
FUNDAMENTALS OF MILITARY MEDICINE



The Coat of Arms
1818
Medical Department of the Army

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Senior Editors

FRANCIS G. O'CONNOR, MD, MPH
Colonel (Retired), Medical Corps, US Army
Professor, Department of Military and Emergency Medicine
Formerly, Chairman and Professor of Military Science, Department of Military and Emergency Medicine
Uniformed Services University of the Health Sciences

ERIC B. SCHOOMAKER, MD, PhD
Lieutenant General (Retired), Medical Corps, US Army
Professor, Department of Military and Emergency Medicine
Uniformed Services University of the Health Sciences
Formerly, Surgeon General, US Army, and Commanding General, US Army Medical Command

DALE C. SMITH, PhD
Professor of Military Medicine and History
Uniformed Services University of the Health Sciences

Office of The Surgeon General
Borden Institute
US Army Medical Department Center and School
Health Readiness Center of Excellence
Fort Sam Houston, Texas

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Editorial Staff: Joan Redding
Senior Production Editor

Douglas Wise
Senior Layout Editor

Robert Dredden
Layout Editor and Illustrator

Lisa O'Brien
Volume Editor

Venetia Valiga
Illustrator

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Contributors

THOMAS J. BALKIN, PhD

Fellow, ORISE Knowledge Preservation Program, Behavioral Biology Branch, Center for Military Psychiatry & Neuroscience, Walter Reed Army Institute of Research, Forest Glen, Maryland

ERIN S. BARRY, MS

Research Assistant Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

KATHRYN BEUTLER, BS

Research Assistant, Consortium for Health and Military Performance, Department of Military and Emergency Medicine, Uniformed Services University, Bethesda, Maryland

MARTIN C. BRICKNELL, MD, PhD

Lieutenant General, Surgeon General, Headquarters Joint Medical Group, Coltman House, Defence Medical Services (Whittington), Tamworth Road, Lichfield, Staffordshire; Professor of Conflict and Health, Conflict and Health Research Group, King's Centre for Global Health, Kings College, London, United Kingdom

MARY T. BRUEGGEMEYER, MD, MPH

Colonel, Medical Corps, US Air Force; Assistant Professor of Preventive Medicine and Biostatistics and Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

CHESTER "TRIP" BUCKENMAIER III, MD

Colonel (Retired), Medical Corps, US Army; Professor of Anesthesiology, Department of Military and Emergency Medicine, Uniformed Services University, Rockville, Maryland

CHRISTOPHER W. BUNT, MD

Lieutenant Colonel, US Air Force Reserves, Medical Corps, Associate Professor, Department of Family Medicine, Medical University of South Carolina, Charleston, South Carolina

CHARLES W. CALLAHAN, DO

Colonel (Retired), Medical Corps, US Army; Professor of Pediatrics, Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland; Vice President, Population Health, University of Maryland Medical Center, Baltimore, Maryland

NAILI CHEN, DO, MPH, MASc

Colonel, Medical Corps, US Air Force; Assistant Professor, Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

GEOFFREY E. CIARLONE, PhD

Lieutenant, Medical Service Corps, US Navy; Research Physiologist, Undersea Medicine Department, Naval Medical Research Center, Silver Spring, Maryland

TERESA COMBS, PhD

Assistant Professor, Daniel K. Inouye Graduate School of Nursing, Uniformed Services University of the Health Sciences, Bethesda, Maryland

SARAH J. DE LA MOTTE, PhD, MPH

Assistant Professor and Scientific Director, Injury Prevention Research Laboratory, Consortium for Health and Military Performance, Department of Military and Emergency Medicine, Uniformed Services University, Bethesda, Maryland

GERARD DEMERS, DO, DHSc, MPH

Captain, Medical Corps, US Navy; Navy Medicine East EMS/Disaster, Medical Director, Prehospital and Disaster Medicine Specialty Leader, Department of Emergency Medicine, Walter Reed National Military Medical Center, Bethesda, Maryland; Associate Professor, Department of Military and Emergency Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

PATRICIA A. DEUSTER, PhD, MPH

Professor and Director, Consortium for Health and Military Performance (CHAMP), Uniformed Services University of the Health Sciences, Bethesda, Maryland

BRENDON G. DREW, DO

Commander, Medical Corps, US Navy; Chairman of Emergency Medicine, Naval Medical Center San Diego, San Diego, California

CINDY DULLEA, RN, MBA

Rear Admiral (Retired), Nurse Corps, US Navy Reserve; Chief Marketing Officer, Experian Health Inc, Franklin, Tennessee

KATHERINE ELLIS, MD

Major, Medical Corps, US Air Force; Medical Director, Malcolm Grow Medical Clinic Emergent Care Center, Joint Base Andrews, Maryland

SHAWN M. GARCIA, MD, MPH

Lieutenant Commander, Medical Corps, US Navy; Assistant Professor of Preventive Medicine and Biostatistics, Uniformed Services University of the Health Sciences, Bethesda, Maryland

OLUWASEYI GBADE-ALABI, MD

Major, Medical Corps, US Army; Chief, Inpatient Physical Medicine and Rehabilitation, Walter Reed National Military Medical Center, Bethesda, Maryland

