The DOD: More Than Just Protecting Our Troops

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The Department of Defense (DOD) is one of the oldest and largest government federal agencies. We have roots back in the American Revolution, and, in medical research, our research agenda has grown with the nation as we have matured through the years and learned through our various defense and offense activities.

RESPONSIBILITIES OF THE DEPARTMENT OF DEFENSE

Today, the DOD includes more than 1.3 million active-duty service members—men and women; another 1.1 million guardsmen who serve routinely during crises around the world; and a civilian workforce of more than 680,000. We are responsible in the DOD health system to care for our employees, their family members, and military retirees who are entitled to care. Therefore, we provide health care to approximately 9.4 million people, and, as such, we engage in clinical research to support our ability to provide and improve care.

The DOD maintains facilities and installations in approximately 5000 locations in more than 160 countries. We have a health care challenge to provide care in every time zone and every climate and on land, at sea, and in the air. Because of this challenge, we invest a significant amount of research to identify if our care differs in different environments. The DOD’s mission, of course, is to defend and protect the United States and its citizens. We are responsible for keeping America safe from harm, including harm from disease, and we focus on protecting the well-being of the war fighters so they can optimize their health and perform their mission throughout their careers.

RESEARCH IN THE DEPARTMENT OF DEFENSE

The DOD has an assistant secretary of defense for Office of Health Affairs who has a central budget and who shares research initiatives and oversight across the DOD to ensure that the United States maintains a healthy force, especially during the last 7 years: to ensure that we have a strong infrastructure and a robust ability to deliver care for wounded warriors as they return from conflict.

Regarding research, the Office of Health Affairs and specifically the Office for Force Health Protection and Readiness are responsible to ensure optimal research investment. We must promote awareness of cutting edge biomedical expertise in technologies as they apply to our particular challenges. We must ensure an expedited technology and product transition and philosophy. We prioritize moving findings from bench to battlefield and from bench to bedside. The tasks to balance the battlefield and bedside requirements are difficult, but the bench part is easy. Finally, we are responsible to coordinate the research activities across the department with our federal, academic, and industry partners. Lately, we have focused on human-performance optimization because a warrior is only successful as long as he or she can optimally perform the mission.

Within the DOD, we focus on clinical research in the context of military operations and deployments. Our primary focus is on research to protect, enhance, recover from war-fighting issues, and sustain that performance. We have a number of threats and hazards that affect our forces, and we spend a lot of time researching those threats and hazards. Many of those issues are not endemic to the United States: the issues are not typical of the US population. As a result, we are uniquely engaged in research that will benefit not only the United States but may also benefit civilians and military forces from other countries with which we collaborate.

CURRENT PRIORITIES

Regarding parasitic diseases, which we have encountered in the Iraq and Afghanistan environments, we have been conducting research on leishmaniasis, a disease that does not particularly interest the US public but that interests the DOD. We have a number of people at threat because of leishmaniasis. Environmental hazards, for example, the equations in Afghanistan and the summer heat in Iraq, have posed some interesting challenges, so we have conducted a number of research projects in that arena. Occupational hazards such as eye injuries associated with the use of laser technologies (blast injuries) also pose a threat, and we have sponsored significant research in those areas, both at the bench level and in the clinical level, to treat unexpected symptoms that we discovered through the health care system.

Currently, we are seeing that, with weaponry and supplies, a marine will carry approximately 90 lbs as they move from one site to another to effect their particular mission. In addition, they each carry an additional 40 pounds of body armor. After habitually carrying 130 pounds, these soldiers are experiencing certain health effects, both short-term and long-term, so we are extensively researching this issue.

Combat injuries caused by our enemies, and whether the result of insurgency or mines or improvised explosive devices, are causing complex injuries, polytrauma, and brain injuries. We observe a lot of tissue loss, and we must understand how to restore function in these individuals. Our soldiers have lost limbs, hearing, and sight—these are known and continuous risk to our soldiers who are in battle environments. We continue to expend time and energy at the clinical level to reduce the impact of these losses and to define ways to protect against these losses at home and in war. We are making progress, because many of these combat injuries would have proven fatal in the past, but we are now are confronted with issues related to complex polytrauma. While we have more to learn, the research to improve these outcomes has been extensive.

