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Mt. Everest Tested ... TATRC Approved!

Ron Everest Yeaw, Deputy Lab Manager for mHIC, and his team of fellow trekkers during their ascent to Everest Base Camp.

Photo Courtesy of: Tashi Sherpa

This Spring, Mobile Health Innovation Center (mHIC) Deputy Lab Manager, Ronald 'Everest' Yeaw redefined testing in austere environments when he conducted several field tests of the mHIC Mobile Health App known as mCare, as well as its supporting MHCE infrastructure, at Everest Base Camp 1 (EBC1) in Nepal, just 12.1 miles from the summit of Mt. Everest.

Conditions on Mt. Everest are some of the most austere and grim in the world, with winds reaching 200 mph and temperatures dropping to 80 below, as you near the summit. From Ron's position at EBC1, one could actually begin to see the curvature of the Earth itself. At an altitude of 17,600 feet, Mr. Yeaw tested mCare's ability to accurately receive Bluetooth glucometer and pedometer readings. Mr. Yeaw's pulse, blood oxygen saturation, and body temperature readings were also broadcasted live, and in real time during the strenuous seven day, 65 mile ascent to EBC1, to a public facing health dashboard monitored and supported by TATRC through a partnership with mountaineering vendor, WiCis Health.

In addition to the perilous fall risk attempting to even reach EBC1, Acute Mountain Sickness, or AMS, is also a significant life-threating concern for climbers. Any altitude above 8,000 feet can begin to trigger AMS symptoms, which present most commonly as dizziness, nausea, headaches, and shortness of breath. Above 12,000 feet, AMS can be deadly, with an exponential increase in the possibility of high altitude pulmonary edema. There is 48% less oxygen at EBC1, and the air pressure is so low that water boils at a mere 150°F (versus 212°F at sea level). It's actually impossible to boil an egg on Everest, or more importantly, to sanitize water through cooking. While a normal blood oxygen saturation level is 98%, Ron's descended as far down as 73% due to the lack of air on Everest. Ron's vital signs were monitored in real time throughout the trip by Ms. Mabel Cooper RN, BSN, CCRC, a nurse case manager assigned to TATRC's mHIC team in Fort Gordon, GA. In addition, Nurse Cooper was able to direct medical consultation to Ron throughout the entire expedition by way of a satellite phone, also provided by TATRC.

Analysis from TATRC's field tests on Everest showed a data delay of less than 2 seconds from the moment Ron's

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biosensors communicated the data to when the information was publically visible on Ron's WiCis dashboard. Pictures of Ron's ascent, experiments at EBC1 and the public website for his vitals, were also captured and communicated by TATRC via social media throughout the whole journey. Ron's WiCis Health dashboard alone was followed by 171 different individuals during his three week adventure.

Ron, and his party of 10 trekkers, were also monitored on site by an embedded provider, COL Steve Birchfield M.D., US Army Europe (USAREUR) & 7th Army Deputy Surgeon. Dr. Birchfield was part of the expedition for the entire trek to and from EBC1, evaluating the expedition's AMS symptoms as well as those groups Ron and his team came into contact with. It was through Dr. Birchfield's direct efforts, that several American climbers encountered in the Tingbouche village decided to abandon their attempts to reach EBC1. Based on Dr. Birchfield's medical assessment of the team's health and cascading AMS symptoms, the team wisely trekked down to lower altitudes immediately. It was later discovered that two of the American climbers had to be medically helicoptered out even after descending from altitude. Lead EBC trekking guide, Tashi Sherpa, directly credited Dr. Birchfield's intervention with saving the lives of the two climbers. Unfortunately, Ron's expedition was not able to provide care for the 46 year old Singapore climber, Amy Wong Kim Ling, who succumbed to an AMS pulmonary edema the same morning Ron's expedition also arrived in Lobuche village. The Nepal Mountaineering Association (NMA) reported that overall, 10 people died attempting to summit and / or reach Everest Base camp during the 13 days that Ron and his party trekked up the mountain.

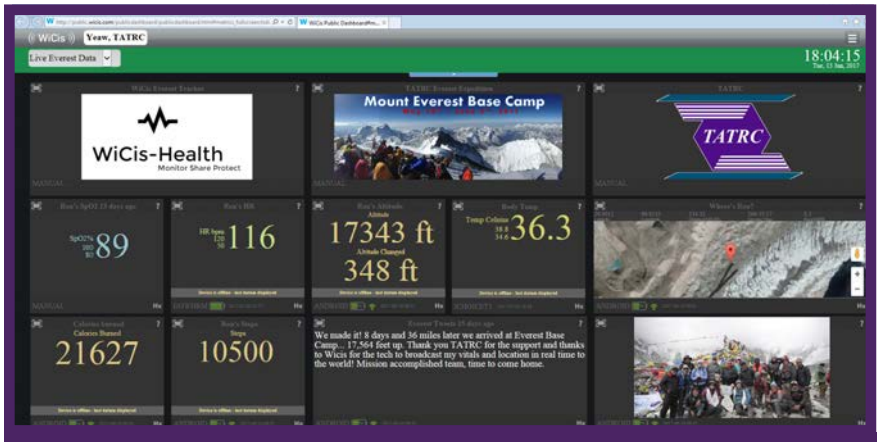
Over the course of the 13 day trek, Ron's body produced 25% more hemoglobin and larger quantities of Erythropoietin (EPO) to account for the lack of oxygen. Research has shown that just two weeks at such extreme elevations can change a climber's blood for up to 3 months. TATRC mHIC's ability to perform remote patient monitoring for Ron while on Mt. Everest in real time, in conjunction with tele-consultation, was a critical element to ensuring his safety during the extreme mCare field tests. Per Nurse Cooper, "Although some of the dips in Ron's vitals made me a little crazy, it was amazing to see first-hand what the human body is capable of. This experience also makes me even more hopeful for the future of technology in medicine and the potential for life-saving advancements."

Ron Yeaw, pictured with COL Birchfield, reviews glucometer readings through TATRC's mCare app while the results are reported in real-time back to TATRC mHIC for monitoring.

Photo Courtesy of: Tashi Sherpa

According to mHIC Lab Manager, Ms. Jeanette Little, the field tests performed by her team on Mt. Everest are a foretaste of support for the operational environment. "Our research and demonstrations show the flexibility and capability to provide virtual health anywhere in the world where we have Soldiers and beneficiaries requiring care."

In addition to the opportunity to put mCare through the ultimate field test at the top of the world, Mt. Everest holds special meaning to Ron and his entire family. Ron's grandmother was Grace Everest, the great-great granddaughter of Sir George Everest, the man for whom the mountain was named in 1865. Ron's whole family, and both of his children, carry Everest as their middle name ever since. Sir George Everest never actually stepped foot on, let alone, saw Mt. Everest with his own eyes; as it was named after him by a member of his British survey team who actually measured the height of the mountain (foreigners were not permitted to work in



The WiCis health dashboard that allowed the public to track Ron's health & wellness statistics during his Mt. Everest adventure.

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Nepal at that time). According to the NMA President, though public accounts are not conclusive, it is believed that Ron, who was also joined by his twin sister, Donna Everest Yeaw, during the expedition, are the first Everests to ever reach EBC1.

Ron and Donna brought with them the Everest Family crest plaque. Passed down for 5 generations, the arrival of the Everest family crest plaque in Kathmandu was marked by audible gasps in the main conference room of the NMA headquarters, the government agency charged with the operation of Nepal's Himalayan tourism. Eager to meet living descendants of George Everest, the NMA held a special counsel meeting to greet Ron's party and perform a Buddhist blessing to wish them success on their journey. The president of the NMA reported that a group photo of Ron's expedition and the NMA leadership, along with the Everest family crest plaque, was later to be framed and permanently hung on the wall of the NMA headquarters in Kathmandu; an incredible honor and an amazing start to the journey that Ron, his sister Donna, COL Birchfield, and the rest of their expedition was about to embark on.

Ron's actual Glucose Readings from the TATRC mCare Dashboard during his summit to Mt. Everest Base Camp.

The Everest family crest was not the only thing that Mr. Yeaw brought with him to Everest Base Camp. To commemorate this triumphant feat, a hand stitched, make-shift TATRC flag sewn by HTIC's Lab Manager, Ms. Ollie Gray, was raised proudly by Ron at Everest Base Camp. This TATRC Flag is a permanent testament to the lengths that Army medicine will go to ensure its solutions can work anytime and anywhere and gives a whole new meaning to a "TATRC North Field Office."

Ron reported that, "stepping foot on the mountain named after my family line has been a bucket list dream of mine since as long as I can remember. Being able to do that, while also supporting operational medicine research for our Soldiers, Sailors, Airmen & Marines is an honor and a privilege. They say that Mt. Everest will humble you, but I am already humbled every day, getting to perform the work we do at TATRC supporting our Active Duty."

TATRC's Ron Yeaw makes it to Mt. Everest Base Camp where he proudly displays a handmade TATRC flag. ***Photo Courtesy of: Tashi Sherpa***

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TATRC Receives Federal Health IT Innovation Awards for Two of its Revolutionary Projects

A big shout out and hearty congratulations to Team TATRC for being recognized by the Federal Health (FedHealth) IT Innovation Awards for the BioGears® physiology engine out of TATRC's Medical Modeling & Simulation Innovation Center (MMSIC) lab, and to the Mobile Health Care Environment (MHCE) project from TATRC's Mobile Health Innovation Center (mHIC) Lab.

TATRC's BioGears® and MHCE Projects were recognized at the 3rd annual FedHealth IT Innovation awards ceremony on 6 June, as standing out among over 100 programs nominated on behalf of Veterans Affairs, Military Health System (MHS), Health and Human Services, and Centers for Medicare & Medicaid Services. Nominated by TATRC support services contractor, Irving Burton Associates, Inc. (IBA), BioGears® and MHCE were among 25 programs that stood out from the rest based on their willingness to take on achievable risk and, more importantly, their demonstrated delivery of real results in support of their mission. Awardees were determined by a panel of judges that included government and industry leaders who evaluated applicants from across the industry, selecting winners for five distinct categories: Interoperability, Data Solutions, Mobile/IoT, Cloud, and Digital Engagement. The winners were announced as part of the digital launch of the 2017 Summer Edition of FedHealth IT magazine and the awards ceremony was held at the Woolly Mammoth Theatre in Washington, DC with more than 250 Federal Health leaders from government and industry.

"We are so delighted and humbled by this highly coveted recognition from the FedHealth IT Innovation Award. I am incredibly proud of the hard work done by the TATRC Team, both here at Fort Detrick, and at our Fort Gordon location," said Mr. Tim McCarthy, Deputy Director of TATRC.

Pictured left to right: Mr. Harvey Magee (MMSIC), Mr. Geoff Miller (MMSIC), Mr. Tim McCarthy (Deputy Director), Mr. Ron Yeaw (mHIC) and Mr. Rob Chewning (mHIC) display their prestigious FedHealth IT Awards for TATRC's BioGears and MHCE Projects.

BioGears®, an advanced medical simulation engine, was conceptualized under a cooperative agreement sponsored by TATRC. The BioGears® physiology engine encapsulates existing and emerging models of organs and physiological systems into a simple, interoperable framework that lowers the barriers to future simulation development and allows users to more quickly produce deliverables. BioGears® is downloadable at no cost at https://biogearsengine.com.

TATRC's MHCE system and its secure mobile application, mCare, were initially developed in direct response to a healthcare delivery gap that surrounded an inability to consistently meet required case management contact rates for remote service members. The resulting application is a secure, HIPAA-compliant mobile communication solution that leverages end users personal mobile devices in a manner uniquely distinct from text messaging or email.