MELISSA GIVENS, MD, MPH

Colonel, Medical Corps, US Army; Associate Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

TRESS GOODWIN, MD

Assistant Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland; Attending Physician, Children's National Health System, Washington, DC

CRAIG GOOLSBY, MD, MEd

Associate Professor and Vice Chair, Education, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

ALTHEA GREEN, PhD

Command Sergeant Major, US Army (Retired); Director, Recruitment and Outreach, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

TIMOTHY C. GRIBBIN, MD

Research Associate, Injury Prevention Research Laboratory, Consortium for Health and Military Performance, Department of Military and Emergency Medicine, Uniformed Services University, Bethesda, Maryland

JAMIE GRIMES, MD

Colonel, Medical Corps, US Army; Chair, Neurology Department, Uniformed Services University of the Health Sciences, Bethesda, Maryland

NEIL E. GRUNBERG, PhD

Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

MICHAEL H. HOFFMAN, JD

Associate Professor, US Army Command and General Staff College; Assistant Professor, Uniformed Services University of the Health Science; Barden Education Center, Ft Belvoir, Virginia

LUCAS A. JOHNSON, MD, MTM&H

Lieutenant Commander, Medical Corps, US Navy; Assistant Professor of Preventive Medicine and Biostatistics, Uniformed Services University of the Health Sciences, Bethesda, Maryland

WILLIAM RAINEY JOHNSON, MD

Lieutenant, Medical Corps, US Navy; Undersea Medical Officer, Undersea Medicine Department, Naval Medical Research Center, Silver Spring, Maryland

SHAWN F. KANE, MD

Colonel (Retired), Medical Corps, US Army; Dive Medical Officer, Master Flight Surgeon, former Commander, Special Warfare Medical Group (Airborne); Dean, Joint Special Operations Medical Training Center, Fort Bragg, North Carolina; Associate Professor, Department of Family Medicine, Uniformed Services University of the Health Sciences

ARTHUR L. KELLERMANN, MD, MPH

Dean, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

DAVID KEYSER, PhD

Program Director, Traumatic Injury Research Program; Assistant Professor, Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

CHETAN U. KHAROD, MD, MPH

Colonel (Retired), US Air Force, Medical Corps, Senior Flight Surgeon; Program Director, Military EMS & Disaster Medicine Fellowship, San Antonio Military Medical Center, Joint Base San Antonio-Fort Sam Houston, Texas

TONY S. KIM, MD

Colonel, Medical Corps, US Air Force; Assistant Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

BRIAN R. KUPCHAK, PhD

Lieutenant, Medical Service Corps, US Navy; Assistant Professor, Department of Military and Emergency Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

RYAN LANDOLL, PhD

Major, United States Air Force, Biomedical Sciences Corps; and Assistant Professor, Department of Family Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

OMOTOLA O. LANLOKUN, BS

Research Intern, ORISE, Behavioral Biology Branch, Center for Military Psychiatry & Neuroscience, Walter Reed Army Institute of Research, Forest Glen, Maryland

THERESA LATTIMORE, MSN

Director, Army Traumatic Brain Injury Program, US Army Office of The Surgeon General, Falls Church, Virginia

MATTHEW L. LOPRESTI, PhD

Major, Medical Service Corps, US Army; Deputy Director, US Army Medical Research Directorate-West, Walter Reed Army Institute of Research, Joint Base Lewis-McChord, Washington

LANNY F. LITTLEJOHN, MD

Commander, Medical Corps, US Navy; Command Surgeon, Naval Special Warfare Development Group, Dam Neck, Virginia Beach, Virginia

EDWARD LUCCI, MD

Colonel (Retired), Medical Corps, US Army; Chief, Department of Emergency Medicine, Walter Reed National Military Medical Center, Bethesda, Maryland

TRAVIS K. LUNASCO, PsyD

Senior Operational Psychologist, Consortium for Health and Military Performance (CHAMP), Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

ROBERT L. MABRY, MD

Colonel, Medical Corps, US Army; Command Surgeon, Joint Special Operations Command, Fort Bragg, North Carolina

MICHAEL J. MEESE, PhD

Brigadier General (Retired), Professor, US Military Academy, US Army; Executive Vice President of American Armed Forces Mutual Aid Association, Fort Myer, Virginia

MEGAN C. MULLER

Major, Medical Service Corps, US Army; Executive Officer, 264th Medical Battalion, 32nd Medical Brigade, Joint Base San Antonio-Fort Sam Houston, Texas

SEAN MULVANEY, MD

Colonel (Retired), Medical Corps, US Army; Associate Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

DANA R. NGUYEN, MD

Lieutenant Colonel, Medical Corps, US Army; Assistant Professor, Department of Family Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

FRANCIS G. O'CONNOR, MD, MPH

Colonel (Retired), Medical Corps, US Army; Professor and former Department Chair, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

REGINA P. OWEN, DNP

Major, Medical Corps, US Air Force; Mental Health Clinic Officer in Charge, Dover Air Force Base, Delaware

JAMES PALMA, MD, MPH

Commander, Medical Corps, US Navy; Associate Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

PAUL PASQUINA, MD

Professor and Chair, Department of Rehabilitation Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland; Chief, Department of Rehabilitation, Walter Reed National Military Medical Center, Bethesda, Maryland

