. forces to operate across this broad spectrum focus on: (1) flexibility and rapid response to achieve national objectives within the required time frame; (2) the creation of task-tailored units capable of operating in a dispersed, independent manner with a small footprint; and (3) interoperability at the joint, total force, multinational military, and civilian levels.

To support these doctrinal changes, medical units must be functional as joint, task-tailored, multidisciplinary teams containing members with the requisite skills and knowledge to provide broad-spectrum health care support. These units must also be capable of effectively and independently carrying out multinational and interagency operations in a cross-cultural environment.

As a specific example, Lieutenant Colonel Lynch, focused on the mission of providing disaster assistance to a friendly nation. She pointed out that, although such missions are generally referred to as “humanitarian” missions, they clearly have strategic value in helping to create regional, social, and economic stability. To support and accomplish these kinds of missions, military health care providers must (1) have a broad understanding of public health and disaster management; (2) understand epidemiology and be able to conduct population health assessments; (3) be capable of operating effectively in austere and culturally unfamiliar environments; (4) be able to perform well both as leaders and as team members; and (5) have language skills and competence in multinational and coalition military operations and in working with non-military international agencies.

Finally, Lieutenant Colonel Lynch pointed out that significant challenges exist in incorporating new educational material that will address these changing missions and doctrine while at the same time ensuring that health care providers still receive the requisite education and training in these critical core concepts and skills. Lieutenant Colonel Lynch suggested that one solution to this educational dilemma is to look at health care education as a continuum. This would involve introducing concepts and developing basic skills during undergraduate training by using a variety of educational modalities, and then providing advanced and reinforcing skills and knowledge in a systematic way throughout the professional lifetime of health care providers.

Emerging Technologies

Brigadier General Shafer noted that the Air Force Medical Service plans to operate in a theater with incrementally deployable medical capabilities that support the Air Force's expeditionary concept. He used examples of currently available rapid deployment packages that build in the theater as the need becomes evident and lift becomes available. He cited as examples the Prevention and Aerospace Medicine (PAM) Team that is charged with assessing disease threats in deployment areas; the Small Portable Expeditionary Aeromedical Rapid Response (SPEAR) team that can deploy quickly for

initial medical support and can stabilize and prepare patients for evacuation; and the Critical Care Aeromedical Transport (CCAT) teams that are dedicated to evacuating recently stabilized patients. He stressed the importance of educating military physicians to operate in fluid deployment situations that require rapid deployments and re-deployments, as well as educating for competencies that span the spectrum from generalist to critical care specialist capable of stabilizing and transporting critically injured or ill patients.

Societal Expectations and Ethics

Colonel Martha Turner chose to focus primarily on the process that her group would use to elicit the changes likely to occur in the world and in medicine over the next twenty to thirty years and the corresponding changes in health care education that need to occur. The methodology she proposed was brainstorming and mind-mapping to capture on paper all ideas in a non-linear fashion. Colonel Turner cautioned against being overly inclusive in the process because of the time constraints but encouraged unconstrained thinking within defined boundaries.

One of the ways in which Colonel Turner felt the world would change is the focus of health care. Up until now, the primary focus of health care within the United States has been on the individual. In the future, Colonel Turner felt that population health would assume an increasing importance and that this would have global implications.

Colonel Turner decided to highlight as an area of future change the increasing degree of cultural diversity within the United States and the increasing importance of cross-cultural awareness in military health care delivery. The two factors behind these changes are the large immigrant population in the United States and the increasing frequency of non-combat, overseas military operations.

Colonel Turner pointed out that culture influences almost every aspect of life, from the common things everyone recognizes, such as language and food, to such things as how children are burped and how pain is perceived and managed. The impact of culture is enormously important when a healing relationship is established between health care provider and patient. The ability to communicate through spoken and written language is particularly important. Pain management, for example, requires an understanding of how different cultures interpret and deal with pain and an understanding of they view different drug delivery systems, i.e., tablet, liquid, powder, or injectable form. How a drug is delivered will affect a drug's success within differing cultures.

Colonel Turner emphasized the importance of looking at outcomes as opposed to processes—in particular, the importance of looking at the outcomes a patient desires, which may be different from the health care provider's desires. Specifically, Colonel Turner suggested that that there will be increasing focus in the future on alternative and complimentary therapies. To prepare health care providers for this changed practice environment, Colonel Turner emphasized the importance of teaching cross-cultural thinking.

SERVICE BRIEFINGS PROVIDED FOR WEB VERSION OF THESE PROCEEDINGS

1. USMC: RADM James A. Johnson, The Medical Officer of the Marine Corps provided the Marine Corps medical doctrine briefing:

The title of this for all of us is doctrinal changes and I'm going to alter that a bit and talk about what I refer to as doctrinal enhancement. Because what Marines are talking about doing in this century is what they have done for the last couple of hundred years. So it's not so much a doctrinal change, but a doctrinal enhancement to deal with the threats of the 21st century.

And you can look for yourself and see all of the things that are going on. CNN has something on every single day about unrest somewhere in the world. What's really important to take away, most of you have probably heard this before, is the urbanization of the world's population. That is a very key and important point.

Most of us practice running around in the desert or in lonely forests but most of the world's population and most of the world's commodities are made and exchanged in a space of 300 miles or so of a coastline. And more times than not in an urban area or suburban area. Not in the desert. Not in the forest.

So one of the things that all of us have to take into account is the fact that we are going to have to deal with dramatic increases of population in an urban environment.

The city of New York City we believe has a population of 8 million. But Sao Paulo Brazil is going up 26 million, Seoul Korea 11 million, Bombay India 14.5 million. There are many more cities larger than our largest city. And when you think about the city itself you also have to take into account the area that surrounds it. And by the way New York City is not the only place that has skyscrapers. A lot of the third world countries now have plenty of skyscrapers, tall large buildings and fighting in those environments is a very different picture.

As you can see, here are some of the usual suspects in the 21st century that are adversaries. They are still around. But what's important to take home from this is that so many of the adversaries out there now are not nation states or parts of nation states. What they do may be sponsored by nation states, but they themselves are not nation states and they may arise from different ethnic groups and cultures. They are often very ideological, fanatical, and play by a different set of rules than the kind of rules that go on in places like the United Nations.

These are the four competencies of the United States Marine Corps. They are not new. The Marines have always operated from a forward presence.

There has also been an issue of forcible entry. They have always wanted to do the full spectrum of conflict operations. So none of this is new. As I said this is not a doctrinal change, this is a doctrinal enhancement.

As you look at these slides there are some important things to take away. And I want you for a minute to envision fortunately some of the things that Hollywood has done for

us. Think about all the WWII pictures that you saw, with Marines island hopping from one place to another in the Pacific or think of the Longest Day movie which most of you have seen. That is a classic amphibious operation. In which the German Colonel wakes up from his bunker, looks out, and sees an ocean filled with ships with little boats coming in. And eventually there is a barrage, lots of activity going on the beach, and a lot of the guys dying trying to get onto the beach. That's a classic amphibious operation. That's not the only thing the Marines plan on doing.

Because of the advances of technology, not the least of which is ships that are more capable, tactical aircraft that are more capable, it is possible for the Marine Forces to get to their objective without building up, at least initially, on the beachhead. It is also possible to attack from a sea base that's over the horizon.

Now the German Officer wakes up looks out and sees nothing, because all the ships are over the horizon. Eventually he may see some things like our amphibious vehicles that don't stop at his gun turret but go by on to some other objective.

Now what's key here is that this could be 200 nautical miles from where the ship is to where the objective is. And yet the Marine is still effectively, decisively, enabling for a follow-on force. This is very important for us who are in the medical business. When it comes to casualty treatment most of what we do in the wars prior to the 21st Century was what I will call scoop and run.

We got hurt. Some sort of first responder care was done where you got hurt by whatever means. You got on some kind of tactical conveyance whether it is was a horse, a sled, a jeep or whatever and within a relatively short distance, in a relative short time, you were deposited in some kind of treatment center that was within the sight and sound of the battlefield.

Everybody has seen MASH. Every single MASH episode has an operating room scene. In most of the MASH episodes the lights go out, and the ground shakes. Something happens because it is clear that that the MASH unit is within sight and sound of the battle field.

This is not a picture of being within sight and sound of the objectives. The basic sea base is nowhere near sight and sound. It's over the horizon. There is, if you look at this, there's not much being built up on the beach. It's all over here.

That means that you've got to have forward surgery resuscitation methods and different ways of transporting people in a tactical environment in order for them to survive.

These are some of the things that you may have heard of that Marines talk about; expeditionary maneuver warfare. It is a family of concepts of how Marine Forces are employed. It includes full engagement operations. As we speak there are always Marines embarked with Navy ships in the various threat areas of the world. By definition, our entire Marine force is expeditionary. It is often called upon to do decisive operations and also must be prepared for sustained operations ashore. It's not always about kicking the door in and then leaving right away.

Once they got to Vietnam, and you look at the I Corps AOR, that region in the northern part of Vietnam the Marines had as their obligation. It was sustained operations ashore. It was not just a question of coming in and turning it over to somebody else.

So the Marines as a way of doctrinal enhancement have to be able to do things in which they may not be only the enabling force, but may have to be there for a while.

Health Services generally fits as a supporting concept. We do much of our business with the logisticians.

Here are the requirements for any expeditionary warfare. None of this is new. You have to get to the fight and win quickly. Marines assume that the force will be vital to whatever force they bring to bare. That's it not going to be on our turf. Generally speaking the Marine Corps plays away games. Not home games. Away games.

We assume that there is not going to be any host nation and there isn't going to be any intermediate support base build up. At least initially. And that we can sustain ourselves with a combined task force. Very important.

These are some of the major enablers. This is what we call an Amphibious Readiness Group. LHA or LHD class. This is a typical amphibious ready group. There are usually two out being deployed all of the time. This is looking from the well deck of one of these ships of which you can gain access either by sea or by air. And this is an LCAC which has the capability of going very high speed, launched out of the back of one of these from over the horizon going toward their objective. Not stopping on the beach, but continuing to go inland.

This is the most capable Casualty Receiving and Treatment Ship deployed outside of the hospital ship. It is very important to understand how these things work. Most of you know our two big hospital ships. Very capable 1,000 bed wonderful facility, but hard to get on and off of. Because they only have one spot that you can really use for helicopter landings.

What you see here on the LHD is multiple spots. The rotary ring and VSTOL aircraft as well as a well deck, which can take on a variety of watercraft. So the ability to get on and off this deep draft is much enhanced compared to a hospital ship.

This is typically the capability that one has built into the deep draft amphib. Four to 6 ORs depending on the class and 17 ICU beds. 45 primary care beds. There is an asterisk here because often times people say well you know there are another 500 beds only they are overflow. Its not 500 beds, its 500 spots you can lay a human being out. Not a human being who requires a lot of care.

