MEDSIM EVOLVES
New Technology & Techniques

OPERATIONAL MEDICINE
Detrick’s Groundbreaking Research

Leadership Perspective

COL (Dr.) Michael R. Nelson
Director
Training, Education, and Research
Walter Reed Nat’l Military Med Ctr
Bethesda, MD

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Cover: Staff members of the Expeditionary Medical Facility (EMF) at Camp Lemonnier, Djibouti, treat a simulated casualty during a mass casualty exercise on 14 May 2014. The exercise is a biannual training event between French and American services to practice saving lives during mass casualty incidents. (Senior Airman Riley Johnson)
From lessons learned in the classroom and in the field, one message remains clear: Nothing replaces the education wrought by real-time action. However, technology is enabling ever more realistic simulations. In the Q3 2014 issue of Combat & Casualty Care (C&CC), we highlight some of the skills keeping U.S. combat medicine professionals at the top of their game. Sharing one goal, the improvement of tactical combat casualty care from point of trauma through to long-term treatment, the men and women who provide a bridge between what is and what can be in quality of life post-initial trauma still represent the best chance for a “return to the world” for those who experience combat-related injury.

In the midst of budgetary restrictions across the defense sector, the field of simulation technology is growing at an ever-increasing pace. The folks at facilities such as U.S. Army Medical Research and Materiel Command (USAMRMC), Fort Detrick, MD, and U.S. Army San Antonio Military Medical Center (SAMMC), Fort Sam Houston, TX, are responding to the demand for readiness training to prepare those who would be real-world combat medics before and after they set foot on the battlefield. This issue looks specifically at the latest in medical simulation capabilities being brought to bear at SAMMC and Brooke Army Medical Center that are enhancing wound care training and long-term healthcare outcomes.

Other coverage of field medicine includes a profile of the Military Operational Medicine Research Program of USAMRMC, which manages research studying the physiological and psychological issues facing servicemembers today and going forward. It also features a conversation with an Air Force pararescue jumper on the equipment and training needed to meet the demands of Special Operations medicine.

Turning attention to long-term care, the issue’s exclusive interview with COL (Dr.) Michael R. Nelson, Director for Training, Education, and Research, Walter Reed National Military Medical Center (WRNMMC), Bethesda, MD, gives readers insight into the focus and challenges the new WRNMMC faces in addressing the unique readiness needs of a joint medical force. We also examine critical technologies, such as cutting-edge burn care and exoskeletal support of injured limbs, improving the prognosis for higher quality of life in the face of debilitating physical and emotional challenges.

As always, feel free to contact me with questions, comments!

Sincerely,

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Noncommissioned officers are a vital part of the military’s only burn facility, the U.S. Army Institute of Surgical Research Burn Center at Fort Sam Houston, TX. When patients need care for life, NCOs help provide individualized care for each of them.

By Meghan Portillo, NCO Journal

Noncommissioned officers (NCOs) who are licensed vocational nurses, nutritionists, interns, and physical, occupational, and respiratory therapists work together to help each burn patient reach the highest level of functioning, often returning soldiers to the jobs they were trained to do. Depending on the severity of a burn and the overall health of a patient, some burn victims may remain in the hospital for more than a year. Others may only require a few days. As a general rule of thumb for those with partial- to full-thickness burns, a day of hospitalization will be required for every one percent of the body that is burned, said Steven Galvan, the public affairs officer for the U.S. Army Institute of Surgical Research. When a patient first arrives, he or she is evaluated by a therapist and often starts therapy from day one. Therapists work closely with patients seven days a week until they are able to function on their own and transition to outpatient status.

Staff Sergeant Mike Calaway, who in 2013 was the NCO in charge of Outpatient Burn Rehabilitation, said one of the keys to patients’ progress is a seamless transition from their life as an inpatient to the routine of living at home and making frequent visits to the center for therapy. “They do so much on the inpatient side, and we know exactly where they are in their recovery when they come to us. So we don’t let them skip a beat,” Calaway said.

Flight Team

In addition to the team of health care providers at the hospital, the burn center has a flight team prepared to fly at a moment’s notice to Afghanistan, Singapore, Germany, or anywhere else in the world where there is a burned or critically injured soldier and transport him or her to the burn center in San Antonio.

The five-member team, usually composed of a burn surgeon, nurses, a therapist, and a supporting NCO, leaves San Antonio on a commercial flight. The team then coordinates with units caring for the patient at their destination, often synchronizing efforts with Marine Corps, Air Force, and Navy personnel to provide a seamless transition onto the aircraft that transports them back to San Antonio. The flight team provides constant care in-flight and lands on a helipad on the roof of the burn center, where a team meets them to bring the patient directly into the intensive care unit or the operating room.

Though it typically takes three or four days from the time of injury to a patient’s arrival at the burn center, the team has completed a mission within 39 hours, Galvan said. No matter how long the trip takes, however, the team travels with all of the equipment it would use in the intensive care unit, allowing them to provide nonstop care.

“Various specialties work together to care for these patients as we bring them back from theater to the institute’s burn center for..."
NCO Medicine

Burn Care

Care. NCOs are a crucial part of that,” said Dr. David Baer, director of research at the burn center. “They do the classic NCO job of being the operations NCO—making sure all the equipment is ready to go and maintained, and all the supplies are ready to go—because those teams, when the phone rings, they have about six hours before they need to be wheels-up on a plane heading out to meet the patient. So being ready to go and having the training ready to go is a key part of what the NCOs do. But NCOs are also crucial health care providers on the flight team.”

As members of the flight team, NCOs work as licensed vocational nurses (LVNs), in charge of continuous evaluation and monitoring of the patient before, during, and after the flight and transportation. The LVN is also responsible for wound care, maintaining the patient’s blood pressure, and pre-combat checks and inspections of all flight equipment. Another key position on the team filled by an NCO is that of the respiratory therapist, the team member in charge of evaluating the patient’s airways, ventilation, and oxygen levels throughout changes in altitude, all while in flight and prepped in a foreign country with limited resources.

Cutting-edge Therapy and Technology

When scar tissue forms, the skin becomes less elastic and cannot extend as much as uninjured skin. Therapists at the burn center use splints and slings designed by the research team specifically for burn patients to keep their bodies in positions that will elongate their joints while they are healing. These methods, combined with compression and gentle stretching, help patients retain their range of motion.

“For facial burns, material is needed the most. Once a scar has matured, technicians create custom compression garments for a patient’s arms, legs, chest, or other areas to be worn like a shirt, sleeve, or glove. The garment provides protection from ultraviolet radiation and even pressure to the area to prevent swelling and further scar growth. If a patient is burned on his or her face, therapists use custom-made silicone masks held in place with a hockey mask-like harness to apply the needed pressure.

“Compression is key in recovery,” said Sergeant First Class Hugo Roman, who last year was the NCOIC for burn occupational therapy. “For facial burns, material is applied to the burn victim’s face using the compression mask. And that’s going to influence whether the patient retains many of their facial features or not. Because of edema and other changes a patient goes through, they may go through several masks.”

“Using the old equipment, it would take 8 to 10 hours to create a mask. With the equipment we have now, it takes us 30 to 45 minutes. We take a scan of the patient’s face and manipulate the scan, make a mold of the face with a milling machine, then apply the thermoplastic material to create the mask.”

For patients who are unconscious or bed-bound for lengthy periods of time, therapists use mechanized chairs or frames that can lift a patient from a flat position into a sitting or standing position. Even if the patient is still unconscious, such positions are beneficial because gravity helps push fluids throughout the body. The frames also have an attached table, and the therapists encourage patients who are able to use their arms and hands and to engage in activities.

“We always try to dissociate the patient with their pain,” Gilmore said. “They may be horrifically burned—it’s very, very painful. Sometimes, if we ask them to do something, and that pain is their area of concentration, they are not going to be able to fully do what we want them to do. So if we can get them thinking about something else, the pain is still there, but they are not thinking about it, so it becomes more bearable.

“I remember we were trying to get a patient up to standing for an hour, but we couldn’t do more than 10 or 15 minutes before he was just in too much pain. We found out that he liked to play chess. I like to play chess, so we brought the standing
The burn victim survival rate is much higher than it used to be, but there are still many unknowns when it comes to scar formation and other aspects of patient recovery.

frame in there, I started playing chess with him, and hours would fly by. Within a couple of days, he was walking again. The pain was still there the whole time, but I got him concentrating on the game, and he was able to cope.”