RENEE PAZDAN, MD

Captain, US Public Health Service; Director of Traumatic Brain Injury, Warrior Recovery Center, Fort Carson, Colorado

J.D. POLK, DO

Chief Medical Officer, NASA Headquarters, Washington, DC

JEFFREY E. RHODES, MDiv, DMIn

Commander (Retired), US Navy; VA Mental Health and Chaplaincy Department, Durham, North Carolina

BONNIE SANCHEZ

Senior Master Sergeant, US Air Force; Air Force District of Washington Functional Manager, Malcolm Grow Medical Clinics and Surgery Center, Joint Base Andrews, Maryland

ADAM K. SAPERSTEIN, MD

Commander, Medical Corps, United States Navy, and Associate Professor, Department of Family Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

SAMUAL SAUER, MD, MPH

Colonel (Retired), Medical Corps, US Army

RICHARD A. SCHEURING, DO, MS

Colonel, US Army Reserve Medical Corps; Associate Professor, Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

JOSEF F. SCHMID, MD

Major General, Medical Corps, US Air Force Reserve; NASA, Johnson Space Center, Houston, Texas

ERIC B. SCHOOMAKER, MD, PhD

Professor and Vice Chair, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland; formerly, Surgeon General, US Army, and Commanding General, US Army Medical Command

JAMES F. SCHWARTZ, MHRM

Lieutenant Colonel (Retired), Medical Service Corps, US Army; Assistant Professor and Chief of Staff, Department of Military and Emergency Medicine, F. Edward Hébert School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

JONATHAN M. SCOTT, PhD

Assistant Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Science, Bethesda, Maryland

BRENNA M. SHACKELFORD, MD

Consultant Emergency Physician, New Zealand

TRUEMAN W. SHARP, MD, MPH

Captain, Medical Corps, US Navy (Retired); Deputy Director, Office of Bioequivalence, Office of Generic Drugs, Center for Drug Evaluation and Research, Food and Drug Administration; past Chair, Department of Military and Emergency Medicine; Uniformed Services University of the Health Sciences, Bethesda, Maryland

DAVID SLONIKER, MSS, MBA

Colonel, Medical Service Corps, US Army; Commander, 6th Medical Logistics Management Center, Fort Detrick, Maryland

DALE C. SMITH, PhD

Professor of Military Medicine and History, Uniformed Services University of the Health Sciences, Bethesda, Maryland

SAMUEL J. SMITH JR, JD

Colonel (Retired), Judge Advocate General's Corps, US Army; Deputy General Counsel, Uniformed Services University of the Health Sciences, Bethesda, Maryland

MARK B. STEPHENS, MD

Captain (Retired), US Navy; Professor of Family and Community Medicine, Penn State University, State College, Pennsylvania

MATTHEW T. STEVENS, MDiv

Commander, US Navy; Director, Pastoral Care Plans/Ops, Bureau of Medicine and Surgery, Falls Church, Virginia

MICHAEL J. STONE, MBA, MHA

Lieutenant Colonel, Medical Service Corps, US Air Force; Assistant Professor, Department of Military and Emergency Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland

RICHARD W. THOMAS, MD, DDS

Major General (Retired), Medical Corps, US Army; President, Uniformed Services University of the Health Sciences, Bethesda, Maryland

CHRISTOPHER H. WARNER, MD

Colonel, US Army Medical Corps; Psychiatry Consultant to The US Army Surgeon General, USA MEDDAC-Fort Stewart, Fort Stewart, Georgia

JAMES C. WEST, MD

Captain, Medical Corps, US Navy; Assistant Professor of Psychiatry, Uniformed Services University of the Health Sciences, Bethesda, Maryland

EDWARD WHITT, MS

Master Sergeant (Retired), US Army; Senior Health Policy Analyst, Defense Health Agency, Falls Church, Virginia

JOHN WIGHTMAN, MD

Colonel, US Air Force, Medical Corps; formerly, Wing Surgeon, 24th Special Operations Wing, Air Force Special Operations Command, Hurlburt Field, Florida; Professor and Chair, Department of Military and Emergency Medicine, Uniformed Services University Bethesda, Maryland

CONRAD R. WILMOSKI, MHAP

Major, Medical Service Corps, US Army; Sustainment Branch, Concepts and Capabilities Division, Health Readiness Center of Excellence, Capability Development Integration Directorate, Joint Base San Antonio–Fort Sam Houston, Texas

ISAIAH WILSON III, PhD

Colonel (Retired), Aviation, US Army; Senior Lecturer of Global Affairs, Jackson Institute for Global Affairs, Yale University, New Haven, Connecticut

JONATHAN WOODSON, MD

Professor of Surgery, Department of Surgery, Boston University, Boston, Massachusetts; formerly, Assistant Secretary of Defense (Health Affairs)

JUSTIN WOODSON, MD, MPH

Colonel, Medical Corps, US Army; Associate Professor, Uniformed Services University of the Health Sciences, Bethesda, Maryland

ANGELA M. YARNELL, PhD

Major, Medical Service Corps, US Army; Research Psychologist, Behavioral Biology Branch, Center for Military Psychiatry Neuroscience Research, Walter Reed Army Institute of Research, Silver Spring, Maryland

