COMBAT & CASUALTY CARE

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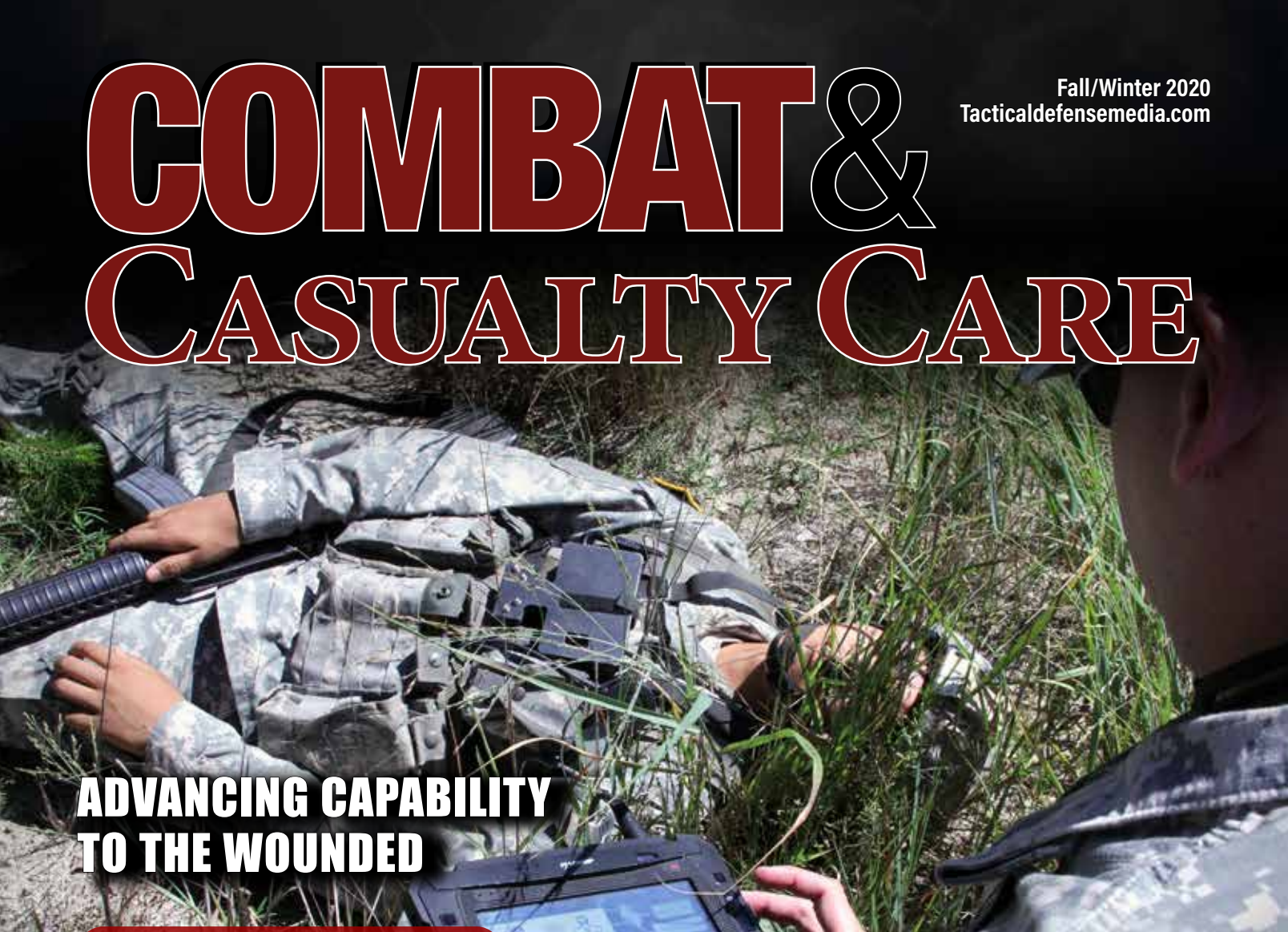

ADVANCING CAPABILITY TO THE WOUNDED

COMMANDER'S CORNER

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COL Mark Stackle
Commander
U.S. Army Institute of Surgical Research

Col. Peter Learn
Acting Director for Surgery
Walter Reed National Military Medical Center
Bethesda, MD

COL Sean Hipp
Director
Virtual Medical Center
Brooke Army Medical Center
Ft. Sam Houston

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SURGICAL TELE-MENTORING: A BRIDGE TO FUTURE MEDICINE

Naval Readiness and Training Command San Diego's new Virtual Medical Operations Center (VMOC) is helping to advance telemedicine in surgery.

By CAPT Gordon Wisbach

Features

COMMANDER'S CORNER

FUTURE MEDICAL FORCE MODERNIZATION

COL Mark Stackle
Commander
U.S. Army Institute of Surgical Research
Joint Base San Antonio-Ft. Sam Houston, TX

LEADERSHIP PERSPECTIVE

ADVANCING SURGICAL SERVICES READINESS

Col. Peter Learn
Acting Director for Surgery
Walter Reed National Military Medical Center
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VIRTUAL MEDICINE FOCUS

ADVANCING OPERATIONAL VIRTUAL HEALTH

COL Sean Hipp
Director
Virtual Medical Center
Brooke Army Medical Center
Ft. Sam Houston, TX

Cover: The U.S. Army uses hand-held technologies and tactical 4G networks to explore whether real-time, point-of-treatment care is possible. (Edric Thompson, CCDC)

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MITIGATING VIRAL RESURGENCE EFFECT
The U.S. Defense Department and Defense Logistics Agency (DLA) Troop Support recently coordinated to see that troops and families are PPE re-supplied for the second wave of COVID-19.
By Beth Reece

THE POSITIVE OF PANDEMIC-DRIVEN CONSEQUENCE
U.S. Army Medical Research Development Command's Telemedicine and Advanced Technology Research Center (TATRC) is countering increased combat injury transport time and decreased "Golden Hour" survival rates with advances in field telemedicine.
By COL Justin Stewart

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INSIGHTS

The Fall/Winter 2020 issue of *Combat & Casualty Care* looks into the evolving world of virtual and simulation-based operational medicine, and its application from telemedicine to modern robotic surgery via tele-mentoring, much of which has been fueled by the realities of a pandemic still gripping the nation.

A relative newcomer to the realm of robotic surgical training, tele-mentoring is a convergence of education and application. *C&CC* had the good fortune to speak with CAPT Gordon Wisbach, Director, Robotic Surgery Program & Surgical Director, Bioskills & Simulation Training Center, Naval Readiness and Training Command San Diego, regarding the implementation of a new Virtual Medical Operations Center (VMOC) and ways surgical expertise and care are being improved through the use of live video-based instruction. With distance all too often a major hurdle to critical casualty treatment, information transfer between tele-mentor and hands-on surgeon, even in the remotest of environments, is quickly becoming a difference-maker for the critically-wounded, where immediate surgical intervention is the only hope for survival.

From tele-mentoring to telemedicine, what works well in live procedure application can also be applied effectively in live doctor-patient interaction. The U.S. Army Telemedicine and Advanced Technology Research Center (TATRC), a unit of Army Medical Research and Development Command (USAMRDC), Ft. Detrick, MD, is helping guide the evolution of telehealth toward greater autonomy of function with patients in truly austere locations as likely to receive expert health-related advice as those experiencing in-person care. COL Justin Stewart, TATRC's Deputy Director, tells *C&CC* about the facilitation of synchronous (real-time video) and asynchronous (non-real time secure messaging) connectivity by way of the National Emergency Tele-Critical Care Network (NETCC) that is helping bring healthcare consultation to people in places thought impossible not long ago.

At the forefront of Army surgical research efforts, the U.S. Army Institute of Surgical Research (USAISR), led by its new commander COL Mark Stackle, is working to "optimize combat casualty care" in both the current combat environment and in future conflicts, helping achieve the lowest casualty mortality rates in modern warfare over the past twenty years. From the Combat Application Tourniquet (CAT), advances in damage control surgery and resuscitation, the introduction of the Burn Navigator decision support tool, and novel use of blood products at the point of injury, an evolution in medical technology has revolutionized the application of combat field care. In other perspectives from the Dept. of Surgery at Walter Reed National Military Medical Center, Bethesda, MD and Brooke Army Medical Center, Ft. Sam Houston, TX, we see how advances in telehealth through such efforts as the Surgical Critical Care Initiative and training readiness by way of a state-of-the-art Virtual Medical Center (VMC) are defining the future of field medicine delivery.