Mr. Tim McCarthy, TATRC Deputy Director, accepts two awards on behalf of the TATRC leadership team.

"We would like to commend the TATRC team for its immense impact on the medical community and for its contributions to MHS mobile health efforts," said Robert Chewning, IBA's Program Manager and Team Lead for TATRC. "The IBA team is honored to be a part of these important Health IT initiatives at the US Army and celebrates the well-deserved recognition from the Fed Health IT Innovation awards."

Mr. Tim McCarthy was on hand to proudly accept the award on behalf of the TATRC leadership team. Also in attendance at the award ceremony was Mr. Geoff Miller, MMSIC Lab Manager, Mr. Harvey Magee, Technical Director from the MMSIC Lab (for BioGears®) and Mr. Ron Yeaw, Deputy Lab Manager from the mHIC Lab (representing MHCE).

AAMTI Success Story: Smartphone-Based Mobile Thermal Imaging Technology to Assess Limb Perfusion and Tourniquet Effectiveness

Over the past decade there has been a resurgence of tourniquet use in civilian and military settings. Several key challenges include assessment of limb perfusion and adequacy of tourniquet placement, particularly in the austere or prehospital environments. A major concern regarding the use of tourniquets in both the military and civilian practice, is the training and the presence of standard protocols for proper application, as well as the ability to assess and monitor the effectiveness of tourniquet inflow occlusion. It is well known, and intuitive, that improperly placed tourniquets continue to allow hemorrhage and are detrimental to patients with extremity injuries.

A technology that is gaining traction in the medical community, due to high quality and low cost, is portable thermal imaging. Thermal imaging cameras are now commercially available as standalone devices, and as peripheral attachments for smartphones that provide quick assessment of environmental thermal profiles. A team from Madigan Army Medical Center (MAMC) investigated the utility of these thermal imaging devices to assess adequacy of tourniquet placement.

An example of thermal imaging used to assess tourniquet effectiveness during this study. This technology is commercially available as a standalone and available via attachments to smartphones.

The MAMC Team randomized 10 swine to undergo massive hemorrhage, or no hemorrhage, then applied tourniquets (adequately and inadequately), and took thermal images in light and blackout conditions. After tourniquets were applied, there was a reliable and steady decrease in thermal temperatures over 30 minutes. The average temperature decrease when a tourniquet was correctly applied, was 6.5°C, but only 0.6°C when a tourniquet was inadequately applied. They presented the images to 62 blinded evaluators in a crowdsourcing fashion to assess whether they could identify the correctly placed tourniquet. The overall accuracy in identifying the limb with a properly placed tourniquet was 97.6% and 98.8% at 5 and 10 minutes (our two earliest time points). The team found the same temperature differences and high levels of accuracy of identification irrespective of hemorrhage status or lighting conditions.

Thermal imaging is a unique technology that is currently not being utilized in trauma and general surgery. Future directions are to continue to hone in on the application of thermal imaging in tourniquet assessment and get it to the battlefield, trauma bay, and civilian EMS. COL Matthew Martin, MD, FACS, FASMBS, the Principal Investigator, Trauma Medical Director and Director of Surgical Research at MAMC for this project stated, "This is very important because in reviews of OIF and OEF, approximately 14% of soldiers with preventable extremity hemorrhage resulted in death." Based on the results, this technology will lead to an improvement in the number of service members who survive potentially fatal extremity injury where a tourniquet is applied.

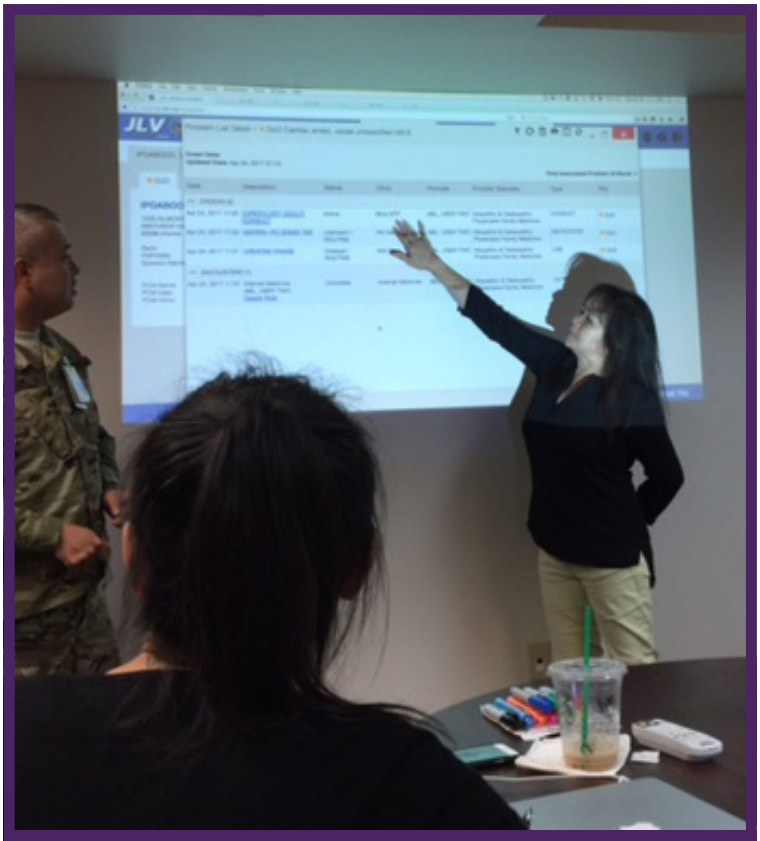
There are two additional parts to this project that are currently under investigation. Thermal imaging assessment of resuscitative endovascular balloon occlusion of the aorta (REBOA), in a swine model is completed and currently in submission for presentation at the next major trauma meeting. Thermal imaging assessment of tourniquets in various environments in humans is currently in the data collection phase.

This AMEDD Advanced Medical Technology Initiative (AAMTI) funded project on thermal imaging and tourniquets was presented as a podium presentation at the 47th Western Trauma Association meeting in Snowbird, UT. It received 1st place in the Earl Young resident competition, despite several other great presentations given by major military and civilian trauma centers from around the country. It was also presented at the SAGES Military Symposium in Houston, TX and will be presented at the upcoming Asian Pacific Military Health Exchange (APMHE) in Singapore. Additionally, the manuscript has been submitted for publication in the Journal of Trauma and Acute Care Surgery.

Team HTIC Huddles in Hawaii for Phase II Planning of Linked Problem List

In late April, key members from the Health Technology Innovation Center (HTIC) which included Ms. Ollie Gray, Lab Manager, Ms. Stephanie Hutson, Project Officer and Ms. Kim Pham, Developer, met in Honolulu, Hawaii to kick-off the Phase II planning of the Linked Problem List (LPL). The LPL project focuses on enhancing the problem list widget in the Joint Legacy Viewer (JLV) with associations of artifacts that are related to the problem. The JLV is the legacy system used to view health related information between the DoD, VA, and some private sector providers. The JLV problem list widget pulls the data from the DoD Armed Forces Health Longitudinal Technology Application (AHLTA) Electronic Health Records (EHR); AHLTA's problem list function has proven to be a powerful tool to providers. The upgrades made to the problem list widget allow for a one-stop-shop for providers searching for problem related encounters, lab/radiology results, and consult orders artifacts. In Phase I of the LPL Project, the developers were able to implement EHR created linkages between the problems and related artifacts from AHLTA.

The HTIC team met at the Hokukahu headquarters, home to the software programming subcontractor, in Honolulu for a week to start discussing Phase II items and planning user stories that coincide with their Agile software development framework. The Hokukahu team includes developers Jane Shen, Tia Nguyen, and Brad Goo. The week started off with a demo to the team members of current linked artifacts capabilities that were completed in Phase I. The team then moved into SCRUM mode to complete backlog refinement and SPRINT planning sessions to complete the last functionalities planned for Phase I. The last SPRINT focuses on a filter function of major/minor procedures and diagnoses between AHLTA and JLV problem list, date range queries for lab/consultation results, linking of dispensed medications from an encounter to the problem list, and ability to view problem/encounter comments from AHLTA in the JLV problem list widget. Filtering the major/minor procedures/diagnoses will assist providers in finding the information they are looking for by narrowing the focus on pertinent health information.



HTIC's Developer Ms. Kim Pham discusses innovative ideas during the Phase II planning session.

During the planning session, the team was joined by COL John Scott, Director for Informatics Policy, Office of the Assistant Secretary of Defense for Health Affairs, Dr. Reese Omizo, Director Pacific Joint Interoperability Technology Center (JITC), Dr. George Underwood, Consultant, Medical Informatics, Clinical Informatics, Information Management Division Staff Pulmonologist, Tripler Army Medical Center (TAMC), Dr. Eric Swanson, Chief, Internal Medicine Clinic, Tripler Army Medical Center (TAMC), and Ms. Rachel Wiebe, RD, Analyst JLV Team. The functional users provided their expertise for the team's Phase II discussions. "It was a real pleasure to brainstorm the next phase of our project with experienced clinicians who are using the systems every day. I became even more confident that what we're working on will help them help our patients," said COL John Scott.

Phase II of LPL will focus on manual artifact linking capabilities within the problem list. Providers will soon be able to create their own associations

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in the problem list widget via drag-and-drop method. They will be able to view EHR created associations, linkages built by other providers, and share with the community their manually created artifact links. "The problem list enhancements will be a significant asset," Dr. George Underwood remarked.

The LPL Phase II planning also covered the creation of user stories that correctly reflect the development work that needs to be done during the next few months.

Dr. Eric Swanson stated, "It was a great pleasure working with the TATRC team! It was very gratifying to be a part of the research and development that helps improve our information systems for Service Members, their families, Veterans, retirees and other Tricare beneficiaries. Many thanks and much aloha from Hawaii!"

The working group for the Phase II planning of Linked Problem List are provided with expertise from some of the functional users.

TATRC Recharges at 22nd Annual Organization Day

On 9 June, Team TATRC took some time to recharge and enjoy each other's company at the 22nd Annual Organization Day & Summer Picnic. Each year, the Organization Day provides an opportunity to bring together TATRC Alumni, current TATRC staff and their families in a social, casual environment in order to see where the Organization currently is, and review how far we have progressed and improved over the past year. It's also a wonderful time for fellowship and teambuilding, and of course the infamous water balloon and bean bag toss tournaments! The 22nd Annual Organization Day was quite a success, and we look forward to continuing the tradition and seeing how far TATRC has come at next year's 23rd Annual Organization Day! Happy Summer!

Team TATRC really knows how to "have a ball!"

Showing his form: Tom Bigott shows Peter Lucas how it's done.

The competition was fierce even amongst our youngest visitors at Org Day!