So really this is the capability and that's an important point about the CRTS. You can do a lot of surgery on them but you can't keep a lot of seriously ill patients. They will fill-up pretty quickly. So as far as our deployment concept, you have got to be able to get people off from these things and onto something else. Whether it is to a hospital ship or some facility ashore, strategic airlift back home or to some sort of pre-positioned ship, but they can't stay here forever. This is a very good initial platform to operate from.

These are very medically capable ships. This is a concept that started out in the 60's when I started out as a junior officer. I was on a LPH. I only had 2-ORs. That's when the concept started. We have been doing this for a long time.

Far Forward Resuscitative surgery. A lot of people think this is something new. Not really. What it is, considering the kinds of injuries we may take and considering the tactical vehicles they have to go on, and considering the distance and time – if we don't employ some surgical techniques far forward in addition to non-surgical techniques, we're going to lose people.

So that's what we are talking about. We're talking about resuscitative surgery. That's different than definitive surgery. It's doing enough to make someone ready for transporting. It's not trying to fix everything. Starting to fix things is what occurs on the ship in a safe environment.

This is a difficult task. This is a difficult situation and this is to remind everybody where it all starts. Most of us in this room are probably officers who think about hospital ships and those sorts of things. It starts with these guys. The Corpsman and the medics. If they don't do what they have to do, if they're not supportive then everything else as a change for not. So let's not ever forget these guys. This is where it all starts.

The primary mission of far forward surgery is to get the ball going. It can be used as initial surgical capabilities in a traditional amphibious assault married up with very specialized care. Or may be the only thing that is put ashore.

But the Marines are always very much task organized for whatever has to be done. Doing humanitarian assistance and disaster relief is a secondary mission.

Marines, Sailors, and all the other services have always done this sort of thing. The question is can we get this piece, which is now becoming a real mission, articulated in a way so we get the right kind of person as opposed to always taking it out of our wartime complement.

I don't want you to focus too much on all the numbers. Some things are at in a state of flux. But what's important is that the specific number of casualties, that the unit is capable of doing with out any re-supply. Again it's assumed that they are going to an area where there is no host nation support. No real support base.

If you have any of those things this makes the job easier. But you can't assume that to be the case.

These kinds of quick surgeries are the kinds of things that we are talking about doing. Some of this will be made easier by some of the things that we have available in the R&D pipeline. Such as fiber bandages and things like that. So that by the time the person who gets to this level, he or she has had less severe blood loss. Because the people that get to him first are able to do things to stem the blood loss. But in turn we don't have any in the inventory today.

Again like our Air Force colleagues there are certain parameters logistically that we are facing. It's assumed that about 8 people are going to be involved in one of these units.

That there will be no Marines to provide security. That they will have a very small footprint. That no material handling equipment is necessary.

So you've got to be able to have a couple people pick up something that's only 350lbs. If it gets much bigger than that people can't pick it up. Two doctors and six personnel, can't pick it up, it's not going to be picked up because there isn't going to be anybody else to pick it up. So these things are all built in.

Everybody is faced with budget issues. An FRSS has to fold into what we call our surgical companies, etc. as part of the design you are looking at.

This is what we think mostly of the sort of people who are going to be there. A surgeon, an anesthesiologist, a nurse anesthetist, a critical care nurse, and five Corpsman. You could have one doc, two nurses, five Corpsmen or two docs, one nurse. But it's eight people. That's the key here. That's not a lot of folk who will be involved in this.

Which raises the question of what are we going to do for enroute care. This is a pretty complicated looking picture here. It's not necessarily going to easily fit onto a tactical conveyance. Which is what's going to be out there on the tactical battlefield. So we again have to look at what can we do so that once we save that person in terms of reducing some of this stuff so they can survive a ride for two to three hours on one of these things. V-22 or H-46 because that's the battle space we anticipate having to deal with. Or they may have to get one of our tactical amphibious vehicles like the AAV.

The point is in the kind of battle space that we expect to be in there is probably not going to be a vehicle that is just "a medical vehicle". It will be on some kind of vehicle that has to be multipurpose and so we have to get simpler in what we do.

Again, don't focus so much on the absolutes. This medical attendant of one already we're looking at that and saying probably may require more than one nurse. Particularly for aeromedical situations. In the civilian world, as we all know, there are medical situations that require trained attendants.

But these are the kinds of things that we have to take into account. Ultimately that's the whole reason why we are doing it. Because when the Marines go into battle anyone who knows the inside and outs of this replica of the Iwo Jima Memorial of raising the flag on Mount Suribachi will know that one of those raising the flag is a Hospital Corpsman.

Wherever the Marines go, the Corpsmen go with them. They are up close and personal, side-by-side. So whatever the Marines figure on doing we have to just as importantly support.

2. USN: Capt Brian G. Brannman, MSC, USN, Director, Medical Resources, Plan and Policy Division (N931), Office of the Chief of Naval Operations provided the US Navy's medical doctrine briefing: US Navy Medical Doctrine Posture

The Navy and Marine Corps are joined at the hip, and a discussion about Navy medicine must also include mention of the Marine Corps.

The end of the Cold War has forced the Navy and the Marine Corps to relearn old tricks. They were focused almost entirely on the Soviet Union for many years, but the change in the world's balance of power after the Cold War has encouraged thinking about the world as a multi-faceted environment with a variety of players. This shift has numerous implications for Navy medicine.

Navy and Marine Corps Strategy

The United States is a maritime nation, with about 90 percent of its trade coming in by sea. In fact, the entire world is heavily dependent upon maritime traffic for trade and business, with about 85 percent of the world's gross domestic product traveling on ships.

Many of the products used by Americans each day arrive on large ships and tankers, including oil from the Persian Gulf. But even though oil from the Persian Gulf accounts for only about 10 percent of the total oil used in the United States, about 40 percent of the world's supply of oil comes from that region. Any disruption in the Middle East can have disastrous effects on the world's oil supply, which will in turn affect the United States. And container ships do not simply stop at one or two ports-of-call. Very often, they stop at as many as 10 major ports during one trip, so blocking one nation's shipping can have a ripple effect all across the globe.

To keep the world's sea lanes open and free in the twenty-first century, and the Navy must:

- ?? Maintain command and freedom of the seas: project national power and influence beyond the nation's shores, which contributes to sustaining the global and national economy
- ?? Project U.S. sovereign power: provide timely crisis response and the power to shape regions of U.S. interest, deter potential adversaries, and reassure friends and allies
- ?? Assure access to the battle space for joint forces: The Navy and Marine Corps must be the enabler that allows the Joint Forces fight to take place
- ?? Enable the transformation of the Joint Forces: project defense ashore and provide "artillery from the sea," as well as support the transformation of the Joint Force into a lighter, more rapidly deployable expeditionary force

Implications for Navy Medicine

The forward and expeditionary nature of the Navy and Marine Corps requires that Naval medicine be able to support these types of operations with flexible responses. Lessons of the past few years—including the 1992 Marine Corps landing on the beach in Somalia—have given Navy medicine many examples of challenging deployments in unfriendly environments. To ensure a flexible

response in support of operations, supplies and personnel must be lighter, and facilities must be more mobile to enhance deployment.

Ways in which Navy medicine can support Naval strategy include:

- ?? CINC's theater engagement policy support of the National Security Strategy: BUMED trains, equips, and provides personnel to support CINC requirements; operational mission support pulls personnel out of Naval medical facilities, affecting Naval medicine's ability to provide care

- ?? Maintaining core competencies enables support of OPLANs

How Navy Medicine Can Remain Aligned in the Twenty-first Century

Currently, the Navy's Medical Resources, Plans, and Policy Division is involved in studying how to secure the right sized forces, the right tools, the right personnel, and the right training for a changing operational environment. *This will likely change the way the fleet hospital program is organized.*

Currently, Naval medicine has a good procurement pipeline, but this might not be enough for the year 2020. It takes the Navy 10 years to build a military medical facility, from the moment their need for the facility is acknowledged to opening day. It takes a similar time period to decide on a platform, and that's too long. Navy medicine is searching for some new ideas on how the procurement process can be expedited.

In addition, Navy medicine must identify field capabilities to support future requirements, including:

- ?? The Chief of Naval Operations (CNO) is conducting a study for the Navy's Medical Resources, Plans, and Policy Division on future deployable medical systems

- ?? Naval operations will be pursued more, and more in places where disease is of great concern to the troops. Forward Deployable Preventive Medicine Units (FD-PMU) have been created to travel throughout the world to analyze threats such as diseases and chemical warfare

- ?? The need for a High Speed Vessel program to transfer casualties quickly became obvious during the Cuban operation *and will have to be developed*

- ?? A forward resuscitative surgery system is critical, but there are some situations where this feature might prove to be a challenge—for example, if troops are in a place like the Congo without friendly airlift to get the surgical teams there.

- ?? Operational logistics, such as securing and delivering medical supplies, setting up and using medical information systems that allow for visibility within the system, and blood technology with the artificial blood products program, are areas undergoing changes, as well. In the case of just-in-time delivery of medical supplies, we are grappling with developing a system capable of delivering “just-in-time” medical supplies to our ships. It's one thing to be able to get supplies to a CONUS hospital, but another when that hospital is on a ship floating offshore from Sierra Leone
- ?? Information systems will help health care workers. As an example, to keep better track of patients and their conditions
- ?? New advances in blood technology, including synthetic agents, are on the horizon
- ?? Many health care positions have gone unfilled, the mix and number of physicians has traditionally been insufficient to meet the need, and a nursing shortage is making recruitment of nurses especially difficult. This may also happen in the future when recruiting physicians and will also have to be addressed.

3. DOCTRINE FOR THE AIR FORCE ONHEALTH SERVICE SUPPORT

Colonel Rick Hersack, MC, USAF, CFS, United States Air Force Surgeon General Chair to the Air University, Maxwell, AFB, AI provided the following US Air Force medical doctrine briefing:

This briefing covered the doctrine process in the Air Force and in the Air Force Medical Service (AFMS), and described how medical doctrine influences medical education.

Prior to the 1980s, the Air Force had no officially sanctioned strategic or operational level doctrine that was universally accepted. The Air Force had tinkered with attempts to develop strategic level doctrine but the only approved doctrine at the time was at the tactical level. With the passage of the Goldwater-Nichols Defense Reorganization Act, the Air Force determined that doctrine for the employment of air and space power must be broader than the tactical level (how to deliver what kind of bomb against a particular target), addressing the strategic and operational levels as well. The establishment of the Air Force Doctrine Center at Maxwell Air Force Base, Alabama in 1997 institutionalized the Air Force's official doctrine development process. The AFDC Commander reports directly to the Air Force Chief of Staff.

The intent of doctrine is to describe how best to employ air and space power in joint, coalition and allied operations. There are three levels of Air Force doctrine: basic (or strategic), as outlined in the Air Force Doctrine Document 1; operational, as outlined in the Air Force Doctrine Document 2, and tactical, as outlined in the Air Force Tactics, Techniques, and Procedures. Air Force doctrine documents are organized into three

series based on the level of doctrine they address. The Series 1 doctrine documents address the basic (or strategic) level of doctrine, Series 2 documents address the operational level, and Series 3 documents (also called "Tactics, Techniques, and Procedures (TTPs)") address the tactical level of doctrine.