As always, your comments are welcome. Thanks for the readership and stay safe!

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SURGICAL TELE-MENTORING: A BRIDGE TO FUTURE MEDICINE

The new Virtual Medical Operations Center (VMOC), Naval Readiness and Training Command San Diego, will serve as a "hub" of the Indo Pacific Region supporting a relatively new capability called surgical tele-mentoring. This capability strategically aligns with Defense Health Agency (DHA) Medical Affairs lines of effort and leverages advances in technology to expand surgical expertise and improve surgical patient care within the DHA.

By CAPT Gordon Wisbach, MC, USN, Director, Robotic Surgery Program & Surgical Director, Bioskills & Simulation Training Center, Naval Readiness and Training Command San Diego

Ensign John Cook, a Uniformed Services University of the Health Sciences (USUHS) intern assigned to Naval Medical Center San Diego (NMCSD), trains on a fundamentals of laparoscopic surgery simulation unit task trainer in the hospital's Bioskills Laboratory and Simulation Center. (Mass Communication Specialist 3rd Class Jake Greenberg)

Scheduled for initial stand up in January 2021 with complete installation of equipment in February, Naval Readiness and Training Command San Diego's new Virtual Medical Operations Center, or VMOC, will improve the skills and efficiency of care providers and improve the quality and safety of military care, addressing multiple challenges including: a dire shortage of military surgeons, geographical barriers, financial burdens, complications, and risky or prohibitive long-distance travel. With this information, the expert tele-mentor can apply their knowledge enhanced with the oversight of an expert plus advanced real-time procedural metrics and analysis. This effort will develop the capability to provide surgical tele-mentoring on a path towards surgical telesurgery to improve patient care from a Virtual Medical Center (VMOC) without geographic limitations during times of peace, war and pandemic outbreaks, including COVID-19.

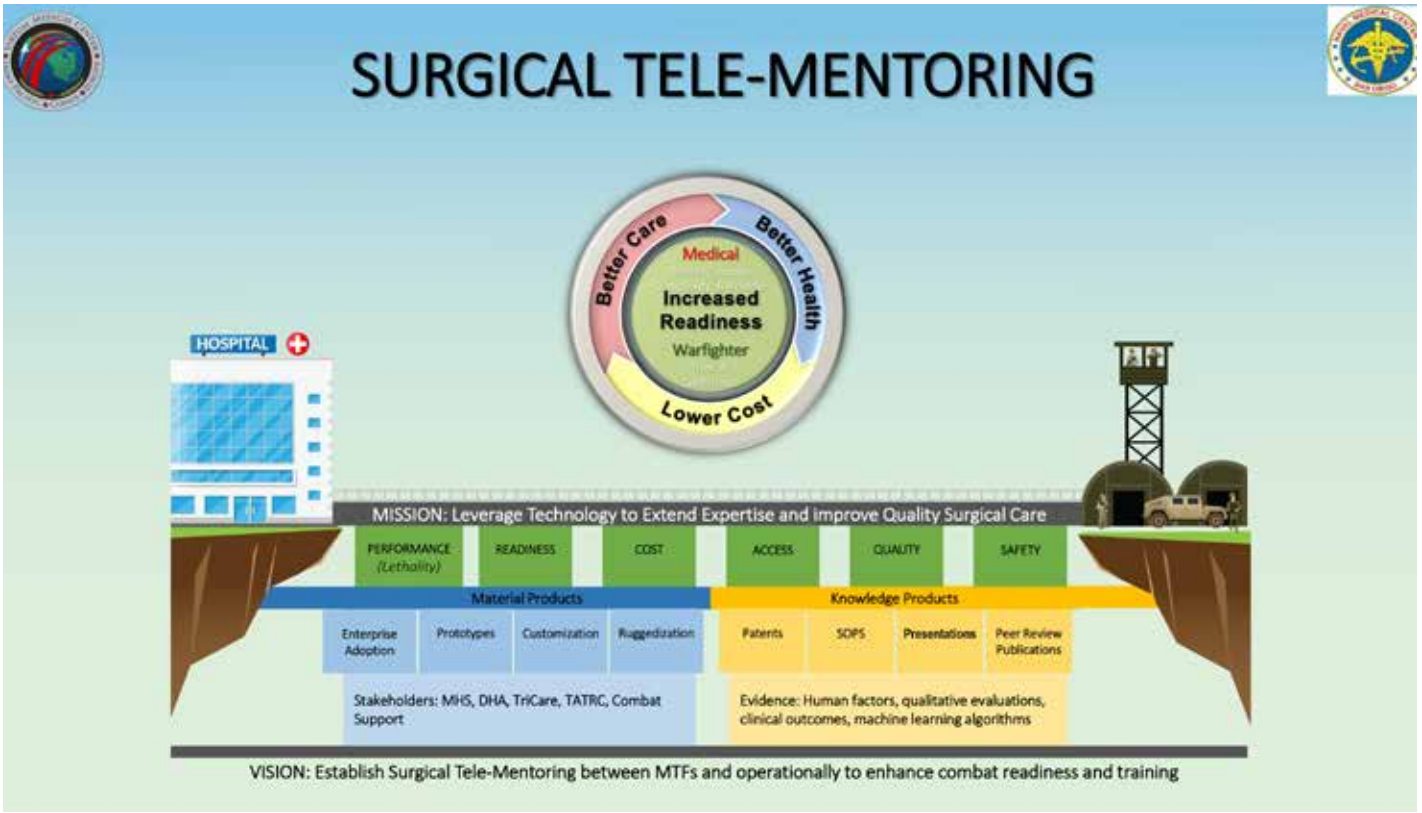
ALIGNMENT WITH IDENTIFIED GAP

This project addresses gaps identified in future military medicine in the areas of tele-medicine. This includes the mentoring of resident surgeons and leveraging experts without needing to physically travel and disrupt surgical schedules. Surgical tele-mentoring reduces costs, improves care and allows this care to be extended by the virtue of internet communication networks. The creation of the VMOC at Naval Medical Center San Diego (NMCSD) is designed to support the aim of improving readiness, advancing health outcomes and reducing health care costs. A major component of our project involves specifically improving outcomes and reducing costs in robotically assisted surgeries and training at a distance.

CAPT Gordon Wisbach

ADDRESSING THE CHALLENGE OF DISTANCE

The Military Health System (MHS) delivers a global healthcare service to members and beneficiaries. While robotic surgery has become commonly preferred technique for many invasive procedures, robotic surgical expertise remains limited. Telemedicine allows us to transcend distance and travel restrictions, enabling a smaller group of specialized physicians to extend expertise to virtually



FY21 Advanced Medical Technology Initiative (AMTI) funded Surgical Tele-mentoring project. (Graphic courtesy of the Telemedicine & Advanced Technology Research Center, U.S. Army)

any military treatment facility on the planet. This same capability also allows us to minimize the contagious spread of disease between provider and patient. In the era of the COVID-19 pandemic, this protective measure may be an equally compelling reason to replace in-person care with virtual care. Providing expertise from a remote surgeon to assist the bedside surgeon also has the potential to improve the maintenance of surgical knowledge, skills, and abilities (KSA's). The establishment of an immersive surgical tele-mentoring system testing connectivity, engineering and human factors will be addressed in this study. This effort will establish a foundation by enabling surgical robotic tele-mentorship. This multidisciplinary team is unique with an ongoing collaboration between DoD clinicians and Intuitive Surgical engineers with unbound potential. The trajectory of efforts will establish surgical tele-mentoring processes and techniques that will provide a foundation to support remote tele-surgery efforts and may eventually lead to semi- and fully autonomous surgical systems.

IMPACT ON THE MILITARY HEALTH SYSTEM

The MHS has long recognized the value and strategic importance of telehealth (TH) services in supporting medically ready force and a ready medical force. Great strides have been made in the development and implementation of telehealth through cooperation between Army, Navy, Air Force, and the Defense Health Agency. While telemedicine technology has advanced considerably over the last two decades, there has not been a significant driving pressure to force innovation related to surgical telehealth due to multiple barriers. The MHS provides an ideal setting for TH research and development due to being a world-wide health care system, lack of provider competition, ease of privileging and organization emphasis on obtaining enterprise-wide capabilities. Surgical tele-mentoring, tele-consultation, remote presence and, ultimately, tele-surgery are promising solutions to the growing challenge of maintaining work force competency and patient accessibility in the setting of rapidly evolving surgical technology. This virtual surgery protocol will leverage advances in technology in an effort to expand surgical expertise and improve surgical patient care within the Defense Health Agency. Modern rapid advancement of technology and surgery predict TH applications are poised for exponential growth that demands a coordinated effort by stakeholders working in healthcare systems not yet poised for this paradigm shift.