Foreword

As he completed his final preparations to deploy the XVIIIth Airborne Corps headquarters to serve as the higher command in the latter part of Operation Iraqi Freedom, then-Lieutenant General Lloyd Austin was visited by the regional medical commander with responsibility for Fort Bragg, North Carolina, from which the corps was deploying. The regional commander had the combined responsibility for deploying some of his own medical soldiers to support the general's units in Iraq; for ensuring that the XVIIIth Airborne Corps soldiers were medically and mentally fit to deploy; for caring for any deployed soldiers who were wounded, ill, or injured and evacuated back home; and for caring for XVIIIth Corps families left on installations and communities. They talked about many matters concerning his deploying soldiers and the families for which they shared many concerns. As they concluded their time together, the medical leader asked the warfighting general about what he, the medical leader, was responsible for that Lieutenant General Austin lost sleep over. The general, a thoughtful man of few words, destined later to become the Army Vice Chief of Staff and Commanding General, U.S. Central Command, paused and spoke slowly and eloquently:

The American fighting man and woman demonstrate extraordinary courage and complete dangerous tasks in defense of the nation. They kick down doors in the most dangerous neighborhoods in the world, prepared to confront an enemy intent on killing them. They do this because our warriors know that your medical soldiers are right behind them to save their lives, to safely carry them back to their homes, to give them the best chance of being restored to health and returning to their comrades or to life as a productive citizen. I worry that you medics will forget these responsibilities and the skills required to achieve this. If so, the warrior will pay the price.

This book is intended to pass on these lessons and to “never leave a fallen comrade.” Four years in the making, this is a first-of-its-kind textbook. It leverages the extraordinary scholarship of leading academics while tapping into the experience of some of the most senior and accomplished medical officers and enlisted professionals to have ever worn the uniform. While anyone with an interest in military medicine can learn from this textbook, it is intended for the new medical officer from any service in any medical, surgical, dental, nursing, administrative, veterinary, or other discipline. A product of the Department of Military and Emergency Medicine at the F. Edward Hébert School of Medicine in the Uniformed Services University of the Health Sciences, it has become the principal textbook for their military medical practice and leadership offerings.

As Army Surgeon General and sponsor for the Borden Institute, the publisher of this and many other volumes in military medicine, I am particularly proud of this unique book. The support offered by the editors and director of the Institute throughout the book's development have been invaluable. While one cannot be certain that lessons will not be lost and that future medical officers will not be sent in harm's way without the education and training that they require, the authors, editors and publisher of *The Fundamentals of Military Medicine* and I have done all in our power to provide the doctrinal and experiential resources for highly effective, adaptable, and confident military medical leaders, planners, and practitioners. We strive to meet General Austin's challenge by providing the most professional counsel to commanders in the field, fleet, and flight line and to extend to the next generation of warriors—on the ground, at sea and in the air—the protection and care they both expect and deserve.

Nadja Y. West, MD
Lieutenant General, U.S. Army
44th Army Surgeon General and
Commanding General, U.S. Army Medical Command

Washington, DC
October 2018

Preface

Almost a half century ago, at the end of the Vietnam War, President Nixon and the US Congress agreed to end the draft and transition to an all-volunteer military and ready reserve. Compulsory service would be reserved for times when the nation's survival was at risk. To achieve this goal, our military needed to make many changes. One significant change was the establishment of a "health professions scholarship program" to encourage medical students to commit to a minimum period of military service; another was the creation of a "Uniformed Services University of the Health Sciences" (USU) to serve as the leadership academy for military medicine. USU's school of medicine, named for the visionary Louisiana congressman who worked for decades to create it, educates aspiring physicians in the unique aspects of military medical practice and leadership.

Today, the F. Edward Hébert School of Medicine at USU meets or exceeds every civilian standard for medical education. But "America's medical school" does far more than educate doctors; it also prepares military medical officers for leadership and a career of national service. As the 21st century began, USU's faculty, along with many others involved in American medical education, recognized that steady expansion of the knowledge base undergirding both the practice of medicine and techniques of adult education mandated a major overhaul of the curriculum. As a result, USU undertook a major redesign of the way we educate medical students to practice medicine and become high-performing military medical officers.

Today's military medical practice and leadership curriculum relies heavily on self-directed and small-group-based learning. We continually reevaluate aspects of military medical practice to ensure our curriculum remains current with the latest lessons learned on battlefields and deployed settings abroad, and on bases and military treatment facilities inside the United States. Based on ongoing feedback from senior leadership of the armed services, military medical practitioners, and patients, four major themes of emphasis in the curriculum have emerged: (1) professionalism and leadership; (2) system of care (health service support) in the deployed environment; (3) the importance of force health protection (both physical and psycho-social) in deployed environments; and (4) the challenging nature of forward medical care.

Drawing on the insights and experience of hundreds of national faculty members as well as local members of USU's Department of Military and Emergency Medicine, the authors of this textbook have developed and expanded these themes. The result is the first introductory English-language textbook in more than a century that compiles and codifies the knowledge required of military health professionals to support their unit commanders, protect the health of the force, and deliver high-quality care to those who go into harm's way. Directors of military graduate medical education programs may also want to use this book to ensure their residents master the core concepts of military medical practice and leadership before they undertake their first deployment.