It is important to note that in the Air Force the medics do not own the doctrine—the Line of the Air Force owns the doctrine. Doctrine describes how the Air Force will train and equip its forces then employ them in a military operation. The medics develop and write the medical doctrine, but it is the Line of the Air Force that approves the medical doctrine, taking ownership of the medical doctrine. In other words, once approved, Air Force medical doctrine becomes the officially sanctioned view of the Line of the Air Force for how best to employ its Air Force medical assets to support the Air Force mission. In addition, the AFMS has ensured that there is clinical representation in the medical doctrine development writing groups working on the medical doctrine documents.

Air Force Doctrine Document 1

The publication, *Air Force Basic Doctrine* (Air Force Doctrine Document 1, or AFDD 1) is the premier statement of the Air Force's basic doctrine. It covers what the Air Force believes to be true about air and space power. In addition to defining doctrine, the publication explains:

- ✍️ Doctrine's relations to strategy
- ✍️ Principles of war
- ✍️ Tenets of aerospace power
- ✍️ Core competencies
- ✍️ Aerospace power functions
- ✍️ The organization of U.S. Air Force forces

Air Force Doctrine Document 2

Air Force Doctrine Document 2 (AFDD 2, or 2-series documents) covers operational doctrine and organization and employment issues. This includes:

- ✍️ The nature and uses of air and space power in three operational areas or environments: peacetime engagement and crisis response, deterrence and contingency actions, and war-winning operations
- ✍️ The organizing principles for expeditionary operations
- ✍️ Planning aerospace operations

AFDD 1 and AFDD 2 are the capstone documents for the United States Air Force. All other doctrine documents flow from these two documents.

Air Force Doctrine Document 2-4.2

The Air Force Doctrine Document 2-4.2 (AFDD 2-4.2) is an operational level document written and approved in the mid-1990s. Currently, it presents an overall strategic vision for how the AFMS should achieve the objective of customer satisfaction by describing four supporting pillars: (1) medical readiness for any type

of mission; (2) the application of managed health care delivery during peacetime; (3) the use of tailored forces; and (4) building healthy communities.

In its current form, AFDD 2-4.2 is not addressing doctrine, which defines how to use wartime medical assets in an operational scenario. Rather, it is presenting policy by addressing how the AFMS should accomplish its overall mission by focusing on the provision of peacetime managed health care. As a result, the AFMS has requested and the Line of the Air Force has approved revising this doctrine document so that it will have primarily an operational focus. The revised doctrine document will address three major areas related to doctrine: core competencies, deployment scenarios, and command and control.

Air Force Medical Service Core Competencies

A core competency as defined in AFDD 1 is not doctrine by itself. Rather, it is an enabler that allows the Air Force to accomplish its doctrine. Doctrine describes how a capability based on a core competency would be employed to accomplish an objective, linking means with ends. AFDD 1 outlines six core competencies for the Air Force:

- ~~///~~ Aerospace superiority
- ~~///~~ Information superiority
- ~~///~~ Global attack
- ~~///~~ Precision engagement
- ~~///~~ Rapid global mobility
- ~~///~~ Agile combat support

From these have emerged seven proposed Air Force Medical Services core competencies, and how they are applied in medical education (waiting final approval from the Surgeon General and his staff):

- ~~///~~ Fixed-wing aeromedical evacuation of a broad spectrum of casualties, from the "walking wounded" to the critically ill.
- ~~///~~ Medical care in military operations, with special emphasis on expeditionary medical support.
- ~~///~~ Interface with world health care systems and organizations for the purpose of permitting integration of medical assets.
- ~~///~~ Human performance sustainment and enhancement.
- ~~///~~ Population health through preventive medicine and health promotion strategies as applied to the life cycle of the human weapons system.
- ~~///~~ Information management.
- ~~///~~ Space medicine.
- ~~///~~ (Editor's note: since the conference the AF Surgeon General has approved the first five of the above as the AFMS Core Competencies, deleting Information management and Space medicine.)

All seven AFMS core competencies must derive from and support the Air Force's core competencies.

Deployed Scenarios

A deployed scenario is the environment in which a military operation occurs. The Air Force Medical Service will address the deployed scenarios in AFDD 2-4.2 where it will be expected to provide medical support to the Air Force Mission. Specifically, the Air Force Medical Service must be able to provide full-scale support throughout the entire continuum of military operations. Referencing AFDD 2, these deployed scenarios include:

- ✍ Peacetime engagement and crisis response which encompasses humanitarian assistance, military to military contacts, unilateral and multilateral exercises, disaster relief, counter-drug and counter-terrorism operations, and rescue and noncombatant evacuation operations
- ✍ Deterrence and contingency operations which encompass aerial occupation, show of force, forced entry, raids, and coercion
- ✍ War-winning operations which encompass destruction, disruption, deployment and sustainment operations for the duration of the conflict and information operations

This part of the doctrine will address interfaces between ground contingency support and casualty evacuation. It also will cover how to make smooth exchange with international partners, such as non-governmental organizations (NGO), not only in military operations, but also during disaster relief and humanitarian events both domestic and foreign. There should be an efficient transition from the Air Force's rapid response capability to an NGO's long-term support efforts. In order to respond in times of crisis, the Air Force is also building or has already built rapidly deployable medical systems.

Command and Control

It is very important to understand that Air Force Medical Service reports directly to the Line of the Air Force at every level of command. This is part of our culture and is fundamental for how the Air Force goes to war. This section will address command relationships, including operational relationships with other governmental agencies and international organizations. For the AFMS, this can be easily summarized by recognizing that everything the AFMS does should somehow support the Air Force mission, which supports joint military operations in support of our national military strategy, as a part of our overarching national security strategy.

Air Force Tactics, Techniques, and Procedures Doctrine Documents

All functional levels throughout the Air Force are developing an Air Force Tactics, Techniques, and Procedures doctrine documents (AFTTP, 3-series tactical doctrine documents) to describe various specific components of their systems and how those components would best be employed at the tactical level.

The AFMS is developing TTP's that will describe a fully integrated casualty care system that is consistent with the principles outlined in "Force Health Protection," the joint medical support concept for Joint Vision 2020. Key components include: focused logistics via rapidly deployable modular medical capability, provision of essential care rather than definitive medical care forward, a continuum of casualty care through a critical care aeromedical evacuation system that builds in parallel and interfaces with ground contingency medical support, force health promotion and human performance enhancement during deployed operations, and casualty prevention which includes real time environmental monitoring and assessment of health threats at deployed locations.

Originally, the AFMS planned to put everything in one large document. TTP's are reviewed annually and any revisions of a large document would be cumbersome. Therefore, the AFMS has decided to break up the information into eight smaller, more user-friendly documents that cover the following areas:

~~2/2~~ Aerospace medical contingency ground support systems, including Preventive Aerospace Medicine Teams, Mobile Field Surgical Teams, ground Critical Care Teams, Small Portable Expeditionary Aeromedical Rapid Response Teams, and Air Force Theater Hospitals.

~~2/2~~

- Aeromedical evacuation.
- Medical command and control.
- Medical logistics and blood support operations.
- Medical operations in nuclear, biological, and chemical environments.
- Medical support for special operations forces.
- Medical estimate and casualty prevention, including medical intelligence, deployment health services, and environmental health.
- Medical support for the human weapon system, including human performance, team aerospace, and dental operations.

The first four of these documents are finished. The two documents that cover medical operations in Nuclear, Biological and Chemical (NBC) environments and medical support for special operations forces will be finished during the summer of 2001. The final two will be completed during the fall of 2001. These documents will be reviewed annually to incorporate lessons learned during deployments and operations.

All the medical doctrine documents and their status of development are available on-line. For more information about Air Force medical support doctrine, the Air Force Surgeon General has established a link to Medical Doctrine on the AF/SG Web page at <https://www.afms.mil/sg/index.htm>.

The TTP writing groups have included clinical representation. Since Air Force doctrine for medical support describes how best to employ medical assets to accomplish objectives which involve patient care, it is important that clinical

issues are considered while developing doctrine for medical support. For that reason doctrine can be used by our medical education system to target our medical education towards what we will do in a deployed scenario.

Finally, in considering how to use doctrine as a tool to direct future medical education it is important to understand the limitations of doctrine. Doctrine links current means with current ends based on historical experience or considered expert opinion to address current realities. It does not predict the future. Nor does doctrine address strategic policy and vision, which include peacetime issues and future trends - areas that are much broader than the employment of medical assets in military operations. Doctrine is derived from strategic policy and vision and it addresses in a very focused manner their accomplishment in current military operations, but it is not comprehensive. Certainly, medical education needs to be consistent with and address doctrine, but, to be complete, medical education should recognize the limitations of doctrine and take into account areas which lie beyond the scope of doctrine.

SECTION II: PANELS' EDUCATIONAL IMPACT SUMMARIES

A. Emerging Threats

Panel Leader: Col Naomi Aronson, USA
Facilitator: LCDR Jay Erickson, MC, USN
Recorder: Bill Whitman (USUHS)
Educator: Dr. Barry Wolcott, COL, USA (Ret)

BG Lester Martinez-Lopez, MC, USA	CDR Kenneth Cole, MSC, USN
COL David Burris, MC, USA	LTC Mike Roy, MC, USA
COL Ted Cieslak, MC, USA	LTC Scott A. Stanek, USA
CAPT John Coyne, MSC, USN	CPT Darrell Singer, MC, USA
Col Gary Gackstetter, BSC, USAF	LT Douglas Tadaki, USN
CAPT Michael G. Lilienthal, MC, USN	CPT Raymond Vasquez, USA
Col William Thornton, MC, USAF	Dr. Coleen Weese
	Mr. Fred Ambrose (DIA)

Emerging threats can be categorized into four basic groups: (1) those that target the human body; (2) those that target the human mind; (3) those that target equipment (hardware); and (4) those that target software. Each of these threats can inflict upon its target a degree of force that will produce short-term incapacitation, long-term incapacitation, or total destruction or death. Each of the emerging threats described by this working group can be thus categorized and stratified.

In this working group, experts from several threat arenas presented their ideas regarding those emerging threats that may be facing our military troops over the next twenty to thirty years. They offered their opinions as to the medical implications of these threats and suggested medical education objectives to be met in order to prepare future health care providers to deal with the medical consequences of these threats.

The panel developed and ranked an organized and prioritized list of specific threats from most likely to occur and most significant to least likely and least significant. Eight of these threats are listed below:

- A. Chemical, biological, radiological, and nuclear threats (CBRNT)
- B. Toxic industrial chemicals (TIC)
- C. Infectious diseases and drug resistant organisms
- D. New or significantly modified conventional weapons
- E. New infectious diseases
- F. Disinformation threats
- G. Non-battle injuries
- H. Post-combat traumatic stress syndromes

Each threat was looked at from the perspective of the potential impact it could have on military medical practice. Then, the panel determined the educational objectives that need

to be met to prepare military health care providers to work in that new practice environment.