While this project involves tele-mentoring, it is also the foundation of future tele-surgery. We contend that tele-surgery is based on and is not possible without effective tele-mentoring. This project will allow centralized implementation of training and standard procedures in robotic surgeries. Servicemembers will benefit by having the exact same quality and standard of care without travelling to a major military medical center. Costs are saved by reduced expert surgeon travel time. Safety in robotic procedures are improved along with the oversight of expert mentoring surgeons. A mentoring surgeon educator will extend expertise to residents in training by providing a more immersive connection between the resident and mentor surgeons.

MILITARY RELEVANCE

The military will benefit from this project by enhancing its ability to deliver care to smaller and more remote hospitals, and to bring the highest level of available surgical expertise and guidance to these facilities that may be understaffed or staffed with less experienced surgeons and surgical teams. It will also benefit by allowing a more rapid, less expensive and more efficient mechanism

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to train and mentor military surgeons. Surgical tele-mentoring is a promising solution to the growing challenge of maintaining work force competency and patient accessibility in the setting of rapidly evolving surgical technology. We hypothesize that the addition of surgical tele-mentoring, tele-presence and, ultimately, telesurgery will improve the performance of surgical procedures by staff surgeons with the remote involvement by an expert surgeon. This capability will impact Graduate Health Science Education, with an emphasis on medical training, by extending the Attending/Resident teaching experience to procedures performed outside of the Attending's primary hospital assignment, and not limited by geography or other spatial and situational factors.

PLAN OF ACTION

Goal: We will develop the capability to provide surgical tele-mentoring a path towards remote telesurgery to improve patient care from a VMOC in garrison and overseas without geographic limitations during times of peace, war, and pandemic outbreaks, including COVID-19.

Methodical Launch: The foundation of this capability will be established in the Bioskills Training & Simulation Center using virtual as well as task trainers. The safety and feasibility will be determined prior to use in involving surgical teams in the clinical environment. All clinical procedures will be standard of care and all instruments/devices in the study are FDA approved. A credentialed and capable staff surgeon will always be present in the local operating room participating in the operation. Robotic Surgery Team members in the fields of General Surgery and subspecialties, Urology, and Gynecology will be enrolled in our IRB-approved protocol at NMCSD. Essential robotic surgery equipment is provided via a Cooperative Research and Development Agreement with Intuitive Surgical, Inc and substantial funding awarded by the Telemedicine and Advanced Technology Research Center.

Conclusion: Multiple characteristics of our planned concept will ensure a successful model for surgical tele-mentoring. We will establish a "hub" in the VOMC for virtual health and, specifically, surgical tele-mentoring. The robotic console provides an immersion between surgeons and team. Human factors variability will be improved with the console surgeons in a "cockpit" with a reliable standardized experience for communication and telestration. Medico-legal challenges as well as state-to-state credentialing issues are minimal. The demand for access to expertise across the global MHS enterprise will drive surgical tele-mentoring.

DISCLOSURE

This work is supported by the Telemedicine and Advanced Technology Research Center (TATRC) at the U.S. Army Medical Research and Development Command (USAMRDC). The views expressed in this article reflect the results of research, opinions, interpretations, conclusions, and recommendations of the author and do not necessarily reflect the official policy or position of the Departments of the Army and Navy, Department of Defense, nor the U.S. Government.

ENCOMPASSING PANDEMIC DEFEAT WITHIN FUTURE MEDICAL FORCE MODERNIZATION

Colonel Mark Stackle, serves currently as Commander, U.S. Army Institute of Surgical Research (USAISR), Joint Base San Antonio-Ft. Sam Houston, TX. Stackle began his Army career after graduating in 1997 from Gonzaga University where he also served as the student body president. He received his Doctor of Medicine degree in 2001 from Georgetown University School of Medicine and went on to complete his Family Medicine residency at Tripler Army Medical Center, Hawaii, where he served as Chief Resident.

After completion of his residency training, Colonel Stackle commanded the United States Army Health Clinic Babenhausen, Germany, from 2004 to 2006, and served as the Medical Director for the Army Medical Department's Armed Force Health Longitudinal Technology Application (AHLTA) Program Office in Washington, D.C., from 2006 to 2009, part of which he served with the 526th Brigade Support Battalion, 2nd Brigade Combat Team, 101st Airborne Division, during Operation Iraqi Freedom. In 2011, Colonel Stackle completed the Madigan Faculty Development Fellowship during which he earned his Masters in Business Administration from Pacific Lutheran University. After completion of his fellowship, he served as a faculty physician with the Eisenhower Army Medical Center Family Medicine Residency Program at Fort Gordon, Georgia, before serving as Family Medicine Residency Program Director at Womack Army Medical Center at Fort Bragg, North Carolina from 2012 to 2015. Subsequently, he was assigned as the Deputy Commander for Clinical Services at US Army Medical Activity Japan from 2015 to 2017. From 2017 to 2019, Colonel Stackle served as the Command Surgeon for the 4th Infantry Division at Fort Carson, Colorado and deployed as the United States Forces Afghanistan Command Surgeon in support of Operation Freedom's Sentinel and Resolute Support. Colonel Stackle's most recent assignment was a one-year assignment at the United States Army War College in Carlisle Barracks, Pennsylvania where he earned his Masters in Strategic Studies degree in 2020.

Combat & Casualty Care had the chance to speak with COL Mark Stackle, Commander, U.S. Army Institute of Surgical Research (USAISR), Joint Base San Antonio-Ft. Sam Houston, TX, regarding command mission re-focus to address COVID-19 during the past several months and some key efforts to bring critically-needed technology to bear in support of future Large Scale Combat Operations.

COL MARK STACKLE

COMMANDER
U.S. ARMY INSTITUTE OF SURGICAL RESEARCH

C&CC: Speak to USAISR's overall mission and how that mission has evolved in addressing this year's COVID-19 pandemic.

COL Stackle: The U.S. Army Institute of Surgical Research (USAISR) is the premier medical research lab under the U.S. Army Medical Research and Development Command (USAMRDC). Our focus and mission is "optimizing combat casualty care" in both the current combat environment and in future conflicts. The USAISR has played a critical role in helping achieve the lowest combat casualty mortality rates in modern warfare over the past twenty years. This has been accomplished by developing both materiel and knowledge solutions which have revolutionized how medical care is delivered on the battlefield. These contributions have included the Combat Application Tourniquet, advances in damage control surgery and resuscitation, the introduction of the Burn Navigator decision support tool, and novel use of blood products at the point of injury, to name a few. When the COVID-19 hit our area and we were forced to shut down, our mission remained the same, but our focus shifted.

The USAISR responded to the summer spike in San Antonio, TX COVID-19 cases, by transforming our research vivarium into multiple


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CAPT Farley Raquel, a USAISR Burn Center en route critical care nurse, and SGT Rebecca Hummer, respiratory noncommissioned officer, do a system check on ventilators in the USAISR "Victory" Intensive Care Unit at Joint Base San Antonio-Fort Sam Houston, TX. (Photo by Col. [Dr.] Erik Weitzel)

intensive care unit and ward beds in support of the potential patient overflow facing Brooke Army Medical Center (BAMC) at the height of the surge. BAMC is the only Level 1 trauma center in the Department of Defense (DoD). The only DoD burn center, operated by the USAISR, has been collocated with BAMC since 1949 and the two organizations have always worked closely together. When we had to shut down our research efforts due to COVID-19, we transformed some of our research spaces to support BAMC. The "Victory ICU" or VICU was designed to be a 72-bed facility with capability to care for up to 32 critically ill COVID-19 patients with personnel support from BAMC. The VICU was part of BAMC's emergency expansion plan and since our research building is outside of the physical hospital building, the VICU was ready to support the COVID-19 mission if/when BAMC reached full capacity. The unique thing about the VICU project is that it truly was a Tri-Service effort. For example, the pharmacy services on Joint Base San Antonio-Fort Sam Houston are led by the Air Force. They assigned an Air Force pharmacist to lead the process of developing pharmacy services for the VICU. We also received support from multiple Navy physicians who were detailed to help provide services both in the Burn Center and the VICU. Thankfully, the VICU's capacity was never required as the COVID surge subsided and we have since converted the VICU back into research space. But, while we were preparing our research spaces for a COVID-19 surge, our Burn Center staff continued to provide the world-class care for our patients at the Burn Center.