**New Research: The Future of Patient Care**

In the past few decades, researchers have made leaps and bounds, Gilmore said. The burn victim survival rate is much higher than it used to be, but there are still many unknowns when it comes to scar formation and other aspects of patient recovery. To address this, the burn center has its own research department, which publishes studies through the American Burn Association.

One advantage patients at the burn center now have is that of replacement skin. The main treatment used for burn patients continues to be skin transplants from their own bodies, but because donor sites are painful and there often is not enough skin to cover large burns, research efforts have been focused on developing synthetic options that require little or no skin from the patient.

Burn victims at the Institute of Surgical Research Burn Center may now participate in the clinical trial for ReCell, a spray-on skin made from a small biopsy of the patients’ skin. The biopsy is used to create a substance containing keratinocytes, regenerative cells that promote the growth of new skin cells.

“We surgically remove any skin that is burned, and then the sprayed skin sort of ‘seeds the lawn’ and helps with the growth of new skin. Those cells actually grow in place and create new skin. It is amazing,” Baer said. “Not only can those who get treated here at the burn center enroll in an experimental protocol like this, but everyone across the country can benefit from that. We know it will make the care for soldiers better, in addition to the care for civilians.” Another method now in clinical trials is the use of skin sheets. A small sample of skin is taken from the patient and sent off to a company that puts it in a culture and grows it into sheets. The sheets of skin are sent back to the burn center and applied to the patient’s burns.

“It’s good to have more than one option for treatment,” Baer said. “The use of spray-on skin is limited by the depth of the burn, but we can use it immediately. You don’t need to send the cells off to another company to grow them for a few weeks and send [them] back. So it’s faster. The other kind takes longer, but it has a better outcome for full thickness, third-degree burns.”

An experimental line of research in an earlier phase involves the use of adult stem cells harvested from fat that would normally be discarded in surgery to create “off-the-shelf skin,” Baer said. The spray-on skin will hopefully not require any skin from the patient, and will be ready to use on any type of burn, whenever a patient needs it.

“The research is very significant. It is what makes us unique,” Roman said. “We can apply this immediately, whereas other burn centers in the U.S. do not have that luxury. They may learn from our published studies and apply it in their own clinic, but we have that advantage right away.”

Meghan Portillo writes for the NCO Journal, the Army’s official magazine for noncommissioned officer professional development, available at ncojournal.dodlive.mil.

Lead art: Staff Sergeant Mike Calaway, the NCO in charge of outpatient burn rehabilitation, gently stretches the scarred skin on Private First Class Antoine Reeves’ hands to reduce stiffness and increase his range of motion. (Meghan Portillo)
Injury Recovery Center for the Intrepid

RETURNING Function to Form

A mechanized limb support system revolutionizes the lives of injured soldiers

By Meghan Portillo, NCO Journal

After suffering a severe wound to his leg during training and then breaking it while hiking years later, doctors had told Master Sergeant Tim Crusing they might need to fuse his ankle, which would have taken away his range of motion. But Crusing refused to give up hope and opted for a less aggressive, cutting-edge approach. His doctor, who had completed his residency at the Center for the Intrepid (CFI), part of the Brooke Army Medical Center at Fort Sam Houston, TX, sent Crusing there for an evaluation. Crusing was thrilled to learn he was approved as a candidate for the center’s Return to Run Clinical Pathway.

Whether soldiers want to get back to the fight or simply want to be able to chase their kids around the backyard, the Return to Run program changes their lives, partly through the use of the Army’s Intrepid Dynamic Exoskeletal Orthosis (IDEO). The IDEO is a device used by soldiers who have trouble walking or standing because of lower leg injuries. Participants in the program are not amputees, but the IDEO they wear resembles a prosthetic. It is worn over the injured leg, allowing wounded warriors to run once more.

At first, the IDEO was only available at CFI. Now, it is available at Walter Reed National Military Medical Center in Bethesda, MD, at the Naval Medical Center in San Diego, CA, and even to civilians in Washington state. As more become aware of what the device can do, the program at CFI has remained at capacity, and several new participants join each week to learn to use the IDEO and train their muscles to run again.

“Don’t think that this is just for someone who has had a traumatic injury like a limb salvage from a blast injury,” said Johnny Owens, chief of the Human Performance Optimization Program at CFI. “Now we’re really getting a lot more who have bad arthritis or an ankle sprain from a jump and just can’t run any more. If there is any lower leg pain or loss of leg power, that individual may be a candidate for the program.”

Starting Anew

In 2008, Owens and Lieutenant Colonel Joseph Hsu, an orthopedic surgeon at the U.S. Army Institute of...
Surgical Research, noticed that though new surgical techniques were allowing many wounded warriors to keep their legs, the soldiers often returned years later requesting amputations. Soldiers expressed disappointment because of the limitations imposed on them by their injuries, and envied the amputees who were able to run, jump, climb, participate in active sports, and remain on active duty. “They wanted to amputate because of their inability to run,” Owens said. “There were a lot of reasons why they were not able to run—they didn’t have power in their legs from their injury, the joint was too destroyed and they had a lot of pain, or they didn’t have the range of motion they needed at the foot and ankle. We needed a solution.”

Hsu and Owens shared their ideas with Ryan Blanck, a prosthetist who, until recently, worked at CFI. Using inspiration from an amputee’s running prosthesis, Blank created the IDEO, an energy-storing device that is worn over the injured leg and supports the foot and ankle.

The device can fit into boots or tennis shoes, with a foot and ankle plate connected by carbon-fiber rods to a cuff below the knee. When the foot hits the ground, the IDEO cycles the energy and delivers it back to propel the individual forward.

Patients’ success with the device increased dramatically with intense rehabilitation and instruction on how to use it correctly, so Owens integrated use of the IDEO into CFI’s existing rehabilitation program to create the Return to Run Clinical Pathway, which is now overseen by John Fergason, director of prosthetics.

A Life-changing Program
Every IDEO is custom-made. Initially, each soldier is seen by CFI staff and given an evaluation by one of the prosthetists. Using a mold of the soldier’s leg, a temporary plastic version of the device is created. The user wears the plastic IDEO to ascertain its effectiveness and is given a physical therapy evaluation. The individual is then informed if they are a good candidate for the program. Crusing, whose injuries made him a good candidate for the program. Crusing, whose injuries made him an ideal fit for Return to Run, recalled the liberation he felt the first time he tried on the IDEO.

“Just putting on that fragile plastic mold of the IDEO, it was the first pain-free step that I had taken in 12 years,” he said. “I almost broke down … I have pain every day, but when I’m wearing it, it immediately takes it away.”

Command Sergeant Major Rory L. Malloy, former commandant of the U.S. Army Sergeants Major Academy at Fort Bliss, TX, had a similar experience. During a training exercise on 16 June 1995, Malloy stepped on a tree branch while carrying a fellow soldier, breaking his own leg in seven places. Luckily, a surgeon was able to save Malloy’s leg, and he remained on active duty. But over the years, he developed debilitating arthritis in his ankle.

“I told my surgeon, Dr. Justin Orr in El Paso, ‘Either cut my leg off or fix it. I can’t handle the pain anymore,’” Malloy said. “That’s how bad it got.

“The only options were to live with the pain, amputate the leg, or cut the ankle out and do a fusion—put a few cadaver parts in. So that’s what I went with, and all of the expectations that I had for the surgery were exceeded by far. Dr. Orr is just a phenomenal surgeon.”

Malloy said though the surgery relieved more than 80 percent of his pain, he would not be able to walk normally and would never be able to run again. However, the IDEO changed all of that. Eighteen years after his injury, he is learning how to run again and is completely pain-free.

“Before, I always had to think about what I couldn’t do,” Malloy said. “My daughter would say, ‘Hey dad, let’s go out and shoot some hoops,’ or ‘Let’s go for a hike.’ Well, I couldn’t. When my wife and I would go to the mall, we always had to figure out where we could park, what doors we could go into that had benches nearby for me to rest my foot.

“Now, I go out and I walk all day without any pain. I’m able to ride a bicycle now; we are going rock climbing this Friday. I’m able to throw a rucksack on and do all of the military stuff I used to do. They have given me my life back.”

Rehabilitation: Pushing the Limit
Four to six weeks after a soldier’s initial trip to CFI, a carbon and fiberglass version of the device is made, and the user returns to the center for about a month of physical therapy and training. Malloy emphasized that this period of instruction and rehab is as important as the IDEO itself.