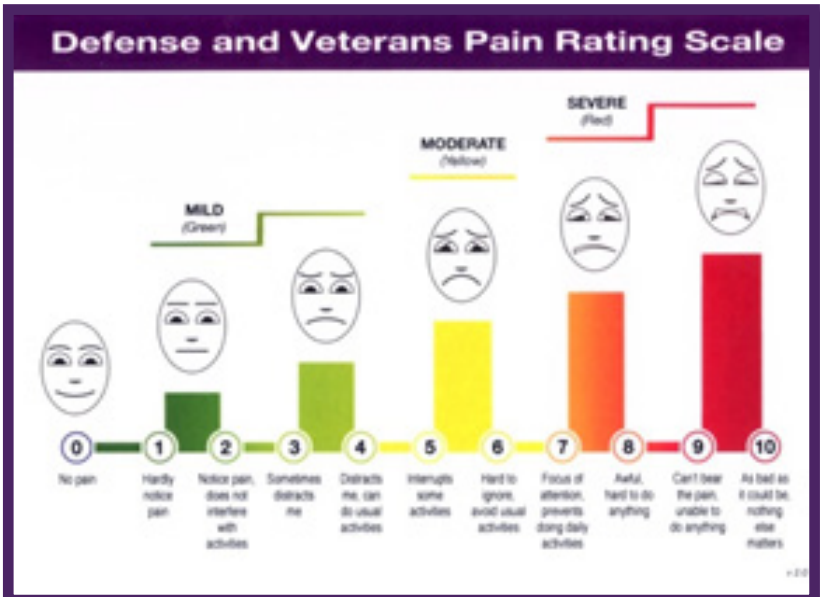
Acute Pain Study Launched at WRNMMC Inside the Secure mCare App

In April 2017, the Mobile Health Care Environment (MHCE) Research System and its secure mobile app, known as mCare, was deployed for use in a clinical research study at the Walter Reed National Military Medical Center (WRNMMC) in Bethesda, MD. The focus of this research study was to track a patient's pain levels at home, after being discharged from the hospital. The specific use case is to see if the patient is experiencing any issues, such as anesthesia and / or nerve blocks post-operatively. To track the patient's recovery after discharge, each individual patient is assigned a pain survey based on the Defense and Veteran's Pain Rating Scale (DVPRS), 2 days post-operatively, and 7 days post-operatively respectively.

The patient's responses to the mobile DVPRS pain scale survey are available to the WRNMMC team via a secure web-portal, and the MHCE system also provides escalation warnings and other alerts as required to the team. Having the ability to track patients at home via mobile health, provides efficiencies to the WRNMMC staff in the immediate follow-up that is required after discharge.

"This study is another example of the versatility of the mCare application and how it can be part of the patient care toolkit. As a nurse, I am particularly cognizant of the importance of pain control in patients and I feel proud that we can provide this simple solution which allows them to effectively communicate directly with providers regarding their pain levels using the most current version of the pain scale," said Ms. Mabel Cooper RN, BSN, CCRC a Registered Nurse assigned to team TATRC's Mobile Health Innovation Center located in Fort Gordon.

The research study has already enrolled 50% of the targeted subjects, and is expected to conclude in the Summer of 2017.



The DVPRS given to patient's to use for their pain survey questions that are responded to via a secure web portal.

TATRC to Play a Key Role in New Army Research Task Areas

In FY19, the Medical Simulation and Information Sciences Research Program, led by Dr. Janet Harris will launch three new Army research task areas: Autonomous and Unmanned Systems, Virtual Health, and Medical Robotics respectively.

TATRC will play a key role in all three of these new research task areas, and planning for these new activities is already underway in earnest. Specifically, Dr. Gary Gilbert, TATRC's Operational Telemedicine Lab Manager, has been named as the Capability Area Manager (CAM) for the Autonomous and Unmanned Systems and Medical Robotics research. Additionally, Ms. Jeanette Little, TATRC's Mobile Health Innovation Center Lab Manager, will serve as the CAM for Virtual Health research.

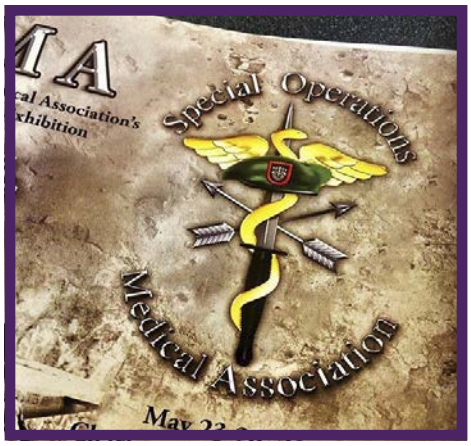
Each of these new research areas will focus on future capabilities, including the technologies and practices that would support the Multi-Domain Battlefield concept in 2030 and beyond. On 4 May, the first IPT for these new research activities took place at Fort Detrick.

COL Dan Kral, TATRC's Director, stated, "Presently, TATRC is working collaboratively with other laboratories within the Command involved in shaping the overarching goals and objectives for these new research areas. These intramural collaborations include the United States Army Institute for Surgical Research and the Walter Reed Army Institute of Research. TATRC is eager to help shape these new and evolving research task areas. "Over the years TATRC has strategically positioned itself, and its portfolio of capabilities, to specifically align with what we identified as a critical emerging field; that of telemedicine. We see TATRC's prominent position within the Medical Simulation and Information Sciences Research Program as a validation of that vision. And now, as TATRC's talented team and their great body of work truly begin to get enterprise exposure, we see TATRC perfectly suited to continue to provide the innovative foundational research necessary to support MEDCOM's ever evolving mission."

TATRC On the Road at SOMSA 2017

Senior members from USAMRMC and TATRC were well represented at this year's Special Operations Medical Scientific Assembly (SOMSA) held 22-25 May, in Charlotte, NC. Among the MRMC attendees were seven members of the TATRC family. SOMSA is an annual meeting sponsored and run by the Special Operations Medical Association (SOMA). Founded in 1987, the SOMA brings together the unique blend of pre-hospital, tactical, wilderness, austere, disaster and deployed medicine with the primary goal of advancing the art and science of special operations medical care through the education and professional development of special operations medical providers. Through both SOMA's official publication, the Journal of Special Operations Medicine JSOM, and the annual SOMSA meeting, the SOMA provides a unique forum for military and civilian medical providers, academia and industry from around the world to meet and exchange ideas to advance the science, technology and skills of unconventional medicine.

Immediately preceded by two days of in-depth special operations medic training which included diverse topics like active shooter response, "tactical" ultrasound, K9 tactical emergency care, and battlefield acupuncture; this year's SOMSA included talks and posters on the latest trends in Special Operations Forces (SOF) medicine to include Prolonged Field Care, Tactical Combat Casualty Care, Global Engagement, and scientific advances directly impacting special operations medicine. Among the most noteworthy of this year's presentations were operational vignettes presented by special operations medics from recent real-world missions and key note talks by VADM(Ret) Richard Carmona, former Surgeon General of the United States, and COL James Czarnik, SOCAFRICOM Surgeon. Dr. Carmona focused on the need for even more specialized SOF medic training to meet the challenges of dispersed and remote global deployments in response to the ever increasing threat of terrorism and insurgencies. COL Czarnik built on that theme stressing that within remote indigenous settings, SOF medics, now, and conventional medical providers in the future, must be prepared and plan to work with what is locally available in terms of medical supplies, equipment, personnel, and practice. With such diverse and remote deployments, we can no longer expect to "fly in planeloads of stuff to set up shop as if we were at Walter Reed." Clearly such missions within austere environments are good candidates for innovative uses of virtual health technologies, of which TATRC is now playing a key role. Within several of the SOMSA breakout sessions, LTC Jeremy Pamplin led a group of SOF physicians and medics that presented their experiences with virtual health systems, at both the deployed site of care, and at the CONUS consultant end of deployments to USCENTCOM and AFRICOM. Panel members stressed that the simplest and most flexible telemedicine call systems were the most reliable and effective. Many of the systems used were funded and supported through the AMEDD Advanced Medical Technology Initiative (AAMTI), which is administered and managed by TATRC. Another noteworthy presentation, which was the winner of the best research award, was made by SFC Paul Loos on innovative use of social media for SOF medic information exchange and education. Perhaps the best presentation was the last one given by former Navy SEAL CAPT (Ret), Frank Butler, MD who gave an update on Tactical Combat Casualty Care. Several talks had been



presented on experiences in the use of fresh whole blood at sites of injury by SOF forces, especially the 75th Ranger Regiment. CAPT Butler stressed that while difficult to manage, whole blood is, by far, the most effective and immediate fluid replacement for combat casualties suffering from exsanguination. A direct outcome of this discussion is an effort to document a capability need to provide just-in-time delivery of whole blood to special operations forces, as well as recovery of unused blood after mission completions. This prompted SOCOM, USASOC, USAMMDA and TATRC to revive and extend previous studies of potential solutions such as smart parachutes and drones. TATRC's Operational Medicine Lab is pursuing courses of action with the other stakeholders.

Said Dr. Gary Gilbert, TATRC, a lifetime member of SOMA and current member of the Board of Directors, "Like every year, the culminating highlight of the event is the SOMA banquet at which both the SOF Medic of the Year presentations are made for each of the services, international SOF forces, and civilian EMS first responders; followed by reading of the names and deposit of symbolic dog tags for those SOF personnel who were killed in action during the past year."

TATRC Team To Have Expanded Role in 2017 DHITS Conference

TATRC will be sending a large contingent to the Defense Health Information Technology (DHITS) conference this year to reflect their equally growing and expanding portfolio, particularly in the areas of Virtual Health (*see "TATRC to play a Key Role in New Army Research Task Areas" page 8*). TATRC will have five key speakers in the educational tracks, as well as three separate demonstration booths in the Exhibit Hall this year.

TATRC Director, COL Dan Kral, and the Mobile Health Innovation Center (mHIC) Lab Manager, Ms. Jeanette Little will present first, speaking about the future needs of Army Medicine in a multi-domain battlefield. They will articulate the need to define a more forward thinking vision for Army Medicine so that the key research partners, like TATRC, can get "out in front of the formation" far enough to lay down the technical development roadmap to meet those capability gaps.

Health Information Technology Center (HTIC) Lab Manager, Ms. Ollie Gray and mHIC Deputy Lab Manager, Mr. Ron Yeaw will be leading breakout sessions, speaking about how TATRC's current portfolio of projects are aligning to meet future state Army Medicine needs. Ms. Gray will focus on key HTIC projects such as *Team Fitness Tracker, Joint Legacy Viewer Linked Problem List,* and *SBIR Virtual Medical Concierge*; while Mr. Yeaw will be presenting a combined mobile and operational medicine topic centered on virtual health and remote patient monitoring across the spectrum of care, from the battlefield to the home.

TATRC's expanded role will also be seen in the Exhibit hall. TATRC will have various demonstrations covering Direct & Beneficiary Care Research Areas, TATRC's AMEDD Advanced Medical Technology Initiative (AAMTI) Program and our expanded Virtual Health Research portfolio, which will include covering mHIC and the new Virtual Health Support Office. Additionally, each booth will be facilitating group discussions at various times throughout the symposium, to allow conference attendees to sign up for individual one-on-one sessions with TATRC's key personnel. In these sessions, TATRC staff will articulate the reasoning behind each element of the TATRC portfolio and be available to answer questions.

According to TATRC Director, COL Dan Kral, "so much of what you often see at conferences is focused on the 'what' and the 'how'. But what is critical, however, is the 'why' …and that is what we will get after this year at DHITS."

The 2017 DHITS conference will take place in Orlando, FL from 25-27th July. For more information on this event, please visit: http://dhits.cvent.com.

TATRC Pedals Its Way in Annual Bike to Work Day

On 19 May, a team of five TATRC staff, affectionately referred to as the TATRC "Cyclomaniacs," led by COL Dan Kral, along with several hundred members of the Fort Detrick community, took part in the Annual "Bike to Work" Day to celebrate bicycling as a clean, fun and healthy way to get to work! The group rode from Fort Detrick to Alumnae Hall at Hood College to meet up with the rest of the teams participating in the Frederick area. A 4.4-mile recreational ride then took place through the City Of Frederick, winding past Fort Detrick and Frederick's City Hall, and ended at the Frederick City Transit Center. At the conclusion of the ride, the TATRC gang ended with a team building breakfast.