C&CC: Tell us about Operation Warp Speed and how ISR responded to the need for blood plasma for COVID-19 infected patients.

COL Stackle: The USAISR has played a key role in the national response to the COVID-19 pandemic. This work has primarily been provided in direct support of Operation Warp Speed (OWS). OWS is the U.S. Government partnership established to facilitate and accelerate the development, manufacturing, and distribution of COVID-19 vaccines, therapeutics, and diagnostic systems. It is a whole of government partnership among components of the Department of Defense (DoD), the Department of Health and Human Services (HHS), including the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), the National Institutes of Health (NIH), and the Biomedical Advanced Research and Development Authority (BARDA). OWS also engages with private firms and other federal agencies, including the Department of Agriculture, the Department of Energy, and the Department of Veterans Affairs. It has helped coordinate existing HHS-wide efforts, including the NIH's Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) partnership, NIH's Rapid Acceleration of Diagnostics (RADx) initiative, and other COVID related work by BARDA.

The USAISR became involved with the COVID response of OWS when a regional blood center, the South Texas Blood and Tissue Center (STBTC), needed outside help to increase the amount of COVID Convalescent Plasma (CCP) they could collect. The STBTC is a key organization in Texas that collects and distributes convalescent plasma for treating patients who are COVID-19 positive. Convalescent plasma contains antibodies taken from the blood of someone who has recovered from COVID-19 and is given to a COVID-19 positive patient with the idea that the CCP antibodies will accelerate clearance of the virus from the patient. This was crucial since CCP is one of a very limited number of treatment options authorized by the U.S. Food and Drug Administration (FDA) to treat patients infected with COVID-19. The STBTC initiated a request to OWS for additional subject matter experts in blood bank capability, and the USAISR responded by sending twelve Army Medical Laboratory Specialists to assist. As a result of the hard work provided by these USAISR Soldiers, the STBTC was able to collect thousands of CCP units which were used to treat COVID infected patients throughout the region. Additionally, the USAISR scientists and clinicians have supported OWS by providing expertise to the FDA and other government agencies on how best to employ CCP in the treatment of patients.

C&CC: In the initial months of the pandemic, how was ISR able to transform itself to support COVID-19 patient overflow from BAMC?

COL Stackle: The USAISR made modifications in how we conducted day-to-day business while maintaining our overall research mission of "optimizing combat casualty care" and, further, providing the best quality care to patients at the only DoD Burn Center. In the initial months of the pandemic, we added some force protection measures to protect our staff so they could continue to do the great job they do of providing the best quality care. The Burn Center staff worked with their research counterparts to convert the vivarium into VICU to maximize the number of available beds in the case of an influx in patients at BAMC. The research facilities were built with a mass casualty conversion capability, but that capability had never been utilized in the past. In times of need, about 50,000 square feet of the two research building basements can be converted to support BAMC overflow. To ensure the wellbeing and safety of our staff, we minimized the number of non-essential personnel at work as much as possible. We took an aggressive stance on tracking and self-quarantining ill staff to ensure they remained away from the USAISR buildings, and did not spread the disease to our staff and patients.

Year-round, our Burn Center personnel routinely treat the patients with the highest acuity in the DoD. Thus, it was not surprising that the Burn Center team confidently adapted to caring for patients with both burns and COVID-19. The Burn Center continued to provide a large number of extracorporeal membrane oxygenation (ECMO) nurse-specialists to staff the ECMO program at BAMC, during an influx of patients from the local community with severe lung failure from COVID-19. ECMO is an advanced life support capability employed when a patient's heart and lungs cannot function adequately on their

own and is commonly needed in the most seriously ill patients with COVID 19. Finally, the Burn Center supported BAMC by transferring patients from the BAMC surgical ICU into the Burn Center in order to create additional space for COVID-19 patients.

C&CC: The USAISR recently provided support to several casualties suffering from carbon monoxide poisoning from Hurricane Laura which devastated parts of southern Texas. Please talk about how the ISR coordinated with BAMC to deliver emergent hyperbaric oxygen therapy to these critically ill patients?

COL Stackle: The death toll following Hurricane Laura in August 2020 continued to rise many days after the category 4 Hurricane made landfall. The culprit was severe carbon monoxide poisoning. Sixteen people died as a result of Hurricane Laura, with over half of those deaths attributed to severe carbon monoxide poisoning. Following the loss of electrical power after damage from the hurricane, many families turned to gas generators to support basic needs such as lighting, heating, and cooking. In one such example, a group of seven Vietnamese shrimp boat laborers sought refuge in a pool hall. The building was powered by a gas generator but was not well ventilated. After several hours of exposure to exhaust gases, the individuals fell victim to smoke inhalation injury-induced carbon monoxide poisoning. Three of the laborers were pronounced dead on site. One of the victims was transported to a hospital in Houston and three were transported to a local medical center and then transported via aeromedical evacuation to the USAISR Burn Center's Intensive Care Unit for management of their inhalation injuries. In addition to multisystem organ support, treatment of severe cases of carbon monoxide poisoning include treatment with hyperbaric oxygen therapy (HBO).

The USAISR Burn Center has significant expertise in the care of patients with severe carbon monoxide poisoning and other inhalation injuries since these are common in burn patients. The treatment for carbon monoxide poisoning involves the delivery of 100 percent inhaled oxygen to the patient. Over time, the high concentration of oxygen will displace the carbon monoxide. This oxygen therapy can be made more effective when delivered in a hyperbaric chamber where the increased pressure of the chamber can clear carbon monoxide from the body more effectively. Each patient is typically treated three times within the first 24 hours, with treatments lasting between 1.5 and 2.5 hours. The unusual factor in this case was the mass-casualty perspective, which placed us in a position of needing to do nine treatments within a 24-hour period of time. This required extremely long hours and persistence from our staff and detailed coordination of patient care between the BAMC Emergency Department, Burn Center Intensive Care Unit, and the BAMC Hyperbaric Medicine Department.

Two of the patients were discharged from the hospital with minimal to no lasting effect from their injuries. One patient suffered advanced brain injury relating to inhalation injury and was transferred to a hospital closer to his family members for ongoing care. This is a perfect example of how our Institute and BAMC work closely together to offer the best care available.

C&CC: In terms of cross-training for Burn Center personnel, how will exposure to Critical Care Air Transport Team expertise increase readiness?

COL Stackle: Another unique capability of the USAISR is that it is the home of the only Burn Flight Teams in the military. There are two Burn Flight Teams at the USAISR Burn Center, each with a Burn Surgeon/Intensivist, ICU Registered Nurse, ICU Licensed Vocational Nurse, and a Respiratory Therapist. The Burn Flight Teams provide the Army with a strategic capability to evacuate the most critically sick patients. During the ongoing wars in the Middle East, the Burn Flight Team transported more than 350 burned combat casualties on more than 90 flights from Landstuhl Regional Medical Center (LRMC) in Germany to the USAISR Burn Center. Real-world missions have markedly decreased in the last two years with only one mission during 2019 which involved the evacuation of a patient from Colombia, South America. While the requirements for the entire Burn Flight Team have diminished, individual members continue to support BAMC extracorporeal membrane oxygenation (ECMO) transport missions including the recent high-profile transport of the former Emir of Kuwait from Germany to the Mayo Clinic.

In order to further enhance the training and capability of the Burn Flight Teams, the USAISR is now participating in U.S. Air Force Critical Care Air Transport (CCATT) team training. The Air Force CCATT is a unique, highly specialized medical team that can create and operate a portable intensive care unit on board any available transport aircraft during flight. The inclusion of USAISR Burn Flight Team members in this advanced training will improve joint interoperability between the USAISR and the USAF CCATT that will greatly enhance the capability of both organizations.

C&CC: How is the ISR focusing its research efforts to make sure that our medical force is prepared to deliver care in future wars to include those involving Multi-Domain Operations and Large Scale Combat Operations.