“It has taken months for me to get this far, and it may be even another year before I can run two miles,” he said. “The instruction soldiers receive through the Return to Run program sets them up for success. Without that time and training, they will not be able to reap the benefits of the IDEO.”

As muscles change and grow, the IDEO needs to be altered. During participants’ time in the program, it is continuously adjusted to provide a comfortable fit.

“As you go through the training, it’s like a prosthetic—you have to tweak it,” Owens said. “At the end of the training, we hope to have a perfectly fitting device.”

Soldiers work hard during training to push themselves to their limits, because if something goes wrong with the IDEO, therapists hope it will happen while they are at the center so corrections can be made.

“Your body changes, and you don’t really know what you need until you try it out,” Crusing said. “That’s one of the reasons the Return to Run program is so important. You have to come here and use it in a pretty vigorous fashion in order to figure out what’s going to work for you. Plus, if you adjust anything, it will affect other things. With each adjustment, it gets better.”

Training begins with simple but clear instruction on how to step with the device. Soldiers are taught how to use their hips, to keep their weight forward and to not turn out their feet. As they progress, they
begin to exercise harder, jumping from side to side and strengthening their legs with weight training. Wearing the IDEO, they work the muscles they need to run.

Crusing and Staff Sergeant Krish Lalu were among the soldiers training in the program on a hot July afternoon last year. Sweat ran down their foreheads as therapists led participants in exercises to challenge their bodies and the IDEO. They hopped over obstacles, participated in boxing drills, and sprinted as fast as they were able, planting their feet firmly in the grass as they turned sharply around the trees.

Lalu, who had lost 85 to 90 percent of both shin muscles due to a late diagnosis of compartment syndrome, said he was no longer on medication, and no longer in pain.

“Right now, only my pride hurts,” he said after finishing the outside group exercises. “It’s so hot out there, and some of those exercises are quite challenging.”

Participants’ levels of fitness and ability varied widely. Some had injuries more serious than others, but the looks of determination made it clear that each was there for a purpose: They were there to run.

Due to a lack of strength in his shin muscles, Lalu’s toes flopped to the ground first when he walked. The IDEO forces him into a normal gait, and he has now been cleared to return to a conventional unit. After completing the Return to Run Clinical Pathway, he reported to the 82nd Combat Aviation Brigade at Fort Bragg, N.C.

“I’m looking forward to it,” Lalu said. “It will be a miracle if I can work myself up and go to jump school. That gives me something to strive for. Jumping won’t be a problem, but I need to work on my running. That’s the only thing that scares me—being able to keep up with the running that is required at Airborne school. If I can overcome that hurdle, then I should breeze through it.”

Joseph Mallett, a physical therapy assistant and contractor at CFI who is also a staff sergeant in the Army Reserve, explained that the program concentrates on running as the basis for other activities.

“Running is pretty much the starting point for any activity, whether it is Airborne, air assault, or whether they want to do triathlons,” Mallett said. “It’s inspiring. They are able to use this as a platform.”

Mallett said many in the program haven’t run in years. They are encouraged by the progress of others in the program or of the amputees they see at the CFI, and they make new goals for themselves. Mallet said he often sees participants reach levels of fitness far beyond what they had achieved before their injury.

“They go on a lot of trips such as skiing, hiking, skydiving, or kayaking,” he said. “They push themselves to reach new goals, and having someone else there who has a similar injury is more inspiration. They drive a little bit harder together.”

Program participants return to CFI several weeks after finishing their training to pick up a backup IDEO as well as a thinner, lightweight version that can be worn in dress shoes. If they feel they need more practice and if their unit approves, soldiers may stay a few extra weeks for more training. Once they leave with their backup device, they usually only return to the CFI for replacements or adjustments.

**Back in Action**

Many factors influence a wounded soldier’s decision to remain in or leave the military, but the ability to run is often the deciding factor.
When the foot hits the ground, the IDEO cycles the energy and delivers it back to propel the individual forward.

for whether he or she is allowed to stay on active duty or considered for medical discharge, Owens said.

As of 2013, more than 450 soldiers received IDEOs and participated in the Return to Run Clinical Pathway since the program's inception. According to Owens, of the first 146 who went through the program, 51 percent returned to active duty. Many of those who have returned to their units have deployed several times, and they bring back a wealth of information that helps the CFI team improve the IDEO.

“Anytime one of our guys is deployed, we try and get a breakdown of how things went,” Owens said. “One thing a lot of them said was that with fast-rope operations, they felt like their knee might buckle. So we built a knee portion specifically for fast roping and jumping. Some said the device was bursting through their shoes, so we are working with New Balance to develop a new shoe design—more robust to hold up to it. What they tell us after these deployments is huge because it’s all brand new.”

‘Give Soldiers the Opportunity to Heal’

While Malloy was training at CFI, he saw a young recruiter come into the program with only a week to get the IDEO and learn how to use it. Malloy said he was enraged when the recruiter’s commander called and said, “It must be nice just to get to do PT every day.” Malloy said he called that commander and had a chat with him.

“Participating in the Return to Run program for at least three to four weeks is critical,” he said, “because you get the strength back, you understand the device, you learn how to use it so it doesn’t become something that just sits on a bookshelf when you leave here.

“A lot of senior leaders in our Army will talk a good game, but it’s much harder to step up to the plate and actually do it. If you have someone who is injured, embrace the situation and give them the opportunity to heal. In my case, my senior leaders have allowed me to get the surgery and have time for recovery and to get the IDEO. Not all soldiers are afforded that opportunity, because some leaders are being very narrow-minded.”

Malloy emphasized that if leaders give their soldiers the time and the tools they need to recover, in return they will get back a stronger soldier who can actually perform. Without that support, these soldiers will be limited in what they can do for the Army.

“I’m very blessed that I have Sergeant Major of the Army Raymond Chandler, John Sparks, and other folks who have supported me in getting through this,” Malloy said. “SMA Chandler is a great example of the leadership we need all the way across our force. He could have easily said, ‘Hey, you’re broken; you are going to be out for a month getting the surgery and another month getting the IDEO. I need a commandant full-time, so I’m going to have to replace you.’ He could have done that, but he didn’t. Instead, he encouraged me to come down here to CFI and get myself fixed so that I can get back into the fight and continue to serve.”

Meghan Portillo writes for the NCO Journal, the Army’s official magazine for noncommissioned officer professional development, which is available at ncojournal.dodlive.mil.
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Leadership Perspective

Innovation through Evidence-based Care

Colonel Michael R. Nelson is the Director for Education, Training, and Research at Walter Reed National Military Medical Center. COL Nelson is also an Associate Professor in the Department of Medicine at the Uniformed Services University of the Health Sciences and serves as the Allergy-Immunology Consultant to the Office of the Army Surgeon General. He also serves as a leader in multiple national specialty organizations, including Vice Chair of the Accreditation Council for Graduate Medical Education Allergy-Immunology Residency Review Committee and Treasurer for the American Board of Allergy and Immunology. He is regarded as a subject matter expert in allergen extract preparation and has current research interests in allergen immunotherapy, vaccine immunology and healthcare, and aerobiology. He is the current Chair of the Allergenic Products Advisory Committee of the Food and Drug Administration.

COL Nelson graduated from Princeton University and received his MD and PhD (Pharmacology) degrees at the University of Virginia. He completed his internal medicine residency at Eisenhower Army Medical Center in Augusta, GA, and fellowships in Allergy-Immunology and Clinical Laboratory Immunology at Walter Reed Army Medical Center.

He then served in multiple leadership positions at Walter Reed, including Chief of Clinic and Research Services in the Allergy-Immunology Department before ascending to Chief of the Department in 2008 and serving as acting Deputy Commander for Clinical Services during the National Capital Area Realignment and Closure (BRAC) transition in 2011. He served as the inaugural Allergy-Immunology-Immunization Service Chief at Walter Reed National Military Medical Center before being selected for his current position.

COL Nelson was interviewed by C&CC Editor Kevin Hunter.

C&CC: Please discuss your role as Director for Education, Training, and Research, Walter Reed National Military Medical Center (WRNMMC).