A. Chemical, Biological, Radiological, and Nuclear Threats (CBRNT):

Although Weapons of Mass Destruction do exist today, they are likely to be used in the future in ways not previously envisioned. In some respects, the likelihood of such weapons being used in the future may be greater than in the past when such weapons were tightly controlled by nation states. For these reasons, this topic area was included in this discussion. CBRNT is the term presently used to cover all of these weapons.

Practice Changes—Increased likelihood of CBRNT weapons use in the future poses health care challenges in the areas of:

- ~~///~~ Detection and identification of hazardous materials
- ~~///~~ Preparation for initial release, exposure, or attack
- ~~///~~ Medical management of conditions that have an extremely low incidence of occurrence under normal circumstances
- ~~///~~ Quarantine issues
- ~~///~~ Necessity to differentiate between the truly sick and the worried well
- ~~///~~ Threats to health care personnel from exposure, and self-protection issues
- ~~///~~ Health care operations in contaminated environments
- ~~///~~ Psychological stress in general population and in health care providers
- ~~///~~ Need to communicate with and educate individual patients and general populace about CBRNT weapons effects and risks

Educational Response—In the area of CBRNT, health care providers should be able to demonstrate:

- ~~///~~ Ability to operate basic items of equipment to detect and identify hazardous materials
- ~~///~~ Ability to protect patients, unit, and self from an attack or accidental release or detonation of a CBRNT weapon, and medically prepare for casualties resulting from such an attack
- ~~///~~ Appropriate medical management of conditions that have an extremely low incidence of occurrence under normal circumstances, but that have the potential for generating large numbers of casualties
- ~~///~~ An understanding of all medical issues related to quarantine
- ~~///~~ Differentiation between the truly sick and the worried well
- ~~///~~ Ability to recognize, diagnose, and apply echelon-appropriate treatment for CBRNT casualties
- ~~///~~ Ability to safely and effectively carry out health care operations a contaminated environment

- ✍ Ability to recognize and apply echelon-appropriate treatment and preventive measures for psychological stress in the general population and in health care providers
- ✍ Ability to communicate with, and educate, individual patients and general populace about CBRNT weapons effects and risks
- ✍ A familiarity with the “toxidrome” approach to patient management that facilitates the recognition of syndromes and allows for appropriate early treatment in the absence of a definitive diagnosis
- ✍ Knowledge and understanding of surveillance systems
- ✍ Ability to medically deal with suddenly occurring, unexpected, and unknown threats in an echelon-appropriate manner
- ✍ Knowledge of the issues surrounding coordination between civilian and military authorities in a hazardous materials environment, and a rudimentary ability to provide echelon-appropriate medical care in such an environment
- ✍ Information access skills, including skills in data gathering and Internet research, and the ability to apply that knowledge to improve medical care in a CBRNT incident
- ✍ Skills in communicating CBRNT issues to individual patients and the general populace in the areas of protection, recognition, first aid, and risk assessment.

B. Toxic Industrial Chemicals (TIC):

This was considered a separate threat from CBRNT because of the variation in the actual source of exposure. When this panel discussed CBRNT, the focus was on the actual intended use of chemical or biological weapons against troops. When they considered TIC, they focused on the potential consequences of short- or long-term exposure to even the lowest level of industrial chemicals, whether intended or not. This would include exposure of troops stationed in areas near toxic storage sites or the potential results of local civilian accidents, such as the industrial explosion that occurred in Bhopal, India. In summary, TIC covers the continuum of toxic exposures, natural and manmade, and intentional and unintentional.

Practice Changes—Related to the increased worldwide use of toxic industrial chemicals:

- ✍ Increased public concern about the potential long-term health risks associated with real or perceived toxic exposures
- ✍ Public expectation that military will know all environmental threats to which troops are exposed and that it has the ability to diagnose early and prevent and treat all such exposures
- ✍ Increased possibility of a large scale accidental or intentional exposure of U.S. citizens (military and civilian), provoking a sudden, large influx of patients into the medical care system
- ✍ Prolonged deployments in areas not previously under Environmental Protection Agency (EPA) guidelines raises the possibility of chronic exposure to low levels of TIC that may be hazardous to health

Educational Response—Related to toxic industrial chemicals health care providers should be able to demonstrate:

- ✍ Skills in gathering intelligence from the Internet and elsewhere, and the ability to apply that knowledge to the prevention, recognition, and early, echelon-appropriate treatment of patients suffering the effects of TIC
- ✍ Knowledge of common toxic industrial chemicals and of chemical safety data sources
- ✍ Familiarity with agencies that collect toxic exposure data.
- ✍ Ability to identify potential chemical exposures using “toxidrome” recognition and specific diagnostic tests to delineate actual type of exposure
- ✍ General knowledge of emergency response equipment, including instrumentation equipment, risk assessment, and personal protective equipment
- ✍ How to evaluate occupational and environmental exposure risks and effectively communicate those risks to patients, commanders, and supervisors
- ✍ Ability to create a situationally-appropriate differential diagnosis that includes TIC
- ✍ Ability to safely manage, in an echelon-appropriate manner, a large number of patients who may be contaminated with TIC
- ✍ Ability to carry out basic disease surveillance to provide early evidence of an ongoing exposure to TIC
- ✍ Knowledge of, and ability to carry out, safe disposal of TIC, and the ability to prevent the contamination of medical treatment facilities with TIC

C. Infectious Diseases and Drug Resistant Organisms:

This threat includes both the use of resistant biological organisms in a weaponized manner during battle and the increasing frequency of “naturally occurring” drug resistant organisms on troop health in peace and war. The consequences of these drug resistant infectious diseases include not only the medical impact on the patient population, but also the psychological impact on the provider who is both unable to provide adequate treatment to protect the life of the patient and is concerned about his or her own safety.

Practice Changes:

- ✍ Significant increase in “naturally occurring” antibiotic resistance in both numbers of types of resistant organisms and in incidence of multi-drug resistance
- ✍ Increasing ability to genetically modify infectious organisms to increase the durability and infectivity of organisms and to create multi-drug resistance
- ✍ Increased public expectation of health care system's ability to cure infectious diseases, while at the same time it becoming more difficult to cure common and “old” diseases that have become multi-drug resistant, such as tuberculosis
- ✍ Psychological ramifications on health care providers who find themselves unable to cure certain diseases that were previously readily curable

- ✎ Psychological ramifications on troops and public when previously curable diseases cause widespread death

Educational Response—In the area of drug resistant organisms, health care providers should be able to demonstrate:

- ✎ Knowledge of, and basic ability to implement, surveillance and containment measures
- ✎ Ability to recognize an unusual presentation or an inadequate antibiotic response as possibly being due to a drug resistant organism
- ✎ Familiarity with the use of available sources of information in print and electronic media that keep health care providers abreast of changes in drug resistance
- ✎ A basic knowledge of immunology and bacteria genetics related to drug resistance
- ✎ Ability to interpret risk data and effectively communicate risks related to drug resistant organisms to individual patients and the general public
- ✎ Ability to effectively use protective measures to prevent the spread of drug resistant organisms to self, patients, and community
- ✎ Familiarity with current and future technologies and methods for dealing with drug resistant organisms (anti-pathogenic treatment vs. disease treatment – receptor blockade)
- ✎ Knowledge of, and ability to use, reporting systems for drug resistant organisms
- ✎ Ability to effectively communicate with patients and the public to shape expectations and bring them in line with reality
- ✎ Sufficient knowledge of the mechanisms of disease pathogenicity and drug resistance to be able to propose alternative methods of control for multi-drug resistant organisms

D. New or Significantly Modified Weapons:

Although it is not possible to know exactly what new weapons may be developed over the next twenty to thirty years, it is possible to teach military health care providers to recognize new injury patterns that may indicate the use of new, atypical, or unusual weapons on a future battlefield. The emphasis in this working group, as it relates to conventional weapons, was on the potential medical implications of new, or substantially modified, weapons, and on how military medical educators might best prepare future military health care providers to diagnose and treat the new or atypical injury patterns such weapons might create. Some of the specific weapons types discussed included: enhanced fragmentation weapons, fuel-air and thermobaric-enhanced blast weapons, lasers and other directed energy weapons, and modern anti-armor weapons containing depleted uranium or other heavy metals. Many of these weapons are not new or “unusual,” but they are likely to be used with increasing frequency over the next twenty to thirty years, and each presents unique medical management challenges. Additionally, a number of emerging weapons systems, not individually listed here, are designed to incapacitate rather than physically injure or kill. This

incapacitation may involve physical or psychological incapacitation—or a combination of both.¹

Practice Changes:

- ✂ Increased number of living wounded with multiple, small fragmentation and shaped-charge wounds primarily involving the extremities
- ✂ Increased frequency of “occult” injury (primary blast injury, inhalation injury, long-term toxicity such as from heavy metals, including depleted uranium)
- ✂ Improved body armor and increased use of large caliber weapons causing an increase in number of casualties with “behind armor blunt trauma” (BABT) injuries
- ✂ Increased frequency of burn injuries from weapons (thermobaric and others) and from burning fuel, plastics, and light metals
- ✂ Increased frequency of eye injury from small fragments, lasers, and other directed energy weapons
- ✂ Increased importance of rapid diagnosis, treatment, and return-to-duty, because each soldier is more vital to mission success in the environment of small team employment, which increases the need to treat far forward
- ✂ Introduction of new incapacitating, “non-lethal” weapons that produce unique injury patterns and/or psychological effects
- ✂ Introduction of new weapons systems producing new injury patterns previously not observed

Educational Response—Health care providers should be able to demonstrate ability to:

- ✂ Rapidly and accurately differentiate between life and limb threatening, small fragment, and shaped-charge wounds, and minor wounds that can be treated far forward
- ✂ Apply echelon-appropriate treatment for battlefield wounds of all types and make appropriate return to duty decisions
- ✂ Recognize and treat “occult” injury (primary blast injury and crush injury from collapsing buildings) from blast-enhanced weapons, inhalation injury from high temperature gasses, and long-term toxicity of substances, such as heavy metals (depleted uranium, etc.); provide echelon-appropriate care for these injuries
- ✂ Recognize and treat “behind armor blunt trauma,” determine which patients can be returned to duty, and provide echelon-appropriate care for these injuries
- ✂ Provide echelon-appropriate burn care
- ✂ Recognize and provide echelon-appropriate treatment of combat-related eye injuries and be able to determine which patients can be safely treated and returned to duty
- ✂ Deal with combat casualties as a result of new or “unusual” weapons systems in a systematic manner to save life, limb, and sight

- ✍ Describe the mechanism of injury of new weapons systems and their potential impact on human physiology
- ✍ Recognize injury patterns of less-than-lethal weapons, determine which patients can be safely returned to duty, and provide echelon-appropriate care
- ✍ Describe those weapons systems that produce primarily neurological or psychological effects and discuss how patients affected by these weapons systems should be treated and evacuated

E. New and Emerging Infectious Diseases:

This threat includes not only those newly emerging diseases but also the use of mutated organisms that may be used on future battlefields. As stated previously, this threat includes both the intentional and the unintentional exposure of individuals to such infections. Similar to the influenza epidemic in the early twentieth century, our initial understanding and awareness of these new infections may be limited, affecting our ability to properly treat our patients and limit the spread of disease.