COL Stackle: The USAISR's comprehensive research programs address the DoD's most important requirements for medical advances to stabilize and treat combat casualties, to preserve life, limb, eye sight, and other critical functions for our wounded warriors – on the future battlefield and today. We understand the new challenges for combat casualty care due to Multi-Domain Operations (MDO). Within the MDO concept, routine, rapid patient evacuation will not be guaranteed due to contested airspace and the potential for interdiction of evacuation platforms. During these unpredictable periods, personnel must be prepared to sustain casualties in an austere environment for up to 72 hours with organic capabilities and limited resupply. Prolonged Field Care (PFC) is the name for this type of care. The USAISR is already developing future technologies that will be instrumental in taking care of the combat wounded in a future Prolonged Field Care environment. These innovations include the advancement of new monitoring capabilities, including assessment of Compensatory Reserve; refinement of portable extracorporeal life support systems; development of novel analgesics; and creation of autonomous artificial intelligence-driven clinical support tools and robotic surgical capability. In addition to maintaining a world-class group of clinicians and scientists, the USAISR collaborates with hundreds of partners in sister services, international military partners, academia, and industry. The unique combination of the USAISR's robust basic science capability coupled with the USAISR Burn Center creates an irreplaceable synergy that allows for rapid transition of research to the bedside and to the battlefield.

MITIGATING VIRAL RESURGENCE EFFECT

The U.S. Defense Department recently received four months of personal protective equipment (PPE) like respirators, surgical masks and gloves, complements of Defense Logistics Agency (DLA) Troop Support, to see troops and families through the second wave of COVID-19.

By Beth Reece, DLA

Soldiers with the 28th Expeditionary Combat Aviation Brigade receive tests for COVID-19 at their mobilization station at Fort Hood, Texas. The Defense Logistics Agency has helped maintain military readiness during the COVID-19 pandemic by providing personal protective equipment and test kits to troops around the world. (Photo by Capt. Travis Mueller)

Supplies of critical national PPE, not a part of U.S. Defense Department pandemic reserves, were procured by the Defense Logistics Agency to replenish on-hand stock for military services and geographic combatant commands. Much of it will be used for patient care at military treatment facilities and by service members training or deployed, said Army Col. Matthew Voyles, director of DLA Troop Support's medical supply chain.

"The new reality is that all of our service members have got to have personal protective equipment. This PPE will be used across the gamut, from individual units at tactical levels to treatment facilities here stateside and at our overseas locations where all service members and beneficiaries receive care," Voyles said.

COOPERATIVE DETERMINATION

Quantities were based on demand prediction models and coordination with DoD's COVID-19 Joint Acquisition Task Force. Widespread material shortages early in the pandemic prompted DLA Troop Support to work with logistics planners at the Joint Chiefs of Staff and Defense Health Agency to create a Priority and Allocation Board made up of members from the defense medical logistics enterprise that meet weekly to prioritize protective equipment orders based on customer missions and the virus' prevalence in local communities, Voyles said. Readiness and contingency contracts such as those managed through the agency's Warstopper program helped the agency meet initial military needs, as well.

Additional protective equipment is being stored at DLA Distribution warehouses to fulfill emerging DoD requirements, added Beth McMaster, medical supply chain deputy director.

"None of us truly knows what's coming. We've prepared for the upcoming months and will remain aware of manufacturing disruptions, especially for those items that remain in a fragile support state," she said.

COORDINATING WITH SUPPLIERS

DLA contracting officials continue searching for new vendors that can provide COVID-19 supplies. The agency has also provided protective equipment and other items to surge test sites and nationwide nursing homes in support of the Department of Health and Human Services. "Although DLA already had contracts in place for personal protective items when the pandemic rolled across the United States in March and April, the demand was limited to mostly military medical customers," McMaster said.

"It was a very small part of the medical, surgical and pharmaceutical materials we supported, but we quickly became very hyper-focused as demand dramatically increased and the industrial base struggled to keep up," she continued.

Orders for medical supplies are typically shipped directly to customers as part of DLA's prime vendor program rather than from DLA Distribution warehouses. Increased worldwide demands for protective equipment supplied solely through prime vendors led the agency to store and distribute equipment at its locations.

"That was a new muscle movement that hadn't been exercised in a long time, so we had to go out and educate and train our customers to point their electrons to a difference source when placing online orders, as well as make internal changes to our business processes," Voyles said. "The adaptability of the entire supply chain team was pretty incredible in making that happen."

"DLA's strong partnership with industry and long-term contracts for medical supplies helped the agency transition from a peacetime pace to a global pandemic," McMaster added. "But the expertise and personal commitment of acquisition and customer assistance employees made it possible. McMaster made note of her team's support of efforts such as the supply of the USS Mercy and Comfort, saying, "While the scope of this event has been overwhelming, I'm impressed every day by the ability of our staff to come up with innovative solutions and do things differently. It's been pure dedication from day one."

AHEAD

DLA is currently preparing to support the DoD COVID-19 vaccination plan now in development.

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ADAPTING SURGICAL SERVICES READINESS TO A PANDEMIC-CENTERED "NORMAL"

Col. Peter Learn

Acting Director for Surgery
Walter Reed National Military Medical Center
Bethesda, MD

Colonel Peter Learn, MD, FACS, currently serves as the acting Director for Surgery at Walter Reed and Associate Chair of Surgery for Quality and Patient Outcomes in the Uniformed Services University - Walter Reed Department of Surgery. Col. Learn was appointed as the General Surgery Consultant to the US Air Force Surgeon General in 2017. He is a surgical oncologist and an Associate Professor at Uniformed Services University.

Col. Learn deployed to Khost Province in Afghanistan in 2008 and to Bagram Air Base in 2011. At Bagram AB, he served as the Deputy Commander for Clinical Services for Task Force Med-East.

Col. Learn serves on the Board of Governors of the American College of Surgeons. He is the chair of the quality committee of the MHS Strategic Partnership with the American College of Surgeons and co-chair of the DOD National Surgical Quality Improvement Program Steering Panel. He has led numerous initiatives locally and at the enterprise level to develop robust systems for surgical quality improvement. He is a councilmember-at-large on the executive board of the Excelsior Surgical Society. He sits on the editorial board of the Journal of Surgical Research, and he has authored 27 peer-reviewed publications. His research interests focus on large dataset analyses of surgical outcomes and value in surgical care delivery.

Col. Learn graduated from the University of Illinois at Urbana-Champaign with a BS in Electrical Engineering and received his medical degree from the Johns Hopkins School of Medicine. He completed General Surgery residency training in the combined program at Wilford Hall USAF Medical Center-University of Texas Health Science Center in San Antonio, and he completed a Complex Surgical Oncology fellowship at Memorial Sloan Kettering Cancer Center in New York.

C&CC had the opportunity to speak with Col. Peter Learn, Acting Surgery Director at Walter Reed Med Center, Bethesda, regarding some of the focus areas his surgical staff have been facing since the COVID-19 pandemic changed WRNMMC daily routine.

C&CC: As the COVID-19 pandemic has influenced treatment application across the DoD medical community, tell us about the expansion in virtual medical operations within your dept's purview.

Col. Learn: The pandemic really broke through the mental and technological barriers that limited our telehealth offerings. While some of our services had a pre-existing telehealth footprint, most did not, outside of the ability to call a patient by phone. In order to keep delivering care while ensuring both patients and staff feel safe during the pandemic, we really had to drop some preconceptions about the ability to apply telehealth to our work. Unquestionably, the care delivered by our Directorate of Surgical Services is quintessentially hands-on - whether it is performing surgeries or physical rehabilitative services. Still, it is ineffectual to believe that is sufficient reason not to offer telehealth. In fact, many types of postoperative care appointments and rehabilitative therapies can be safely and conveniently delivered through virtual appointments. The demand for available telehealth services accelerated dissemination of the necessary technology platforms to facilitate this care, and I fully expect many of these practices will persist even after we have this pandemic behind us.

C&CC: With the updated CDC's guidelines on the dangers of aerosol-spread contagions such as COVID-19, how have your ENT dept. protective efforts expanded, particularly with FDA approval?

Col. Learn: We are incredibly appreciative of the innovations developed by the surgeons in our Otolaryngology department, led by MAJ (Dr.) Steven Hong. By the very nature of their work, ENT surgeons have

LT Caroline Mosher, a nurse anesthesia student at USU's Graduate School of Nursing, conducts "proof-of-concept" testing using the "COVID-19 Airway Management Isolation Chamber," or CAMIC. (Uniformed Services University)

some of the highest risk exposures to aerosols as was demonstrated to lethal effect early in the pandemic in other countries. In response to this risk, MAJ Hong's team rapidly developed an isolation chamber using commonly available materials that would allow surgeons to safely perform head and neck procedures in patients with known infection or with an unknown infection status. They validated the effectiveness of the chamber in a simulated aerosolization model and began using it in clinical practice. This was quickly adapted by our anesthesiology department to provide them protection when intubating and extubating patients under general anesthesia, another tremendously high-risk procedure. Maj. Hong and his team rapidly disseminated instructions for building and using the COVID-19 Airway Management Isolation Chamber (CAMIC) to medical professionals within the Military Health System (MHS) as well as to providers outside the MHS via medical conference presentations and publication in medical journals. The Food and Drug Administration provided emergency use authorization for the technology in May based on the solid evidence supporting its effectiveness.