COL Nelson: It is a privilege to serve WRNMMC and the DoD in this capacity. The Education, Training, and Research Directorate serves as an institutional and DoD resource for fulfilling the strategic goals and initiatives set by WRNMMC’s Education and Research Pillars. We lead major advances and innovation in knowledge by providing cutting-edge, evidence-based care for our patients. We provide education, training, and professional development for our medical center staff to invest in the future of military medicine. It is rare, if not unprecedented, in military treatment facilities to have a voting board of directors member focused on these missions, let alone at WRNMMC, the hallmark of U.S. military medicine and where the nation heals its heroes.

It is important to note that although my primary focus is supporting education, training, and clinical research operations, one of my main roles as Director is to align these functions with our patient care missions and the military healthcare system’s Quadruple Aim: patient care, readiness, lower cost, and better health.

C&CC: How is WRNMMC working to set the standard of care supporting integrated wartime operations through lessons learned?

COL Nelson: WRNMMC is visited by healthcare systems and military medicine leaders from around the world on a regular basis to leverage lessons learned and take advantage of the care and training models established here. What they see is an energized and integrated team of caregivers focused on the patient and with the full understanding they will often be called upon to be first responders for local emergencies and during deployment in support of contingency operations.
For decades, WRNMMC and its legacy institutions, the National Naval Medical Center and Walter Reed Army Medical Center, have regularly been the first call for emergency preparedness support of federal emergencies and critical high profile events throughout the National Capital Region. Rapid clinical and diagnostic response to anthrax exposures in the region is just one example. We regularly train regional DoD and civil first responders for hazardous material decontamination, mass casualty management, and hazardous material exposures. It is gratifying that in the face of tragedy such as the Boston bombings, the morbidity and mortality experienced by victims was lessened through the use of lessons learned from WRNMMC and military medicine.

[In addition,] our medical center is full of seasoned operational medicine caregivers and leaders who bring back from deployment experiences that are shared on a daily basis with staff and trainees. Our staff conducts research on treatment protocols, surgical approaches, and risk assessments that facilitates medical decision making from point of injury or illness to full recovery and rehabilitation. This research is published and presented in national forums.

We are at the forefront in the development of standard operating procedures and training modules that will prepare the inexperienced to react quickly and appropriately in full support of the readiness goals of the Quadruple Aim. Our innovative educators and leaders are also expanding the use of our state of the art simulation center to enhance skills competency and patient safety. Collectively these efforts will enable our staff to operate at the peak of their skill level and prepare them for whatever they’re called upon to do next. To do so in a tri-service joint facility has pushed the boundaries of collaboration and set the model for joint operations preparatory training in an active military healthcare facility.

Leadership Perspective

It is gratifying that in the face of tragedy such as the Boston bombings, the morbidity and mortality experienced by victims was lessened through the use of lessons learned from Walter Reed National Military Medical Center and military medicine.
C&CC: How is WRNMMC addressing the need for comprehensive streamlining of critical day-to-day and long-term patient care?

COL Nelson: Our impressive collection of caregivers and educators is committed to identifying best practices and lessons learned, collating them, and sharing with the medical community at large. Internally, we conduct academic and skills training across the medical center with a special emphasis on interprofessional and interdisciplinary care. Our graduate medical education programs and Center for Nursing Science and Clinical Inquiry (CNSCI) teach evidenced-based practice principles and demand application to the day-to-day care of our beneficiaries. Given the complex chronic care needs of our wounded, ill, and injured servicemembers and sophisticated specialty care referred patients, the hospitals participating in national programs such as Partnership for Patients and National Surgical Quality Improvement Program (NSQIP) regularly monitor the outcome of care provided. Although we are proud of our benchmark performance placing us in high quality of care categories, we are most proud of the positive outcomes of our individual patients and the training of our caregivers to continuously improve and carry lessons learned to their next duty stations throughout the world.

We also understand that our civilian healthcare system will receive many of our patients, and we are committed to ensuring smooth transitions of care and equipping civilian providers in the hometowns of our discharged heroes with detailed patient care plans and hands on training in our hospital. Our multidisciplinary Trauma Service and John P. Murtha Cancer Center is a model for the military healthcare system. WRNMMC’s CNSCI-led Project SERVE, in support of the First Lady Michelle Obama’s Joining Forces Initiative, established a partnership with nursing schools in the state of Alabama, bringing their students into our wards and clinics to get a firsthand look at our training and state of the art healthcare in action.

Finally, we are in the midst of establishing a leadership academy that recognizes all of our staff as leaders. A key component will be a comprehensive role-based competency matrix that sets competency expectations and goals, and directs our staff to training opportunities to fulfill them.

C&CC: How is WRNMMC working to partner with civilian facilities to broaden and strengthen its reach and care network?

COL Nelson: WRNMMC is breaking new ground in its effort to promote partnerships across federal and civilian research community networks. Under the leadership of WRNMMC’s Director, BG Jeffrey Clark, and the Uniformed Services University (USU) Dean of the School of Medicine, Dr. Arthur Kellermann, the WRNMMC-USU Unity of Effort initiative is a model for military treatment facility and academic school partnerships, driving change for the better. Similarly, RDML Raquel Bono, Manager of the National Capital Region Enhanced Multi-service Market, has fostered the development of regional market-wide education and research initiatives.

WRNMMC serves as the primary site or collaborator in more than 115 multi-center studies. We have rich resources in the form of tissue repositories, patient registries, and longitudinal clinical data.
and diagnostic data that have made WRNMMC a highly valued research partner. We have specifically expanded our relationships with such institutions as the National Cancer Institute and VA facilities as a means to bring state of the art medical care intervention study options to beneficiaries and to establish longstanding relationships that will be built on over time.

Wound healing and treatment decision making device successes are the result of public-private partnerships that are active and numerous. Innovations in education and transition of care in collaboration with Harvard and other elite institutions are making a difference improving the outcomes and safety of patients. Our Three-Dimensional Medical Applications Center is supporting medical research and healthcare nationwide, including medical model and prosthesis contributions to maxillofacial, neurosurgical, and face transplant cases here and at civilian centers through partnerships with institutions such as Johns Hopkins University.

We do this with the full understanding that the best advances in medicine will emanate from combined efforts involving research volunteers and experts nationally and internationally. We also have an obligation to partner with the nation’s elite investigators in the study of our unique patient populations. No one center or investigator can do it all. WRNMMC is a participant or leader in more than 100 education and research agreements.

C&CC: What are some of the key challenges you see facing WRNMMC looking ahead?

COL Nelson: WRNMMC trains more than a third of all military healthcare system providers. Our dedicated learners and their teaching faculty achieve a better than 90 to 95 percent first-time certification examination passage rate for those completing graduate medical education and the licensed practical nurse phase II training programs. WRNMMC hosts the largest clinical investigation program in the DoD with over 1,200 active protocols, more than 1,200 clinical investigators, and more than 700 regional or national presentations and publications supporting our patients, the medical community at large, and more than 75 graduate medical and allied health training programs. I am in awe of the work being done by investigators at this hospital, their many academic partners, and the immediate applicability of their efforts to the care of our patients. To do this in an environment of increasing clinical demands and diminishing resources is extraordinary.

To our knowledge, WRNMMC is the first military treatment facility to develop a clinical investigation program strategic priority plan with collaborating stakeholders that is fully aligned with Defense Health Agency and USU of the Health Sciences clinical research priorities. This strategic plan will allow us to focus resources and efforts in a manner that will push us to deliver medical advances in areas of need, yet continue to support innovative study in other areas.

I am also particularly proud of the Education, Training, and Research Directorate staff who are small in number but mighty in effort as they provide the hidden infrastructure support and oversight that assures adherence to all policies and regulations while promoting efficiencies that streamline the administrative demands on our educators and investigators. We value our volunteers for clinical studies and their protection is paramount. We celebrate our volunteers annually with a medical center-wide forum open to all. Their stories and sincere desire to contribute to advances in medical science inspire us all.

Challenges are ever present and mounting. Whether it is dwindling research and training funding opportunities, increasing complexity of interagency and cross-component research requirements, or striking the right balance between clinical care and academic pursuits for military treatment facility healthcare team members, I am surrounded by tirelessly dedicated and inspiring colleagues who find a way to make things happen.

This is an exciting time for academic military medicine; I consider myself blessed to be a part of it each and every day.
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CLOSING THE REAL-TIME READINESS GAP

The U.S. Army’s San Antonio Military Medical Center, Army Medical Command, Fort Sam Houston, TX, is applying advanced simulation technologies to training, research, and patient care challenges.