Practice Changes:

- ✍ Potential for large scale epidemics and pandemics resulting from new or significantly mutated diseases spreading through immunologically naïve populations
- ✍ Primary care physicians providing rapid epidemiologic assessment of case patterns, clustering, and performing disease surveillance methods to pick up new disease patterns
- ✍ Increased use of advanced biotechnology to diagnose and treat new and mutated infectious diseases
- ✍ Use of information technology to rapidly disseminate medical information about new or mutated diseases
- ✍ Increased news media interest in the emergence of new or mutated diseases

Educational Response—Health care providers should be able to demonstrate:

- ✍ An understanding of “syndrome-based” diagnosis and treatment, and the ability to initiate appropriate care prior to the establishment of a specific disease
- ✍ Knowledge of, and ability to perform, basic outbreak investigation methods
- ✍ Risk communication skills (communication with physicians and the general public)
- ✍ Understanding of how to effectively inform the public and the news media of a disease outbreak when knowledge of is limited, without causing panic
- ✍ Basic science knowledge about infections, including immunology, molecular biology, vaccinology, and synthetic chemistry
- ✍ Ability to utilize available information to postulate likely mechanisms of transmission, and to institute effective measures to prevent the transmission of disease

- ✍ Ability to deal with the psychological aspects, both in individual patients and in the general public, resulting from the occurrence of illness and death caused by an unknown organism
- ✍ Familiarity with, and ability to apply, basic preventive medicine measures that are likely to help control the spread of disease
- ✍ Familiarity with quarantine issues and procedures

F. Disinformation Operations:

The potential medical results of disinformation are significant and are increased when combined with any of the above threats. By combining a small exposure of a new or unknown chemical or biological weapon with a widely disseminated disinformation campaign, an enemy would quickly and efficiently disrupt the ability of both civilian and military health care facilities to respond to the threat.

Practice Changes:

- ✍ Possible disinformation directed at patients and providers who are affected by an alleged or real chemical or biological attack, causing them to distrust official sources of information
- ✍ Confusion about the diagnostic criteria for, and medical management of, an unknown chemical or biological weapon leading to misdiagnosis and incorrect treatment
- ✍ Increased need for a more robust and secure information network
- ✍ Increased need for expanded communications between military facilities, civilian facilities, and local civilian authorities to counter disinformation threats
- ✍ Increased need for, and exercise of, civil and military “disinformation” response plans

Educational Response—Health care providers should be able to demonstrate:

- ✍ Ability to effectively recognize and counter disinformation and misinformation using communication skills to correct patient and public misperceptions
- ✍ Ability to effectively use the Internet and other information systems, and to stratify the value of information acquired from those sources by utility and probable veracity
- ✍ When given discordant information, the ability to utilize all available facts and resources to resolve information conflicts rapidly and correctly
- ✍ Knowledge of how to help develop and exercise a disinformation response plan
- ✍ Skills in briefing media, civilian authorities, and the general population
- ✍ The ability to work with multiple agencies involved in the response to a disinformation attack

G. Non-Battle Injuries:

This area is obviously not new, but it is of such a great significance that the panel felt the need to address it as a major threat. Considering that the number of injuries to military personnel reaches nearly one million per year, and in light of the more highly trained and singularly vital soldier of the future, the loss of even one of these “super soldiers” could seriously influence the mission.

Practice Changes:

- ✍ Increased operational tempo and increased emphasis on fitness increases the likelihood of troops sustaining non-battle injury.
- ✍ Every non-battle injury negatively affects mission accomplishment, especially as forces become smaller, more highly trained, and more dispersed.
- ✍ Older force means that troops will be more susceptible to injury and, when injured, will likely take longer to heal.
- ✍ An increased need to communicate risks to troops and commanders, and to be able to offer suitable alternatives to current training strategies that pose an unacceptable risk of injury

Educational Response—Health care providers should be able to demonstrate:

- ✍ An understanding of the relationship between non-battle injuries, substance use, and high-risk behaviors
- ✍ Knowledge of, and ability to apply, injury prevention strategies
- ✍ Knowledge of, and basic ability to apply, a systems analysis approach to injury prevention to "engineer out" potential risk factors for injury
- ✍ Skills in risk communication and injury surveillance and ability to recognize changes in injury patterns
- ✍ Ability to apply echelon-appropriate treatment for non-battle injuries
- ✍ Knowledge of, and ability to institute, basic physical rehabilitation for troops who have sustained non-battle injuries
- ✍ Ability to educate troops and commanders about the importance of preventing non-battle injuries and about activities that are, or are likely to be, associated with an increased risk of non-battle injuries

H. Post-Combat Traumatic Stress Syndromes:

Although the terminology, Gulf War Syndrome, may be new, the problem is not new to anyone who has studied the impact of war on troops. Whether it is called “battle fatigue,” “shell shock,” or “post-traumatic stress disorder,” troops have always faced the consequences of war in more ways than just physical injury or wounds. The “threat” in this instance is to the credibility of the military health care system and to the confidence of the troops in that system. The military’s inability to rapidly and effectively diagnose and treat those afflicted with post-conflict syndromes has led to a significant level of distrust in the military medical community.

Practice Changes:

- ✎ As each individual warrior becomes increasingly important to mission accomplishment, the result of losses caused by post-combat traumatic stress syndromes becomes increasingly important
- ✎ There is an increasing public expectation that the military health care system will be able, post-conflict, to determine the cause of all disorders that troops may suffer, both immediate and long term
- ✎ There is an increasing recognition of the role of non-physical ailments in long-term disability
- ✎ There has been a loss of trust in the military health care system
- ✎ The public expects that the military health care system will be able to diagnose, treat, and properly disposition stress-related disorders at all levels
- ✎ As the total number of patients suffering from battle injury and disease/non-battle injury (DNBI) decreases (as is anticipated in most conflicts), the relative impact of post-traumatic stress disorders on health care systems becomes increasingly important

Educational Response—Health care providers should be able to demonstrate:

- ✎ A familiarity with, and ability to apply at a basic and echelon-appropriate level, epidemiologic surveillance methodology
- ✎ Knowledge of, and ability to diagnose and provide basic echelon-appropriate treatment for, post-traumatic stress disorders
- ✎ Knowledge of the full spectrum of ways in which post-traumatic stress disorders may manifest themselves and the factors that may contribute to an increased incidence of post-traumatic stress disorders
- ✎ Knowledge of appropriate screening methods to identify high-risk personnel prior to deployment
- ✎ Knowledge of post-deployment debriefings and their role in identifying personnel in need of further evaluation and treatment
- ✎ Knowledge of clinical guideline development and use during post-deployment periods
- ✎ An understanding of cognitive behavioral therapy and its uses
- ✎ Ability to effectively communicate with patients, the general public, and the media about post-combat syndromes in a way that maintains confidence in the military health care system
- ✎ Knowledge of cognitive behavioral therapy and its uses

B. Changing Missions and Operations

Panel Leader: COL Julia Lynch, MC, USA
Facilitator: Col Steve Waller, USAF, MC
Recorder: Capt Susan Lee, USAF, NC
Educator: Lt Col John Wightman, USAF, MC

CAPT Charles Auker, USN
CAPT Richard Cocrane, MSC, USN
COL Warner D. Farr, MC, USA
Col Vicky Fogelman, BSC, USAF

COL Timothy Jones, USA
Col Rick Hersack, USAF, MC
Col Terri Page, USAF, NC
Col Jane Ward, USAF, MC
LTC Laura Brosch, USA, NC
CDR Andy Kirshner, MSC, USN

LTC Jeffrey Longacre, MC, USA
LTC Scott Norton, MC, USA
Lt Col Thomas Rampy, USAF, MC
CDR Mike Sashin, MSC, USN
CDR Kerry Thompson, MSC, USN
Lt Col Chris Zahn, USAF, MC
Maj Ruth Espinoza, USAF, NC
LCDR Sean Biggerstaff, USN
LT Lorenzo Jones, MSC, USN
Dr. Alan Compton

This work panel mainly presented a projection into the future of the current Department of Defense vision for future operations. Keeping in mind service specific issues and the joint environment, this panel created four subgroups to address the issues related to future military missions and operations in the following areas: (1) peacetime health care, (2) Weapons of Mass Destruction (WMD), (3) Major Theater War (MTW), and (4) peacekeeping and peace enforcement, humanitarian assistance and disaster response.

The panel defined what it felt were the principal ways in which changing missions and operations will alter the practice of military medicine and then identified the educational objectives that would have to be met to prepare military health care providers to practice in this changed environment.

The Department of Defense and each of the services are changing their organization and equipment, how they operate, and the types of missions that they are prepared to execute. The pace of these changes will likely increase over the next twenty to thirty years. These changes will profoundly influence how health care is delivered.

1. Changes in Organization and Equipment

The changes in organization and equipment that are most likely to have the greatest influence on health care practice are: (1) more joint organizations and increasing similarity between the Services' command and control structure; (2) more organizations where the mission and function stresses increased flexibility (improved ability to task-organize) and a "flattened" chain of command, perhaps along the lines of a Marine Air-Ground Task Force (MAGTAF); (3) units built around multi-disciplinary teams that can be readily task-organized; and (4) the requirement for rapid deployment will lead to units

that are smaller, have lighter equipment, and have a smaller footprint. Medical treatment facilities also will be smaller and lighter, and their staffing will be required to be multifunctional.

Changes in Practice:

- ✎ Increasingly, health care practitioners will need to be familiar with, and comfortable working with and in, military and non-military organizations other than their own
- ✎ Health care practitioners will need to be capable of functioning independently, yet in an integrated fashion; they will need to be flexible enough to transition quickly from working effectively in a fixed, relatively sophisticated environment that is organized by specialty, to working effectively in a highly mobile, somewhat austere, environment as a cross-functional generalist with specialty training
- ✎ Health care practitioners will increasingly need to be more operationally proficient because there will be less of a medical infrastructure to address their individual and small unit force protection issues, and they will be operating dispersed and more vulnerable environments
- ✎ Increasingly, patients will be moving in and out of dispersed units and across organizational boundaries

Educational Response—Health care providers should be able to demonstrate:

- ✎ A basic understanding of the structure, organization, language, culture, and missions and standard operating procedures of each of the Services, major allies' military forces, and principal governmental and non-governmental agencies with which military medical assets may be required to work
- ✎ Ability to effectively interact with each of the Services, major allies' military forces, and principal governmental and non-governmental agencies to accomplish required medical responsibilities
- ✎ Ability to operate effectively in small, task-organized organizations independent of, yet in an integrated manner with, other similar units and with a larger, remote parent organization
- ✎ Proficiency in a basic set of general medicine skills and knowledge covering the common causes of disease and injury in units operating in combat and non-combat environments
- ✎ Basic proficiency in common warrior survival skills
- ✎ Ability to safely and effectively perform medical and non-medical tasks in a hostile environment (combat and non-combat)
- ✎ An understanding of the issues related to, and the definition and selection of, stabilized patients
- ✎ A understanding of all of the important factors involved in making evacuation decisions, and the ability to package stabilized patients for safe transport
- ✎ An understanding of the types and capabilities of “reach-back” communications technologies, and the ability to operate common systems to transmit patient information and receive consultation

2. Changes in Missions and Operations

Mission areas that are becoming more frequent and have received more emphasis recently include humanitarian assistance/disaster relief, homeland defense and military support to civil authorities, peace keeping and enforcing, engagement and nation building, urban warfare, counter-terrorism, counter-WMD, and counter-drug proliferation. In a number of these future operations, medical units will be used as the principal instrument of national policy and will become the supported, as opposed to the supporting, units. Preparation to conduct a MTW remains, however, a major priority. Missions will increasingly be conducted jointly, with allies, with or as part of a United Nations unit, and in collaboration with one or more non-governmental organization. Today, and in the near future, there will be increasing collaboration between the DoD, the State Department, and other governmental organizations to insure that national strategic objectives are met. All of these missions will be conducted with significant emphasis on all aspects of force protection.

