



BLUE SKY FACULTY FOLIO

IMPACT

Progress from Pain

Medical innovation from the battleground is helping patients at home

The Iraq War took a terrible toll in human life. The suffering, which knows no nationality, was incalculable. Yet that war, as with all others, produced a painful irony: the tragedy led to lifesaving advances in medical care.


The search for progress continues through the efforts of Vikhyat “Vik” Bebarta, MD, Vice Chair of Strategy and Growth for the University of Colorado Department of Emergency Medicine and director of the CU Center for Combat and Battlefield (COMBAT) Research. A dedicated scientific researcher, Bebarta has been awarded some \$60 million for more than three dozen federal grants, including 25 where he was principal investigator, and has published more than 220 scientific manuscripts.

The problems COMBAT is tackling have quite a wingspan. They

include reducing military firearm suicides and opioid misuse, decreasing oxygen use by special operations medics for casualty victims, helping develop a wearable device to detect COVID-19 before symptom onset, employing simulation to prepare combat medics for stressful events, and developing new therapies to treat traumatic brain injuries.

A companion initiative to COMBAT is the NIH-funded Translational Innovation and Antidote Development (TRIAD) Research Colorado, which Bebarta also founded and directs. More than a dozen institutions collaborate to bring life-saving innovation from researchers to clinical trials that ultimately translate into hands-on patient care, whether that be from battlefield medics, military and civilian hospital workers, or anyone committed to improving patient care.





COMBAT and TRIAD are currently working to design easy-to-administer antidotes for chemical exposures. These have occurred on the battlefield, during civilian terrorist attacks, after industrial accidents and train derailments, among other disaster scenarios. Most antidotes must be administered by someone with special training, making timely, large-scale responses difficult.

Currently, the antidote for cyanide requires an intravenous injection, but COMBAT Research and TRIAD is developing an intramuscular injection that operates like an EpiPen.

TIME IS TISSUE

To illustrate the need, Bebarta recalls the 2013 Boston Marathon bombing. The two detonated pressure-cooker bombs sprayed shrapnel through the densely packed crowds, killing three and injuring hundreds of others. In the attack, bystanders, taxi drivers, store owners, and police cared for the wounded until hospital transport arrived.

"It wasn't nurses rolling up sleeves and putting IVs in," Bebarta recalls, as would have been required if poisonous chemicals had wafted through the streets, searing lungs by the thousands.

The ongoing threat of domestic terrorism remains, he warns.

"Chemicals are too easy to get," Bebarta says. At the same time, he adds, the specter of chemical weapons being used against soldiers and civilians in wartime hovers over conflicts, such as Ukraine. Both examples highlight the need for effective countermeasures.

"WE NEED TO DESIGN FOR THE MILITARY AND FOR CIVILIAN AGENCIES, IN AN INNOVATIVE AND COLLABORATIVE WAY, AND WITH INDUSTRY, FOR COUNTERMEASURES THAT ARE SAFE AND THAT ANYBODY CAN PICK UP AND USE," BEBARTA SAYS.

COMBAT Research and TRIAD's intramuscular injection antidote would empower military personnel, civilians, first responders, and even bystanders, to respond quickly to both deliberate chemical attacks and accidental toxic releases. The FDA is currently reviewing the antidote solution, delivered in 2-milliliter doses, for use in both the military and civilian settings. Bebarta hopes for approval in the next two years.

"For a chemical exposure, time is tissue," he says. "The same is true of trauma."

Bebarta sums up the work of the COMBAT and TRIAD in terms of translating basic science to practical application. As that applies to the chemical antidote and countermeasures, that means taking "molecules to market," from the "bench to the bedside to the bystander" and from the "bench to the battlefield."

His team is working with the Department of Homeland Security and locally to train responders and understand what they need to use antidotes in the pre-hospital, trauma, and clinical settings.

"When we understand what responders need, we take that back to the bench," Bebarta says.

A host of other questions must be answered, he adds. Of course, antidotes must be safe and easy to use. But it's also necessary to consider how they will be used and to establish clinical guidelines for their application.

"WE'RE TRYING TO COVER MORE THAN ONE CHEMICAL AS WELL AS INJURIES WITH CHEMICAL EXPOSURES, TRAUMA, AND HEMORRHAGE OCCURRING TOGETHER," BEBARTA SAYS. "WE ARE LEADING A TEAM TO STUDY THIS, FIGURE OUT THE MECHANISMS AND GET SOLUTIONS OUT THE DOOR."

STORIES OF SACRIFICE

Meeting these and other goals is far more than an academic exercise for Bebarta, who completed four tours of duty overseas, including two in Iraq, in 2005 and 2006.

In a 2012 article in the journal *Annals of Emergency Medicine*, Bebarta wrote, "The war isn't about the medical care we give...it's about the soldiers whose stories we'll never read and the sailors who arrive home draped in a flag. Their sacrifices have tremendously advanced our knowledge of trauma and emergency medicine."

Bebarta assumed the role of medical innovator in heat-seared battle theaters nearly 20 years ago. On civilian ground, his mission to

find new ways to save the lives of the service men and women who protect us remains unchanged.

"Our research, development, and innovation bring academia, industry, and the military together to deliver innovative solutions now that Marines could have used back then in Iraq," he says.

Support from external grants and gifts make change possible on a grand scale, saving lives today and tomorrow, for people in war zones and at home. He can't change history, but through his COMBAT initiatives, Bebarta has an opportunity to change the future. ■