Modern medicine is a team sport, and military medicine is no exception. In deployed environments, effective healthcare requires more than physicians and surgeons. It needs the best efforts of physician assistants, advanced practice nurses, clinical psychologists, medics, corpsmen, medical technicians, and many others. For this reason, experts in a wide variety of military occupational specialties have contributed to this book. In addition to physicians and surgeons, they include nurses, lawyers, administrators, scientists, enlisted medical personnel, and line officers. This diversity is reflected in the growth of the USU's mission since it was first chartered in 1972. At various points over the past 50 years, Congress has asked us to establish a graduate school of nursing to educate advanced practice nursing officers, a postgraduate dental college to strengthen dental readiness, and most recently, a college of allied health sciences to advance the education and career development of enlisted healthcare providers. As a result, USU has become more than the leadership academy for military medicine. USU is now a comprehensive hub for military health education and research; the topics covered in this textbook reflect this larger mission.

To remain current with evolving knowledge, this book will undoubtedly require future updates. However, military medicine also rests on enduring foundations. Many of the concepts outlined on this book's pages are based on military traditions and principles devised by Major Jonathan Letterman during the American Civil War. Others can trace their origins to insights first described centuries, if not millennia, before.

We commend all who played a part in creating this remarkable book. The information it conveys will help military health professionals save lives, preserve fighting strength, and defend the national security of the United States.

Richard W. Thomas, MD, DDS
President, Uniformed Services University of the Health Sciences

Arthur L. Kellermann, MD, MPH
Dean, F. Edward Hébert School of Medicine—“America’s Medical School”
Uniformed Services University of the Health Sciences

Bethesda, Maryland
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Introduction

Historical Development of Military Medicine

Healthcare providers have been associated with armies (and later navies) for almost as long as there are historical records. In premodern times, these providers were usually trained in an apprentice system and cared for most patients in a society, both civilians and soldiers. It was a law of the state in ancient Egypt that medical care would be provided the soldier on campaign. During the Roman Empire, *medici ordinarii* accompanied legions across the known world. But in a very real way, military medicine, as it is understood in the 21st century, is a product of the wars of the 18th century and of the progress of medicine in the early modern era. Because 18th century leaders had armies and navies under different governmental organizations, military medicine (in the limited sense of land force) and naval medicine had related but distinct histories into the 20th century. With the development of air power, and with it aviation medicine, and the emergence of joint operations linking the military operations of ground, air, maritime, and space forces, military establishments began to be unified in a governmental and sometimes in a strategic sense. Since the Uniformed Services University's first lectures on the subject in 1976, "military medicine" has had a joint meaning: it includes the knowledge, skills, and abilities needed to serve with the US military's land forces, sea services, and aerospace components.

Despite the importance of "jointness," it is a fact that even in the navies and air forces of the world, most personnel spend most of their days on land. Armies are typically larger and sicker than the more technologically oriented weapons system services, so much of the knowledge related to keeping a force fit and healthy is derived from land force military medicine. Therefore, the editors of this book decided that the best organizing principle for a basic textbook of military medicine was to consider land force medicine as the default position and describe differences from it as they arise; this approach has the secondary virtue of reflecting how the knowledge was developed.

Historically, practitioners accompanied armies for a variety of reasons. The most common was a broad humanitarianism—the belief that a soldier, when injured, deserved care. Such concerns motivated Isabella of Castile to supply ambulances and barber surgeons for the wounded of the crusading wars retaking the Iberian Peninsula in the 15th century. That mercenary companies, from Renaissance through early modern Europe, employed surgeons to tend to their own wounded suggests some understanding of the worth of troops (at least to themselves) and the potential effect of the availability of medical care on morale. That 15th century barber surgeons were employed to accompany highly trained Welsh archers by Henry V also reflected these concerns of *humanitas* and morale. Perhaps there was, additionally, a growing understanding of the importance of returning valuable trained soldiers to duty (if a leader was concerned with the supply of arrows, the historian may presume a concern with the supply of archers, but logistics of arrows were also much easier to manage than logistics of archers). These were the social motivations of the early modern military physicians, men who increasingly recognized they were doing something different from other practitioners. As merchants, explorers, and finally navies began to sail out of sight of land, the value of surgeons going to sea was also acknowledged. As voyages grew longer in the 17th century, surgeons in sea service began to study the knowledge of contemporary physicians, recognizing that more and more of their practice was shaped by disease—both its prevention and its treatment.

Disease prevention received increasing attention as the impact of professional combatant skills became more evident and public health policies were developed. In the 18th century a clear understanding emerged of military medicine as a military technology—the idea of keeping soldiers and sailors healthy and fit to increase their ability to fight. This new understanding became increasingly important as time passed, particularly as armies and navies became increasingly complex social institutions. The reader will discover that this text considers prevention, prophylaxis, and optimization at least as important to military medical practice as diagnosis and treatment. Therefore, exactly what military medicine includes is a fair question to ask of the editors.