The League of American Bicyclists began Bike to Work Day as part of Bike Month in 1956. Over the years, Bike to Work Day has grown into a widespread event with countless bicyclists taking to the streets nationwide, in an effort to get commuters to try bicycling to work as a healthy and safe alternative to driving alone. In the Metropolitan Washington region, Bike to Work Day has grown from a small group of a few hundred in 2001 to over 17,500 participants in 2016.

Congratulations to all who took part in this fun and environmentally friendly activity! A big shout out to our "Cyclomaniacs," COL Kral, Dr. Fran McVeigh, Ms. Cheryl Merritt, Mr. James Beach, and Mr. Joe Barrick, who participated in this health conscious event! Pedal Power!

Fort Detrick's "Bike to Work" team including COL Dan Kral, Mr. Jim Beach, Dr. Francis McVeigh, Ms. Cheryl Merritt and Mr. Joe Barrick, is ready to ride.

TATRC Hosts NATO Chiefs of Military Medical Services

On 1 June, TATRC was visited by the Committee of the Chiefs of Military Medical Services in NATO (COMEDS). This stop was part of a larger USAMRMC post-wide tour. While at the TATRC Innovation Campus, the members of COMEDS had a chance to view a number of TATRC projects and programs presented by our key Small and Medium-sized Enterprises (SMEs) and TATRC staff. Projects included, Medical Modeling, Simulation and Training manikins, Unmanned Aerial and Ground Systems and Operational Telemedicine as it relates to the point of care teleconsultation and telementoring.

COMEDS, founded in 1994, is the NATO Alliance's senior military medical body on military health matters. It acts as the central point for the development and coordination of military health standards and for providing medical advice to the military committee.

Sixty-five COMEDS members, representing 26 different countries, participated in the visit, which was part of the 47th COMEDS plenary meeting in Washington, D.C., May 31-June 1.

The visit allowed the Command and TATRC to share its efforts with the committee in order to improve coordination, standardization and interoperability in the medical field. Our SMEs presented medical research and products to the Allies' Surgeons General and their staff during the interactive, hands-on tour.

Thank you to all of our distinguished COMEDS guests who visited to learn about TATRC and the Innovative Research being done by our labs and programs!

Mr. James Beach (pictured top), Mr. Nate Fisher (pictured center) and Mr. Geoff Miller (pictured bottom) brief members of the NATO COMEDS Group.

On the Horizon...

Upcoming Events:

4 July: Independence Day

24 - 25 July: AUSA Army Medical Symposium and Exposition; San Antonio, TX

25 - 27 July: DHITS Conference; Orlando, FL

27 - 30 August: MHSRS Conference; Orlando, FL

4 September: Labor Day

11 September: Patriot's Day

Employee Spotlight

Team HTIC Welcomes New Software Assurance Engineer, Jesse Childress

Mr. Jesse Childress, Software Quality Assurance Engineer

The Health Technology Innovation Center (HTIC) is pleased to welcome Mr. Jesse Childress to the team as he assumes his new role as Software Quality Assurance Engineer. In this capacity, Jesse will be testing software code developed for the Team Fitness Tracker and several other HTIC Projects using a semi-automated software testing package. Jesse will be working directly with HTIC's Senior Developers and other project stakeholders to ensure that our software exceeds our customers' expectations.

Jesse has a B.S. in Business Information Technology from Virginia Tech and specializes in Software Quality Assurance (SQA). With over a decade of experience in both manual and automated SQA supporting a wide variety of verticals such as Telecommunications, DoD, Automotive and Manufacturing, he has contributed widely to the development of a higher quality of applications for the HTIC. He has a comprehensive and varied range of experience with multiple software quality testing methodologies and tools, and has most recently supported the continuous development of a testing framework for all applications within Veterans Benefits Administration and Veterans Health Administration.

Jesse is married to his childhood sweetheart, Jenny, and they have 5 children: Bryson (17), Austin (13), Jake (12), Eli (10), and Kyleigh (8). He enjoys watching his children play sports, contributing at his Church, and spending time with family. Team HTIC is happy to have Jesse on board!

HTIC's Senior Developer, Kirit Raja, Receives Prestigious Achievement Award

The Health Technology Innovation Center (HTIC) is proud to announce that their very own Senior Developer, Mr. Kirit Raja, was recently recognized and honored for his development of a web based application "Self-Inspection Program" to convert Montgomery County Maryland's paper based safety inspection process to a completely online process. He received the 2017 Achievement Award for "Risk Management Safety & Health" in the category of Risk and Emergency Management. While this work was completed prior to Kirit joining TATRC, the HTIC is honored to have an award winning developer as part of their development team. The skills Kirit brings to the table are currently being utilized to develop a Team Fitness Tracker, which will go live for testing later this Summer. Congratulations Kirit!

Mr. Kirit Raja, Software Developer

HTIC's System Engineer Earns Highly Regarded Information Technology Cloud and Virtualization Certifications

Mr. Young Lim, Systems Engineer

Mr. Young Lim, a contractor with Laulima Government Solutions, LLC, has been on contract to the Telemedicine and Advanced Technology Research Center's (TATRC), Health Technology Innovation Center (HTIC), as a Systems Engineer for the last 7.5 years. Mr. Lim has provided highly regarded, expert valuable design, development, and database maintenance services to the TATRC Early Stage Platform (ESP). The TATRC ESP, which has been fully described in past issues of the TATRC Newsletter, is a fully-virtualized development, integration, and test lab which is used to evaluate innovative health IT prototypes. It is populated with test instances of the current DoD Electronic Health Record (EHR), AHLTA and CHCS, and contains clinically-relevant, longitudinal, synthetic patient data.

As a true professional who believes in continuing education, Mr. Lim felt it was important to enhance his current certifications with new certifications representing newer emerging technologies. As such, he recently earned a series of highly regarded Cloud and Virtualization Information Technology certifications after passing rigorous examinations. In January 2017, Mr. Lim completed extensive training and earned Microsoft Certified Solutions Expert: Cloud Platform and Infrastructure (MCSE: Cloud). MSCE: Cloud certification focused on Windows Server 2012 and Windows Virtualization Technologies. Not to rest on his laurels, Mr. Lim continued to study hard and earn the VMware Certified Professional 6 – Data Center Virtualization (VCP6-DCV) Certification in March 2017. This certification focuses on VMware vSphere 6 technologies. Last, but not least, Lim also earned the Cisco Certified Network Associate: Data Center (CCNA: Data Center) Certification in April 2017, which covers all aspects of Cisco storage networking and network virtualization technologies.

For those unfamiliar with Cloud Technologies, they are a type of Internet-based computing that provides economical, shared computer processing resources and data to computers and other devices on demand through various subscription models, vice connecting to a locally-established server. Cloud technologies are highly scalable, and allow an organization to focus its efforts on its business requirements vice being always concerned with maintaining and updating its technical architecture. "Virtualization" refers typically to hardware virtualization or platform virtualization that creates "virtual machines" that act like a real computer with an operating system. Software executed on these virtual machines is separated from the underlying hardware resources. Virtualization allows for the consolidation of hardware assets where multiple operating systems and applications can run on fewer physical machines, or where virtual machines can be distributed across cloud-based resources.

Mr. Lim's training and certifications enable TATRC's HTIC Lab to continue to maintain the ESP to provide the best performance, availability, and efficiency using cloud and virtualized data center technologies and is proud of his accomplishments!

Ms. Ollie B. Gray, RN, MSN, PMP, Health Technology Innovation Center Lab Manager, stated, "TATRC is most fortunate to have Mr. Lim on contract as a most highly valued team member. I have been impressed by Mr. Lim's willingness to participate in continuing to further his education and earn these difficult certifications in the interest of providing available, high performing, and scalable ESP services at the most efficient cost to government. Mr. Lim's actions reflect great credit upon himself and the U.S. Army." Congratulations Young!

Employee Spotlight

Congratulations to TATRC's Q3 Employee of the Quarter, Mr. Carl Manemeit

Mr. Carl Manemeit, Deputy Lab Manager for TATRC's Operational Medicine Laboratory, was recognized as the Q3 TATRC Employee of the Quarter because he continuously models and displays the qualities of an ideal award recipient as stated in the Employee of the Quarter Charter Memo. Though absolutely essential for successful mission accomplishment in any organization, division, branch or section, "Deputies" are seldom recognized for their daily contributions to their organizations. They are often left with the boring, repetitive, and "hum-drum" daily duties of making an organization run successfully, while the "Chief" takes on the "glamorous" and exciting tasks and gets most of the credit.

Dr. Gary Gilbert, Lab Manager for TATRC's Operational Telemedicine Lab stated, "I can say without reservation from my 45 years of military and 'government' service that no leader can succeed without a steady and reliable 'Right-hand Person.' In that role, Carl is one of the best that I have ever had." Carl runs the Operational Telemedicine Lab on a daily basis, setting up and attending most meetings and chairing many of them. He assigns and monitors tasks to all lab employees and reviews and consolidates all input for responses to the Lab Manager, or for sending further information up the Chain of Command. He tracks employee attendance, travel, salary disbursements and oversees the execution of the entire lab budget. He is the "de Jure" Chief Officer's Representative (COR) for 18 contracts, and essentially the "de facto" COR for another twelve, in that he reviews the reports and invoices, and makes the primary recommendations either directly as COR, or in support of the COR. This is in addition to executing his own research projects, of which he has two intramural JPC-1 and JPC-6 funded projects and another pending final review, as well as 10 of his own SBIR projects, for which he personally conceived and nominated the topic and serves as both the COR and the responsible Subject Matter Expert.

Mr. Carl Manemeit, Deputy Lab Manager, Operational Telemedicine Lab

If successful performance of that exceptional workload is not enough, his additional accomplishments during this quarter included working directly with the TATRC Marketing team for planning, overseeing and executing all aspects of the Operational Telemedicine Lab's participation in two very large and successful events, the General Officer's Open House in January, as well as the Annual Spring Open House & Technology Demonstration in May. Additionally, Mr. Manemeit is also spearheading the efforts in support of the 2017 CERDEC Ground Activity telemedicine field evaluations scheduled for this Summer.

To summarize, Carl deserves this award for his continued dedicated, reliable, and uncompromised service and loyalty to TATRC, not only for this quarter, but for over the last 9 years.

TATRC Welcomes New Project Officer, Chris Hildebrandt

Mr. Chris Hildebrandt, MMSIC Project Officer

Chris Hildebrandt joins the TATRC team as a Project Officer, with expertise in Human Factors Engineering and will primarily support the Medical Modeling & Simulation Innovation Center. He is very excited to become a part of the TATRC Team & Family.

Chris was born and raised in Annapolis, MD and has a BS degree in Aeronautical Science from Embry-Riddle Aeronautical University in Daytona, FL and has been working towards his MS degree in Human Factors from Embry-Riddle Aeronautical University Worldwide.

Chris is a previous Flight Instructor and Commercial Airline Pilot. His 8 years as an airline pilot, both as a First Officer and Captain, has enabled him to obtain type ratings in the Airbus 320, Boeing 737, Dornier 328 Jet, and Jetstream 41. He most recently comes to us from Textron Systems Unmanned Systems where he spent 2 years as an Unmanned Aerial Vehicle (UAV) Flight Instructor and Operator, and the last 8 years as a Human Factors Engineer, analyzing, designing and implementing human factors design standards for hardware and software human machine interfaces for UAVs, unmanned ground vehicles, ground controls stations, hand-held devices, and supporting equipment for DoD contracts. Chris also owns and operates an aerial photography business on the side using sUAS and drones.

