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Our mission is to provide research, education, advocacy and consultation to maximize performance, optimize safety and prevent sudden death for the athlete, warfighter and laborer.
“Struggle is the fuel for the passionate soul.” - D. Casa

DOUGLAS J. CASA, PHD, ATC, FNAK, FASCN, FNATA
CEO, KOREY STRINGER INSTITUTE

There is a quote in Uncle Tom’s Cabin, the classic book by abolitionist Harriet Beecher Stowe, to the effect of, What is the purpose of principle without persistence? [The exact line appears in Chapter 8 and reads: ‘Sam said, “what’s principles good for, if we isn’t persistent, I wanter know?”’] I took it to mean that if you believe deeply in something, you need to see it through to the end, no matter the cost or the consequences.

In the summer of 2018, my wife and I are taking our kids on a human rights tour of the Southeastern United States. We will visit the Martin Luther King Jr. National Historic Site in Atlanta, the Gettysburg National Monument in Pennsylvania, and multiple sites in Montgomery, Alabama, among other locations. The sites in Montgomery include the Rosa Parks Museum, the Southern Poverty Law Center (of which my wife and I have been long-time benefactors), the Civil Rights Memorial Center, and the brand new Legacy Museum and National Memorial for Peace and Justice that was created by the Equal Justice Institute (read the book Just Mercy!!!). There’s so much to see in Montgomery, but that is only because there is so much to remember. It is with a wicked sense of irony that the Rosa Parks Museum (and these other critical locations) are but a few blocks from the Confederate Memorial Monument. A monument that commemorates those who fought to continue slavery is nearly in view while you are visiting locations recognizing the horrific human suffering due to the cataclysmic disregard for human rights. It is hard to fathom, but yet we have countless statues, memorials, streets, fields, buildings, etc. named in honor for those who led and supported the reprehensible treatment of fellow humans. It is a scar that lingers and still causes harm for our country. We will visit the Confederate Memorial Monument since it will be important for us to recognize that for all of our progress in the realm of human rights, we still have a long road to travel. The message we are trying to convey to our kids is simple: When in the business of advocating for important changes, you need to be in it for the long haul. That is the philosophy of KSI regarding our efforts to invoke desperately needed change to make physical activity safer for the athlete, warfighter, and laborer.

The name of this magazine is Pertinacity. I cannot think of a better word that exists to exemplify the ultimate quest in the persistence I describe in the quote above from Uncle Tom’s Cabin. I came to know that word in the early 90s when my wife was running track for the University of Florida. Her coach was JJ Clark (now the coach at UConn- Go Huskies Track and Field!!!). JJ’s dad, Joe Clark, had instilled this word into JJ’s lexicon and the concept into his philosophies. Joe Clark, you may remember, is the principal featured in the movie Lean on Me that commemorates the overwhelming effort to turn around a troubled school in Paterson, NJ in the late 1980s. This word—pertinacity— has important meaning for me every day. For the past 20 years, I have kept a single-minded focus on working to improve health and safety standards for high school athletes. I have been blessed to do this for the past eight years as part of KSI
(we celebrate its birthday on April 23rd) with the incredible staff we have (and have had) working on these initiatives. We have had many milestone moments along the way that have galvanized our efforts in this arena, including but not limited to: three years hosting (with NATA and AMSSM) the Collaborative Solutions for Safety in Sport meeting (a national gathering of two representatives from each state who play a role in health and safety polices for high school athletes); the 2018 release of the KSI rankings of all 50 states and Washington, D.C. with relation to policies for preventing sudden death for high school athletes that are constantly being re-evaluated and updated on our website; the many research studies we have conducted investigating this topic; and countless visits to individual states to assist with invoking change, among many others.

Well, I am happy to announce the biggest moment is upon us at this very time: KSI has officially announced a three-year, $1 million dollar fundraising campaign called “Raise Your Rank.” In this campaign all proceeds will go toward KSI’s efforts to enhance health and safety standards for high school athletes. Our goal is to use these funds to visit all states and our nation’s capital to support state association staff and volunteers who would assist in the planning and execution necessary to make these meetings and the implementation of policy changes a success. We are very proud that we have already procured 25% of our goal in our first month since announcing the campaign. We invite you to join us in our efforts, whether it be financial or through affiliations, and influence in your state. I want to be very clear—and my experiences have shown this to be truth in its most honest form—this will NOT be an easy task. The obstacles to overcome are numerous (and have been painfully so to date). There’s no need for me to dwell on the specifics of this, but the task will be massive, and it’s best to recognize this before the journey begins. It seems that the greater the challenge, the more ideal it is for KSI to undertake. We may not succeed with every policy in every state, but with pertinacity true to the name of our flagship magazine, Joe Clark’s efforts, and the persistence that Sam spoke of in Miss Stowe’s book, we believe the principle of enhancing the health and safety standards for high school athletes is worth every ounce of our persistence.
Our mission and endeavors could not have been made possible without our corporate partners. We are greatly appreciative of your continued support.

National Football League: The National Football League is a founding partner of the Korey Stringer Institute. The NFL supports multiple player safety initiatives for athletes of all levels. For more information on the NFL’s Health and Safety Initiatives, visit NFL Evolution.

Gatorade: Gatorade is a founding partner of the Korey Stringer Institute. Gatorade and the Gatorade Sport Science Institute continue to search for and study new and innovative ways to help athletes improve performance by facilitating proper hydration and nutrition.

National Athletic Trainers’ Association: The National Athletic Trainers’ Association is the professional membership association for certified athletic trainers and others who support the athletic training profession. Its mission is to engage and foster the continued growth and development of the athletic training profession and athletic trainers as unique health care providers.

University of Connecticut: The Korey Stringer Institute is housed at the University of Connecticut. The Department of Kinesiology faculty are renowned for their research and expertise in the areas of heat and hydration, injury prevention, and strength and conditioning.

Camelbak: The mission of Camelbak is to continuously reinvent and forever change the way people hydrate and perform. Visit Hydrated for useful resources on hydration practice.

Kestrel Pocket Weather Meters by Nielsen-Kellerman: Nielsen-Kellerman is committed to ensuring that people know the weather and environmental conditions that impact their health, safety, and bottom line. NK’s Kestrel meters are rugged, accurate, fully calibrated, portable, affordable and easy to use. KSI uses these wet bulb globe temperature thermometers to determine environmental conditions during research studies both inside the heat chamber and in field studies. Visit heatstress.com for resources on physical activity in heat stress.

Mission: Mission has a dual mission. While delivering world-class innovations that meet the unique needs of an athletic lifestyle, Mission also makes an impact off the field of play through the M Foundation, which promotes the health and safety of youth athletes, and simultaneously recognizes and awards high school athletes that give back to their community.

Heartsmart.com: HeartSmart.com is a leading provider of Automated External Defibrillators, also referred to as AEDs. HeartSmart.com offers AED program to support AED owners with essential services, support, product maintenance, and training.

Eagle Pharmaceuticals: Eagle Pharmaceuticals is a specialty pharmaceutical company focused on developing injectable products, primarily in the areas of critical care, orphan diseases, and oncology. Its goal is to provide safer and more convenient solutions for patients and health care professionals with optimized formulations.
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P E R T I N A C I T Y

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SPOTLIGHT
THE SPOTLIGHT SERIES FEATURES THE PEOPLE OF KSI, AND THOSE WHO SHARE AND REPRESENT THE PASSION OF KSI.

Could you tell us about yourself?