The greatest change in how missions are conducted in the future will be in the increased dispersion of highly mobile, relatively small, but highly capable and lethal, task-organized and networked forces. One way in which these forces might be employed on future battlefields involves the use of battle swarming (e.g., an attack of killer bees), the principal tactic used by Ghenghis Khan. Such a tactic, if it becomes widely used, will present substantial challenges to logistics support and the military health care system. Surgical care and the evacuation of casualties in such operations will be extremely difficult.

Changes in Practice:

- ✍ The provision of medical care to U.S. military forces will increasingly involve multiple Services, multiple countries, and possibly non-military or non-governmental agencies
- ✍ Increasingly, within the United States, military health care capabilities will be integrated with civilian capabilities; military beneficiaries will receive care in civilian facilities and, under certain circumstances (i.e., large natural disasters or terrorist use of WMD), civilians will receive care by military providers and, in some cases, in military medical facilities
- ✍ Medical logistics will increasingly be provided in a focused, “just-in-time” manner possibly utilizing precision aerial resupply
- ✍ The concept of far-forward “damage control” surgery will be used more often.
- ✍ Health care providers in these relatively small and isolated units must be capable of handling all aspects of far-forward care; they will need to be capable of providing essential care to save life and limb and to maintain the fighting strength; and they will need to know how to make rapid triage decisions related to who gets what care, and who gets evacuated and to where
- ✍ As military medicine is increasingly provided in a manner distinctly unlike that of the past, there will be a rapidly growing deficit in the evidence base that exists to support the practice of medicine in these new ways; today, there is already a

substantial deficit between what can be demonstrated as efficacious and how military medicine is practiced, and this is especially the case within the field, deployed, and combat environments

- ✍ Military health care providers assigned to highly dispersed units simply can't be proficient in all of the necessary areas of medicine; therefore, telemedicine and teleconsultation, as well as computer-aided diagnostic and medical care decision-support tools, will become increasingly important
- ✍ In almost every possible future employment of military medicine, the ability of health care providers to be educators and trainers, both for their own unit's personnel and for those of other units or other nations, will be essential to success
- ✍ The need for small, multifunctional, highly capable units increases the importance of both force protection and of force enhancement; force protection is, and will continue to be, a critical component of all military operations
- ✍ Patient follow-up with determination of outcomes linked to specific medical interventions will be essential but increasingly difficult to accomplish, as patients will be cared for in facilities operated by many different agencies that are widely dispersed in distance and time

Educational Response—Health care providers should be able to demonstrate:

- ✍ Knowledge of medical logistics and the ability to effectively utilize focused, “just-in-time,” logistics to ensure that adequate and appropriate medical supplies are on-hand
- ✍ A basic ability to analyze existing medical data and studies and extract from them the relevant components needed to define an evidence base for the practice of military medicine in new or unfamiliar areas
- ✍ A basic ability to design and carry out studies to create an evidence base for future health care systems and medical practice
- ✍ A basic knowledge of, and a sensitivity to, the cultural differences that exist between each of the Services, between military and civilian organizations, between governmental and non-governmental organizations, between nations, and between differing races, religions, and ethnic groups
- ✍ A basic knowledge of the medical implications of differing political philosophies and cultures
- ✍ The knowledge and skills required to function as a medical educator and trainer
- ✍ Proficiency in the use of telemedicine and teleconsultation tools and in the performance of telemedicine and teleconsultation tasks
- ✍ An understanding of what “damage control” surgery is and how and when it should be employed; also, the ability to state the requirements that must be in place to safely practice “damage control surgery”
- ✍ Ability to make competent decisions in a time- and resource-constrained and highly stressful environment
- ✍ Ability to function effectively as both a leader and member of a team that may consist of members who are of different Services and even differing nationalities

- ✍ An understanding of how medicine can be used as an instrument of national policy and the ability to apply medical skills and knowledge to that end (shape, prepare, and respond)
- ✍ The ability to function effectively, within the scope of individual responsibilities, across the full spectrum of military operations
- ✍ Knowledge of and ability to apply force protection measures to insure the safety of patients, unit, and self
- ✍ Knowledge of effective medical means of force enhancement, including performance enhancement
- ✍ Knowledge of how new technologies can be most effectively integrated into medical practice and systems to enhance operations in an integrated yet highly dispersed manner
- ✍ An understanding of the importance of ensuring the security of those critical elements of technology necessary to carry out integrated yet dispersed medical support operations, and the ability to ensure that security

C. Emerging Technologies

Panel Leader: Brigadier General Klaus Schafer, USAF, MC
 Panel Presenter: CAPT Jonathan Cutting, MC, USN
 Facilitator: Mr. Kurt Sandfleven
 Recorders: LCDR Sandy Lindahl, USNR, NC
 Capt Jen-Jen Chen, USAF, NC
 Educator: Donna Waechter, Ph.D.

COL Cherry Gaffney, USA, MC	LTC Robert M. Harris, USA
COL Christoph Kaufman, MC, USA	CDR William Karitis, DC, USN
CAPT Edward M. Lane, USN	LTC Jeremy Olson, USA
CAPT Thomas Nunns, NC, USN	CDR Randall Slater, MSC, USN
COL Warren L. Whitlock, USA	LtCol Vicky Zamarripa, USAF, NC
LTC Kevin Abbott, USA	MAJ(P) Marilyn Arnold, USA
CDR William Arbaugh, MSC, USNR	Maj Mike Feckleton, USAF, MC
LTC Michael McCoy, USA	LCDR Scott Waniewski, MSC, USN

Experts from several technology areas presented their ideas regarding emerging technologies and their influence on medical practice and medical education over the next twenty to thirty years.

After brainstorming, the group came up with a list of thirty-four areas in which technology will affect how medicine is practiced in the future. The list was further reduced to eighteen issues. The group voted to present a final list of thirteen issues. These issues are listed from highest to lowest number of votes received:

1. Advanced math implications and informatics: chaos theory, virtual reality (VR), artificial intelligence (AI), man-machine interactions, etc.
2. Biosensors
3. Human genome
4. Nanotechnology and biotechnology tools
5. New mechanical medical devices and fibrin bandages, blood substitutes, etc.
6. Molecular technology
7. Breakthroughs in our ability to rapidly introduce new technologies into education through new educational modalities
8. Technology-based breakthroughs in the area of prevention
9. Patient-centric technologies
10. Photonics
11. Digitalize health records, including technologies that allow the use of all five senses to gather and evaluate information
12. Acquisition and log systems for use in joint service and multi-national operations
13. Neuroscience to improve education

The group established teams to discuss the top five identified issues: issues five (New mechanical medical devices) and six (Molecular technology) were combined to form one issue. The goal for the five teams was to translate the influence of the technological change on these issues into learning objectives for medical education.

Advanced Math Applications and Informatics

Modeling and Analysis of Complex Phenomenon

To date, advanced math applications and informatics have had a greater influence on the physical sciences than the biological sciences. However, those working on the Human Genome Project are now using these applications to explain how a relatively small number of genes can result in the huge complexity of the human organism. Some biological systems can now be represented by complex mathematical theories.

Practice changes:

- ~~✍~~ Increased use of databases to build improved physiologic models, design new treatment approaches, modify organizations and procedures, and develop advanced displays
- ~~✍~~ Fielding of clinically useful tools to diagnose gene dysfunction and tools that incorporate increasingly sophisticated artificial intelligence
- ~~✍~~ Increased incorporation of virtual reality into clinical practice and education, eventually with the incorporation of systems that will project images directly onto the retina or even generate images directly within the visual cortex
- ~~✍~~ Increased availability of advanced physiologic models (i.e. “molecular cadaver” models) that will enhance education
- ~~✍~~ Increased use of decision support tools that can help health care providers deal with complex situations such as carrying out triage

Educational Response—Health care providers should be able to demonstrate:

- ✎ A basic understanding of the influence of advanced mathematical applications and informatics on medical practice
- ✎ Ability to use common educational models, to include advanced simulators based upon advanced math applications, to enhance their medical education
- ✎ Ability to effectively use common decision support aids derived from advanced math applications analysis of complex data bases
- ✎ Ability to perform, interpret, and validate a data base search

Biosensors

Biosensors include devices designed to monitor patients' physiology and their surrounding. These sensors might be wearable, ingestible, implantable, or might exist in the patient's environment, such as the "smart toilet" that can monitor various aspects of a patient's health.

These sensors would be capable of producing huge amounts of data, requiring new devices to evaluate and manage this information.

Practice Changes:

- ✎ Real-time access to a broader array of continuous biologic data than ever before
- ✎ Increased use of biosensors in the commercial and professional health care markets to monitor patient health
- ✎ Use of data generated by biosensors for making health care decisions for individuals and populations
- ✎ Decreased requirement for large laboratories to support medical practice
- ✎ Increased ability for early identification of environmental hazards
- ✎ Increased ability to track patients and patient behaviors

Educational Response—Health care providers should be able to demonstrate:

- ✎ Ability to effectively and efficiently acquire, assess, and apply information gained from biosensors to improve patient health
- ✎ Ability to use cumulative biosensor data to perform health risk assessments for individuals and populations
- ✎ Ability to effectively integrate information from biosensors into real-time or near real-time patient management decisions
- ✎ Ability to use information provided by biosensors to customize individual patient care
- ✎ Knowledge of the ethical issues related to the management of biosensor-acquired data
- ✎ Knowledge of how biosensor data can be applied to the determination of safe exposure limits for harmful substances
- ✎ Ability to analyze and interpret complex data patterns

Genomics

The group approached defining how genomics could affect the practice of medicine by examining basic human needs—something like Maslow's hierarchy of needs—and considered how genomics might be applied to each. The ways in which these might influence medical practice in the future are listed below.