As a Project Officer at TATRC, Chris will assist in the development of human factors design, testing and applied research for products and services, plan and execute usability experiments and studies in a variety of user environments and perform statistical analysis of behavioral and subjective user data. He will also use proven human factors methodologies and tools and recommend changes to improve overall usability of the design and process.

Chris is married to wife Melissa, and together they have two wonderful and beautiful children – Connor, 12 and Katerina, 10. Their home is completed by Connor's tortoise and 2 large dogs, Brandy & JD. Together they enjoy a variety of outdoor activities including: camping in their travel trailer, hiking, biking, and ATVing. Team TATRC is proud and excited to have Chris join the gang!

This Quarter's TATRC TRIVIA...

Question:

TATRC's new Innovation Campus (TIC) is up and running! What was the name of the outdoor field environment prior to the new campus being built? (Answer in Next Issue!)

Answer to Last Issue's TATRC TRIVIA...

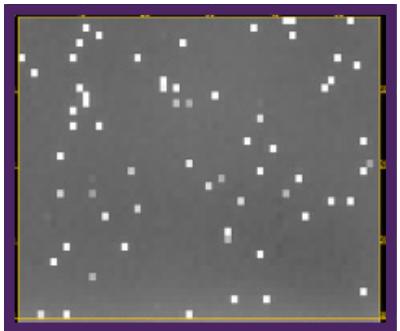
Q: What previous USAMRMC Commander has been called "the Father of Army Telemedicine?"

A: BG Russ Zajtchuk was the previous MRMC Commander that has been called "the Father of Army Telemedicine."

AAMTI Spotlight: An Evaluation of Microarray Mediated Detection of Antibiotic Resistance Genes in Gram-Negative Organisms at a Military Medical Center

Antibiotic resistance is a significant hindrance to the preservation of life and limb in the military healthcare setting and is a significant threat to U.S. military personnel. Indeed, during the height of the conflicts in Iraq and Afghanistan, there was an increase in wound infections caused by multi-drug resistant organisms. Multi-drug resistant organisms are linked to an increase in the morbidity and mortality associated with wound infection and a concomitant increase in the economic burden of wound care treatment. The effect of multi-drug resistant organisms on the military healthcare system was dramatic between 2002 and 2004 when 102 patients being treated in the military health care system were found to have multi-drug resistant Acinetobacter baumannii blood stream infections. Further investigation revealed that the majority of these patients (85%) were injured in association with combat operations in Afghanistan, Iraq, or Kuwait. Infections with this organism were reported at two major military medical centers and onboard a U.S. Navy hospital ship. At one point, it was reported that 15 to 20% of wounded servicemembers returning from Iraq and Afghanistan were infected with an antimicrobial resistant organism.

To counter the threats posed by antimicrobial resistant organisms to U. S. servicemembers, it is necessary to determine which organisms are currently resistant to antimicrobial therapy, which organisms could become resistant, and where reservoirs of resistant organisms are located. Currently, most clinical laboratories identify resistant organisms by phenotype. In other words, they isolate bacteria from the patient and cultivate the isolate in the presence of various antibiotics. In this way, antimicrobial agents capable of inhibiting the growth of the isolate can be identified. Conversely, this method also reveals those that agents do not inhibit the growth of the isolate which gives an indication of the inherent level of resistance.



Electrochemical Signal Detection Readout from a TAMC clinical isolate.

One problem of relying on phenotypic methods for identifying antimicrobial resistance is the fact that this method only identifies organisms that are resistant in the laboratory setting. It is well known that bacteria tend to adapt to the host and will display altered properties when compared with laboratory-grown strains. Another problem with utilizing phenotypic methods is the fact that these methods only identify the current state of the isolate and cannot be used to predict the emergence of resistance. To mitigate these shortcomings, the team utilized funding from TATRC's AAMTI Program to leverage past Department of Defense funding (initially by the Defense Medical Research Program and Defense Threat Reduction Agency) into the development of an antimicrobial resistance microarray or ARDM at the Naval Research Laboratory by evaluating ARDM version 2 (ARDMv.2) in the clinical microbiology laboratory at Tripler Army Medical Center (TAMC). The ARDMv.2 is a small nucleic acid array printed onto a glass slide containing probes for over 200 antimicrobial resistance genes. Nucleic acids extracted from an isolate is incubated with the array allowing resistance genes to bind to the probes. After a brief detection step, the results are read using a portable electrochemical detector and analyzed using a commercial off-the-shelf laptop.

Principal Investigator MAJ Michael A. Washington, PhD

100 isolates of Escherichia coli were examined using this method and found that the majority of antibiotic resistant strains in this study, harbored a gene known as tem-1 that encodes for an enzyme called a beta-lactamase. Beta-lactamases are enzymes capable of degrading antibiotics derived from penicillin. The presence of this gene indicates that whether or not these isolates were able to grow in the presence of penicillin in the laboratory, they are capable of degrading penicillin and thus may be resistant in the patient. This information was not previously available in the clinical laboratory and could potentially help guide treatment decisions. This information can also help track the emergence and spread of antibiotic resistance organisms since a shift in the dominant genes can indicate the introduction of new strains, or a decline in the numbers of previously detected strains. Results with this system can be obtained in as little as 24 hours after the

AAMTI Spotlight *Continued on page 17*

AAMTI Spotlight Continued from page 16

isolation of the organism, and with minimal laboratory staff and a simplified data analysis procedure. In 2015, TATRC's AAMTI Program funded the evaluation of the ARDMv.2 at TAMC. This project has the potential to significantly reduce the human and financial costs associated with antimicrobial resistance in the military health system. Future research will involve evaluating this system at DoD overseas laboratories and exploring the possibility of integrating it into the clinical laboratory workflow. "This project has the potential to significantly reduce the human and financial costs associated with antimicrobial resistance in the military health system," said Principal Investigator, MAJ Michael Washington Ph.D. from TAMC.

Op-T-Med Announces New Phase 3 SBIR Award for UAS Research

On 27 March, Dragonfly Pictures Inc. (DPI) was awarded a Phase 3 SBIR contract to collaborate with TATRC's Operational Medicine Lab on a research project entitled "Emergency Medical Resupply & Enroute Care Unmanned Aerial System (UAS) Research Platform," which was funded by Joint Program Committee-6 for Combat Casualty Care. This joint project is a collaborative effort between DPI, TATRC, and the US Army Aeromedical Research Lab (USAARL) to research future operational concepts that involve leveraging UAS to support combat casualty care and force health protection missions. Under this new contract, DPI will mature their DP-14 tandem rotor vertical takeoff and landing (VTOL) UAS platform to support planned flight tests and field evaluations. In a parallel effort, USAARL is developing a Data Acquisition System (DAS) which will capture vehicle acceleration effects and environmental data within the interior cargo space of the UAS. TATRC is taking the lead on project management and integration of the DAS and UAS systems. At the end of the first phase of this collaborative research effort, a field evaluation and demonstration of an emergency medical resupply mission will be conducted using a remotely piloted DP-14 UAS, with integrated DAS and medical resupply payload. Subsequent phases of this research project will focus on integrating autonomous command and control, medical data exchange, and enroute care capabilities. This demonstration will support the investigation of UAS-specific considerations for the safe transport of patients and medical equipment to inform future research and development of medical capabilities to support dispersed operations. "Ultimately, the DPI contract will provide a cost-effective UAS research prototype to develop and test methods of integrating medical capabilities with emerging multi-role UAS to support future medical operations when manned aircraft are not available or denied access," stated Mr. Nathan Fisher, TATRC Research Manager for Medical Robotics and Autonomous Systems. Dragonfly Picture's relationship with TATRC dates back to 2008 when they were awarded a Phase I Army SBIR to develop a UAS to reduce exposure of personnel and assets to CBRNE (Chemical, Biological, Radiological, Nuclear, Explosives) hazards. This research resulted in the development of the DP-12 platform, a smaller VTOL UAS with autonomous capabilities and a payload capacity of 150lbs. The DP-12 is the predecessor to the DP-14 UAS that is currently being developed by DPI under the JPC-6 research project with TATRC and USAARL. In addition to their SBIR effort, DPI has provided unwavering support at numerous field exercises and trained TATRC personnel in operating small UAS. Their expertise has played an invaluable role in the Operational Medicine Lab's research efforts involving the use of UAS.

'Bottom line', says the Operational Medicine Lab Manager, Dr. Gary Gilbert, "is that in order to do medical care research on relevant unmanned vehicles, you need a relevant unmanned vehicle; likewise, if you're trying to wisely invest your limited medical research dollars in medical research, versus platforms, you need access to an inexpensive platform."

The Dragonfly DP-14 tandem VTOL on display at the 2017 TATRC Spring Open House.

TATRC Team Visits Commercial Medical Technology Giant to Discuss Innovation

Earlier this spring, a team from TATRC traveled to Durham, North Carolina, to visit medical technology company Becton-Dickinson (BD) to participate in a technology sharing session and discuss innovation best practices. Founded in 1897, BD is a $26B American medical technology company that manufactures and sells medical devices, instrument systems, and reagents employing 50,000 people in over 50 countries. According to their website, BD "provides innovative solutions that help advance medical research and genomics, enhance the diagnosis of infectious disease and cancer, improve medication management, promote infection prevention, equip surgical and interventional procedures, and support the management of diabetes."

With TATRC's growing virtual health portfolio and investment in biosensor research, and BD just being named as one of Fortune Magazine companies most likely to "Change the World" in 2015, a potential partnership was a natural evolution. During the site visit, TATRC's Deputy Director Mr. Tim McCarthy provided a briefing to BD on TATRC's current portfolio, as well as our emerging Virtual Health Support Office, emphasizing the need for future Army medical capabilities to provide support during periods of prolonged field care and in the contexts of the recently defined multi-domain battlefield concepts.

The BD presentations for TATRC centered on four key areas, as well as their overall clinical business model that supports each of the following: 1) Smart Devices, 2) Parenteral Sciences, 3) Genomics, and 4) Advanced Diagnostics. In addition to the specific breakthroughs BD has pioneered in the field of biosensors and virtual health, TATRC was also keen on discussing BD's approach to innovation and portfolio management. As a preeminent medical lab, BD has a vast amount of best practices acquired over the years regarding how to keep on the forefront of cutting-edge technology without losing time, and money, chasing short-term industry trends.

According to BD's lead Research & Development Manager Dr. David Sebba, the ability to fail quickly is imperative to the prevention of costly research into ultimate dead-ends. BD's Durham headquarters has all the capabilities in-house to go from idea to clinical trials within just 30 days; a transition period that is unheard of outside the commercial sector. Dr. Sebba defined the BD innovation lifecycle across 7 phases: 1) Instinct, 2) Discovery, 3) Frame, 4) Project, 5) Ideate, 6) Prototype, and 7) Activate. Each phase of the BD innovation lifecycle supports the "intentional disruption" of typical business model approaches to science giving the space for the "exponential technologies for the true moonshot challenge" to emerge.

BD has partnered with Silicon Valley think tank, called Singularity University to help them embrace this. According to its website, Singularity University's defined mission is "to educate, inspire, and empower leaders to apply exponential technologies to address humanity's grand challenges."