C&CC: From already state-of-the-art prosthetic capabilities in current usage, tell us about the latest enhancements enabling direct skeletal connectivity for greater range of motion.

Col. Learn: The osseointegration program is an example of world-class research being applied directly to the core mission of the MHS. Osseointegration allows attachment of a prosthetic device directly to the skeletal frame, as opposed to a traditional prosthesis, which requires enough limb length to fit properly. The pattern of injuries seen in the recent conflicts in the Middle East resulted in a population of patients with complex amputations for whom traditional prostheses cannot be fit appropriately. Osseointegration can open up opportunities for improved quality of life through higher functionality for these patients, who might otherwise not be served by traditional prostheses. The same technology has application in amputations not related to combat injuries, such as those necessitated in the treatment of skeletal cancers. These advancements in care have implications across our beneficiary population, but particularly for our combat-injured service members. Under the expertise of Army Col. (Dr.) B. Kyle Potter, Navy CAPT (Dr.) Johnathan Forsberg, and Navy CDR (Dr.) Jason Souza, the clinical osseointegration program is well underway.

C&CC: With post-trauma infection onset and the lack of timely, effective treatment particularly at point-of-injury in the field, what advances are being made to enable earlier care?

Col. Learn: The Surgical Critical Care Initiative (SC2I) program demonstrates the benefits of the close connections between the Uniformed Services University of the Health Sciences and WRNMMC. SC2I is a multi-institutional initiative that includes partnerships with schools of medicine at Duke University and Emory University. Data from critically ill patients from multiple hospitals, with a significant representation of severely injured service members, is being used to develop predictive analytics tools that enhance clinical judgment in anticipating the need to treat patients aggressively to prevent fatal fungal infections, anticipate a need for massive blood product transfusions, or detect clinical worsening at its earliest stages. These tools are already being applied to clinical care at WRNMMC.

C&CC: Feel free to speak to other challenges/goals, particularly with pandemic-related response.

Col. Learn: We are proud of the fact that many of our medical providers have deployed in support of COVID-19 response operations across the country. The pandemic continues to impact clinical operations at WRNMMC daily, from requiring SARS-CoV-2 testing prior to procedures to maintaining a heightened personal protective equipment posture. While we know far more about this virus than we did in March, there are still many unknowns as to the duration and lasting impacts of this pandemic. Despite these challenges, we have focused on restoring safe access to care to volumes nearly identical to pre-pandemic levels in an effort to ensure that our patients do not go without necessary medical care. Innovation is in the genetic code of this institution, and we will continue to apply that mentality regardless of what challenges face our patients and staff.

ADVANCING OPERATIONAL VIRTUAL HEALTH APPLICATION ACROSS THE FORCE

COL Sean J. Hipp, M.D. received his B.S. in Biology from Georgetown University in 1996 and then his M.D. from Temple University School of Medicine in 2002. He completed a Pediatric residency at the University of North Carolina, Chapel Hill in 2005 with Pediatric board certification in the same year.

COL Hipp was commissioned in the U.S. Army reserves in 2002 and then went active duty after residency in 2005. His first assignment was at the U.S. Army MEDDAC, Heidelberg, Germany as the Chief of Adolescent Medicine. In 2006 COL Hipp became the Chief of Pediatrics at the same location in charge of the local inpatient pediatric ward as well as outlying clinics. He then was deployed to Afghanistan from May 2007 to April 2008 taking care of Soldiers and local nationals in the Himalayas.

Upon return from deployment in 2008 COL Hipp transferred to the Washington, DC area and completed a fellowship in Pediatric Hematology-Oncology at Walter Reed Army Medical Center in June 2011. COL Hipp's area of focus was the imaging of pediatric brain tumors as well as the development of phase I therapeutic trials.

In July of 2011 COL Hipp was transferred to Brooke Army Medical Center (BAMC) in Texas working as a Pediatric Hematologist-Oncologist. He was involved in resident graduate medical education (GME), direct patient care, and started a volunteer program extending homebound education in the hospital.

In June 2013 he was transferred to the Warrior Transition Battalion at BAMC. He served for 2 years as the Battalion Surgeon interfacing with Soldiers, Staff and the Hospital Command.

In June 2015 he returned to Pediatric Hematology-Oncology at BAMC and took over as the Associate Program Director of the Pediatric Residency Program, electronic medical record development and Pediatric clinical trials with the Children's Oncology Group.

July 2016 COL Hipp started to work with Virtual Health/ Telehealth to coordinate programs at BAMC. In the Fall 2016 BAMC competed to become the first Virtual Medical Center in the military to coordinate services across garrison and operational forces and it was awarded in March 2017. In June 2017 COL Hipp was officially designated as the Director of the Virtual Medical Center and continues to develop staff, structure and programs to support virtual medicine across the garrison and operational domains.

Combat & Casualty Care had the opportunity to speak with COL Sean Hipp, Director, Brooke Army Medical Center's Virtual Medical Center, regarding current and planned focus for a state-of-the-art facility the Army hopes will advance telemedical and tele-behavioral health force-wide.

COL Sean Hipp

Director
Virtual Medical Center
Brooke Army Medical Center

C&CC: Speak to the evolution, and more specifically the need for the evolution, of BAMC's Virtual Medical Center (VMC) i.e. date stood up and any parts still in development.

COL Hipp: The VMC was initially funded in 2017 reaching initial operating capacity January 4, 2018. The organization was initially stood up on the Joint Base San Antonio footprint to leverage the clinical, educational and specialty capacity that is the cornerstone of Brooke Army Medical Center. The command structure is directly linked through the BAMC medical treatment facility, but the future state is that the VMC will be nested at in Health Care Operations at the Defense Health Agency. This will give the VMC administrative structure to leverage capacity and administrative support across DHA markets to support the Military Departments (MILDEPs). Over the past two years the VMC has fought against the perception that we only service the Army, but in fact each program the VMC develops is focused on supporting the joint force. Since 2018 the VMC has transitioned into a construct that has three clinical hubs: San Diego, San Antonio, and Europe, with support for tele-critical care, tele-behavioral health, operational support and centralizing clinical quality management.

Brooke Army Medical Center mobile medics stock a medical chest and review a transportable exam station at the Virtual Medical Center, Fort Sam Houston, TX. Mobile medics use a combination of virtual and hands-on health care to triage Soldiers. (U.S. Army photo by Jason W. Edwards)

C&CC: From an injured Soldier's perspective on the battlefield, talk about past and present in terms of the changes in point-of-injury to long-term outcome that virtual connectivity will bring to combat reality.

COL Hipp: Operational Virtual Health (VH) is at the cornerstone of the VMC Construct. Medics, Airmen and Corpsman are excellent at trauma care, stabilization and transport. VH is important to support prolonged field care (PFC) for multi-domain operations and contingency support. ADvanced VIrtual Support for Operational FoRces (ADVISOR) was consolidated at the VMC to support the operational force. It is one phone number that can be used to contact 12 different specialties once local resources are exhausted or the specialty is unavailable. The VMC also stood up the Mobile Medic program, initially for Army, but has expanded for the Air Force and we are coordinating with the Navy. Battlefield care is significantly more often disease non-battle injury (DNBI) than trauma care, but medics do not do enough clinical DNBI experience in garrison. The Mobile Medic program leverages Algorithmic Directed Troop Medical Care (ADTMC) to screen patients and then connect via video to clinicians if the patient is outside their scope of care. This can reduce service member (SM) movement in theater and when using in garrison, train as they fight.

C&CC: In terms of mobile field triage, how do you see existing capabilities in virtual/telemedical procedure advancing by way of the standards setting that MEDCEN will deliver?

COL Hipp: As previously stated, medics are expertly trained in field care stabilization and transport. There are multiple video platforms that can support connections from the operational space to garrison or intra-theater communication. Using ADVISOR medics can access specialties needed to support their clinical decisions making and if necessary, help determine if transport is needed more urgently. Future state is transitioning to more handheld devices with audio data capture, passive vital signs monitoring and a future state that can help the medic with medical decision making when connectivity is lost using local Artificial Intelligence decision support. Drone transport of medications and blood to the field and patient evacuation is on the horizon as data connectivity improves.