Practice Changes:

- ✍ Genetic modification of food, making it more nutritious and more resistant to disease and having a longer shelf life, will improve health; this will have the greatest impact outside the United States where vitamin deficiencies and protein-calorie malnutrition are still widespread
- ✍ Increased use of genetics in the reproductive sciences may allow even older people to have children or to turn on or off the ability to reproduce
- ✍ Use of genetic information to predict disease and predispositions to such conditions as alcoholism and to create customized drugs
- ✍ Use of genetics to custom tailor vaccines
- ✍ Ethical issues notwithstanding, modifications of the human genome may eventually bring about a wide variety of results, such as:
 - improved ability of the human body to better withstand extreme environments
 - decreased susceptibility to disease
 - customized personalities

Educational Response—Health care providers should be able to demonstrate:

- ✍ Ability to apply critical thinking skills to the application of genomics in health care
- ✍ Knowledge of the historical context of genomic research and its application to health and medical care
- ✍ An understanding of, and ability to apply, current ethical and legal standards as they apply to genomics
- ✍ An understanding of the basic tool set used in genomic research and applied medical sciences
- ✍ A general understanding of current genomics research and the emerging and probable future applications of genomics

Nanotechnology and Biotechnology

Nanotechnology has produced very small machines capable of being injected or implanted into the human body. These can be used to monitor a patient's condition, and some may even be able to manufacture therapeutic agents once they are in the patient's body.

Practice Changes:

- ✍ Increased ability to perform remote monitoring of patients health status and to carry out remote stabilization or treatment
- ✍ Earlier detection and prevention of diseases and injuries
- ✍ Faster more accurate diagnosis
- ✍ Fewer, less invasive procedures
- ✍ Sustained release pharmaceuticals
- ✍ Improved utility of patient contact time
- ✍ Fewer health care providers needed for diagnosis and treatment
- ✍ Health care cost containment

Educational Response—Health care providers should be able to demonstrate:

- ✍ A general understanding of the basic science underpinnings for nano- and biotechnologies
- ✍ A general understanding of, and ability to apply, common nano- and biotechnologies related to the general practice of medicine in the areas of:
 - General clinical medicine
 - Prevention and occupational health
 - Practice of medicine in deployed environments
 - Medical informatics
- ✍ Ability to utilize nano- and biotechnologies to remotely monitor and manage patients in a decentralized manner

Molecular Technology

Practice Changes:

- ✍ Development of patient-specific “magic bullets”--specific prescriptions developed for individuals
- ✍ Safer and more effective treatments and therapeutics
- ✍ Less invasive procedures
- ✍ Increased reliance on computer support
- ✍ Increased blurring of the lines or differences between the various specialties and provider types and the creation of new specialties and provider types
- ✍ Increased emphasis on using technology in the prevention of disease and to change the epidemiology of disease

Educational Response—Health care providers should be able to demonstrate:

- ✍ Ability to analyze intra-cellular processes and determine which might be amenable to focused molecular physiologic and pharmacological intervention to treat disease and improve health
- ✍ Ability to identify technologies that might enable safer and less invasive methods to diagnose and treat specific conditions

- ✍ Ability to select technical methods appropriate for unique environments (such as during military deployment)
- ✍ Ability to apply current state-of-the-art technologies to achieve primary, secondary, and tertiary prevention

D. Ethics and Society

Panel Leader: Col Martha Turner, USAF, NC
 Facilitator: LT Michele McCloskey, USN
 Recorder: Maj Marguerite Mitchell, USAF, NC
 Educator: Manoli Cassimatis, COL, USA (Ret)

ADM (Ret) William Rawley, MC, USN
 COL Casey Jones, USA
 CAPT Jan Mitchell, DC, USN
 CAPT John Sentell, MC, USN
 CAPT David Wade, MC, USN
 CAPT (SEL) Jane E. Mead, NC, USN
 LTC Vicki Ransom, NC, USA
 CDR Moni McIntire, NC, USN
 LCDR Joseph Dacorta, MSC, USN

Maj Lynn DiFato, USAF, NC
 Maj Timothy Lacy, USAF, MC
 LCDR Sue Galloway, NC, USN
 LT Barbara Fletcher, MSC, USN
 William Drucker, M.D.
 Robert Leitch, RN
 Dr. Donald Sturtz

The panel sought to understand how societal changes might influence the practice of military medicine. Guiding the panel's work was an outcome statement: “Develop a list of changes that must be made in military health care education to prepare future doctors, nurses, and other military health care providers to practice military medicine over the next twenty to thirty years.”

From this effort, the panel produced a final prioritized list of ten areas of major change that are most likely to affect military medicine. The panel then considered each change and how it might influence the practice of medicine, and what the educational response should be to these changes.

1. Ethical Competency

Practice Changes:

- ✍ New demands on resource allocation
- ✍ Increasingly complex and ambiguous clinical situations

Educational Response – Health care providers should be able to demonstrate:

- ✍ Ability to apply the principles of justice and confidentiality
- ✍ Ability to make ethical decisions in the face of ambiguity and diversity
- ✍ Understanding of the importance of treating the patient as a person

2. Patient Culture and Changing Demographics

Practice Changes:

- ✎ Increasing ethnic, religious, and cultural diversity in the United States
- ✎ Changes in the definition of "family"
- ✎ Globalization increases contact with foreign cultures
- ✎ Increased recognition of the role of "alternative" medicine in patient care
- ✎ Increased need for language skills other than English
- ✎ Higher numbers of female and non-white physicians, and increased numbers of physicians from non-western cultures
- ✎ Lifestyle-related diseases on the rise
- ✎ Patients becoming more involved in their care
- ✎ More orphans worldwide
- ✎ More health care delivered in homes and clinics instead of in a hospital

Educational Response—Health care providers should be able to demonstrate:

- ✎ Tolerance and understanding of the influence of personal biases on individual decision-making
- ✎ The provision of quality care under diverse circumstances to diverse populations with limited resources in an ethically supportable manner

3. Societal Expectations

Practice Changes:

- ✎ Increasingly empowered consumers who expect customized health care and medicines
- ✎ Increased expectation of patient safety and decreased tolerance for iatrogenic injury

Educational Response—Health care providers should be able to demonstrate:

- ✎ Ability to manage patients' expectations
- ✎ Ability to apply both low- and high-tech health care techniques
- ✎ Emphasis on work and rest cycles and lifestyle balance
- ✎ Good communications skills and ability to apply those skills to enhance patient care and help bring patient expectations in line with likely outcomes

4. Team Work

Practice Changes:

- ✎ Health care may increasingly be provided by multi-disciplinary "teams," requiring health care providers to have increased skills in communications, negotiation, conflict resolution, and to recognize of the value of each team member

Educational Response – Health care providers should be able to demonstrate:

- ✎ Ability to perform skills such as conflict resolution, mentoring, listening, therapeutic communications, team building, and the ability to work with interdisciplinary teams

5. Health Care Delivery

Practice Changes:

- ✎ Increases in provider collaboration and shared decisions, and increased involvement of patient in all aspects of decision-making
- ✎ Increasing importance of clinician's ability to use advanced information technology techniques to find, properly interpret, and apply information
- ✎ Increase in need to work with patients to manage their health according to their desires and resources
- ✎ Increasing importance of community health and preventive medicine and emphasis on underserved and indigent populations

Educational Response—Health care providers should be able to demonstrate:

- ✎ Ability to apply collaborative techniques
- ✎ Ability to rapidly access, process, and apply information gained from a wide variety of sources using basic and advanced information technology skills and knowledge
- ✎ Ability to deliver quality health care in a culturally sensitive manner to diverse patient populations
- ✎ Ability to exercise the political and communicative skills required to provide optimal health care to individual patients and to populations

6. Population Health

Practice Changes:

- ✎ Emerging and re-emerging diseases
- ✎ Increasing economic disparities worldwide and in the United States
- ✎ Changes in population demographics, such as aging, changing behavioral norms, cultural changes, etc.
- ✎ Increased importance of finding supporting data for the practice of true evidence-based medicine, implying an increased need for good data mining skills
- ✎ Greater need for physicians to be more "holistic" in their outlook, focusing not just on disease but on the social and spiritual aspects of patient care
- ✎ Increased demand for health care providers to serve as advocates, teachers, and coaches for health promotion and disease and injury prevention

Educational Response—Health care providers should be able to demonstrate:

- ✎ Clinical competence in information management, using multiple resources, coding, and data mining
- ✎ Basic competency in nursing, respiratory therapy, physical therapy, nutrition, and other areas of health care
- ✎ A more holistic approach to medicine
- ✎ Knowledge of the role and importance of exercise, motivational techniques, and other ancillary and alternative health care modalities that address not just the apparent disease process but also the social, spiritual, and psychological well-being of patients
- ✎ Knowledge of women's health care issues
- ✎ Advocacy for the needy

7. Technology

Practice Changes:

- ✍ Changing emphasis in what society values
- ✍ More emphasis on engineering and technology aspects of medicine and health
- ✍ Information overload is an increasing problem for health care providers
- ✍ Increasing tempo of operations and life in general

Educational Response—Health care providers should be able to demonstrate:

- ✍ Awareness of the inter- and intra-personal results of technology
- ✍ Ability to use technology in a humanistic fashion
- ✍ Ability to use electronic techniques that are key to preserving patient confidentiality
- ✍ Decision-making and critical thinking skills in the face of a high operational tempo and information overload.
- ✍ Ability to provide quality medical care in a setting devoid of technology

8. Politics of Medicine

Practice Changes:

- ✍ Increased importance of finance and business issues related to the practice of medicine

Educational Response—Health care providers should be able to demonstrate:

- ✍ Knowledge of health care systems and skills in leadership and systems design and management
- ✍ Professional ethics
- ✍ Competency in constructive engagement and negotiation skills
- ✍ Rudimentary competency in financial and business skills that relate to the practice of medicine

9. Education Delivery

Practice Changes:

- ✍ Changing work patterns and new educational delivery modalities are increasing the importance of acquiring life-long learning skills
- ✍ Increasing emphasis on adult learning principles has increased the importance of including the recipients of education and training in the development of educational goals
- ✍ Education will increasingly be conducted through technological means
- ✍ Education is becoming increasingly directed toward multi-disciplinary audiences involving doctors, nurses, and other health care professionals as opposed to a single specialty
- ✍ Increasing emphasis on the use of just-in-time training to target the right group of people at the right time
- ✍ Increasing need for more educational and decision support tools to prepare health care providers and to assist them in their practice

Educational Response—Health care providers should be able to demonstrate:

- ✍ Ability to use technology in health care delivery and in support of patient's health care goals

10. Military Service Changes and Culture

Practice Changes:

- ✍ Greater contact with, and importance of, the media in military health care delivery
- ✍ Increasing requirement for foreign language and other communication skills
- ✍ Military accepting a wider variety of recruits – more females, more diverse cultures, races, and religions
- ✍ Increased use of team approach and consensus building
- ✍ Society's changing views of the military – increased expectation of military involvement in homeland defense, humanitarian assistance missions, disaster response, peace keeping and peace enforcement to name a few

Educational Response—Health care providers should be able to demonstrate:

- ✍ An understanding of the importance of the role of culture in ethical decision-making in foreign operations
 - ✍ Ability to work with the media to improve health care
 - ✍ An understanding of the values of a more diverse generation of Americans
 - ✍ Ability to apply ethical principles to the provision of health care to culturally and ethnically diverse populations
 - ✍ Ability to adjust training to suit a more diverse population in the military
 - ✍ Understanding and effective using of technology
 - ✍ Management skills in a complex health care environment
- Leadership skills

SECTION III: SUMMARY OF RECOMMENDATIONS

Clearly, the military forces of the United States and the practice of medicine are changing and will change even more substantially over the next twenty to thirty years. Some aspects of the future can be reasonably determined, and because human nature remains fairly constant, many things will remain unchanged regardless of how technology evolves. Although there has been unprecedented change in the technology of war, most of the issues related to the delivery of medicine in war remain unchanged, so most of the current military medicine educational objectives will remain relevant in the foreseeable future.