I’ve been a certified athletic trainer for over 17 years. I love my profession and enjoy seeing it grow. My athletic training education began at James Madison University. It holds a very special place in my heart. I then moved onto my master’s degree in exercise science at the University of Florida where I had my first taste of research under the tutelage of Marybeth Horodyski. Due to an unfortunate loss (see below), I became interested in researching heat illness prevention and treatment. Even though it wasn’t MaryBeth’s specialty, she supported my work in this area. When the opportunity opened for a doctoral position at UConn to research EHI, it was an easy choice to apply. When Doug invited me to accept the doctoral position at UConn, I felt as if I had won the lottery. After graduating from UConn, I was an assistant professor at Indiana State University before accepting a position at the University of South Carolina. USC has become my family’s home and it’s a great place for heat research as our city’s motto is "Famously Hot." I’ve been blessed to serve my profession via the Pronouncements Committee, Free Communications Committee, EHI Position Statement writing team, and secondary school heat guidelines task force writing team. I have a wonderful husband of 14 years, who has put up with research urine in our refrigerator, biked trails to keep participants safe, and tolerated treadmill running in heat chambers. We have a 4-year-old girl and 8-year-old boy who keep us on our toes and know when they are dehydrated on the urine color scale. My husband and I enjoy running long distance relay races and landscaping our yard.

Could you tell us about your first involvement/interaction with KSI?

The year Korey Stringer died, two other football players also died from heat stroke the same week. Eraste Autin collapsed at the University of Florida the day before I started my first day of work. I was not involved with the incident, but I was there when the health care team learned he passed away a few days later. It was heart breaking to see them mourn the loss of a beloved player. We sometimes forget those that grieve outside the immediate family. I never wanted to see a health care team go through that again. Therefore, I decided to focus my master’s thesis on cooling strategies and used telemetric temperature sensors to examine body temperature. When Doug created KSI with Kelsi, I was so happy that his dream of impacting national sport safety guidelines was coming true. When he called a year later to ask if I’d serve on the Medical Advisory Board, I couldn’t have been more honored. How many people get to combine their job, research, and passion and use it to serve the greater community? Not many. I feel as if I get to be a part of team, who’s spread across the US, working towards the common goal of sport safety for all athletes.

In what ways has KSI impacted you?

KSI keeps me connected with EHI research colleagues and has introduced me to new colleagues in other realms, such as concussion and cardiac events. Even though I’m the only one at USC who studies EHI, I can reach out to others on the KSI Board whenever I need to bounce ideas around or need help with a presentation. I often feel overwhelmed when trying to make sport safety changes in my state. Yet I know KSI is in my corner and that I’m not alone. When I give scientific or lay public presentations on sports safety, I’m proud to tell them I’m on KSI’s Medical Advisory Board. When I share with health care professionals the resources available on KSI’s website, it’s awesome to see people realize that they’re supported too. They aren’t alone in trying to make positive change at their schools or clinical sites. I also feel KSI encourages me to keep moving forward. The research and manuscript world can be daunting some days; lost grant funding, rejected manuscripts, etc. But I see KSI working hard every day to get important information in the hands of people who need it, and I know I’m a part of that mission, therefore, I can’t give up. I keep trying to make a difference.

"I often feel overwhelmed when trying to make sport safety changes in my state. Yet I know KSI in my corner and that I’m not alone"
Could you tell us a little about yourself?

I am the Senior Vice President of Product and Innovation at Mission Product Holdings, Inc. As most careers go, it’s been an interesting journey. I started off in the Apparel world at a Textile Dyeing and Finishing facility in my small hometown of Monroeville, Alabama (hometown of the late Harper Lee who wrote “To Kill a Mockingbird”). My first job at this facility was the Environmental Manager of Dyeing and Finishing Operations for a VF Corporation owned facility. My boss discovered one day that I had an interest in Process Engineering of the fabrics we produced and decided to move me into an open position in Textile Process Engineering. From this point on, my career has centered around textiles specifically in apparel and accessories. I love my current position at Mission as it allows me to work on the latest cooling innovations with the great team at KSI.

Could you tell us about your first involvement/interaction with KSI?

I first met Dr. Casa in a conference call centered around Mission’s latest product performance testing that was conducted at KSI. I quickly realized the amazing resource partners we had through our KSI relationship. Since this point, I have continued to partner with Dr. Casa and the KSI team. I am very pleased that Mission recently sponsored the “Mission Heat Lab at UConn’s Korey Stringer Institute” which can be utilized by other key institutions and all brands over the nation and around the world.

In what ways has KSI impacted you?

Working with the KSI team has been a professional highlight of my career. I have learned more in the past couple of years about heat safety and performance than at any point in my career. I consider the KSI team as the leaders in their field and engage the team often for perspective. I would like to encourage the KSI team to keep up the great work in your dedication to provide research, education, advocacy, and consultation to maximize performance, optimize safety, and prevent sudden death in sports and other activities that require being in the heat.

Can you tell us a little about yourself?

I am a senior in the Exercise Science program with a double minor in Nutrition for Exercise and Sport and Biology at the University of Connecticut. Growing up, I was intrigued by science and the workings of the body. I was also heavily involved in sports. All of which lead me to my area of study. I became interested in the field of physical therapy after an injury in high school, and since then, have always been seeking out new knowledge and experience relating to the field. During my time at UConn I have become involved through clubs on campus such as Exercise is Medicine, Husky Ambassadors, and have held a position as the Community Outreach chair of the Pre-Physical Therapy Society. Being involved in such programs, I have formed relationships with other students both in and out of the classroom. My plan after graduation is to attend physical therapy school at the University of Connecticut. Throughout all of my experiences I found the value in making connections with others, an important aspect that has driven me toward my goal of becoming a physical therapist.

Tell about your first involvement/interaction with KSI?

I first became involved with KSI in the fall semester of my sophomore year. I was a Pre-Kinesiology student, applying to Exercise Science in the spring and was looking to get involved in the Department of Kinesiology. I talked to students currently in the program that all emphasized that the Human Performance Lab was an excellent way to gain exposure to the field and become more involved. As a result, I contacted Dr. Casa and he immediately responded, eager to inform me about KSI, its mission, and the opportunity that was available through the institute. Shortly after meeting with Dr. Casa I was assigned to assist Dr. Stearns in the heat lab to collect data on the SMART study. Being interested in Physical Therapy as a career goal, KSI exposed me to Exercise Science in a different light than I had seen it before. Ever since then I have been involved with the institute almost every semester. I have gained a significant amount of knowledge about heat illness and safety, as well as an interest in the mission of the institute.

In what ways has KSI impacted you?