Military Medicine Today

Military medicine, at its simplest, is the application of medical art and science in a military setting for the benefit of the military organization through optimal care of the combatant. However, this relatively broad

definition has included, in the last 300 years of Western history, a wide variety of activities. The understanding of care for the soldier and care for the organization is frequently described as the “utilitarian union”; its very nature introduces the potential for the practitioner to be placed in an ethical posture of “dual agency”: what do you do when the good of the many is in tension with the good of the individual?

For some, military medicine is simply the practice of medicine, or more properly in today’s multi-professional settings, the delivery of healthcare in the military. The military might be seen as simply another social and cultural context for healthcare, except that military medicine also includes key areas often neglected or inadequately addressed because they are uncommon in civilian medicine. For instance, the care of personnel in different disease and threat environments is important for the morale of troops, so is a vital part of our complex military medical system. Military medicine can thus be considered a subdivision of preventive or occupational medicine having to do with the unique risks and predominant health problems associated with a specific, unusual, and dangerous occupation; it is the preservation of the lives and health of soldiers, sailors, airmen, and marines. It is important for humanitarian reasons (and so recruitment), morale, and ultimately, readiness and the accomplishment of the mission. The commitment to mission is not a function of medical professionalism but a key component of officership, or military professionalism, and it is frequently where the potential dual agency becomes a real issue.

The remaining medical aspects include the management and treatment of trauma and mass casualties in frequently austere field and ship environments; the humane clearing of the battlefield; vaccines and protection against exotic global pathogens—both manmade and naturally occurring; the unique psychological stressors of war; biodefense against chemical and nuclear weapons; facilitating return to duty; and the eventual return and reintegration home of valuable human resources. These approaches, which detail medical tasks, look at military medicine from the medical, or iatrogenic, point of view.

Military medicine is frequently considered from a medical point of view in 21st-century America primarily because society is usually focused on the contribution of scientifically inspired technical innovations for the wounded. Historically, on the other hand, military medicine was a subdivision of military activity and was predominantly seen as such until the middle of the 20th century. These two points of view—iatrogenic and military—contribute to different priorities being assigned, depending on the priorities of the commentator, to activities engaged in by the military medical departments.

Peacetime Mission

Military medicine has both two missions and two masters. In peacetime (and to some degree in war), military medicine is part of large healthcare industrial organizations, private and public. It delivers care to the active duty forces (and sometimes their family members) and retirees. This peacetime mission is expensive in manpower and materiel. It is governed by medical standards from the civilian community (licensure, hospital accreditation, malpractice law, etc). These standards are matters of law and regulation as well as (most importantly) social expectation. In Western countries today this mission of military medicine is part of what historians view as the welfare state, the obligation of government by its policy and actions to take care of its citizens.

Thus, military medicine must serve its civilian medical standards master with a full-time healthcare provision mission. Because military physicians are primarily trained in civilian institutions and, even more significantly, they are trained to civilian medical standards, this is the common medical orientation in the military health system. It is the only military component so completely tied to civilian standards and expectations.¹ This standard is largely a function of the 20th century because only for about 100 years have common civilian standards been widely accepted in Western society or have physicians trained to a common standard even been the primary providers of healthcare. Additionally, during the last century, the Western cultural assumption of “the right to healthcare” has become increasingly accepted. This social contract evolved along with the necessity of offering high-quality employer-provided healthcare benefits in the competitive marketplace of the all-volunteer military, a wage compensation reality resulting from wage freezes in World War II and competition at home for employees who were not fighting abroad. In this context, military culture has no social choice in the decision to provide access to care as a benefit of employment.

Wartime Mission

At the same time, military medicine must, like all other military components, plan and train for war. The wartime mission is quite different from the peacetime mission. Different standards apply—the standards of the

military master. But military medicine must also be considered from the military point of view even in peacetime. Professor Robert Joy suggests that military medicine should be defined in the same way that all military activity is defined, and in the United States this is as related to the levels of war: the tactical, the operational, and the strategic.² This modern understanding of warfare, originated by Russian military thinkers, has profoundly influenced American and allied doctrinal development in the last 50 years. It is principally a land-based understanding, although naval and air forces can use it. For medicine, it fits the medical support of land-based operations very well.

The **tactical level** of military medicine is the hands-on application of medicine. It includes field sanitation, administration and inspection of preventive measures, direct point-of-injury care, and the evacuation of patients from the battlefield. The challenges of command and control of medical elements and personnel, implementation of tactical combat casualty care, deployment and execution of forward resuscitative surgery, and facilitation of return to duty typically occur at this level.

The **operational level** of military medicine, or operations above the division level, includes those functions in which medical department personnel offer highly specialized advice to the line command. It includes the planning and implementation of preventive medicine advice; the structure of medical logistics capability; and the determination of need for and placement of medical assets and resources, including forward surgical capability, blood products, and hospitals, given the battle plan and casualty estimates. It is usually described as the system of Health Service Support.

These medical matters are line responsibilities, and the advice of medical staff must be tailored to the overall theater plan. For example, modern medical science has developed vaccines against certain infectious diseases. The medical advisor can suggest that troops receive immunizations, but the decision to require immunization is a command decision. Similarly, for a given campaign, the application of modern medicine may require a certain number of hospitals and a particular mix of healthcare experts, but the decision to use limited lift capability to deploy medical assets is a command decision.