We are also seeing cases of traumatic brain injury, issues related to blasts and accidental issues. These issues are not

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unique to the US military. The US Congress has been generous to the DOD in providing resources to thoroughly investigate the full spectrum of injury, both mild and severe, that results from these blasts and the resulting brain injuries. Because of these additional resources, we have expanded research that has been done by the automobile and sports (hockey and football) industries, and we are learning some amazing and beneficial findings in research for traumatic brain injury prevention, diagnosis, and treatment.

RESEARCH MANAGEMENT AT THE DEPARTMENT OF DEFENSE

The DOD does not address all of the issues that other institutions of clinical research must address. We do have limited funds, but our budget is established; we have implemented a system for storing and organizing our research and clinical data; we have established research laboratories and medical centers to enroll study participants and acquire data; we are able to retain physicians and ensure that their training and accreditation is current; and we are investigating issues that can apply to a broad population. We regularly evaluate to ensure efficiency and effectiveness.

Because the DOD has a limited budget, we must carefully choose what to prioritize in our research. Therefore, we follow a rigorous, requirements-driven process. The DOD defines its requirements of our knowledge and abilities, and the war fighter constantly evaluates our priorities. We then apply our funds to our priorities so we can improve and particularly fill gaps in our knowledge. For each research project, we identify and define several gaps to improve or prevent as well as to restore functions and outcomes. After 7 years of war and repeated deployments, we are currently prioritizing research that addresses posttraumatic disorder and the related mental or psychological health issues.

To best use our findings, we arrange our research in portfolios and try to be consistent in how we collect health care data. To accomplish this consistency, we have created the Armed Forces Health Surveillance Center and a central registry through which we standardize our clinical and research data. In these research portfolios, we manage the full spectrum of our health care and information: from prevention to promotion. We also manage research and our tools to measure the effectiveness of diagnoses and treatment and to ensure that we improve our care as we identify more effective ways to rehabilitate individuals who incur injuries and illnesses associated with their military service.

The DOD has a presence all over the world. We conduct our research in dedicated research laboratories around the world: from Thailand to Kenya and in both North and South America. In these laboratories, we accomplish most of our basic and clinical research and in the traditional research sense: the 6-1 to 6-3 type of research. These research laboratories also serve as surveillance centers through we collect international health data that inform us of how health is improved or prevented based on their different protocols. In most of these laboratories, DOD investigators focus on infectious diseases. We need to understand the emerging infectious diseases, particularly in those arenas where we have forces. Therefore, we are able to better protect our troops, to understand disease processes, and to provide effective treatments and recovery strategies. We can provide information to the CDC and other organizations so they can develop appropriate clinical countermeasures with research and collaboration, not only with the National Institutes of Health but also with other governments and organizations around the world. In addition to these research laboratories, we maintain a small number of laboratories that are dedicated to specific focus areas. For example, we maintain a laboratory in Germany in which research focused exclusively on deployment-related illnesses.

We also conduct research at our military treatment facilities in the United States and in our overseas military centers (Fig. 1). Our physicians in these centers, hospitals, and clinics are engaged in clinical research, which is funded by the DOD office at the Pentagon. We provide funding to the US Army, the US Navy, the US Air Force, the Uniformed Services University for Health Sciences, and each branch engages and distributes resources based on how their administrators define their needs. In all branches, we have centers of excellence in which investigators may research burns or other issues related to our communities of interest. In this way, we improve morale because we provide funding and time to our physicians in our clinical facilities to research. This research improves the physicians’ quality of life, creates incentives for professionalism and accreditation, and enables the DOD, with a mobile clinical work force, to continuously improve our services.

Therefore, in the DOD, we have both physicians and scientists. We are engaged in both intramural and extramural research, collaborating with academic and industry partners and other federal agencies, including the Department of Veterans Affairs with which we have collaborated for more than 6 years to care for wounded warriors. Clinical investigation engages that community in achieving the DOD objectives. Our physicians report in evaluations that because they have the skills, resources, and time to research, we are better able to retain our military and civilian practitioners. Therefore, the DOD examines any conditions of concern for active-duty and retired personnel and also for their dependents.

RESEARCH INTERESTS, PROPOSALS, AND GRANTS

In addition to psychological health, traumatic brain injury, and other deployment-related conditions, the DOD pursues a series of congressional special-interest research issues that are not unique to the military. Congress asks the DOD to engage in researching these interests because we do more directive research than the National Institutes of Health does. We have conducted lung cancer, breast cancer, prostate cancer, and ovarian cancer research for the last 15 years with large amounts of energy. We have researched neurofibromatosis, tuberous sclerosis complex, autism spectrum disorder, and amyotrophic lateral sclerosis at the request and direction of the US Congress.