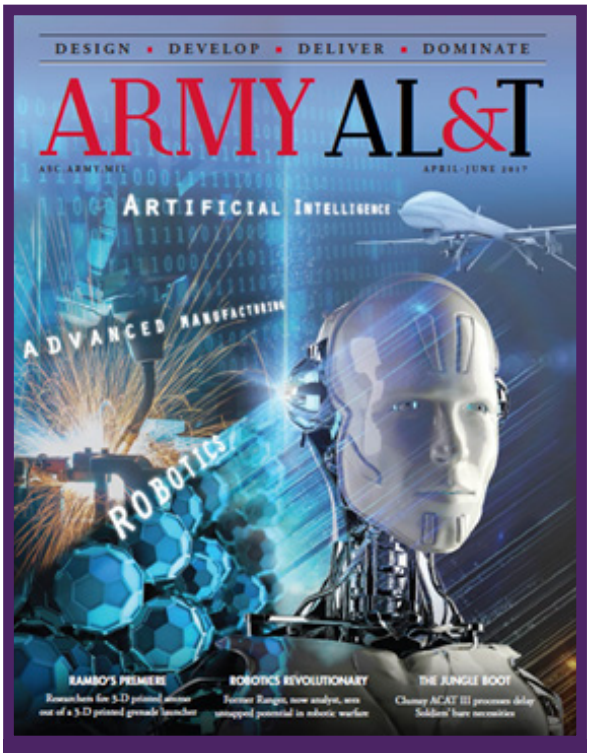
TATRC and BD closed the day with a productive and lively discussion about a collaborative site visit to Singularity University in the Fall, as well as completed plans for a joint grant submission through TATRC's AAMTI program. TATRC's Mobile Health Innovation Center's Deputy Lab Manager, Mr. Ron Yeaw said, "seeing BD's portfolio of pioneering science was one thing, but being given the opportunity to openly discuss the process of how they get after their breakthroughs was worth its weight in TDY. Just an amazing opportunity all around for TATRC leadership."

Dr. David Sebba, Becton-Dickinson's R&D Manager, explains their Business Model during a presentation to Team TATRC.

TATRC Highlights Medical Robotics S&T Enablers for Multi-Domain Battle

TATRC's ongoing research efforts were showcased in the April-June edition of Army AL&T Magazine as part of a set of special feature articles focused on advancements in the areas of robotics, artificial intelligence and autonomous systems. In TATRC's article entitled, "Medical Operations in the Multi-Domain Battle," the potential capability gained by leveraging emerging unmanned systems platforms, e.g. unmanned aerial systems and unmanned ground systems, for medical missions was discussed in the context of the Multi-Domain Battle (MDB) concept. The MDB concept, outlined by the US Army Training and Doctrine Command (TRADOC), speaks to the need to enable highly capable and dispersed units to create and exploit temporary windows of advantage. Based on this future concept, Commanders will likely employ unmanned systems as force multipliers in mobility/resource constrained, or denied environments. The article discusses TATRC's research efforts in developing technologies utilizing emerging unmanned vehicles to augment conventional medical capabilities when dedicated medical vehicles are not immediately available or denied entry, e.g. to support emergency medical resupply and to expedite casualty evacuation missions.

Other future applications of robotics and autonomous systems to augment existing medical capabilities supporting the MDB concept are discussed in a manuscript written by Mr. Nathan Fisher and Dr. Gary Gilbert of TATRC's Operational Medicine Lab, and was recently submitted to the TRADOC G2 "Mad Scientist" initiative. This paper, entitled "Medical Robotic and Autonomous System Technology Enablers for the Multi-Domain Battle 2030-2050" is a follow on to an article on "Unmanned Systems in Support of Future Medical Operations in Dense Urban Environments," which was published in the Small Wars Journal in February 2016. These papers discuss specific robotics technology enablers that have the potential to be innovatively applied to medical operations to address some of the challenges likely imposed by the MDB environment. Beginning in 2019, two new Army medical research task areas in Medical Robotics and Medical Autonomous & Unmanned Capabilities portend to jump-start the Army and other services into rethinking strategies for health services and force health protection in future combat environments. These task areas, for which Dr. Gary Gilbert is the designated Capability Area Manager, are aimed at the use of robotics on the battlefield to support medical tasks such as patient extraction from contested or denied areas and tele-robotic patient assessment and intervention. The Medical Autonomy task area will focus on leveraging emerging unmanned platforms for medical missions such as autonomous ground and air delivery of emergency Class VIII resupply like whole blood products and CASEVAC on unmanned platforms with closed loop enroute care systems. These new Army medical research task areas will be overseen within USAMRMC by the Medical Simulation and Information Sciences Research Program (MSISRP) Program Area Directorate (PAD) and will be executed by TATRC and the Institute for Surgical Research (ISR). Funded by the DoD Joint Robotics Program, various Army RDECOM laboratories, and SBIR programs, the TATRC has conducted exploratory research projects in application of robotics and unmanned systems technologies toward operational medical missions for over 10 years. While these types of projects will be continued going forward, they will now be focused toward executing a research road map being laid out for the new Army research task areas in support of the Army's MDB Concept.



The front cover of the April-June 2017 issue of the Army AL&T magazine.

References:

"Medical Operations in the Multi-Domain Battlefield" http://asc.army.mil/web/news-alt-amj17-medical-operations-in-the-multidomain-battlefield/

BHSAI Receives DTRA Award to Develop Early-Warning Bio-Threat Detection System

The upsurge in terrorism attacks makes the development of effective countermeasures all the more imperative. Biological pathogens can potentially be employed in a terrorism incident and pose substantial risks to Force Health Protection as well as to the public. The Defense Threat Reduction Agency (DTRA), recognizing the risks, solicited for research that provides innovative solutions against terrorism. TATRC's Biotechnology High Performance Computing Software Applications Institute (BHSAI) was awarded a 3-year grant to develop an early warning bio-threat detection system based on physiological and molecular response data.

The timeliness of intervention in the early stages of infection is key to the effectiveness of countermeasures. Early detection of physiological changes in Service members arising from pathogen exposure could be attained by monitoring individuals and assessing the likelihood of exposure using analytical tools, preferentially reflecting multiple (e.g., physiological and molecular) levels of responses. However, the construction of such analytical tools requires empirical data, which are limited in number and practically restricted to animal models of infection in controlled laboratory experiments, reducing the ability to develop analytical tools applicable to humans.

BHSAI's team of experts aims to address this gap by using analytical tools for early warning of human infection that rely on the detection of deviations from an individual's (uninfected) baseline state. In addition, the BHSAI is collaborating with the U.S. Army Medical Research Institute of Infectious Diseases to leverage its extensive collection of existing non-human primate (NHP) viral exposure laboratory data to develop and validate the analytical tools. The project's Principal Investigator, Dr. Jaques Reifman, Director of the BHSAI, explained, "We propose a two-tiered platform, producing early warnings of infection from both physiological (1st tier) and molecular level (2nd tier) measurements." Once validated in NHPs, the analytical tools will be adapted and translated to develop a version for detecting infections in humans.

The uniqueness of this approach is that it relies on existing healthy and infected animal data for analytical-tool development and validation but only requires baseline, healthy human data for adapting the tools to humans. The 1st-tier component of the analytical tools will enable rapid threat detection via non-intrusive, continuous vital-sign monitoring from wearable devices in humans. The 2nd-tier component will provide corroborating evidence through molecular data analytics, for which BHSAI scientists will use existing NHP blood-sample data to identify early biomarkers of infection and orthology methods to map these molecular biomarkers from NHPs to humans.

The establishment of these capabilities builds on BHSAI's extensive experience in developing and deploying both physiological- and molecular-data analytical tools for detecting toxic environmental exposures, identifying casualties with life-threatening hemorrhage, and preventing non-battlefield injuries. The deliverable of this effort will be early warning bio-threat detection analytical tools implemented as apps and made available at the DoD Biosurveillance Ecosystem. This project directly addresses core DoD Chemical and Biological Defense Program goals by establishing new biological defense capabilities to generate early warnings of bio-threat incidents, first relying on data suitable for collection in field environments (vital signs from wearable devices), followed by a second, corroboration stage using genomic data from blood tests. This two-tier design allows for increased statistical reliability of alerts. Another uniqueness of this approach is that it uses already-collected NHP data to develop and validate the detection analytical tools, while only requiring baseline, healthy human data for adapting the tools from NHPs to humans. DTRA commented "…the [BHSAI] team has shown through past performance that it can develop operationally relevant applications…" and "…the proposed work provides a capability to test and utilize physiological monitoring datasets, which is a big S&T area of high value."

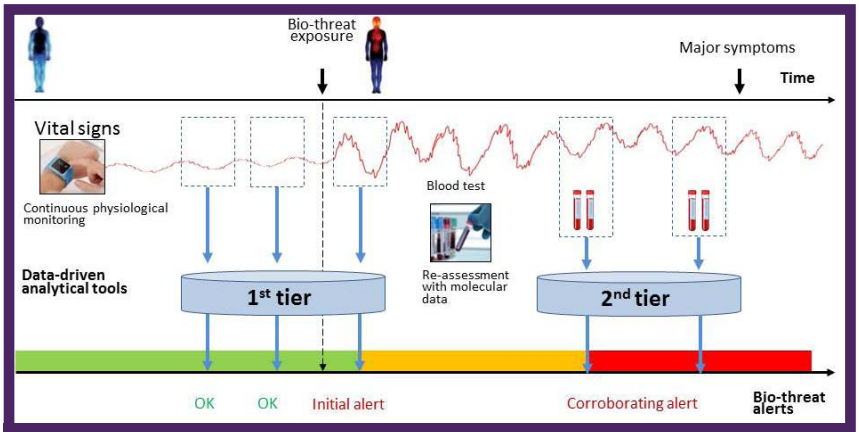


Figure: A two-tiered bio-threat detection system that generates early warnings of human infection events. The 1st-tier component relies on continuous monitoring of physiological vital signs measured from passive, non-invasive wearable devices to produce an initial threat alert. After this initial alert, the 2nd-tier analytics corroborate the early warning using molecular-level data drawn from blood samples via biomarker-based analysis.

TATRC's VHSO Continues Efforts to Support Army TSG Priorities in Telehealth

TATRC's Virtual Health Support Office (VHSO) Team continues to move the virtual health guidon further down the field. Upon completion of our CENTCOM AOR Virtual Health Site Visit to Kuwait and Qatar, in which TATRC Leadership visited commanders and staffs of clinics, combat support hospitals, Special Forces, signal command and others, a thirteen page report consisting of over 60 observations and recommendations was compiled.

This extensive report was sent through command channels to senior individuals and key organizations for awareness and staffing. By mid-May, COL Kral and Dr. McVeigh briefed the major findings of the report to the Army's Deputy Surgeon General (DSG), MG Robert Tenhet. MG Tenhet was grateful for the VHSO's candidness, insights and recommendations. He pointed out that most individuals are not aware of the challenges that exist today in the deployed settings, which include the challenges of using telehealth. During our meeting, MG Tenhet acted swiftly and alerted his staff to address several of the key issues raised and to include both himself and the Army's Surgeon General in updates on their progress. The VHSO and others now provide weekly updates for the Surgeon General's Readiness Workgroup Report.

Dr. Francis McVeigh points out exciting updates and advancements taking place within the VHSO.

As a follow on to our meeting with the DSG, MG Tenhet suggested that the Virtual-Medical Center Operations Order include the need for the Health Readiness Center of Excellence, AMEDD Center and School Capabilities Development and Integration Directorate (CDID), to develop a Capabilities Production Document as well as other documents, for commercial off the shelf products that can be leveraged in operational settings. This is very significant as this is one of the first steps needed in identifying telehealth requirements, which can then result in the inculcation of these requirements into the Army's operational forces' table of organization and equipment (TOE) documents. Once this is accomplished and funded, equipment and personnel can be obtained and deployed with the forces.