Being a part of KSI has made me much more aware of the dangers that are present every day in the sports world and what can be done to prevent them. Although I am not a professional athlete or part of an organized team, KSI has taught me what to look out for when I am participating in activities myself as well as how to protect and make others aware. KSI has also impacted me as a student and upcoming professional. As a student completing an independent study for the Korey Stringer Institute, we are held to high standards in how we act, work, and communicate with others. My involvement taught me how to act in both a lab and office setting, preparing me for the future. As a result, I have had a number of opportunities both through KSI itself and elsewhere, from attending their Annual Fundraising Gala to having various work opportunities and graduate school admissions. I have enjoyed being a part of KSI because along with all of the opportunity, I have formed connections with other undergraduate students, graduate students, and other faculty and staff members. These people have been role models for what it means to work for what you are passionate about, a lesson I plan to hold with me as I continue my education and career.
I recently received my long-awaited copy of the newly published book, *Sport and Physical Activity in the Heat: Maximizing Performance and Safety*, edited by KSI’s CEO Douglas Casa. I would first like to thank Doug for the amazing opportunity to be included as an author within this book and to be able to write alongside some of the leading experts in the world on thermal stress and its effects on human performance and safety during exercise in the heat. Having paged through the book and reflecting on the content embedded within its pages, it is truly astonishing to have such a great resource available to scientists and clinicians on this topic. Guided by five over-arching concepts, this book allows readers to garner a full appreciation of the many factors involved in dictating how we, as humans, are able to safely optimize athletic performance during exercise in the heat. The book opens by discussing the foundational concepts related to human thermal and comparative physiology, which describe the physiologic processes involved in regulating body temperature during exercise. These two chapters help focus the reader’s frame of reference for sections 2 and 3, which provide an in-depth overview of the factors that improve one’s heat tolerance (e.g., body cooling, hydration, and heat acclimatization) and other tools that can be used to monitor one’s response to thermal stress, such as heat tolerance testing. Prior to discussing the medical issues and safety considerations related to exercise in the heat, one of the most unique aspects of this book are the separate chapters related to various populations, including athletes (both individual and team sport athletes), warfighters, and laborers, that can be negatively influenced by thermal stress while exercising or engaged in physical activity. Moreover, each chapter is broken down to provide the reader with an in-depth understanding of the physiology, supporting evidence, and clinical application of the topic so it can be directly implemented into any population setting. For example, within the body cooling chapter, the physiologic reasoning of how and why body cooling can enhance performance and optimize safety is discussed, which is then followed by various examples from scientific literature to substantiate these claims. Lastly, and most importantly, the reader is then provided with a number of recommendations to integrate body cooling into their specific setting and the various considerations that should be made to optimize the utility of body cooling in a sport or physically active setting. Given the breadth of knowledge that this book offers and the ability to translate scientific evidence to clinical practice, I highly recommend this book to those overseeing the safety and performance of athletes, warfighters and laborers.
FOUNDATIONAL CONCEPTS
1. COMPARATIVE PHYSIOLOGY  2. HUMAN HEAT PHYSIOLOGY

ENHANCING HEAT TOLERANCE
3. HEAT ACCLIMATION
4. BODY COOLING
5. HYDRATION
6. WORK TO REST RATIOS
7. SLEEP
8. ALTITUDE

TOOLS AVAILABLE TO ASSIST
9. ENVIRONMENTAL MONITORING
10. TECHNOLOGY
11. BIOMARKERS
12. HEAT TOLERANCE TESTING

POPULATIONS
13. INDIVIDUAL SPORTS
14. TEAM SPORTS
15. LABORERS
16. MILITARY PERSONNEL

INDIVIDUAL ISSUES
17. HEAT ILLNESSES
18. OTHER MEDICAL CONSIDERATIONS
19. DRUGS/SUPPLEMENTS

SPORT AND PHYSICAL ACTIVITY IN THE HEAT: MAXIMIZING PERFORMANCE AND SAFETY
UCONN XC Team Heat Acclimation Training

YASUKI SEKIGUCHI, MS, CSCS, ASSISTANT DIRECTOR OF ATHLETE PERFORMANCE AND SAFETY

KSI HAS BEEN WORKING WITH THE TEAM IN THE NEW LAB TO IMPROVE THEIR RUNNING PERFORMANCE.

The women’s Head Track and Field and Cross-Country Coach at UCONN, J. J. Clark, who has an esteemed reputation in coaching, is applying his sport science knowledge and skills to enhance performance. KSI has supported the team via heat acclimation training. Heat acclimation increases plasma volume and sweat rate and decreases heat rate, core temperature, perceived exertion, and electrolyte concentration in sweat. These effects can improve exercise performance not only in the heat, but also in cooler climate races, such as the 2017 Northeast Regional race in Buffalo, NY. Also, heat acclimation reduces the risk of heat illnesses, such as exertional heat stroke.

The purpose of the heat acclimation last fall was to maintain the heat acclimatization effects that runners gained through summer training, through the end of the cross-country season. Each runner came to the lab and performed an hour of exercise in the heat once or twice a week, starting at the end of September. The athletes were tested in the new heat lab prior to the start of heat acclimation training to assess and obtain baseline measures and post heat acclimation training to assess the training effect. The testing protocol was designed to determine the amount of time it took for the athlete’s internal body temperature to reach 102.2°F (39.0°C) at a fixed exercise intensity. Members of KSI and Coach Clark maintained a steady line of communication throughout the entire process so that runners could continue training with both entities without suffering from over-training. It was very important to give runners the proper volume and intensity of training in the heat as well as outside the heat to improve/maintain their fitness.

Most runners improved their responses to the heat, which was shown by increased time to reaching a core temperature at 102.2°F during the post-test and overall lowering of internal body temperature, heart rate, thermal sensation, and perceived exertion during training in the heat. Some runners mentioned that they needed less effort for running in comparison.

The results were even better than we expected since the original purpose was to maintain the heat acclimatization effects from the summer training and we observed that the athletes actually improved their heat acclimation through this process. The results of the heat acclimation were explained to the team and the coach was satisfied with them. KSI hopes to continue working with the team in the future to further maximize their performance and continue to share our world class facility.
This is a story about love.
This is a story about UConn.
This is a story about measuring the content of a triathlete's sweat.

But at its core, this is a story about two UConn alumni who met on campus as undergraduates, got married, and are absolutely crazy proud of their alma mater.

Former student-athlete Laura Marcoux '10 (CLAS) developed a passion for Ironman triathlons after graduation, but when she faced a life-threatening situation in a recent triathlon, it wasn’t long before she discovered that the best place to get answers to her questions was back home at UConn.

Laura and her husband Ryan '08 (BUS) returned to Storrs last month, primarily for a visit to UConn's nationally renowned Korey Stringer Institute, which specializes in research and education to prevent heat stroke injuries and deaths. The trip was also an opportunity for some Husky nostalgia.

But at KSI, they found hope that Laura will be able to continue in the Ironman triathlons that mean so much to her.

A Husky love story
Ryan and Laura met on the first day of classes in the fall of 2006, when she was a freshman and he was a junior transfer from Manhattan College. They met in front of the Engineering II Building, where a lot of great academic works happens, but it’s an unlikely place to meet your future spouse. Laura was Laura Eichert at the time and a member of the women’s lacrosse team from Columbia, Maryland. Ryan was a marketing major from New Milford, Connecticut, and was working as a student assistant for coach Jim Penders and the Husky baseball team.

They dated throughout their time at UConn, and moved out to Colorado following Lauren’s graduation in 2010.

“We love the outdoors and hiking,” says Laura. “That’s how we decided on Colorado.”