Since 1992, the DOD has received more than $56,000 proposals for congressionally directed research. We have administered nearly $5.3 billion for those programs, and we have provided more than 8300 grants to institutions at home and abroad to address these congressional special-interest issues. The proposals are peer reviewed and are evaluated for scientific merit before we award research. Our military then executes these programs by extramural awardees and administered throughout the world by the medical research and material command laboratories.

BENEFITS FROM THE DEPARTMENT OF DEFENSE’S HISTORY

The DOD is not a self-insulated research entity. We require collaboration and depend on our partners in the federal government, industry, academia. We provide care for our forces in the field, but we also care for them at home and ensure that their families also receive quality care. We are affected by unusual injuries in unusual places and because of that, we have
been able to develop some interesting advances in medical management. We have improved the health of all Americans because of our experience.

In fact, clinical research associated with trauma and infectious disease, particularly that which we have experienced in every major conflict since the American Civil War, has improved medicine. For example, during the American Civil War, physicians developed field hospitals and established procedures for amputation. We discovered that the length between immediate treatment and survival rates were related, and we realized the connection between sanitation and infection prevention.

In World War I, we began blood banking and transfusion. During World War II, physicians initially developed and used minimally invasive procedures. Significantly, our physicians also identified that treating shell wounds to the torso resulted in lower mortality rates for trauma management. The DOD identified through research associated with morphine use that morphine was effective in controlling pain and penicillin was effective in controlling infection. In World War II, we also refined surgical procedures to improve outcomes in abdominothoracic wounds and created new vascular surgery procedures to help the wounded heal more rapidly.

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During the Korean conflict, the DOD introduced air ambulances for the first time and expanded on improvements in vascular surgical techniques and in infection control. In Vietnam, physicians improved hemorrhagic control and expanded capabilities for care in the air. Mortality rates per wounded decreased because the DOD was better at managing air ambulances through helicopters, the results of which helped us form the practice of emergency medicine and to create processes for triage and management of patients in duress.

In Iraq and Afghanistan, because of improvised explosive devices and our responses to these devices, we have discovered battlefield injuries that would have been fatal in the past but that we are better prepared to address. In these conflicts, we have the highest rate of survival in any previous war, although the enemies fight with more lethal weapons. We have accomplished research that has provided breakthrough capabilities in hemorrhagic control, such as bandages that stop severe bleeding almost instantaneously. We have seen a veritable revolution in prosthetics—replacement arms, hands, legs, knees, and feet. For example, 60 Minutes recently reported on a prosthetic hand that was developed by the Defense Advanced Research Projects Agency (DARPA) that is controlled by thought.

Our research during the last 6 years has also led to remarkable advances in diagnostic treatment and rehabilitation for head injuries and for cranial and facial reconstruction. Because of the duration of the current conflict, we have heightened capability to address the full continuum of care associated with psychological health, including posttraumatic stress disorder, depression, anxiety disorder, and the concept of building psychological resilience, which is not limited to the battlefield.

Other recent benefits of combat-related medical research include a portable sensor system that measures tissue perfusion
to guide combat medics in resuscitation; nonsteroidal anti-inflammatory drugs to treat and prevent chronic neuropathic pain–associated spinal chord injury; robotic support for tele-surgery in the battlefield, and a new field of neurogenerative medicine that uses bioengineering techniques to prompt the body to regenerate cells and tissues. This new field of medicine has already yielded much success in the regeneration of human tissues and organs in DOD research laboratories. Recently, medical physicians performed a face transplant. Our physicians have also performed hand transplants, a development that presents great potential for treating people with debilitating, disfiguring, and disabling extremity injuries.

CONCLUSION

The DOD has created niches in our research areas: in clinical trauma care, international infectious-disease management and prevention, and areas in which the military population has specific and unique requirements. We are dedicated to continuing clinical research and in a collaborative way. We have an advantage because we are a health system: we control the pipeline of assets, the resources for research, the rules, and the programs. We have standard mechanisms for collecting and sharing data, and we have a global surveillance system that affects potentially 9.4 million individuals. We are uniquely postured to be able to research, and we do not have a lot of the issues that other research institutions battle, perhaps because we are one large system of systems. We are not a perfect system, but our structure allows us opportunities that other health systems do not have. For that, we are grateful, and we want to share our successes and experiences and to participate more extensively with other institutions to improve what we know and to leverage what they know.