By Steve Melito, TDM Correspondent

San Antonio Military Medical Center (SAMMC) is the Department of Defense’s largest inpatient medical facility. Located at Fort Sam Houston, TX, this certified Level 1 Trauma Center spans 2.1 million square feet and counts 425 beds. As the hospital component of the Brooke Army Medical Center (BAMC), SAMMC has also cared for thousands of servicemembers injured in Operations Iraqi Freedom and Enduring Freedom.

In addition to patient care functions, this state-of-the-art facility provides a range of education, training, and research programs. Part of Army Medical Command, the hospital houses a Simulation Center that has received a rare accreditation by the Society for Simulation in Healthcare (SSH) for simulation instruction and research, which Lieutenant Colonel Rhonda Deen, the Medical Director of the SAMMC Simulation Center says “validates the high quality of the medical training at SAMMC.”

Simulation and Innovation

Simulation-based education is a technique rather than a technology, but advancements help keep institutions such as SAMMC on the cutting edge of trauma care. Emerging technologies are exciting, of course, but supporting the mission can mean applying available simulators in innovative ways. Current military operations also inform training and delivery.

“Advances in medical (especially surgical) care and understanding of the physiology of traumatic injuries have occurred with each successive conflict,” writes Dr. Mark Bowyer, MD, FACS (Fellow, American College of Surgeons) and DMCC (Diploma in the Medical Care of Catastrophes), in an article for Surgical Clinics of North America entitled “Surgical Education in the New Millennium: A Military Perspective.”

Dr. Bowyer, the Ben Eisenman Professor of Surgery, Director of Surgical Simulation, and Chief of the Division of Trauma and Combat Surgery of the Uniformed Services University of Health Sciences, also emphasizes the importance of simulators.

In an article called “Simulation for Trauma and Casualty Care” for Minimally Invasive Therapy & Allied Technologies, he explains that “advances in both technology and application of simulators will continue to affect trauma skills training for the foreseeable future.”

An Organizational Resource

Today, the SAMMC SIM Center is one of the busiest of 10 facilities supported by the Army’s Central Simulation Committee, and just the second such facility to earn SSH accreditation. The SIM Center works with the U.S. Army Institute of Surgical Research, which operates the Army Burn Center at SAMMC, and supports Forward Surgical Teams who train with tools such as the Burn Navigator, a medical simulator that helps teach non-burn specialists how to make medical decisions regarding patient resuscitation.

“The Simulation Center is an organizational resource,” explains Robert V. Coffman, the SIM Center’s Simulation Administrator. In addition to current research programs, the SIM Center evaluates new projects that validate simulation as a viable tool for training and education. The Center also provides support for 35 graduate medical education (GME) programs and subprograms, nine Army and Air Force enlisted training programs, an emergency medical technician refresher course, and annual skills validation training.

Objectives, Outcomes, and Improvements

There are also 17 nursing and credentialing courses such as advanced cardiac life support and pediatric advanced life support. “We support pre- and post-deployment training for any group, unit, or individual that seeks to sharpen their skills,” says Coffman, noting that many program objectives are set by outside credentialing organizations. To integrate simulation with new or existing
curricula, the SIM Center’s simulation administrator and medical director first evaluate participants’ needs.

“Once we determine if simulation can indeed assist with the desired outcome, we work with the program to create measurable objectives and task-oriented checklists to evaluate the training,” notes Coffman. Modifiable critical-thinking rubrics help. Student performance is tracked at the organizational level and reviewed by the GME program director. Remediation occurs when necessary, and a scenario’s complexity can be modified to meet the needs of learners.

Instructors who use the SIM Center to enhance training are selected by their program director and must meet faculty criteria from the San Antonio Uniformed Services Health Education Consortium. Instructors for the credentialing course are monitored by the Cardiopulmonary Resuscitation Office and required by both the American Heart Association and Military Training Network to maintain their teaching credentials.

Before instructors can teach in the Simulation Center, however, they must take a “Not Just for Dummies” course, which is offered monthly. This four-hour overview describes the SIM Center’s medical simulators and outlines best practices for teaching with them. “The emphasis,” Coffman says, “is to let the simulator be your tool—not your table.” In other words, instructors need to leverage the simulator’s physiology. For instructors who are “comfortable and familiar” with prompt-based teaching methods then, “using simulation requires a paradigm shift,” Coffman explains.

Technology Changes the Training Paradigm

When the SSH accredited the Simulation Center for instruction and research, Maria Gallegos of BAMC Public Affairs cited three SIM Center studies: 1) external validation of a virtual reality transurethral resection of the prostate (TURP) simulator; 2) assessment of users to control simulated junctional hemorrhage with the combat-ready clamp; and 3) trauma resuscitation evaluation times and correlating human-patient simulation-training differences. Each SIM Center study examined one or more medical simulation
technologies, and some studies suggest possibilities for follow-on research.

For the first study, an external validation of an established virtual reality (VR) technology, the selected simulator was from Medical Education Technologies, Inc. of Sarasota, FL. One of the first of its kind in the U.S., this VR TURP simulator measures performance by time, blood loss, and excess tissue loss. “The outcomes were favorable from a simulation perspective,” Coffman explains, “but more studies would have to be conducted.”

Today, products for potential follow-on research include robotic models such as the Melerit PelvicVision. Made by Melerit Medical of Linköping, Sweden, PelvicVision provides a full procedure VR real-time simulation model. In an abstract available from the U.S. National Library of Medicine National Institutes of Health, researchers concluded that “the simulator could be used in the early training of urology residents without risk of negative outcome.” PelvicVision’s features include a modified resectoscope connected to a robotic arm with haptic feedback, foot pedals, and a standard desktop computer.

As part of its research, the SAMMC Simulation Center also assessed the use of the combat-ready clamp (CRC) to control simulated junctional hemorrhaging in a high thigh wound. Because of its location, such an injury cannot be treated with a typical tourniquet. As Coffman explains, the soldier with the thigh wound in the movie Blackhawk Down “could have potentially been saved using the CRC.” To replicate bleeding, the SIM Center used a medium-fidelity manikin with the physiological capabilities of a pressurized circulatory system.

The CRC features a vise-like compression disk and base plate that provides bidirectional pressure to stop collateral flow and hemorrhaging. Durable, collapsible, and lightweight, this medical device can be assembled and applied in less than a minute. According to the distributor’s website, the CRC “is the first CoTCCC-recommended device” when an extremity wound is not amenable to a tourniquet, a reference to Committee on Tactical Combat Casualty Care (CoTCCC) treatment guidelines.

To correlate trauma resuscitation evaluation times with human patient simulation differences, the SAMMC Simulation Center modified the Laerdal SimMan 3G. Made by Laerdal Medical of Wappingers Falls, N.Y., the SimMan 3G is a wireless simulator with an instructor tablet and patient monitoring. After configuring the manikin to replicate the typical traumas seen in the ER, the SAMMC SIM Center used the software and an evaluator to time-stamp actions and treatments.

Additional Task Trainers

Coffman notes that additional task trainers are used for more invasive replication. Technologies include the TraumaMan System from Simulab Corporation of Seattle, WA. An anatomical surgical mannequin, this simulator features realistic bleeding tissues and four surgical zones. At the SIM Center, the insertion of chest tubes and the acquisition of emergency airway access were demonstrated. Other applications for the TraumaMan System include needle decompression and IV cutdown.

TechLine Technologies of Willow Grove, PA, also provides state-of-the-art medical simulators, including the Tactical Operation Medical
Manikin (TOMManikin). Developed in collaboration with Innovative Tactical Training Solutions (ITTS), TOMManikin is what David Parry, Vice President at Techline, calls a “breathing, bleeding, talking manikin with a pulse.” The Philadelphia-area company also offers wearable wound simulators that do not require make-up or adhesives and that allow medical trainees to practice their hemorrhage control skills beyond bandaging.

With the TOMManikin, multiple appendages present a variety of wounds, including gunshot, blast, and burn injuries. Trainees can practice point-of-injury care in multiple combat scenarios, such as machine gun, IED, and helicopter attacks. These simulated battlefield conditions “drive your scenario with tactical combat casualty care,” Parry explains. He says that the TOMManikin is equipped with an MP3 player for patient voice recordings, which lets trainers add tactical details such as information about the direction in which shots were fired and teaches trainees how to interact with and remove injured personnel.