The couple now live in Morrison, Colorado. When they were married three years ago, they incorporated a number of UConn themes in their wedding: Each guest table was named after a building on the UConn campus, and the cake topper even included Engineering II; “UConn Husky” was played as the entrance song, and guests gestured U-C-O-N-N for pictures.
Finding new limits

During Laura’s time as a lacrosse player at UConn, there were several changes in head coaches, but the strength and conditioning program was consistent, including Amanda Kimball, who remains on the UConn staff today. Unlike many student-athletes, Laura enjoyed the time spent conditioning more than practice. “I worked with the highest level of strength and conditioning coaches at UConn,” she says. “Our sessions were designed to take us out of our comfort zones both mentally and physically, and to break new barriers and find new limits.” Her love of training developed into a passion for the Ironman triathlon – a grueling event with a 2.4 mile swim, and 112 miles of biking, followed by a marathon run of 26.2 miles. Laura did her first sprint triathlon the summer before her senior year, and was hooked. She has finished four full Ironman triathlons, including the World Championship in Hawaii. She placed in the top 10 three times, and was in the top three twice. But while competing at the Ironman Los Cabos in Mexico last November, Laura developed a condition called hyponatremia and was unable to finish. “It was a hot race and I felt super-bloated. I was stopping at all the aid stations during the bike ride and pouring water over myself, but it did not help,” she says. “I began to panic.” She pushed herself further than she should, wound up finishing the bike ride, and started the run, but at that point it was a walk for her. She walked about 11-and-a-half miles and then had to pull out and sit down. Ryan knew she was in trouble and found her on the course. He immediately got medical help, and soon an ambulance was on the way. Laura had become unable to answer even the most basic questions. She didn’t know her name or Ryan’s, where she was, or where she was from. She was able to remember just one fact, the name of her pet dog – Luna. The dog is of course a Husky, whose middle name happens to be Jonathan. Laura was given several IV treatments at a local hospital, but blacked out and lost consciousness for about eight hours.

"It was the scare of a lifetime."
Fans of all things UConn

“We are like proud parents when it comes to UConn,” says Ryan. The Marcoux family have every television sports package available, and are constantly re-arranging plans to watch Husky teams.

“It doesn’t matter what sport it is, we love them all,” he says. “A few years ago, the women’s soccer team was on ESPN playing for the American Conference championship. We canceled everything we were doing that afternoon to watch.”

The Marcoux family are huge fans of Hall of Fame women’s basketball coach Geno Auriemma.

“I try to draw parallels from Geno’s coaching strategies to triathlons,” says Laura, who is also a triathlon coach, fitness director at a gym, and a personal trainer. “I’ve learned that if you hold athletes to the highest standards, believe in them, and put them in positions to develop belief in themselves, then they will live up to those standards.”

Ryan works in systems integration for Conga Inc., in Colorado. He credits lessons learned from Penders during his involvement with the Husky baseball team.

“Coach Penders puts an emphasis not only on player development, but also on personal development,” says Ryan. “I still hold onto many of Coach Penders’ mantras, like WIN (What’s Important Now) and ACE (Attitude, Concentration, Execution). I would not be the person I am today without the guidance I received from Coach.” Ryan himself is just getting into competitive running, and still plays baseball in an adult league back home as an infielder.

‘The best place in the country’

As the Marcoux family were searching for solutions to Laura’s issues, they wanted to find the best place in the country to get help. After a few conversations, all recommendations pointed to the Korey Stringer Institute at UConn.

“The fact that the best teaching facility in the country was at the school I love was a sign just too strong to ignore,” says Laura.

The center is named for Korey Stringer, a Pro Bowl offensive tackle from the Minnesota Vikings who died of heat stroke during training camp of 2001. His wife Kelci worked with the NFL to create a non-profit organization dedicated to preventing sudden death in sport, which later became the KSI at UConn in 2010. Laura submitted an inquiry on the KSI website and got a phone call back in about 30 seconds from KSI vice president of research and athletic performance Rob Huggins.

She was impressed by the prompt response, and by Huggins’ interest and concern for her case. She says it reinforced her UConn pride.

The Marcoux family quickly planned a trip to UConn for mid-January for Laura to get testing at KSI. It was also a chance to visit the campus they love.
Developing a personalized strategy

The first day on campus, KSI staff met with Laura to gather additional information. She then went through a rigorous test to measure her substrate utilization and determine the appropriate level of calories she needs at various levels of exercise intensity.

“This test will allow Laura to develop a caloric strategy for the events she takes part in,” said Huggins. “We will be able to let her know what she needs to do during the different parts of the Ironman triathlons.”

That same night, the Marcoux family took the opportunity to attend a UConn women’s basketball game at Gampel Pavilion.

The next day, Laura was back at KSI for an intensive sweat electrolyte test. The team wanted to know literally everything about her sweat — how much sodium is in it, what her rate of sweat is, and how much fluid she is losing and at what rate.

This testing consisted of a two-hour stationary bike ride followed by a “washdown” to collect her sweat and a one-hour stationary run followed by another “washdown.” Laura did these tests in a chamber at KSI that was set for 95 degrees and 60 percent humidity. Her core temperature was monitored throughout the process through a pill she took.

It will take some time for KSI staff to determine the full results of these tests, and what Laura needs to concentrate on to stay healthy in the Ironman triathlons, as she looks forward to her next event in Dallas on April 29.

She hopes to find out exactly what she is losing in sweat during an Ironman, in terms of both water and electrolytes, so that she can turn the information into a precise fueling and hydration strategy for her upcoming races.

Although there are some general guidelines for Ironman athletes regarding how to properly fuel in a race, Laura has learned that these guidelines don’t work for her because of her uniquely low sweat rate and probably some other factors that she will find out from KSI.

“In order for me to take the next step in my triathlon career, in both safety and performance, being able to utilize the data that I will receive from KSI will allow me to replace exactly what I lose in a race,” she says, “and therefore allow me to decrease the rate at which I fatigue — which is the name of the game in Ironman!”

A positive experience at KSI, a chance to see the Huskies play, spending “way too much money” at the UConn Bookstore, and a few good meals in Storrs Center.

All in all, a perfect few days for the Marcoux family.
Sources of Stress

- **Travel**: Extensive travel can affect sleep and daily habits, especially if switching between time zones. This can be stressful on an individual. Additionally, changes in altitude can negatively affect performance. Be sure to fully acclimatize.

- **Sleep Deprivation**: Lack of sleep impairs psychological and physiological functions and can add to increased stress about exercise. It reduces recovery, and therefore has negative impacts on athletic performance.

- **Poor Nutrition and Hydration**: Proper amounts of carbohydrates and other essential nutrients are important for maintaining a healthy body. In addition, dehydration can negatively affect perception of effort in performance.

- **Injury**: Major sources of stress in athletics stems from fear of injury and loss of control. Skills such as goal-setting and relaxation can help to reduce this stress.
Stress and subsequent fatigue are a normal part of sport and life and often desired in order to augment adaption to training.

The concept of periodization, being the organization of training stress and recovery, is usually on the forefront of performance and medical practitioners minds. When training and physical stress are balanced with adequate rest and recovery, acute fatigue is often diminished in a matter of hours or days. However, if the body is not allowed to return to a balanced state (homeostasis) before excess stresses are introduced, maladaptation occurs. In optimizing performance for sport or life, it's important to note that not all stresses are desired or accounted for. In the midst of a hectic season or normal life demands, it's easy to forget to acknowledge and appropriately prepare for things such as the stress of travel, sleep impairment, poor nutrition and/or hydration and injury. Implementing fatigue countermeasures begins first with recognition of outside stressors and then adherence to a few best-practice techniques.

For further techniques, investigate methods for circadian phase shifting and fatigue countermeasures.
Recovery Techniques

**Sleep**
7-9 Hours per night

Focus attention on recovery methods such as relaxation techniques and cold water immersion.

Sleep disturbance after training can negatively impact the recovery process.

**Stay Hydrated**
Replenish Body Tissues

Fluid loss during exercise should be no more than 2% of an individual’s body weight.

**Relax**

**Milk & High Glycemic Index Meals**
Drinking milk products after training or exercise replenishes substrate stores and increases muscle-damage repair.
KOREY STRINGER INSTITUTE INTRODUCES:

Raise Your Rank

A $1 MILLION DOLLAR FUNDRAISING CAMPAIGN TO MAKE HIGH SCHOOL SPORTS SAFER

WHAT IS RAISE YOUR RANK CAMPAIGN?