C&CC: As virtual capability delves more into surgical application and ongoing remote monitoring, what are some challenges standing in the way of fully connecting patient to technology?

COL Hipp: The greatest issues are bandwidth and stability of service. Robotic surgery is expanding exponentially in the military, but it is

Mobile Medics from the Virtual Medical Center utilize the Battlefield Assisted Trauma Distributed Observation Kit (BATDOK) software to document simulated casualty care during Cyber Quest 2020 event at Ft. Gordon, GA, September 2020. (U.S. Army photo)

Air Force 4N0s, (Aerospace Medical Service Technician), and Army 68Ws, (Combat Medic Specialist), join forces to provide simulated prolonged field care as one of the scenarios at the Cyber Quest event at Ft. Gordon, GA, September 2020. (U.S. Army photo)

still tethered to a surgeon in the operating suite. There needs to be a stable, secure, high speed connection that supports the operation for the surgeon to be in another location. With advances in 5G technology military medicine is focused on narrowing the gap on these issues.

Remote monitoring is moving forward rapidly in the military. There are programs evolving for continuous pulse-oximetry monitoring at home as well as transmission of bedside monitoring for critical care to centralized oversight through the Joint Tele-Critical Care Network developed at the VMC San Diego by U.S. Navy CAPT Konrad Davis. In response to the COVID-19 pandemic BAMC is installing cameras and a centralized bedside monitoring system in over 60 patient care rooms to expand tele-critical care oversight and reduce clinician exposure. This will save personal protective equipment, increase rapidity of critical care consultation and create the largest TCC monitored facility in the military.

C&CC: With the Mobile Medics program proving a key asset to both garrison and deployed settings, what are some training aspects that you see most critical to ensuring ongoing combat casualty readiness?

COL Hipp: Medics need to be using ADTMC and their clinical skills regularly in garrison. If they are not seeing patients then there is a risk that they are not prepared to perform the mission in theater. Untrained medics could lead to increased DNBI and less SMs on the battlefield. If medics are regularly using ADTMC, and then connecting to clinicians for more complicated cases they will be more independent when disconnected. Keys for any medic is being well trained, continuous learning in garrison and reach back support to get help when necessary with technology.

C&CC: Feel free to speak to other MEDCEN challenges/goals moving forward.

COL Hipp: Key future challenges include the DHA transition, bandwidth and platform interconnectivity. The VMC is focused on creating programs that service all the MILDEPs and also utilizes clinical resources across the services. Nesting the VMC construct at a joint construct would best leverage the resources that exist within the MILDEPs. If the VMC construct is appropriately transitioned and the MILDEPs are willing to continue to use and share personnel then VH services will not be duplicative and can expand uniformly to service the operational need.

Connectivity and bandwidth to the operational space is important in order to get the care that is needed. Unique and creative connectivity solutions are coming out of the military community and being driven by 5G initiatives. Additionally, the bandwidth needs to be secure, at times encrypted and even de-identified to reduce risk of putting the force at risk from a near-peer foe. These complications have not been the wheelhouse of the medical force, but the more we expand to real-time support we must work aligned with the signal community.

VH platforms are pervasive in the civilian world, but there are multiple different networks within the military that have separate requirements for data transmission. The DHA wants to deploy one platform integrated with Cerner Genesis that can support from operational to garrison. This will necessitate cyber and signal leader's agreeing on what can be placed on their network.

THE POSITIVE OF PANDEMIC-DRIVEN CONSEQUENCE

When wars are fought, warfighters are injured and killed. Recent wars in such places as Afghanistan and Iraq demonstrated that the sooner you bring the wounded to definitive care the better the survival rate. As our near-peer adversaries increase their spheres of influence, time to evacuate wounded to definitive medical care will increase. The Golden Hour will no longer be available to improve survival. So instead of brining the wounded to the capabilities, you bring the capabilities to the wounded. A new paradigm in medicine is arising to meet that challenge.

By COL Justin J. Stewart, Deputy Director, Telemedicine & Advanced Technology Research Center (TATRC)

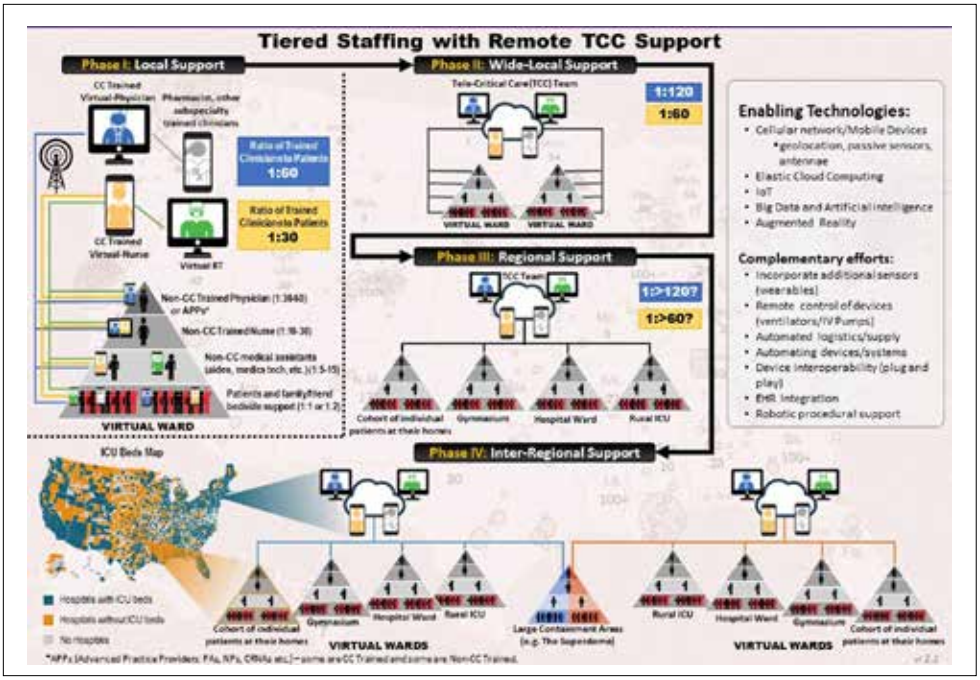
Telehealth capabilities can be as simple as calling in a prescription or as complex as having a video consultation occur in real-time. (U.S. Army photo)

The wars in Iraq and Afghanistan represented the U.S. counter-insurgency strategy. As near-peer adversaries increased in power, a new strategy was needed to meet that challenge. The U.S. Army in Multi-Domain Operations 2028 was published in 2018 in order to lay the foundation for the future fight. One of the trends highlighted in that strategy is located on page vi, "adversaries are contesting all domains." The Army will no longer have the luxury of the Golden Hour in which to evacuate casualties to higher echelons of definitive care. Multiple care modalities will be needed in order to continue survival of the wounded on the battlefield. Telemedicine and medical robotic and autonomous systems represent ways of making this happen.

COL Justin Stewart

Telemedicine is a current capability that has been in use in deployed settings for many years. A medic discussing a case over a phone or tactical radio is considered telemedicine. As technology has improved, telehealth has expanded to include asynchronous messages with or without OPSEC clean images sent by text, email, or other secure applications to remote experts as well as video visits that occur in real time. The Advanced Virtual Support for Operational Forces (ADVISOR) is the current operational virtual health (OVH) capability within the DoD that provides telehealth to our forces deployed across the world. Telehealth is one way to bring the capability to the front of the fight. But the next iteration of telehealth will involve less human interaction and more autonomous and robotic care.

The U.S. Army Training and Doctrine Command (TRADOC) published the U.S. Army Robotic and Autonomous Strategy in 2017. The strategy outlined five



Concept of NETCCN showing how fewer providers can care for more patients in distant locations. (TATRC)

capability objectives (p. 1): "Increase situational awareness; lighten the Soldiers' physical and cognitive workloads; Sustain the force with increased distribution, throughput and efficiency; facilitate movement and maneuver; protect the force." Medical robotic and autonomous systems in particular offer ways to "lighten the Soldiers' physical and cognitive workloads" and "protect the force." Ongoing research at the Telemedicine and Advanced Technology Research Center (TATRC) within the U.S. Army Medical Research and Development Command (USAMRDC) under Army Futures Command (AFC) is developing autonomous systems that can deliver blood products on unmanned aerial systems and clinical decision support software that guides the medic on next steps in Tactical Combat Casualty Care (or Prolonged Field Care). These systems minimize the human footprint as well as decrease the thought burden associated with aspects of medical care. These aspects are key in providing care in the current COVID pandemic where the need for decreasing human contact and assisting non specialty health care providers (to include patients themselves) are vital in helping sick patients and decrease the spread of the disease.