Other recent medical, military medical, and military operational conferences have examined many of the same issues that were discussed in this conference. This conference was unique because it focused on how these future changes will alter military medical practice and on how military medical education will need to change to prepare military health care providers to deliver quality care in this new practice environment.

Some core concepts emerged from the working panels:

(1) Technology, by itself, is not nearly as significant a factor in altering the practice of medicine in general, and military medicine specifically, as is the way technology is integrated into a new way of doing business. To paraphrase military historians, technology permeates medicine but does not govern it. It is not the technology but rather how that technology is used and integrated into the overall health care delivery system that is, and will be, important (Arquilla and Ronfeldt 1997).

(2) Information technology and the Internet will fundamentally shift the relationship between physician and patient. “To the extent that...doctors are involved at all, they [will] increasingly undergo a role change, shifting from the role of impersonal expert who is assumed to know best, to that of listener, teacher, and guide working with the patient or client.” “Self-care—the idea that people can and should be more medically self-reliant—is a fast rolling new bandwagon.” (Toffler 1980). In this conference, Dr. Rowley discusses the development of a personal digital medical assistant and reflected on how patient access to such information will affect the patient-physician relationship. Physicians and other health care providers will have to be to interpret medical information and help patients make risk-benefit decisions that are right for their personal lifestyle choices.

(3) The Department of Defense has been in the process of a major reorganization for the past several years (Revolution in Military Affairs). The pace of this reorganization will only accelerate over the next twenty to thirty years. The reorganization of the military toward smaller, more flexible, multi-functional and highly dispersed units, made up of more educated and trained (and therefore older) individuals, will have a profound influence on military medicine. As noted by Szafranski (1997), “[In the future] all armed military forces must be or become elite forces...[P]eople and forces selected, organized, trained, and equipped to rapidly adapt to, and even shape, changing or unforeseen circumstances...organized as multifunctional or cross-functional teams or networks...[that] know precisely when, where and how to intervene for maximum effect, and [can] execute overt or covert violent operations...[Finally,] those lethal forces...should be small.” In addition to the changing function, size, and composition of military units, the increasing velocity of war has its own medical consequences.

The significance of all of this from a medical education perspective is profound. First, each warrior will be more valuable to the organization than ever, making it even more critical than ever to keep him or her healthy and productive. Preventive medicine and population health become preeminently important, and because behavior is one of the main factors in determining health status, health care providers will need to be trained in techniques of behavior modification. Second, each warrior will be older, on average, and will be more likely to have chronic medical problems that will have to be managed. Finally, each warrior will likely be more remote from a central medical facility when deployed (which will be more often than in the past). This means that each warrior will have to be more medically self-reliant or each relatively small unit will need to have a highly trained medic/corpsman who can independently provide fairly sophisticated medical care. All of this may change the role most physicians have as direct providers of

health care to include that of educator, supervisor, mentor, and consultant to these sophisticated medics/corpsmen. This should also reduce the total professional medical infrastructure needed for direct patient care. There are profound implications in all of this for military medicine, both in terms of organizational structure and in training and education.

(4) Changing missions and concepts for the use of military force is having, and will continue to have, a significant influence on military medical practice. It is increasingly recognized that the defeat of an enemy's armed forces is only one, albeit an important, aspect of achieving our nation's military objectives. In the realm of accomplishing national strategic objectives without the use of force, military medicine is playing an increasingly important role, moving at times from a supporting element to that of a supported element. This has implications for training and education. It is now essential for all military personnel to understand the culture and world-view of our actual and potential adversaries and to understand their verbal and nonverbal languages. The importance of learning language and culture was emphasized in *The Ugly American*, in which it was pointed out that, "[our competitors]...will win the world by their successes in a multitude of tiny battles. Many of these will be fought around conference tables, in the...fields... at village meetings, in schools; but mainly they will take place in the minds of men. Only occasionally will the battles be violent; but the sum of these tiny battles will decide whether our way of life is to perish or to persist. The United States must either prepare itself to win these many tiny conflicts, which are the substance of coexistence; or go down in defeat...grand patterns are no more than the sum of their tiniest parts..." (Lederer and Burdick 1958) More than ever, health care providers need to learn foreign languages (or at least how to use a "universal translator"), learn about foreign cultures, and learn how medicine can most effectively facilitate national strategy.

(5) Violent military confrontations, when they do occur, will increasingly occur in urban or suburban, and mostly coastal, environments. This has implications for combat casualty care because urban warfare presents unique medical support challenges, in particular in the areas of far forward care casualty evacuation (CASEVAC), and is associated with unique injury patterns, such as increased crush injuries and related problems. Another aspect of future wars is that they will be "come as you are," with no time to prepare and little time to deploy. Preparing health care providers for what lies ahead presents a challenge to military medical educators at all levels.

(6) Changing global and national demographics will affect military missions, medical support for those missions, and even the military organization itself. The average age in most industrialized nations is getting older and, in most countries, populations are declining. In many third world countries, however, the average age is falling and populations are soaring. This means that the pool of young military recruits for most developed countries is shrinking and increasingly becoming comprised of more immigrants. For the United States, this means that its troops will be drawn from an aging population, will often come from another culture, and will frequently speak English as a second language. All of this has significant military medical implications, and much of it has strategic military implications.

(7) Although it is not possible to predict all of the different diseases or toxic threats that might arise in the next twenty to thirty years, it is fairly certain that such threats will emerge and may cause large numbers of civilian and military casualties. These threats may be old diseases that have become resistant to current therapies, they may be diseases that have been modified to produce new symptomatology, or they may be new diseases that have either arisen spontaneously or are the result of genetic engineering. Toxic threats may come from chemical and biologic toxins that have been intentionally produced and released for the purpose of causing casualties, or they may come from the inadvertent or intentional release of industrial toxins. Because it is not possible to teach health care providers about every possible disease or toxic threat that exists or might occur in the future, the panel recommended a more general approach. Health care providers should be taught a toxidrome or syndrome-based approach to the initial management of casualties sustaining an unknown exposure. By recognizing certain “toxidromes,” health care providers could categorize the types of diseases and toxins that might be responsible and could base initial therapies on likely causes. They should also be taught a general approach to gathering incident or outbreak information that could identify the source of the toxin or disease and for other epidemiologic purposes. Students should also be taught to safely manage patients suffering from unknown diseases or toxins and they should know, in general, the appropriate procedures to take when faced with any outbreak of unknown etiology. Of course, military health care providers must also be taught enough of the basic science underpinning new diseases and toxins to understand their mechanisms of action, the types of pathological changes they produce, and possible approaches for control and cure.

(8) Despite the emergence, or potential for emergence, of several new weapons systems with novel methods of injury or incapacitation (anti-materiel pulsed lasers, for example), ballistic threats will continue to be the most common casualty-producing mechanism. Patterns and types of wounds are, however, changing and will continue to change. Two recent trends in the mechanisms of combat injury are an increased incidence of burns and eye injuries. These are best attributed to changes in types of combat and to a range of weapons types, rather than to the development of particular individual weapons. Enhanced blast weapons, such as thermobaric weapons and fuel-air explosives, are likely to increase the incidence of primary blast injury as they are used with increasing frequency. Other changes in wounding patterns and type are likely to arise from a wide array of improved and new weapons, including “non-lethal” weapons. These weapons will produce an alteration in both the current epidemiology and distribution of wounding, and will create entirely new forms of injury.

(9) There is increasing societal expectation that in future wars American casualties will be minimized. The whole “Gulf War Syndrome” issue has also made it clear that Americans have an expectation that even during times of war, the U.S. military will provide state-of-the-art health care, adhere to FDA regulations, and do everything possible to minimize troop exposures to hazardous materials, or at least know precisely when such exposures have occurred and be able to track patients afterwards. These expectations have significant implications for the military medical health care system

and, by extension, the military medical education system. Not only must military health care providers be taught how to deliver high-quality medical care in an austere environment, but they must also be taught how to recognize disease patterns that suggest toxic exposure and how to collect data that can be used for epidemiological studies. Military health care providers must also be educated as advocates for, and experts in, disease and injury prevention.

(10) A change that is affecting all aspects of society is the progressive elimination of boundaries and a growing realization that, at some level, almost everything is inter-related. This has led to a breaking down of formerly “stove-piped” organizational charts into more functional groupings. Accordingly, health care delivery will be increasingly accomplished through an overall system that is made of teams, and patient care will be approached holistically. This creates an educational requirement for increased training in how to optimally function as a team and in leadership and communications skills. The panel also noted that mainstream medical education should at least discuss alternative medicine, and health care providers should know enough about this subject to be able to counsel their patients as to the risks and possible benefits of these therapies. They should also be able to recognize the adverse medical effects that might result from such treatments. It is also important for health care providers to know what alternative therapies are culturally unique.

(11) A pervasive theme throughout most of the working panels was how important communication skills are becoming. The ability to effectively communicate medical, military medical, and medical-related information to patients, the public, and the news media will be highly valued in almost every possible future world that the panels envisioned.

If one thing is clear from this conference it is that the focus of military health care educators now needs to be on teaching future health care providers to be flexible thinkers and problem solvers. They need to be skilled at accessing databases and understanding health care systems. They must be teachers who can educate patients, commanders, and the general public. They need to be capable of providing the initial management of a wide-range of acute medical problems and of making proper disposition decisions for an even wider array of diseases and injuries. Another area in which future health care providers will have to become expert is that of expectation management. As noted earlier, society expects “bloodless war,” and patients have come to expect perfect or near perfect medical outcomes. Being able to work with society and individuals to bring their expectations more in line with reality will be a highly valued skill. Because of the highly dispersed and highly mobile nature of the modern battlefield, professional health care clinicians must be educated not only as teachers but also as consultants. They must be skilled in the use of telemedicine and serve as mentors and supervisors of the highly skilled, but non-professional, independent health care practitioners who will, by necessity, be providing care for most of the troops in these dispersed, relatively small, units. Finally, there remains the educational challenge of teaching health care providers not only how to practice state-of-the-art medicine in fixed modern facilities but also how to deliver high quality medical care in austere and often hostile environments.

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