Given that each state determines the health and safety policies for their high schools, Raise Your Rank aims to improve the number of mandated best practice policies within each state to ultimately decrease the number of catastrophic sport injuries.

TARGETING THE CAUSES OF ATHLETE DEATH

Over 90% of sport related deaths are due to 4 causes: cardiac arrest, exertional heat stroke, traumatic brain injuries, and exertional sickling; but simple, cost-effective strategies can prevent nearly all deaths!
CURRENT MANDATE SAFETY STANDARDS

Currently, no state meets 100% of minimum best practice standards! Based on research published by the Korey Stringer Institute in 2017, which compared best-practice policy recommendations for catastrophic injuries in sport and mandated state policies, states mandate anywhere between 20–79% of the best practice policies for the top causes of sport related death.

The Goal & Timing

The goal of the Raise Your Rank campaign is to raise funds to host meetings with representatives from states (both medical & executive directors), in order to:

1. Improve best-practice policy mandates by state high school athletic associations which ultimately improve the health & safety of athletes.

2. Increase implementation of these mandates locally within schools, to ensure potentially catastrophic events are mitigated.

We are working to raise $1 million by 2021
2018 Collaborative Solutions for Safety in Sport Florida Meeting
SAMANTHA SCARNEO, PHD, ATC
VICE PRESIDENT OF SPORT SAFETY

Dr. Casa and I were fortunate enough to attend the 2018 Collaborative Solutions for Safety in Sport (CSSS) meeting for the state of Florida in early 2018. Stemming from the National CSSS meeting, the goal for this meeting was to implement the best practice policies at a state level for high school athletes. This same meeting occurred in 2017, and while the program was educational and started the conversation surrounding improving high school sport safety, the ultimate goal of the current meeting was to build upon the foundation of the 2017 meeting and develop well thought-out policies for the Sports Medicine Advisory Committee (SMAC) and Board of Directors to review. While this program was meant to be educational, it was not meant to be continuing education, but rather a workshop with the goal to create and fully vet the wording of policy to be implemented by the Florida High School Athletics Association (FHSAA).

The program, designed and facilitated by Bob Sefcik, ATC, included dinner and a keynote address from Dr. Casa on Monday evening. Dr. Casa’s presentation provided context to the reasoning behind, and the methodology utilized for, the creation of the policy rubric and the rankings. Starting bright and early on Tuesday, the meeting was kicked off by Dr. George Canizares and Dr. Casa. They discussed the current policies and stated that the current meeting was held based on the foundation that was laid in the 2017 meeting. They also noted that the goal of this meeting was to leave with written policy language. Following the morning speakers, we heard from two families whose children suffered catastrophic injuries while playing high school sports in Florida. Courtney Sapp’s son, Payton, suffered a catastrophic head injury while participating in junior varsity football. She described the pain and long-term consequences that not only Payton, but her entire family has endured since his injury. Lori and Ed Giordano’s son, Zach Martin, suffered a fatal exertional heat stroke during a football practice in the summer of 2016. Unfortunately, in both cases, there was no Athletic Trainer present to care for the safety of the student athletes. In response to these tragedies, the families advocated for increased education of sport related injuries such as concussion, exertional heat stroke, and cardiac arrest. They charged the members in attendance to remember their stories and to do everything in their power to make sports safer.
The five specific areas to create policies for during this meeting included: cold-water immersion, environmental monitoring, concussion, coach education, and minimal expectations for high schools. Each topic area had its own break-out group with a variety of stakeholders (athletic trainers, physicians, administrators, coaches, and parents) represented in each group. I was fortunate enough to facilitate the Environmental Monitoring group with Dr. Seth Smith. Having tangible and realistic goals of creating specific wording for policies from the breakout sessions allowed for a focused message and resulting actionable items for the SMAC to discuss at their meeting that night.

I was honored to be invited to the SMAC meeting that evening to provide additional insight and expertise, if needed. The members of the FHSAA SMAC are very professional, determined and organized with the common goal of wanting to improve the health and safety standards for student athletes. I was very grateful for the invitation, and thoroughly enjoyed listening to the discussions that occurred.

To conclude, it was remarkable to see the amount that can be accomplished when key stakeholders within a state, with a common goal, collaborate to improve the current standards. It is truly a team effort and the comradery between the members in attendance was aspiring to be a part of. The policy ranking project was meant to be a project to help states identify areas of strengths and areas of improvement. We are excited to see states such as Florida take the findings of the project and use it as fuel to help improve the safety for our athletes. We fully believe that through policy change at the state level, and influencing the local implementation, that we can significantly reduce the amount of catastrophic injuries.

I would like to reiterate our deepest gratitude to Bob Sefcick for his generosity, helpfulness, and invitation for Dr. Casa and I to participate in this event. We would also like to thank George Tomyn and the FHSAA for hosting the meeting.
As part of the Raise your Rank campaign, we are fundraising to reach our goal of one million dollars to help KSI travel to states to improve policies. We had the pleasure of convening our second meeting of this campaign in New Jersey on Friday, April 13, 2018. The garden state is currently ranked 4th in our state rankings, with a score of 67%. New Jersey is unique as it is one of the few states that makes every attempt to be as proactive as possible with sport safety policies. The constituents of this state do not wait for a catastrophic or fatal injury to occur, rather work to make sports as safe as possible to prevent a death from happening. The purpose of this one-day meeting was to work to improve policies pertaining to: cold water immersion tubs, heat monitoring, traumatic head injuries, and strength and conditioning session regulations.

The Collaborative Solutions for Safety in New Jersey Sports meeting was hosted by the New York Jets at their training facility in Morristown, NJ. The meeting started off with an inspirational quote from David Csillan,"Since you and I exist, together we can make a difference!" (Eggers, 2006). This quote set the stage for the entire meeting, demonstrating that this group of 20 individuals at the meeting could be responsible for saving lives through 4 simple policy changes. Following David's introduction, Dr. Douglas Casa took the stage to provide an introduction and context for the need for statewide policies.
From here, the attendees were split into pre-assigned groups, based off their interest area, for a breakout session. Each attendee was provided with their breakout session group topic and a white paper document to help them prepare for their discussion. The four breakout groups discussed the four topics pertaining to the purpose of the meeting. The groups were tasked with deciding if 1) the topic should move forward to the New Jersey State Interscholastic Athletic Association (NJSIAA) as a mandated policy for states to follow, and, if so, 2) what the policy wording should be along with implementation strategies for schools to comply with the policy. After deliberation, the groups presented a summary of their discussions to the larger group for critique and discussion.

All four groups decided to move forward with sending their policy topic as a mandate to the Sports Medicine Advisory Committee (SMAC) to vote on. The ultimate goal was for the NJSIAA to adopt these policies into the constitution as a mandate for all member schools.

The socio-ecological framework provides a context to organize evidence and evaluate intervention success. In this framework, policies lay on the outer most circle and have the potential to influence the most people. In state high school athletics associations, individuals who hold roles of power (i.e. executive directors or SMAC chairs) are in a unique position to influence thousands of high school athletes by deciding to mandate a policy. Policy mandates from the these individuals impacts the school environment, the organization, the athletic administrators, athletic trainers, coaches, parents, and, most importantly, the student athletes.
To our potential donors; we urge you to consider how far your money will go. Every dollar we receive will allow us to be one step closer to host Collaborative Solutions in Sport Meeting’s in states across the nation, positively affecting thousands of athletes. To state leaders and sports medicine advocates considering hosting a Collaborative Solution for Safety in Sport state meeting: please consider the influence that a meeting with leaders in your state can leave on the safety of student athletes.