The VHSO recently completed an analysis of the Pacific Asynchronous Telehealth Platform's way ahead to serve as the Military Health Systems' (all three Services) single, global asynchronous program. This analysis culminated in a position paper, which consisted of our findings and recommendations; and is being staffed through command channels at the Office of the Surgeon General.

At the 2017 American Telemedicine Association Meeting in April, the TATRC VHSO Team met with countless MHS individuals, vendors, academic and clinical individuals. During this event, the VHSO successfully hosted an evening collaborative planning session which included informal discussions with over 22 personnel who work directly in the Army's virtual health space.

A few weeks later, during the TATRC's Spring Open House, the VHSO Team hosted demonstrations in the following areas: the Telemedicine Examination Station, which is used between Blanchfield Army Hospital providers and Special Forces medics in Africa; Telehealth in A Bag, which is being used throughout Europe to include eastern Russia and bordering nations; Africa and other countries-connecting Landstuhl providers with medics and providers around the world; and the tele-behavioral health initiative, which was stood up by TATRC in 2010 with the help of the Medical Communications for Combat Casualty Care (MC4) Team. Tele-Behavioral Health remains active and in use today in Afghanistan, Iraq, and Kuwait. Visitors to the VHSO stations were impressed to see operational, live demonstrations. An especially noteworthy moment was when the Defense Health Agency, Operations Officer, MG Jeffrey Clark, connected and carried on a visual and auditory conversation with a provider who was located in Cameroon, Africa — as my mother used to say the 'proof is in the pudding' — these capabilities exist and are needed!

Very recently the MC4, an Acquisition Program Office, who has more than a decade of experience in managing the Army's deployable medical recording system, agreed to transition TATRC's tele-Behavioral Health Initiative's capability into its baseline. An MC4 project team is currently working to determine an Acquisition based strategy to ensure the capability is institutionalized into

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the Army Basis of Issue. MC4 will evaluate and field a solution that will be tested in deployed settings. This capability will allow the camera on laptops to be used for teleconsultations (as of now, they cannot be operated). This is a significant advancement for tele-Behavioral Health, as it will allow Soldiers far forward on the battlefields, to talk to and virtually see behavioral health providers when they feel it is needed.

Although transitioning a capability to a Program Office is our ultimate goal, and is a huge success, we cannot rest until further virtual health capabilities are evaluated; requirements are built; and these requirements are inculcated into the Army's TOEs.

What else needs to be done? Peripheral devices that capture and allow for the transmission of their data such as, blood pressure monitors, vital sign machines, laryngoscopes and non-embedded cameras need to be included in the necessary virtual health requirement documents. These capabilities need to be evaluated using synchronous and asynchronous modalities where applicable, and run the spectrum of being functional in areas that range from 'no' communications, to 'high' communications capabilities. The requirement documentation mission rests with the CDID. The OTSG's Virtual Health Office is working with CDID to develop the best way forward to advance operational virtual health.

It is time to move the Army Medical Department from a Pilot Purgatory Existence into a recognized virtual health environment that consists of documented requirements which will allow providers, no matter where they are located (Garrison or Operational environments), to possess the necessary virtual health capabilities needed to bi-directionally provide the best possible care, anywhere, at any time. Dr. Francis McVeigh, TATRC's VHSO Lead stated, "We can build the best Virtual Medical Center in the world, but if our deployed providers cannot communicate with the Virtual MEDCEN providers, then we have failed."

The VHSO is currently in the process of finalizing a paper for the Surgeon General on all of the known existing synchronous pilots and demonstration projects. The VHSO has conducted numerous interviews with the leads of these initiatives, as well as the end users covering clinical, administrative and technical aspects. Our report will summarize these findings, analyze their capabilities and make recommendations on the best ways ahead.

It is safe to say that the VHSO Team in support of the Army Surgeon General's Virtual Health Business Plan, has increased awareness of today's and future virtual health initiatives; provided analysis of these initiatives; made recommendations for virtual health enhancement; and has laid out the challenges and opportunities in the virtual health operational space. The VHSO team will continue to work with and support the OTSG Virtual Health staff, Virtual-MEDCEN staff, researchers and the movers and shakers who are leading multiple virtual health initiatives. "Make no mistake, the VHSO's end goal is to put useful telehealth solutions into the hands of our operational forces that will increase access, enhance readiness and improve outcomes. We will not rest until this is accomplished!" concluded Dr. McVeigh.

TATRC MMSIC Lab Proudly Launches their New Webpage!

TATRC's Medical Modeling & Simulation Innovation Center (MMSIC) is pleased to announce the launch of their newly designed webpage as part of its unique and evolving mission to push forward and aid in the evaluation of emerging medical simulation technologies.

Our Medical Modeling & Simulation team is focused on advancing medical excellence through innovative research and development, with the goals of providing training and assessment platforms to optimally prepare individuals, teams and systems to respond to Military Health System needs, and ensure personnel are ready and able to protect, improve, conserve and sustain the health and resilience of Service members for optimal mission performance across global military activities and operations.

MMSIC serves as a home to simulation developer resources, such as the BioGears® physiology engine and other open source tools. MMSIC's expertise is in high demand with the lab currently funded to assist in medical simulator transition efforts. MMSIC's laboratory research focuses on experimental concepts and novel applications. We collaborate with forward thinking research groups to realize this vision. The MMSIC lab, for many years has been on the forefront of helping to guide and shepherd the best in innovation as it pertains to the education and preparations of medical personnel for various roles in military medicine. The new webpage has an extensive history tab that will outline this rich tradition.

Please make sure you bookmark this page and visit often to see the new and exciting initiatives that the lab is involved in. http://www.tatrc.org/www/labs-and-programs/medical-modeling-and-simulation/

For additional information, please feel free to contact Mr. Geoff Miller, MMSIC Lab Manager at geoffrey.t.miller4.civ@mail.mil.

TATRC Assisting in the Development of New Medical Simulation Training Center (MSTC) Advancements: Part 2

This article is adapted from a presentation on "Developing, Sustaining and Assuring Technical/Procedural Readiness in Military Medical Personnel" Mr. Geoffrey Miller, TATRC Research Scientist, provided at the Medical Simulation Training Center (MSTC) Working Group Meeting To Develop A New MSTC Increment II Capability Production Document (CPD), hosted at the AMEDDCS/HRCoE, 27-29 SEP16.

This is the second article of a three part series on enhancing training effectiveness, sustainment and transfer to practice of military health healthcare personnel. These articles will provide the reader with evidence-based and informed rationale for developing future military education and training effectiveness.

2. Retention – Sustaining Technical / Procedural Skills

Introduction

As we discussed in the first article in this series, there is substantial literature focused on the science of skill acquisition, retention and transfer. For our purposes in this article, these terms are defined as follows: 1) acquisition – developing and gaining new knowledge, skills or behaviors, 2) Retention – the durability of flexibility of the acquired skills, and 3) transfer – the ability to apply these skills to new contexts, situations and environments. The following outlines key points from this body of knowledge, which TATRC's Medical Modeling and Simulation Innovation Center (MMSIC) is employing to assure and advance the effectiveness of simulation-based training and assessment, and readiness of military medical personnel.

Retention

Infrequent use of learned skills, especially complex procedures or those, which must be performed under emergency or stressful conditions, leads to skill decay. Retention is particularly important in professions where individuals are responsible for performing skills that are rarely practiced. Lack of use leads to decreased memory, as declarative knowledge is forgotten, leading to mistakes, missed steps, increased response times and decreased accuracy. As such, it is easy to see the importance of assuring that an investment is made to optimize original learning conditions, and to continue to reinforce and sustain acquired knowledge and procedural skills.

Retention focuses specifically on measuring the performance of the actual training task, meaning that the assessment is conducted under post-training conditions that are the same as the training conditions. This concept differs from transfer, which explores the application of training tasks in settings or conditions different than the training task conditions and settings. This difference is noted as it is highly unlikely that the post-training context that these procedures will be performed under the same physical, emotional, and/or environmental conditions presented during training. Simply put, the training environment and practice environment are never exactly the same.

We should also note that learning (acquisition) is an imperfect indicator of subsequent or future performance. Learning (acquisition) and retention should be considered together. Because of the close relationship between these two factors, it is essential to understand how acquired knowledge and skills are reassessed, retrained and how they should be maintained over the long term. Fundamentally, improved retention begins during the acquisition phase of learning and may be substantially affected by the methods employed to provide early knowledge and skill acquisition.

Retention variables, and strategies for enhancing retention

Retention of knowledge, procedural skills and abilities is affected by a wide array of variables. In terms of procedural skill retention beyond the original learning period, these include, but are not limited to complexity of the procedural skill or task, the use of decision support tools or performance aids, time limits, stress, individual aptitude, and the methods and amount of original learning.

These variables are generally categorized into four broad areas: task, training, retention interval, and the individual. This article will focus on the first two categories: task and training.

Task:

Task factors impacting retention have generally been characterized as follows:

1. Complexity (e.g. the number of steps or step difficulty),
2. Order of steps (e.g. does the order of steps matter?),
3. Nature of the steps (e.g. do steps require cognitive, motor skills or both?),
4. Presence of feedback, and
5. Presence of decision support tools, job or memory aids

One of the major predictors of skill decay or loss is the complexity of the task as defined by three parts: 1) the number of steps in the task, 2) whether the steps must be performed in a set order and 3) the presence of feedback, indicating correct or incorrect of each step. Retention frequently decreases as the number of task steps increases, which may be further complicated by the significance of

ordering of task steps. Tasks with a single ordered sequence of steps are generally easier to master. Finally, decision support tools, job and memory aids also substantially aid in performance and retention of procedural skills, and appear to counteract mistakes and missed steps that can occur from reliance on memory recall alone.

Training Factors:

First and foremost, the overall quality of training affects learning, which has substantial bearing on retention and transfer to practice. Several studies have demonstrated that the introduction of rigorous formative and summative assessment during the original learning (acquisition) phase coupled with immediate feedback and error correction has a substantial impact on improved learning and performance.

The temporal distribution or spacing of training and practice sessions has been found to enhance retention, unless training and practice intervals are so long as to allow forgetting of prior information or psychomotor skill precision. Practice sessions spaced over time appear to be superior to "massed" practice, however, this method requires additional total training time which is a considerable factor from a management standpoint.

Given these training variables, several strategies can be employed or integrated into the learning phase, which, have been demonstrated to improve original learning and lead to improved retention. This article presents and discusses the following three, deliberate and repetitive practice, mastery learning, and overlearning.

Deliberate and Repetitive Practice:

Deliberate and repetitive practice involves repeated performance of desired cognitive or psychomotor skills in a focused domain, paired with rigorous formative assessment and feedback. The goal of this learning strategy is constant skill improvement. Substantial research on this method has demonstrated that it is a more reliable predictor of superior or expert performance than experience or academic aptitude. Further, this research has demonstrated that this method of training and practice is critical for development and sustainment of procedures, which are rarely performed (e.g. surgical airway), and would not be mastered without this deliberate practice and feedback.

Deliberate and repetitive practice incorporates nine key features listed below:

1. Highly motivate learners, with good concentration, who address
2. Well defined learning objectives or tasks, at an
3. Appropriate level of task difficulty, with
4. Focused and repetitive practice of the defined task, that yields
5. Rigorous reliable measurements, that provide
6. Informative feedback, that promotes
7. Monitoring, error correction and more deliberate practice, that enables
8. Evaluation and performance that reaches a mastery standard, and allows
9. Advancement to the next task

Mastery Learning:

The principle goal of mastery learning is to ensure that all learners achieve the objective level of mastery performance as defined by standard setting, a higher level than competence alone, with no variation from standard. This strategy will require each individual learner to achieve the defined standard equally, but may take different amounts of time and practice; essentially each learner will have their own "learning curve" during the process of mastery learning achievement. Deliberate and repetitive practice is frequently incorporated into this method.