According to Parry, the TOMManikin is also extremely rugged. These simulators have been subjected to and survived the crush of concrete and vehicles, and have also been dropped from airplanes. By the end of the year, TechLine Technologies expects to release what Parry calls a “water version” of the TOMManikin for marine rescues such as “man overboard drills.”

**Expanded Education, Google Glass, and Hybrid Simulation**

Medical simulation is evolving rapidly, and facilities like the SAMMC SIM Center regularly learn of new products with exciting possibilities. At the same time, medical professionals also devise new applications for existing products. “Emerging technologies are great,” Coffman says, “but thinking outside the box using current simulators has so many benefits.” As an example, he cites the work of Dr. Bonnie Haupt at Veterans Affairs Connecticut Healthcare Systems.

In a practice dissertation for the Doctorate in Nursing Program at Sacred Heart University, Dr. Haupt provided pre-operative education to veterans who were scheduled to receive coronary artery bypass graft surgeries. Coffman says that Dr. Haupt’s research found that “veterans who participated in simulation education revealed a significant increase in knowledge and satisfaction over traditional teaching methods,” including a reduction in patient anxiety.

For Coffman, Dr. Haupt’s study suggests that simulation education is a “valuable tool” not just for training medical professionals, but also for educating patients and their families. “I would love to get SAMMC in for a follow-on study,” he adds. Just as apps for handheld mobile devices help medical trainees to test their knowledge and build critical thinking skills, patients and their families might better understand why specific treatment decisions are made.

In addition to this research, Coffman is also optimistic about Google Glass, which he says “will be a huge leg up for training evaluation.” By enabling an evaluator to see what a student is focusing upon, Google Glass can help trainers to provide individualized feedback with regard to technologies such as CT, X-Ray, or ultrasound. In this way, evaluators can share a trainee’s point-of-view and “really get into their mind and see their rationale for patient care,” Coffman says.

Technologies such as the HC1 headset computer project from Motorola Solutions may also hold possibilities. Powered by voice command and equipped for remote video chats and the display of complex schematics, the HC1 uses Microsoft Windows and can connect via WiFi, Bluetooth, or mobile hot spot. Designed for harsh environments and remote locations, this hands-free mobile computer could also let trainers see what trainees see.

Hybrid simulation is also expected to play a major role in medical training. According to Coffman, examples include the prompt birthing simulator, which allows real-time patient interaction with a trained actor or standardized patient (SP) while a simulator recreates the complication of a simulated birth. The cut suit, another hybrid simulation example, involves an SP who acts as if he or she were involved in a traumatic accident. The suit replaces actual injuries that must be treated while a patient is conscious. “This adds the realism that static or even hi-fi manikins lack,” Coffman says.

**Looking Ahead**

The future of simulation-based medical education is promising, and Coffman is excited to see its evolution and advocate for its use. He notes that tracking the validity of simulation training can be difficult, but that the benefits outweigh the challenges. “I bet that if you had the opportunity to ask a care provider immediately following a critical incident if simulation training helped at all,” Coffman says, “they would respond with a resounding ‘yes.’”
During the thirteen years of U.S. operations in Iraq and Afghanistan, servicemembers were exposed to psychological and physical strains common to warfare and yet unique to their wars. Survival rates from combat wounds are currently at their highest levels in history, which is a remarkable scientific and organizational feat; at the same time, concerns over traumatic brain injury and a lack of psychological healthcare as well as scandals at DoD health facilities dominate headlines related to military medicine. Clearly, there is more work to be done.

The DoD's Military Operational Medicine Research Program (MOMRP) is one joint effort to improve the lives of warfighters in theater and back home. With a mission “to develop effective countermeasures against stressors and to maximize health, performance, and fitness,” MOMRP works to identify issues that affect soldiers now and in the future, resulting in research efforts that will be relevant long after the last American forces have left Afghanistan.

The Process
According to Army Lieutenant Colonel Dennis McGurk, deputy director of MOMRP, the program funds investigators who delve into problem areas, while he and his staff manage and coordinate the process. This may sound simple, but it requires balancing both the complex factors at work in military medicine and the great demand for research in numerous areas. To do this, MOMRP received between $120-140 million in FY 14 from the Army's Assistant Secretary for Acquisition, Logistics, and Technology and from the Office of the Secretary of Defense for Health Affairs.

MOMRP is divided into four research focus areas: Injury Prevention and Reduction, Psychological Health and Resilience, Physiological Health, and Environmental Health and Protection. (See sidebar on page 22)

Guidance on what research to pursue comes from multiple sources. “Everything starts from the White House and the National Defense Authorization Act,” McGurk said. “The priorities from the services and DoD also come down, and [we] react to those.” Congress can direct the program to fund research in specific topics. MOMRP also seeks to find research topics using a bottom-up approach. “We meet regularly with the key people who are out with the troops to find out ‘What are the gaps that research could identify and address?’” McGurk said. This can include speaking with doctors and medics recently back from deployment. The Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, for example, helps the program by speaking with medical personnel about what treatment gaps research can improve upon.

The above processes provide MOMRP with some research focus, but the specifics of a project are not always known beforehand: MOMRP receives proposals for research projects from researchers through broad agency announcements. These proposals are scientifically reviewed, then programmatically reviewed, and finally, if budget allows, funded.

Another way the program finds researchers is Requests for Proposals (RFPs). These are often specific in their description of the problem and the assessment methodology that should be used. Research is performed by academicians, Army and DoD laboratories, and others. McGurk was very positive about the range and balance of the researchers MOMRP funds—he
considers their data gathering and problem solving abilities to be remarkably strong.

**Spreading the Word**

McGurk spelled out MOMRP’s mission very clearly: “What we’re trying to do is make sure that [our research influences] decisions made by policymakers, clinical practice guidelines, and training.” He explained to C&CC that senior leaders in the DoD—MOMRP is a joint effort—want evidence-based research to affect positive change. Overall, the program’s research findings are accepted due in part to the passion that flag officers and top civilians have about improving soldier care.

Researchers publish their findings to inform the public and DoD community of their results. These findings can be used to make recommendations for policy changes, such as new training that could help prevent injuries or modifications to clinical practice guidelines. MOMRP teams with organizations such as the Defense Suicide Prevention Office and Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury to help disseminate their findings.

**In Theater**

Not all research programs are geared towards the future—sometimes their effect can be immediate. For example, in 2013, a mental health advisory team (MHAT) deployed to Afghanistan to perform a mental health assessment of the entire theater. The MHAT spoke with and tested soldiers and Marines on the ground. “They run analyses while in theater and give findings to the leaders in theater on what care is provided or what trainings might happen,” McGurk said. “This is the first time these sort of assessments have been conducted during the war with the intent to make changes in real time to take care of servicemembers.”

**Current Efforts**

Following Army Surgeon General LTG Patricia Horoho’s guidance to move military medicine to a “system of health” from a healthcare system, MOMRP is already deep into managing research on adequate sleep, proper exercise, and nutrition, among other subjects. With numerous projects in different domains, McGurk unpacked a few ongoing programs as examples of the projects larger efforts.

MOMRP’s Deputy Director discussed a Walter Reed Army Institute of Research sleep group funded by MOMRP that studies the effects of partial or full sleep deprivation. “A lot of operations take place at night, and folks by nature become shift workers when they are deployed,” he said. “So they’re doing research to look at the effects of sleep deprivation and countermeasures that would help improve performance when people are sleep deprived.” Some of the results have indicated that caffeine gum and sleep banking—extra sleep before a long night of operations—can mitigate the negative effects of sleep deprivation.
Research Areas

MOMRP is divided into four research focus areas, and each area concentrates on different struggles, with the overall goal of providing a thorough analysis of warfighter health needs. The program’s stated mission is to protect “the soldier from head to toe, inside and out, at home, and on the battlefield. Science to soldier is our focus.”

Injury prevention and reduction research develops models to predict the degree of injury from known threats, develops design guidelines and performance specifications for protective equipment, and identifies countermeasures to prevent or mitigate injury to the warrior. Key threats addressed by this research area include blast overpressure, blunt and penetrating trauma, musculoskeletal and training injuries, and neurosensory injury.

Psychological health and resilience research is focused on prevention, treatment, and recovery of soldiers—and families—behavioral health, which are critical to force health and readiness. Research is necessary to guide policy and ensure optimal delivery of behavioral health training and services across the continuum of care and deployment cycle. Threats addressed by this research component include post-traumatic stress disorder (PTSD), suicide, family separation, and family violence.