“Since you and I exist, together we can make a difference!”
Paving the Way for Heat Safety in Warfighters and Laborers

Yuri Hosokawa, PhD, ATC, Korey Stringer Institute Medical and Science Advisory Board Member

Every October, members of KSI travel to Washington D.C. to volunteer at the Marine Corps Marathon medical tent. This year’s trip was also a special one because we were able to continue our efforts from last year in building relationships and exchange ideas with the National Oceanic and Atmospheric Administration (NOAA), Uniformed Services University of the Health Sciences (USUHS), the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH).

On Thursday, October 19th, KSI had the honor of gathering representatives from federal sectors that regulate heat activity modification guidelines or study implications of heat in the welfare of warfighters and laborers.

The meeting was sponsored by the National Integrated Heat Health Information System (NIHHIS: https://toolkit.climate.gov/nihhis/), whose mission is to understand global health threat from extreme heat, develop a robust and science-informed response, and build capacity and communication networks to improve resilience. Participating agencies of NIHHIS include: Office of the Assistant Secretary for Preparedness and Response (ASP), Centers for Disease Control and Prevention (CDC), United States Environmental Protection Agency (EPA), the Federal Emergency Management Agency (FEMA), NIOSH, NOAA, OSHA, and the Substance Abuse and Mental Health Services Administration (SAMHSA).

KSI has a good history in working collaboratively with the occupational and military sectors, however, it was not until last year that we were able to gather representatives from all three sectors—athletic, occupational, and military—to convene at single location and exchange ideas for future collaborations. Integration of climate and weather data from NOAA is also critical in making data driven decision to enhance the policies and guidelines for the people in these settings who are often exposed to extreme heat.

"Participants of this year’s meeting are currently working on a manuscript that gathers current consensus regarding heat activity modification guidelines for the physically active population (athletes, warfighters, and laborers), which we hope to release next year."

SPRING 2018   25
As of February 21st, 2018, the ATLAS project is **100% Mapped**. Translation: we have identified every high school with an athletics program in the United States (including the District of Columbia) and whether or not the student-athletes have access to an athletic trainer (AT). We have identified **20,443** public, private, magnet, alternative and special education high schools. Within these high schools we have identified a total of **15,136 athletic trainers** working either full or part time and providing care for the student-athletes during treatment and rehabilitation programs, practices and game competitions.

A mission of KSI is to promote the AT profession as well as increase the number of ATs and appropriate health care provided to the athletes across all levels of sport. Our ATLAS data has determined that **66% (n = 13,492)** of **schools** with athletic programs have **access** to an AT in some capacity.

The National Athletic Trainers’ Association District 2 (DE, NY, NJ, PA) has the highest percentage of ATs, providing 57% of full-time coverage and 25% part-time.
Introduction
Exertional heat stroke (EHS) is an emergent hyperthermic condition that occurs in individuals performing physical activity, typically in warm environments (3,4), but can also occur with exertion or impaired heat dissipation in cool environments (5). This is contrasted by classic heat stroke, which occurs more commonly in those lacking normal thermoregulation, such as the elderly and infants during heat waves. EHS is characterized by severe hyperthermia (>40.5°C) and end organ dysfunction, which typically manifests as central nervous system (CNS) dysfunction (6). Optimal outcomes from EHS requires rapid reversal of hyperthermia through whole body cooling (7,8). Evidence has shown that immediate and aggressive cooling after collapse ensures survivals with limited sequelae (8-12), highlighting the need for appropriate prehospital care.

Cold water immersion (CWI) is considered to be the gold standard treatment for EHS (13), but unfortunately, there are many situations in which CWI is not available. In the current practices of Emergency Medicine, Prehospital Medicine, and Sports Medicine, there is wide variability in care practices for EHS despite published evidence for optimal EHS care. Efforts are required to standardize treatment by these providers and coordinate efforts toward providing optimal EHS care in the prehospital setting.

On March 1st, 2016 the Korey Stringer Institute convened a meeting with experts in the fields of emergency and sports medicine to identify best practices for the care of EHS in the prehospital setting. Meeting participants provided input on topic areas related to exertional heat stroke care to achieve a consensus on best practices for the prehospital healthcare provider. The purpose of this paper is to introduce a paradigm for the emergency and sports medicine professional to develop prehospital protocols that increase the likelihood of survival and reduces the morbidity from EHS. As shown in Figure 1, the steps for survival from EHS require a rapid response by the prehospital provider.

![Figure 1 Basic Paradigm for the Care of EHS.](image-url)
**Rapid Recognition** The first step to optimize treatment for EHS is the early recognition of the condition. Recognition of EHS in an individual who has collapsed during or following exercise often relies on first responders and lay persons. Emergency medical services dispatchers' input may be critical in guiding initial triage and treatment of a potential EHS patient. Recognizing the signs, symptoms and situations associated with EHS can greatly aid in identifying the EHS patient. Providing education to EMS dispatchers will improve recognition of this condition and allow for earlier implementation of treatment, thereby improving outcomes. EHS typically occurs in warm environments in individuals performing strenuous exercise. However, it should be noted that even in cooler conditions, intense exercise by itself may result in an individual succumbing to EHS (14). The EHS patient will initially present with CNS disturbances (e.g. confusion, irritability or other irrational behavior) and may culminate in a collapse or loss of consciousness (6).

It should be noted that in some patients a lucid interval occurs, with CNS function rapidly declining afterwards (6). In addition, it is a common misconception that all EHS patients will have stopped sweating, have hot skin, or be unconscious, when in fact none of these symptoms are required for a diagnosis of EHS. In fact, many case reports have observed that the EHS patient may not only be awake, but have cool, clammy skin or likely still be sweating profusely. A basic algorithm for the recognition of EHS is presented in Figure 2.

**Rapid Assessment** The two pathognomonic characteristics of EHS are hyperthermia and CNS dysfunction. The EHS patient can present in a variety of mental states, ranging from mildly disoriented or combative to comatose, which typically resolves rapidly with treatment and return to normothermia (15). The differential diagnoses for a collapsed athlete with altered mental status are broad (e.g. traumatic brain injury, hyponatremia, exertional sickling, cardiac arrhythmia etc.), so an accurate measurement of internal body temperature is necessary to appropriately make a diagnosis of EHS (16,17). The only acceptable standard for body temperature measurement in exercising individuals is a rectal temperature (TREC). Previous research has shown that aural, oral, tympanic, axillary and temporal measurements have been shown to be invalid during and immediately following intense exercise in the heat (18-22). Furthermore, surface temperature readings are likely to provide a false sense of reassurance that the patient is normothermic, when in fact the patient may be suffering from EHS.

![Figure 2 Algorithm for the Treatment of EHS. (Rectal Temperature, TREC; Central Nervous System, CNS)](image-url)
With suspected EHS, a prehospital healthcare provider should immediately perform a TREC assessment, at an insertion depth of 15 cm (23). The typical temperature threshold associated with EHS is 40.5°C. In practice, however, based on the typical time for emergency medical services to arrive on-scene, it is important not to attempt to rule out EHS if the TREC is slightly below the threshold (24). The identification of a suspected EHS with confirmation via TREC should immediately trigger the next step of the process: immediate and rapid cooling. If a TREC is not available or difficult to obtain (e.g. due to a combative patient), cooling should not be delayed in cases of suspected EHS.