The following seven features are essential to effective mastery learning implementation:

1. Establishment of a minimum passing mastery standard for each educational unit or task,
2. Baseline assessment to determine appropriate level of difficulty of initial educational activity,
3. Clear learning objectives, sequenced as units ordered by increasing difficulty,
4. Engagement in educational activities (e.g. skills practice, data interpretation) that are focused on reaching the objectives,
5. Formative testing to gauge unit/task completion at the minimum mastery standard,
6. Advancement to the next educational or training unit when repeated measured performance meets or exceeds the standard, or
7. Continued practice or study on an educational unit/task until the mastery standard is reached.

FY18 AAMTI Update

The AAMTI Team, led by Ms. Holly Pavliscsak had a very successful submission season this year! There were 83 AAMTI pre-proposals submitted for the FY18 AAMTI Cycle, including 35 new submitters! There were 14 reviewers from a wide variety of backgrounds that reviewed the pre-proposals through 8 June. Invitations for full proposal submissions were sent out the week of 26 June. Thank you to all those who took the time to submit your great ideas! The AAMTI Team appreciates your contributions.

Process for Developing Implementing Mastery Learning

8. Determine learning outcomes – What competencies should the learners master at the completion of the intervention?
9. Develop learning objectives based on the desired outcomes
10. Develop metrics (checklists/rating scales) – These may be previously developed, based on an expert model, based on existing national requirements/ standards, or needing to be developed in consultation with subject matter experts
11. Determine the minimum passing score using appropriate standard-setting methods
12. Ensure instructor and rater training and calibration
13. Pilot the rating instrument to determine reliability (make necessary changes and re-test)
14. Conduct educational intervention with deliberate practice and feedback
15. Perform a clinical skills evaluation using the developed checklist – participants must meet the minimum passing standard (MPS)
16. Learners who do not meet the MPS should engage in additional deliberate and repetitive practice until they meet the MPS

Overlearning:

Overlearning, defined as the immediate continuation of learning or practice after the learner achieves mastery of a specific task is another strategy that may be employed to reduce decay of knowledge and skill. Overlearning has been shown to produce better performance (e.g. time to task completion, increased knowledge, skill precision), especially in the case of performance of emergency procedures.

Overlearning is implemented by measuring the number of attempts each learner requires on a given, defined task to achieve repeated error-free performances. The learner is then instructed to perform an additional 50% overtraining of the same task (e.g. original learning = 54 attempts, overlearning = 27 additional repetitions). This continued training has demonstrated improved automaticity of task performance, reducing cognitive demands and enhanced long-term procedural task performance.

One concern with this strategy, as well as the previous strategies, is determination of the cost-to-benefit ratio for their use (e.g. financial, time, resource as compared to desired learning/skill development level). Especially when facing the need to train many learners a large number of tasks and procedures. It is important to note however, that the initial "costs" using these methods may be offset by the improved retention and fewer re-training or refresher requirements, as well as improved clinical care outcomes.

Conclusions:

Learning and skill retention depends on the type of knowledge or skills, the strategies used to design and conduct the initial learning, the rate of skill and knowledge decay, and the effort and time required to return or raise these skills to required levels of performance. Improving retention, as we have previously noted, begins during the "original learning" (acquisition) phase. There are many variables, techniques and methods that can aid learners in achieving higher levels of original learning, thus improving the potential for longer term retention. Common methods to improve the effectiveness of original learning, task performance and learning durability (retention), involves the amount of practice for a given task. Several strategies may be employed, the addition of deliberate and repetitive practice, mastery learning, or overlearning coupled with manipulating the difficulty of the task or the task criteria. These strategies have demonstrated the ability to require the learner to engage in more practice to achieve the set standards or criterion, or perform at a higher level of original learning, which enhances retention.

Developers of medical training programs should strongly consider the adoption and integration of these training techniques into their programs, to not only improve the overall effectiveness of the initial training program, but to improve the durability and retention of the wide range of military medical personnel procedural skills and tasks.

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TATRC's 3rd Annual Spring Open House Breaks Attendance Records Again!

Due to the resounding success of TATRC's first two Open Houses, along with January's General Officer's event, TATRC opened its doors again for its' 3rd Annual Spring Open House and Technology Demonstration on 5 May 2017.

The theme at this year's event was "Supporting Military Readiness through Innovative Technologies," and it allowed guests to experience firsthand, TATRC's unique skill sets and expertise. With over 55 interactive demos and exhibits from TATRC's six labs and key programs, along with the new Virtual Health Support Office, visitors were impressed with the comprehensive range of innovative technologies that were newly donned at this year's Open House. TATRC couldn't keep away the more than 350 registrants from this exciting event!

Guests in attendance were comprised of key staff from the areas of academia, industry and the military, including Senior Leaders from DHA, OTSG, VA and Health Affairs, as well as countless small businesses who interacted with the TATRC team. TATRC was honored to have MG Jeffrey Clark, Director of the J-3 Operations Directorate at DHA, as well as staff members from the White House Medical Unit, in attendance.

"This knowledge management event continues to serve as a valuable educational tool for the military medicine community, as well as our external partners, on our current focus areas and is an excellent opportunity to personally engage one on one with the TATRC team," said COL Dan Kral, TATRC's Director.

TATRC's work continues to support military readiness across the military health system, and events like the Open House highlight the range of their competency areas and research portfolios.

Thank you to all of our distinguished guests and colleagues who took the time to attend the 3rd Annual TATRC Open House & Technology Demonstration! There were many new connections made, which can only lead to discussions and partnerships to further the status and progress of military medicine. We hope that seeing more than 55 of our projects was beneficial and meaningful for you and that it was time well spent. We'd also like to say a BIG thank you to all those who worked tirelessly, behind the scenes to put this event together. Without your countless hours and boundless energy, the Open House would not have taken place!

If you missed this year's event, please make sure to send us your contact information so we can add you to the invite list for next year!

TATRC's Support Team demonstrates new innovations in Operational Medicine.

COL Kral discusses some of TATRC's key projects with MG Jeffrey Clark, DHA's Director of J-3 Operations.

In Search of Innovation: AAMTI PM Travels to West Point & Keller Army Community Hospital

The Army Surgeon General, through TATRC, provides a special Defense Health Program, Operations and Maintenance appropriation to enable technology proofs of concept and demonstrations throughout the MEDCOM. TATRC created the AMEDD Advanced Medical Technology Initiative (AAMTI) to solicit and fund these types of projects. The fundamental goals of the AAMTI are: to demonstrate medical technologies and their impact on cost, access, quality, and safety of care, and medical readiness; to provide senior MEDCOM leadership with medical technology watch capabilities; and, to encourage medical technology entrepreneurship by funding MEDCOM technology innovators through a bottom-up (provider/Medical Treatment Facility level) approach. Always in search of new and innovative projects, Ms. Holly Pavliscsak, the AAMTI Program Manager has been a road warrior traveling around to sites within the AMEDD to promote the AAMTI program and hear first-hand, about AAMTI success stories and note suggestions for improvements to the program for the future.

Her most recent site visit earlier this month, took her to the Regional Health Command-Atlantic, where she spoke to interested investigators at Keller Army Community Hospital (KACH), a general medical and surgical hospital in West Point, NY, about the AAMTI program. COL Don Goss, PT, PhD, OCS, ATC served as her host while she was on site. COL Goss is a Director and Associate Professor, at Baylor University who is assigned to Keller Army Community Hospital where he manages the KACH D1 Sports PT Fellowship program. COL Goss arranged for Ms. Pavliscsak to meet with past recipients as well as other interested parties who may have not heard of the AAMTI program before. KAHC currently has 6 active AAMTI projects and have had over 13 funded AAMTI projects since 2014. While at KACH, Holly had an opportunity to meet with several of the investigators onsite to get a better understanding of their projects, as well as obtain a status update and resolve any outstanding issues. She was even able to sit in on several presentations from the KACH D1 Sports Physical Therapy Fellowship program that focus on step rate and foot strike patterns in runners. These fellowship projects were sponsored in part by AAMTI funds, and while they provide much needed support to the fellows, these projects also provide enhanced knowledge of topics that are militarily unique and relevant.

Ms. Pavliscsak's adventures have taken her far and wide. She would love to visit your facility and learn more about the innovative technologies and initiatives that you are spearheading, that have the potential to make an impact on patients, providers, and the Military Health System as a whole. Please contact her if you would like to learn more about the AAMTI program, and she would be more than happy to schedule a visit.

AAMTI Program Manager, Ms. Holly Pavliscsak, meets with Keller Army Community Hospital staff and AAMTI investigators.

DoD Lab Days Features BHSAI's Innovative and Visionary APPRAISE Project

On 18 May, top researchers & scientists from all branches of DoD, gathered for an interactive exhibition in the central courtyard at the Pentagon in Arlington, Virginia. Designed to showcase next-generation knowledge and materiel products from the Army, Navy and Air Force, the event featured hundreds of enlisted personnel, contractors and government employees, and further served as a chance for DoD leaders to both assess the progress of current funding efforts and to identify upcoming capability gaps.

This second Pentagon Lab Day, highlighted some of the forward thinking and groundbreaking medical technologies that will give our US Military the edge on the battlefield and beyond.

Mary J. Miller, acting assistant secretary of defense for research and engineering, hosted the second biennial Defense Department Lab Day in the Pentagon Center Courtyard. Joining her on stage were James MacStravic, performing the duties of the undersecretary of defense for acquisition, technology and logistics, and Dale A. Ormond, principal director for research in the Office of the Assistant Secretary of Defense for Research and Engineering.

"The defense laboratory enterprise helps meet today's urgent operational needs while ensuring decisive overmatch for the force of the future," Miller said. "It provides foundational capabilities for the joint warfighter across the entire spectrum of operations."

TATRC was honored to be one of the featured labs at this premiere event and showcased the APPRAISE Project, which was demonstrated by Dr. Nick Tountas, Senior Researcher from TATRC's Biotechnology High Performance Computing Software Applications Institute Lab. APPRAISE is an artificial intelligence–based system that can automatically alert medics when trauma patients are in need of massive blood transfusions. Essentially, the APPRAISE system collects and analyzes in real time, vital signs information from patients during pre-hospital transport. It then uses the results of that analysis to determine if the patient will need a massive blood transfusion, all before the patient ever arrives at the hospital.

"This occasion provided an exclusive opportunity to be able to demonstrate an Army product to the key leaders and decision makers of each service and we are honored to have been selected," said Dr. Tountas.

Dr. Tountas' presentation on the APPRAISE Project, was just one of many products spotlighted by the US Army Medical Research and Materiel Command during the event. Other displays included Dr. James McClung's presentation of the Performance Readiness Bar, a calcium-fortified snack bar developed to optimize bone health in basic trainees from US Army Medical Research Institute of Environmental Medicine (USARIEM), as well as updates on both freeze-dried blood products from the US Army Medical Materiel Development Activity and early-stage clinical trials of a new Zika vaccine from the Walter Reed Army Institute of Research.

"The entire event is really an opportunity to showcase what we do on a daily basis, and then to bring that hard work to a larger audience," said USAMRMC and Fort Detrick Commanding General Maj. Gen. Barbara R. Holcomb who toured all 90 displays during a VIP walk through on the morning of 18 May.

TATRC BHSAI's Dr. Nick Tountas discusses the APPRAISE system at the 2017 DoD Lab Days.