Physiological health research focuses on developing medical standards, predictive models, and countermeasures to prevent or mitigate the effects of physiological stressors on the performance and fitness of warriors. These stressors include inappropriate nutrition, poor physical fitness, sleep loss, sleep deprivation, fatigue, and burnout. The focus is on threats and stressors in both the garrison and operational environments.

Environmental health and protection research develops medical standards, predictive models, and countermeasures to prevent or mitigate the effects of extreme environments and toxic material exposure in the military. Threats addressed by this program include extremes of heat/cold and hydration, high altitude, and toxic industrial chemicals and materials.

Another effort relevant to all the services regardless of peace or war conditions is further developing return to duty standards. Broad guidelines exist already, but research managed by MOMRP hopes to refine these, improving efficiency and safety. New research will tailor return to duty to specific military occupational specialties. “If you’re an artilleryman where you have to lift a heavy projectile, that might be a different return to duty standard than someone who works as a medic or an artilleryman where you have to lift a heavy projectile, that might be a different return to duty standard than someone who works as a medic,” McGurk said. This effort includes the development of both physical and psychological standards.

Psychological metrics, however, are less well defined than physiological standards. “It has been recognized for a long time that when a leg is broken, it has to heal to a certain extent before a soldier can return to duty and function in their job,” McGurk said. “I think there’s been a good recognition recently about the psychological difficulties that servicemembers came into the military with or developed during deployments. There is research to determine as well as you can objective standards to see when they are able to return to duty.”

As the military tries to reduce suicide rates, suicide prevention is another area of critical importance to MOMRP, which manages the Military Suicide Research Consortium—whose goal is “to quickly identify those at risk for suicide and provide effective evidence-based prevention and treatment strategies.” McGurk claimed the effort has yielded some promising interventions that have the potential to reduce the suicide rate amongst veterans and serving soldiers.

Another such project is Army STARRS (Study To Assess Risk and Resilience in Servicemembers), which is developing algorithms that can help identify those at high-risk of suicide or other conditions. Virtual reality therapy research is also being funded.

On the physiological side, injury prevention is an important portfolio for MOMRP. Musculoskeletal injuries are common in the course of military service, regardless of whether someone has been in combat or not. “In training is where a lot of folks get injured, so this won’t stop when the wars are over,” McGurk said. “Prevention is an important thing in training, in garrison, and when deployed.”

MOMRP funds a U.S. Army Institute for Environmental Medicine project looking at the effects of loads on soldier performance and soldier injuries.

Pressing Ahead: Future Research

Despite the end of major overseas combat operations, in the next few years MOMRP will be supporting a variety of new research. For example, a project for determining specific criteria for military occupational specialties will develop and test evidence-based standards to find the best people for certain jobs. “This would be gender neutral,” McGurk told C&CC. “As females enter combat occupations, the standard would be ‘Can you do the job?’”

Concerning environmental health, the harsh environments of Iraq and Afghanistan are a reminder of how difficult it is to fight at and maintain peak performance. MOMRP is addressing this problem, backing research into monitors that sense the conditions and algorithms that may help predict when someone has acute mountain syndrome or potentially let a leader know when and how much hydration is required in certain conditions.

McGurk, who holds a PhD in Experimental Psychology, was very bullish on two ongoing efforts to improve psychological care: compressed Post-traumatic Stress Disorder (PTSD) therapy and biomarkers. PTSD therapy normally comprises approximately 15 weeks for a full treatment; MOMRP is funding a study that is assessing whether 15 weeks of treatment can be accomplished in approximately two weeks. This more intensive version should allow servicemembers to receive treatment with fewer distractions.

Biomarkers, defined by the National Institutes of Health as “key molecular or cellular events that link a specific environmental exposure to a health outcome,” can result from studies in genomics, proteomics, or hematology. “The hope would be—not in the too distant future—to have a way to look at blood or neuroimaging to be able to determine whether someone has a disorder,” McGurk said. If biomarkers could be developed to diagnose PTSD, for example, then “we could determine if we gave them an evidence-based treatment did it work for them? Or are there some populations it would work better for? Then you can have targeted treatment or individualized medicine.”

Lead art: Major Brad Warr, Army Research Institute of Environmental Medicine researching physician assistant, uses a digital gauge to measure how much weight a soldier lifts when recovering the spade trail arm and blade on an M777 howitzer on 5 June 2013. Warr was part of the Gender-Neutral Physical Standards Study. (Staff Sgt. Timothy Hughes)
Small Joints Wrap Introduced

Arctic Ease, leader in cold and compression therapy and maker of the patent-pending Arctic Ease Cold Therapy Wrap, has announced the launch of their new Small Joints Wrap, which is specially designed to treat aches and pains in ankles, elbows, and wrists.

The Arctic Ease Wrap is a reusable cooling wrap that provides hours of relief without the need for refrigeration. Previously the wrap was available in one large size, 4 inches by 60 inches. The new Small Joints Wrap is 2.75 inches by 36 inches. The Small Joints Wrap retails for only $9.99, providing the marketplace with the first under $10 offering from Arctic Ease.

The product combines the benefits of cold and compression therapy with the ability for the user to remain active and mobile. In a clinical study, Arctic Ease proved as effective as the commonly used ice treatment RICE (rest, ice, compression, and elevation) in reducing pain, swelling, and improving mobility. And because it was more comfortable and convenient, patients kept it on longer. Arctic Ease is easy to use—simply unroll, wrap, and start healing on-the-go. Arctic Ease wraps are biodegradable, eco-friendly, anti-microbial, and odor free, making this product a must have for Ironman athletes as well as fitness novices and every day active adults.

More info: arcticeasewrap.com

Reconstructive Transplantation Research

The FY 2014 Defense Appropriations Act provides $15 million to the Department of Defense Reconstructive Transplantation Research Program (RTR) to support the science and execution of complex limb and face transplants. This program is administered by the U.S. Army Medical Research and Materiel Command, the Clinical and Rehabilitative Medicine Research Program (CRMRP), through the Office of Congressionally Directed Medical Research Programs (CDMRP) and the Tissue Injury and Regenerative Medicine Project Management Office.

An FY14 DMRDP-CRMRP-RTR Program Announcement and General Application Instructions for the following award mechanism are anticipated to be posted on the Grants.gov website in July 2014. Pre-application and application deadlines will be available when the Program Announcement is released. This pre-announcement should not be construed as an obligation by the government.

The CRMRP challenges the scientific community to design innovative research that will foster new directions for and address neglected issues in the field of reconstructive transplantation research (RTR), specifically vascular composite allotransplantation (VCA)-focused research. VCA refers to the transplantation of multiple tissues such as muscle, bone, nerve, and skin, as a functional unit (e.g., a hand, or face) from a deceased donor to a recipient with a severe injury. Applications from investigators within the military services and applications involving multidisciplinary collaborations among academia, industry, the services, the Department of Veterans Affairs, and other Federal Government agencies are highly encouraged. Though the RTR Award mechanism supports groundbreaking research, all projects must demonstrate solid scientific rationale with military-relevant utility.

More info: health.mil

VA to Modernize Electronic Health Records

ASM Research has been awarded a three-year, $162 million contract from the Department of Veterans Affairs (VA) to support the Veterans Health Information Systems and Technology Architecture (VistA) Clinical Application and Enterprise Core Services. VistA is the VA’s award-winning Health Information Technology system, providing an integrated inpatient and outpatient electronic health record to optimize quality medical care for veterans and their families.

The VistA Core project work is designed to strengthen and expand veteran healthcare services. Work under the contract enables greater interoperability of systems and healthcare records and will meet the highest security standards.

ASM also will update VistA’s Computerized Patient Record System (CPRS), providing a modern, web-based approach to patient records. CPRS is a critical component of VistA that provides clinicians, managers, support staff, and researchers an integrated patient record management system which provides a single interface for physicians to manage patient care and records.

Work under the contract will help improve data sharing, including care transitions and implementation of standards of care. ASM will deliver technical architecture, clinical analysis, software development, engineering management, and training to support VistA modernization.