**Rapid Cooling** Best practices require successful cooling of the patient in less than 30 minutes from the time of collapse (25). In most situations, this leaves the prehospital healthcare provider with little time to deliver appropriate treatment. The current best practice for cooling an EHS patient is whole-body CWI from the neck down (13). Concerns for adverse side effects from CWI have been shown to be unfounded in hyperthermic individuals (26). If the dispatcher or first responder suspects EHS, the individual should be cooled with any available on-site measures until more advanced care arrives. If EHS is confirmed by responders, more aggressive cooling must begin immediately.

In situations where EHS is known or expected to occur, such as running races or football practices, advanced planning is essential to ensure adequate staffing, and access to the necessary supplies for CWI in order to allow for on-site cooling. Regardless of the nature and locale of an EHS patient, the goal for treatment is to minimize the amount of time the individual is hyperthermic (10,12,27). This reasoning underlies the principle of “cool first, transport second”. Given the significant increase in organ damage, morbidity and mortality that occurs after 30 minutes of hyperthermia, rapid cooling onsite should be built into local existing protocols wherever feasible. This can only be accomplished with the understanding and cooperation of event planners, on-site medical teams, and pre-planning with the local EMS system. Transportation of an EHS patient should occur only if it is impossible to cool adequately onsite or after adequate cooling has been verified by a body temperature assessment.

There are two key principles for external cooling of an EHS patient: 1) provide a modality of adequate cooling capacity, and 2) apply this modality to a sufficient body surface area. These two components combined determine the effectiveness of a cooling modality. Due to its superior cooling capacity, modalities involving CWI applied to most of the body surface area typically yield the fastest cooling rates. The recommended minimum rate of cooling for treating an EHS patient is at least 0.15°C per minute (2,28). Cooling rates for some common methods are shown in Figure 3. Cooling should be terminated when the body temperature reaches 38.6°C to minimize the risk of severe hypothermia (6,29). Mild hypothermic overshoot is common and benign, but patients should be passively rewarmed to 37.0°C.

CWI has been shown to have the highest documented cooling rates for the reversal of hyperthermia. In ideal conditions, Proulx et al. was able to achieve a cooling rate of 0.35°C per minute in hyperthermic healthy subjects (30). Meanwhile, Demartini et al. reported a cooling rate of 0.22°C per minute in a dataset of 274 EHS cases (8). An example of a CWI setup is shown in Figure 4.
cooling method available should be applied during transport until the recommended treatment endpoints are reached. For example, continuously applying cold-wet towels over the patient’s body is an example of a cooling modality that can be applied in an ambulance and requires minimal supplies. During heat waves or other situations where increases in EHS are anticipated, prehospital providers should be prepared to initiate pre-established cooling options using their available resources. It should be noted that cold saline infusion by itself has not been shown to reach acceptable cooling rates (34). However, when cold saline infusion is used in combination with other cooling modalities patient outcomes may be improved (7,34).

In order to minimize the risks of severe hypothermia from CWI, TREC needs to be monitored throughout the cooling process. Cooling should be stopped when the body temperature reaches 38.6°C (35). In cases where hypothermia persists, normal rewarming procedures may be followed while monitoring body temperature.

In some situations, non-critical but distracting conditions may arise while cooling an EHS patient. Diarrhea, emesis, and some combativeness can be seen and should be managed without disturbing the essential priority of rapid cooling. Only in rare cases an arrhythmia, seizure, or other serious condition will occur during an EHS episode. In these situations, the more emergent condition should be addressed first, with the goal of rapid re-initiation of cooling treatment for EHS should be resumed as soon as the more concerning medical issue is stabilized.

In some instances where advanced resources and personnel are available onsite, and the EHS patient is appropriately treated, the patient can be discharged without being transported to a medical facility (7). However, for most cases of EHS the final step in care is the rapid initiation of supportive care and evaluation for other end organ dysfunction at an appropriate Emergency Department (ED).
Rapid Advanced Care

In the case of an EHS being transported to the hospital, EMS dispatch and/or on-site medical officials should notify the hospital medical team in advance to allow staff to prepare for treatment to begin immediately upon patient arrival. The diagnosis of EHS in an ED may be difficult, as the EHS patient may present with a temperature less than 40.5°C either due to active or passive cooling that has already occurred (33). Furthermore, if it is not possible to adequately cool the patient in the prehospital setting, the hospital or medical center needs to be prepared to cool the patient to 38.6°C.

Most hospital EDs are not equipped with various mechanisms or modalities for cooling, making rapid cooling difficult to achieve once the patient arrives. CWI remains a viable option to successfully cool an EHS patient in the hospital, even if initial cooling was delayed (36). The hospital should consider having appropriate treatment areas ready for EHS cooling during heat waves or large-scale sporting events (e.g. road races). In many cases the decontamination room provides adequate drainage to employ CWI or dousing.

The ED and hospital should be prepared for common sequelae of EHS, such as rhabdomyolysis, disseminated intravascular coagulation, and liver failure, especially in cases where cooling was delayed (37). In addition, EHS may present very similar to a malignant hyperthermia-like syndrome (38). Beyond this, further care for EHS patients in-hospital after cooling are described elsewhere (39).

EHS, like many other emergent medical conditions, such as acute ST elevation myocardial infarction, acute ischemic stroke, and trauma, requires timely intervention during the initial “golden hour” to achieve the best outcome for the patient (40-42). The importance of these concepts to the survival of EHS has led some states to developprehospital EHS related statutes and legal support (43). The advancing evidence-based standard of care for EHS requires that medical systems need to plan, develop, practice, and evaluate their capabilities for prehospital treatment and to implement protocols supporting immediate and aggressive cooling on site and during transport (44). We provide an updated paradigm for emergency medical services to initiate treatment in cases of EHS.

Scan code for link to published article with reference list.

“Exertional heat stroke is an important community health concern that requires EMS and onsite medical personnel to work together to find collaborative solutions to improve patient outcomes.”- Luke Belval
As one of my last tasks as the Vice President of Education and Communication, I attended the 98th American Meteorological Society (AMS) Meeting in Austin to present at the joint session, *Informing Heat-Health Practitioners to Reduce Risk through Impact-Based Decision Support*. The first half of the session was comprised of case study presentations that showcased the use of weather data, such as the wet bulb globe temperature (WBGT), to conduct health risk assessment in public health, occupational health, and athletics. While there still remain limitations in deducing the association between WBGT and health outcomes, use of weather data to make informed decisions for future heat events to minimize its adverse effects on health, economy, and productivity are being investigated across the U.S. A continued effort in observational and intervention-based studies are warranted to identify successful models. Presentations included in the latter half of the session, including my presentation from KSI, were reports from current initiatives supported by the National Integrated Heat Health Information System (NIHHS). The NIHHS is being developed by the Centers for Disease Control and Prevention (CDC), the National Oceanic and Atmospheric Administration, and domestic and international partners to understand this problem, develop a robust and science-informed response, and build capacity and communication networks to improve resilience. My presentation at the session featured KSI’s on-going inter-agency collaboration in drafting a round table document among athletics, military, and occupational settings to use WBGT for activity modifications in the heat. Other NIHHS projects featured in the session included a project lead by the National Oceanic and Atmospheric Administration in North Carolina that investigated the use of a web-based forecasting tool (Heat Health Vulnerability Tool) by community stakeholders and the Hot Spots project, which aimed to increase the heat resilience in the Mexico border region through education and evidence-driven public health interventions. As depicted by presentations in the session, a successful environmental heat risk assessment requires inter-agency and interdisciplinary networks. Projects lead by NIHHS provide great examples for others to follow, and it is no doubt that exercise physiologists and athletic trainers play integral roles in examining the impact of heat.
KSI had the awesome, unique opportunity to test two CamelBak sponsored pro-athletes over the course of two days. The athletes were Lea Davison, a two-time Olympic Mountain Biker (2012 & 2016), and Gediminas Grinius, a world champion Lithuanian trail runner. A very fit, athletically decorated media personnel also underwent testing. The athletes were able to undergo heat and sweat testing, where they exercised for 60-minutes total. During the testing session in a hot environment, the athletes were asked to collect their sweat in a specially prepared towel. At the end of their hour, whole-body wash downs were performed to collect samples. These samples assessed their sweat electrolyte concentrations. Whole-body wash downs are the gold standard for assessing whole-body sweat electrolyte concentration and very few labs across the country still use this technique. Many have moved over to local collection in sweat pouches, which is a great method of assessing local sweat, but not necessarily valid for whole-body calculations. The athletes were also able to complete an anaerobic threshold test or a VO2max test where we tested their ability to ward-off an accumulation of lactate (a by-product of anaerobic metabolism). In this test, we could extrapolate their anaerobic threshold based on continual readings, or their maximal oxygen uptake, by exercising until volitional fatigue, respectively. This was a great opportunity for KSI and allowed us to use our expertise to interact with some incredible athletes. One of the three media personnel that we were able to test was Adam Chase, who is also a highly trained athlete himself. He is still currently training and also writes for Motiv Running. On the next page is an article that he wrote recounting his experience at KSI for the testing sponsored by CamelBak.
Understanding the Science of Sweat