ROLE OF COVID IN ACCELERATING RESEARCH

The first cases of COVID-19, the disease caused by SARS-CoV-2, started in Wuhan City, China in December 2019 and are widely believed to have originated from a wholesale food market (WHO, https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200423-sitrep-94-covid-19.pdf?sfvrsn=b8304bf0_4). As of October 29, 2020, approximately 11 months later, there have been nearly 9 million cases in the United States and daily new cases reached a new high of more than 68,000. Both urban and rural areas have had times where intensive care units (ICU) were full, however, these shortages were not even across the country. Certain "hot spots" experienced shortages whereas some areas experienced minimal cases. This represented an opportunity for telemedicine where critical care expertise could be shifted from areas of low demand to high demand. TATRC conducted research to create the National Emergency Tele-Critical Care Network (NETCCN) that funded teams to create platforms that could reach across state lines. NETCCN provided asynchronous (secure messaging not in real time) as well as synchronous (real-time video) consultation capability for non-specialty caregivers (noncritical care trained physicians, nurses, patients among others) with critical care specialists to help manage COVID-19 patients in locations where specialty critical care was not available. Working with partners from the Department of Health and Human Services Office of the Assistant Secretary for Preparedness and Response (ASPR) and the Society of Critical Care Medicine (SCCM), NETCCN has been deployed to Guam, South Dakota and Minnesota to assist those locations in caring for patients with COVID-19.

Future research efforts involve creating an ecosystem called Technology in Disaster Environments (TiDE) in which NETCCN will be a part. Increasing capabilities such as remote-controlled or autonomous ventilators (currently in use in Europe) and leader dashboards with AI-enabled data visualization are being developed to decrease the number of humans needed in the room to care for the patient. These efforts have only been possible due to the policy makers decreasing the obstacles that have existed in telemedicine. COVID provided the catalyst for these boundaries to be overcome. In order for telehealth to remain a viable option in treating patients in austere locations across the country and the world, these obstacles need to be addressed.

OBSTACLES TO TELEMEDICINE

One of the biggest obstacles to telehealth across the U.S. is the fact that states provide licenses to practice medicine not the federal government. In order for a provider to practice telemedicine, they must be licensed in the state where the patient is located. So if a provider in Texas wishes to provide care for a patient in Nebraska, having a Texas license is not good enough; the provider must have a license in Nebraska. These vary in price from a few hundred dollars to close to one thousand dollars to maintain each year. COVID helped overcome this obstacle when states began issuing waivers that allowed practice across state lines. As of October 2020, more than 42 states have some sort of waiver in place to facilitate care provided by out-of-state licensed providers (https://www.fsmb.org/siteassets/advocacy/pdf/states-waiving-licensure-requirements-for-telehealth-in-response-to-covid-19.pdf).

Second, the Health Insurance Portability and Accountability Act (HIPAA) makes the storage and transfer of clinical data between health care providers and entities difficult. The cost of compliance is also expensive with each physician practice as of 2019 spending on average $35,000 on information technology that complies with HIPAA (https://www.medicaleconomics.com/view/hipaa-what-cost). But even compliance with HIPAA does not guarantee that your data will not be breached. There were 510 health care data breaches of

500 or more records in 2019 which was an increase from 371 data breaches in 2018 (hipaajournal.com). The total number of records breached in 2019 was 41,335,889, up from 13,947,909 in 2018 (hipaajournal.com; https://www.hipaajournal.com/2019-healthcare-data-breach-report/). Civilian institutions are beginning to need military-grade cybersecurity defense in order to keep hackers out.

Finally, prior to the COVID pandemic, telehealth services were not comparably compensated compared to in-person visits. Although evaluation and management Medicare codes are now equivalent between in-person and telehealth visits, only certain types of telehealth visits are covered. Live video visits are covered whereas asynchronous store-and-forward visits, where a patient emails a provider a picture or video that is not in real-time, are only covered in two states (Alaska and Hawaii--https://evisit.com/resources/medicare-telemedicine-reimbursement/; https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet). Despite these obstacles, telehealth represents great opportunity for novel care not only in the civilian sector, but more importantly in the care of our Warfighters.

Handheld devices today can record medical data as well as provide clinical decision support to the medic in austere conditions. (U.S. Army photo)

TELEHEALTH TO DIGITAL/VIRTUAL HEALTH

Although obstacles exist currently to telehealth today, the inertia of change in health care brought on by the COVID response will decrease these obstacles and offer the opportunity to view medicine in a whole new light. Opportunities to evaluate patients without visiting a physician by just using smart watches and smart phones are on the horizon. There are multiple research efforts across the DoD looking at ways to sense what the warfighter is doing at all times with minimal impact on Soldiers completing their mission. Establishing a personalized baseline, or a digital twin, is key to unlocking the prevention of injury as well as improving mortality on the battlefield. Only by knowing what is normal or "right" for the patient can we determine what is wrong. Using sensors and the modeled digital twin changes in gait, heart rate, pupillary dilation, voice intonation and other human characteristics can predict injury and help get the Warfighter help they need. Identifying potential injuries before they happen will be a game-changer in keeping Servicemembers in the fight.

Unburdening the cognitive load of front-line providers with technological assistance also offers opportunities to improve care on the battlefield. Autonomous systems that can perform procedures to assist medics in the care of patients are being researched within TATRC and its external partners such as the University of Pittsburgh and Walter Reed National Military Medical Center. Clinical Decision Support Systems are being developed by TATRC in partnership with another USAMRDC asset, the U.S. Army Institute of Surgical Research (USAISR) located in San Antonio, TX, offering clinical guidance at the tips of the provider's fingers. These efforts are only the tip of the iceberg and not all of the efforts at TATRC, USAMRDC, and U.S. Army Futures Command aimed at achieving overmatch, both on the battlefield and in the medical space.

LOOKING AHEAD

Telehealth is being transformed into digital health despite the current obstacles in place. The COVID-19 pandemic accelerated that transformation by demonstrating Digital Health's potential when physical face-to-face visits are not available as well as giving subspecialty expertise to those where it is not present. When this pandemic is past, health care will not go back to the way it was before. Using future autonomous systems to allow front-line providers to care for sick and dying patients is one of the main goals of the research occurring today. We want to use any technology possible to help our Warfighters survive battle. Because, in the end, all that matters is saving lives.

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DECEMBER 11 - 12
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DECEMBER 16 – 17
West Coast Defense Contracting Summit
San Diego, CA
Usdlf.org

FEBRUARY 8 – 9
Air Force Contracting Summit
Desin-Miramar, FL
Usdlf.org

MARCH 20 – 21
Operational Medicine Symposium
San Antonio, TX
Operationalmedicine.dsigroup.org

APRIL 6 – 7
Southwest Defense Contracting Summit
San Antonio, TX
Usdlf.org

APRIL 12 – 14
Trauma Critical Care and Acute Care Surgery
Las Vegas, NV
Trauma-criticalcare.com

MAY 24 – 28
SOMSA 2021
Charlotte, NC
Specialoperationsmedecine.org

JUNE 24 – 25
Navy Contracting Summit
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AUGUST 1 – 4
Sea Air and Space
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- DLA DAPA Agreement: SP0200-03-H-0008
- DLA VIPA Agreement: VMP-1412-03
- FSS Contract 65IIa/GSA Schedule - V797D-30127

NSN 6515-01-626-8691
Masimo PN 3639

- U.S. Army Air Worthiness Release Certification
- Air Force Safe-to-Fly Certification
- ECAT Contract: SPE2D1-16-D-0009
- DLA DAPA Agreement: SP0200-03-H-0008
- FSS Contract 65IIa/GSA Schedule - V797D-30127

NSN 6515-01-655-9412*
Masimo PN 9709, 9809, 9909
(Bluetooth LE Option with a Rotational Screen)

- Air Force Safe-to-Fly Certification
- ECAT Contract: SPE2D1-16-D-0009
- DLA DAPA Agreement: SP0200-03-H-0008
- FSS Contract 65IIa/GSA Schedule - V797D-30127

* NSN applies to PN 9709

For more information, visit www.masimo.com

Caution: Federal (USA) law restricts this device to sale by or on the order of a physician. See instructions for use for full prescribing information, including indications, contraindications, warnings, and precautions.

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PLCO-004120/PLMM-11758A-0720
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