The operational level of military medicine, primarily the responsibility of line officers, requires a certain level of military medical knowledge on the part of all officers. Just as an infantry officer in command of a combined arms task force must know something of the capabilities and support requirements of artillery and armor, so must such a commander know something about military medicine. That being stated, line commanders at the operational level rely heavily on the advice and guidance of their special staff medical officers to assist in executing the medical plan in conjunction with the overall mission.

At the **strategic level**, military medicine is concerned with preparedness and joint coordination of care for casualties—combat wounded, as well as those with diseases and injuries other than those inflicted by the enemy. Issues of disease threat prediction, research and development of drugs and vaccines needed in the military, the national supply base for mobilization of health personnel, and planning to ensure medical industries can make available what the military might need in times of war all require advance thinking and activity. Again, some awareness of the military medical issues outside the medical establishment is essential because military medicine's strategic resources come from the military resources of the nation, and care ultimately is transferred back to civilian or nonmilitary federal caregivers, such as the Veterans Health Administration.

The application of these land-based levels of war to naval and air forces and their medicine creates some peculiarities. In service with the fleet, command responsibility at a junior level is somewhat different. A company commander or platoon leader has command that, at least in the past times, has frequently been independent of his or her seniors. The department head or division head on a capital ship is not detached from the overall command in any significant way. Thus, in deployed activities, the front line medical support of naval forces at sea is more involved with the provision of advice, teaching, and inspection, and less involved with direct command responsibility of medical personnel than the regimental surgeon might be in service with Marines or the battalion and brigade surgeon with the Army.

For air forces, historically, most of the treated casualties and DNBI (disease and nonbattle injuries) patients were in forward bases and so fit the land model. Increasingly the technologies of air force weapon systems are allowing basing further from the fight. Like navies, air forces have fewer independent junior commands, which reduce tactical-level command experiences, but the unique role of the flight surgeon means there are more staff roles where medical findings (eg, not medically fit) are implemented by command authority (eg, do not fly).

Similarly, there are no straightforward equivalents to corps and above-corps activities in seagoing naval and aviation operations. The basic structure of task forces, battle groups, and fleets is much more flexible than the land-based system (although land doctrine is moving toward a more flexible capability).³ The naval medical

staff are, as a result, called upon to operate at a variety of levels, and in ocean-going naval operations, preserving the more traditional distinction of staff and command at all levels of medical activity is probably advantageous. However the service military medicine mission is described, it involves much more than providing excellent scientific care for a patient who comes to a fixed clinic or emergency room. No matter how capable the tactical expertise of individual physicians, nurses, or corpsmen, there are differences between the medicine practiced at Naval Medical Center, Portsmouth, and on the hospital ship *Comfort*, not to mention treatment facilities even more diverse.

The humanitarian motivation for democratic society's provision of medical care impacts all three levels of military medical activity and its peacetime practices. However, this motivation is most obvious at the tactical and operational levels. At the tactical level, it demands good medicine in peace and war regardless of setting. At the operational level, it requires that those who go into harm's way be protected from unnecessary risks, and that "the system" provides appropriate care to those who are injured. At least since the British public's disgust over newspaper reports of conditions in the Crimea in 1854, military and political leaders have had to consider public expectations for the care of troops. Similarly, the issues of morale and return to duty are in the short run tactical and operational, but to be adequately staffed and prepared to address these issues requires strategic preparation. Force preservation efforts, medical logistics, casualty evacuation, en-route medical care, and other uniquely military concerns within military medicine are primarily seen at the operational and strategic levels. These issues are as much the concern of line officers as they are the province of the medical officer. They are seldom directly of concern to politicians and the public at large, unless, of course, they fail in execution; in this case they have profound impact on humanitarian and morale concerns.

Categories of Military Medical Activity

To understand the interrelations of these different missions and the roles of the different masters, it is possible to categorize military medical activity in yet another way: by what different personnel, at different times, need to know. In this approach, the activities of military medicine may be considered as (a) common military tasks, (b) medical science in a military setting, or (c) the military tasks requiring specialized medical knowledge. **Common military tasks** are those needed by all military personnel in a particular environment (field skills for the infantry, platform-specific knowledge such as damage control and fire-fighting on a naval vessel, etc). Military medicine is often practiced in unique and austere environments, and if practitioners cannot take care of themselves in such environments, they are virtually useless to the military unit.

The **medical science in a military setting** component is that portion of medical science and healthcare practice used exclusively or primarily in military deployments, whether on land, onboard ship, or on the flight line. It is a special part of peacetime medicine that is also a component of military medicine. For example, in Western society today, malaria is a disease seldom seen in civilian practice, yet it remains the most damaging disease in the world. When deployed, military personnel will possibly be exposed to infection, so knowledge about the prevention and treatment of malaria is an important medical skill for military physicians. Many other areas of prevention and treatment are also predominately of concern to the military, for example, high-velocity missile wounds, chemical casualties, and combat stress reactions. The medicine involved is part of the larger field of medical science, but the specifics are of little or no concern to civilian practitioners or even the drug and medical instrument industries.