More info: newsroom.accenture.com
New Biological Technologies
Office Starts Up

DARPA has created a new division, the Biological Technologies Office (BTO), to explore the increasingly dynamic intersection of biology and the physical sciences. Its goals are to harness the power of biological systems by applying the rigorous tools of engineering and related disciplines, and to design next-generation technologies that are inspired by insights gained from the life sciences. BTO’s programs will operate across a wide range of spatial and temporal scales—from individual cells to humans and other organisms and the communities in which they operate, and from the time it takes for a nerve to fire to the time it may take a new virus to spread around the world one sneeze at a time. All told, BTO will explore the intricate and highly adapted mechanisms of natural processes and demonstrate how they can be applied to the mission of national defense.

The initial BTO portfolio includes programs transferred from Defense Sciences (DSO) and Microsystems Technology (MTO) Offices, but will also include new opportunities, beginning with the recently announced Hand Proprioception & Touch Interfaces (HAPTIX) program that expands on the work of DARPA’s Revolutionizing Prosthetics and Reliable Neural-Interface Technology programs. In keeping with DARPA tradition, future programs will be created from ideas brought to the agency by program managers and through conversations with the research community.

BTO’s three research focus areas:

Restoring Active Memory Program

DARPA has selected two universities to initially lead the agency’s Restoring Active Memory (RAM) program, which aims to develop and test wireless, implantable “neuroprosthetics” that can help servicemembers, veterans, and others overcome memory deficits incurred as a result of traumatic brain injury (TBI) or disease.

The University of California, Los Angeles (UCLA), and the University of Pennsylvania (Penn) will each head a multidisciplinary team to develop and test electronic interfaces that can sense memory deficits caused by injury and attempt to restore normal function. Under the terms of separate cooperative agreements with DARPA, UCLA will receive up to $15 million and Penn will receive up to $22.5 million over four years, with full funding contingent on the performer teams successfully meeting a series of technical milestones. DARPA also has a cooperative agreement worth up to $2.5 million in place with Lawrence Livermore National Laboratory to develop an implantable neural device for the UCLA-led effort.

To start, DARPA will support the development of multi-scale computational models with high spatial and temporal resolution that describe how neurons code declarative memories—those well-defined parcels of knowledge that can be consciously recalled and described in words, such as events, times, and places. Researchers will also explore new methods for analysis and decoding of neural signals to understand how targeted stimulation might be applied to help the brain reestablish
an ability to encode new memories following brain injury. “Encoding” refers to the process by which newly learned information is attended to and processed by the brain when first encountered.

Building on this foundational work, researchers will attempt to integrate the computational models developed under RAM into new, implantable, closed-loop systems able to deliver targeted neural stimulation that may ultimately help restore memory function. These studies will involve volunteers living with deficits in the encoding and/or retrieval of declarative memories and/or volunteers undergoing neurosurgery for other neurological conditions.

In addition to human clinical efforts, RAM will support animal studies to advance the state-of-the-art of quantitative models that account for the encoding and retrieval of complex memories and memory attributes, including their hierarchical associations with one another. This work will also seek to identify any characteristic neural and behavioral correlates of memories facilitated by therapeutic devices.

Networks Of The Brain

Work on DARPA’s Systems-Based Neurotechnology for Emerging Therapies (SUBNETS) program is set to begin with teams led by UC San Francisco (UCSF), and Massachusetts General Hospital (MGH). The SUBNETS program seeks to reduce the severity of neuropsychological illness in service members and veterans by developing closed-loop therapies that incorporate recording and analysis of brain activity with near-real-time neural stimulation. The program, which will use next-generation devices inspired by current Deep Brain Stimulation (DBS) technology, was launched in support of President Obama’s brain initiative.

SUBNETS is premised on the understanding that brain function—and dysfunction, in the case of neuropsychological illness—plays out across distributed neural systems, as opposed to being strictly relegated to distinct anatomical regions of the brain. The program also aims to take advantage of neural plasticity, a feature of the brain by which the organ’s anatomy and physiology can alter over time to support normal brain function. Plasticity runs counter to previously held ideas that the adult brain is a “finished” entity that can be statically mapped. Because of plasticity, researchers are optimistic that the brain can be trained or treated to restore normal functionality following injury or the onset of neuropsychological illness.

The UCSF team’s approach is to develop a device that focuses on regions of the brain involved in an individual’s psychiatric or neurologic disease. The device will use direct recording, stimulation, and therapeutic approaches to encourage neural plasticity, with the aim of rehabilitating the circuits that appear to be driving pathology and free an individual from psychiatric or neurologic symptoms. If successful, the approach would allow for the eventual removal of the device.

More info: darpa.mil
The Pararescue Jumpers, or PJs, are some of the Air Force’s best trained and most daring personnel. Charged with full-spectrum personnel recovery missions, PJs can go behind enemy lines and into the most austere places to rescue, care for, and extract servicemembers. These battlefield airmen are trained in small unit tactics, various types of airborne operations, and waterborne rescue, among other skills. According to the Air Force, since 11 September 2001, PJs have executed over 12,000 lifesaving combat rescue missions. They are certainly living up to their motto “These Things We Do, That Others May Live.”

To give readers an idea of the priorities and training regimen of the PJs, C&CC Assistant Editor George Jagels spoke with Special Tactics Pararescueman Senior Master Sergeant Eric Barry of the 24th Special Operations Wing, who is currently stationed at Hurlburt Air Force Base, FL.

C&CC: Please describe some of the mission sets the PJs undertook in Operations Iraqi Freedom and Enduring Freedom and some of the lessons learned from those conflicts.

Barry: One mission set that required careful consideration of lessons learned was vehicle extrication. In the early days of Operation Enduring Freedom, there were conditions that demanded a great deal of adaptability. [Vehicles had a lack of armor and different military specs at the time.] and the sheer variety of vehicles being used by U.S. and Coalition forces, combined with the number of IED blasts, created challenges. We found, in some cases, our equipment was insufficient to deal with extrication in a timely manner. Our cutting tools and heavy lift equipment was cumbersome and needed to be downsized and made lighter. We also discovered we were ill equipped for dealing with vehicle fires.

On the training side, we familiarized ourselves with all vehicles, both U.S. and foreign, used in the area of operations [so] we would be better prepared. These adaptations had immediate results and continue to save lives today.

C&CC: Generally speaking, what physical tasks does a PJ have to be prepared to undertake? In what environments must he be able to operate?

Barry: PJs must be prepared to operate in all environments; our core functions of personnel and equipment recovery put us in many challenging environments [such as] high mountain peaks, urban areas, and open ocean. Being in top physical condition not only increases our odds of mission success, but it ensures team safety and resiliency. Recovering and caring for the wounded requires that we thrive in these challenging environments, not just survive them. Physical conditioning is one of the factors that allows us to thrive.
C&CC: As trauma specialists, please speak to some of the core training principles that guide the medical side of being a PJ.

Barry: Dealing with trauma is like detective work. You read the clues, which lead you to a diagnosis, and from there you prioritize and make the appropriate interventions. At a very basic level, the key is to understand and anticipate what will kill your patient first, and it’s not always their injuries. Many times it’s the environment we’re working in, and the best thing you can do for your patient is return fire, take cover, move, or all three.

C&CC: From a first responders perspective, please speak to some of the primary PJ training techniques for addressing on-site casualty stabilization and medevac prep. What do the PJs have to do differently than other medics?

Barry: The principles of patient stabilization and preparing them for transport are pretty standard among all medics. The difference, however, is mainly driven by the “on-site” factor. Working in conditions outside the norm, for most first responders, requires specialized equipment, training, and often a different approach all together. For example, when working in the confined spaces of a collapsed building, aside from stabilizing the structure itself you could be dealing with issues such as live electrical wires, hazardous volatile materials, and poor air quality which affect the patient and rescuer alike. Getting to these patients safely, stabilizing them, and getting them back out requires a specific mind-set, gear, and training.

C&CC: Please describe some scenarios where the PJs might be or have been deployed and how their specialized training suited them to the task.

Barry: One scenario is the dive recovery mission. PJs receive specialized training in black water dive recovery—zero visibility diving. There were several cases where vehicles and passengers ended up in the waterways adjacent to roads, usually from IED blasts but also due to eroded river banks, collapsed bridges, or overloaded ferries. So our task then became to locate and recover the casualties. The hope is they’re all still in the vehicle, but that isn’t always the case and we have to search for them.

Recognizing hazards to the divers such as pollution, understanding how objects interact with moving water, being able to identify likely areas to search, and actually conducting the search dive are all skills that make PJs suited for this task.
## Calendar of Events

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<td>Sept 9-10</td>
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