Those parts of medicine included in military medicine vary with time and place depending on the changing nature of civilian practice. Malaria, to return to the original example, is an issue of military medicine for physicians in the US Army in the 21st century. It is not for a practitioner in today's Indian army, and was not for the US Army in the mid-19th century; in these cases malaria is or was an integral part of civilian medicine. It is possible that, in this century, issues of biological attacks and chemical casualty treatment may move from the province of military medicine into general knowledge required by all civilian healthcare providers.

Finally, the military role that requires **specialized knowledge** is that which most often sets apart the military medical officer. It is the component used by the least number of medical practitioners at any given time; it is also the component that must be shared, at least to some extent, with line officers. This component includes the staff and command roles and operates at all levels of military activity — tactical, operational, and strategic. To illustrate the utilization of this component, we will consider again the strategic military medical effort to reduce malaria infection in troops. Most of those engaged in the study of malaria need to know nothing of the military. The knowledge they have of malaria as a disease is medical science in a military setting. The people responsible for

initiating the project to reduce infection among troops (those who recognized the malaria threat as a threat to the military effectiveness of troops, a special staff function), and those individuals (often non-medical) who funded the research (a command decision), are a small initial group using a special knowledge for military purposes.

This group will commission a staff study on how malaria might be reduced. The staff will need to know a lot about malaria. It can presumably be treated more effectively than current therapy permits, so one arm of the program might be treatment research. Malaria is an infection, and at least theoretically a vaccine might be produced and administered to all troops at potential risk, so vaccine research may be another arm of the effort. Classically, the most effective prevention for malaria is drug-based prophylaxis, so new prophylactic drugs might be studied. If drug prophylaxis fails, then personal protection and mosquito (the vector of malaria) control are the best means of control, so new repellants and insecticides might be studied.

The research efforts on treatments, vaccines, and other means of prevention will all be based in medical knowledge that American civilian practitioners do not often need, but that can be acquired by skilled professionals. Therefore, the leadership will need to know how the Department of Defense can get this research done (contracts, internal laboratories, etc). They will probably need to be aware of several joint systems (eg, the Army Medical Research and Development Command, the Naval Medical Research Command, the Armed Forces Pest Management Board). Should a vaccine or other new prophylactic be developed, it will require personnel who understand the threat and can implement the new program. This will require both military and medical knowledge. Evaluating the program will require living with the troops in the field to develop a realistic and practical set of procedures, devices, and inspections, if nothing else, and this requires common military tasks on the part of some practitioners.

However, the staff might realize that the low-hanging fruit in malaria prevention is more systematic and effective use of the tools currently available. Improving current practices will require command influence on commanders in areas of risk. To determine how these practices can be strengthened, the staff will need to use both open source data from the World Health Organization (eg, what vectors and levels of resistance are seen in what areas of the world) and service-specific data from the National Center for Medical Intelligence (eg, what practices are most effective among deployed forces at risk).

This first edition of *The Fundamentals of Military Medicine* is the product of nearly 40 years of educational and curricular experience at the Uniformed Services University of the Health Sciences. We have assembled experts from across the world—active duty, retired military, and civilian authorities from all disciplines and services—to put down in print for the first time the core concepts that define military medicine for the emerging military medical provider. Our text will begin with a history of the military medical officer, and then examine issues of contemporary military practice of importance to the medical officer, as well as how to apply medical knowledge in a military setting.

The second section, which will describe issues in health service support or operational medicine, is the military medical practice equivalent of learning the role of the medical staff in the modern hospital, or how the hospital is staffed and organized to support practice. Section three is an orientation to some aspects of strategic military medical knowledge, addressing what is being done to improve the health of the force and assure that lessons of the recent wars are integrated in to the readiness of tomorrow's units. The final section covers the actual care of patients, or tactical military medicine in the deployed or operational setting, addressing how deployment makes practice different from your accustomed practice setting.

It is the hope of the editors and our colleagues who made this book possible that it will help you provide care for those who go into harm's way.

Notes

1. This is not to say other activities are not tied to civilian standards. For example, logistics, aviation, and information technology (IT) have substantial overlaps, as evidenced by the revolving door between civilian and military logistics and IT realms. One case in point is the efforts of Army Staff's senior logistics officer, General William "Gus" Pagonis, to revitalize Sears's logistics supply chain management after he retired using principles and techniques of the Persian Gulf War. (William Pagonis. Wikipedia. https://en.wikipedia.org/wiki/William_Pagonis. Updated May 29, 2017. Accessed March 1, 2018.)
2. Joy RJT. Armed forces of the USA: medical service. In: Walton J, Barondess JA, Lock, S, eds. *The Oxford Medical Companion*. New York, NY: Oxford University Press; 1994: 49–54.

3. Contingency operations, especially since the end of the Cold War, including humanitarian missions and war in the Balkans, were marked by the development in the ground forces of smaller, tailored, multifunctional, even multicomponent (active duty, Reserve, and National Guard), joint and coalition medical units to protect and care for combatants in these unique missions. On the Cold War aspects, see Charles Wolf's 1968 RAND Corporation study, *Controlling Small Wars* (<https://www.rand.org/content/dam/rand/pubs/papers/2006/P3994.pdf>); for more recent concerns see the US Marine Corps Small Wars Center website (<http://www.mccdc.marines.mil/Units/SWCIWID/>) or related material from other services.