Adam W. Chase: Originally Published on Motiv Running (December 2017)

Rectal thermometers.
Children dread them. And most adults probably do, too. They’re something one figures will be nicely tucked away, in the rear view, so to speak, never to be seen or, rather, felt once capable of holding an oral thermometer under the tongue. However, taking a subject’s core temperature during hard physical exertion has, until recently, always required the insertion of a rectal thermometer connected to a long wire. [See Exhibit A below.] Fortunately, thanks to NASA and its Space Shuttle astronauts, including then-77-year-old Senator John Glenn, there is now a digestible transmitting thermometer that serves as an alternative. [See Exhibit B.] The size of a giant vitamin pill, or about three Tic Tacs, the transmitter is swallowed and, after a couple hours from ingestion, it reaches the intestinal tract and is able to send a wireless transmission, providing real-time core temperature readings. The transmitter then passes through the digestive system and is eliminated within a normal cycle of 18-30 hours. It’s one of the many advancements that have helped improve the study of human performance in athletics, including and especially endurance sports.

Stringer was an offensive tackle for the Minnesota Vikings who died in 2001 from EHS—Gatorade, Camelbak, and the namesake thermo-regulating active wear company, Mission.

I was fortunate enough to visit the lab and serve as an early test subject less than two weeks after it had opened. I was even more fortunate to have the option of using the digestible thermometer, thus foregoing the rectal alternative. Taking the subjects' core temp readings is an absolute requirement of the lab. If the core rises above 103 degrees F, the test ends.

Other test participants were cyclists, including two-time Olympic mountain biker Lea Davison, and runners, such as Gediminas Grinius, winner of this year’s Ultra Trail World Tour. As a runner, I was put on a treadmill and told to go at an exertion level I could maintain for 90 minutes. The room measured 94 degrees F and the humidity was set at 60 percent. The highly-trained lab technicians, PhDs and doctoral students, guided by KSI’s CEO and UConn’s Director of Athletic Training Education, Dr. Doug Casa, a passionate trail runner, performed the gold standard “body washdown” test on us. Very few labs are equipped to do this test, designed to measure your sweat content, down to the drop.

Before and after the exertion we were carefully weighed and then, while we ran or rode, we mopped up all the sweat and the technicians kept the wet towels. After we finished we were washed down.

UCONN’S NEW FACILITY

On September 22, 2017, the University of Connecticut’s Korey Stringer Institute (KSI) opened its $700,000 “Mission Stringer Lab,” a state-of-the-art laboratory designed to facilitate research and education for maximal performance, optimal safety and the prevention of death from exertional heatstroke (EHS). The lab was made possible by donations from, among others, the NFL—Korey
inside of a giant trash bag, with a set amount of purified water so that the lab techs could later remove that control from the sample. Any water we consumed during the test was also factored into the results. Before the test, we had to follow a careful protocol of washing, including our exercise clothes, using only water, as detergent, lotion or deodorant would alter the results. Similarly, we were instructed not to drink alcohol or coffee for 24 hours before the testing.

RESULTS

Once we were washed down with the pre-measured purified water (see above), the technicians placed the sweaty towels and our drenched exercise clothing into the “sweat soup” to be measured for various electrolyte levels. My sweat loss was 3.8 percent of my body mass and my sodium loss was 980.0mg, which was in the normal range (0.18 to 1.5) for exercise in heat.

Based on our before and after weight and the amount of water consumed during the exertion, KSI determined our sweat rate, measured as liters per hour. Normal sweat rates are 1.5-2.5 L/hr for men, 1.3-2 L/hr for women. I lost almost exactly 5 pounds during my test and had a high sweat rate of 2.31 L/hr. My core rose to the high of 103.1F, running a max speed of 9mph and I consumed a measly 35g of water. My heart rate went from 90 to 160 and, according to my follow-up anaerobic threshold test, spent the last 15 minutes above that heart rate level.

Alberto Salazar was tested at UConn’s predecessor lab, run by Dr. Lawrence Armstrong, a leading expert on hydration and who now serves on KSI’s Medical and Science Advisory Board, and he had the outlier sweat rate of 3.7 L/hr. Salazar would lose as much as 8 percent of his body weight during his races and he put great emphasis on training for heat tolerance before the 1984 Olympic Marathon in Los Angeles. Humans are only able to take in 1.3-1.4 L/hr so, while a high sweat rate helps to cool the body during exertion, it isn’t all good because the loss of hydration can be a real detriment if you lose too much. According to my measured sodium loss, I’d need to have consumed 4.5 salt capsules or drank enough Nuun hydration mix for 2.5 tabs.

CLEAR AND COPIOUS

Dr. Armstrong invented the urine color chart and, with that simple educational measure, has probably done more for more individuals than any other campaign to address dehydration. The chart has been helpful to many and was even converted to resemble beer types at one of the Western States 100 aid stations, where they used it to illustrate the command of avoiding stouts and sticking to lagers. Clear and copious urine is usually a sign of adequate hydration.

We learned from Dr. Armstrong that, without excess, caffeine doesn’t have an impact on hydration. But he and Dr. Casa were quick to point out that one needn’t be dehydrated to suffer heat stroke and that if you wait until you are thirsty, you are already late because thirst isn’t triggered until you dehydrated by 1-2 percent. In contrast, however, there are schools of thought, namely, Dr. Tim Noakes of South Africa, who professes that runners are over-hydrating and need to listen to their bodies and let thirst be their guide. Dr. Casa agreed with Noakes that, for purposes of avoiding hyponatremia, a sodium imbalance suffered by recreational runners who drink excessive water, thirst is a safe guide.

The key determining factors of one’s sweat rate are intensity of exertion, body size and environmental factors, such as heat and humidity. The body is an incredible system for trying to thermoregulate and what you drink can show up in your sweat as soon as 10 minutes after you consume it.
The takeaway from KSI's Mission Heat Lab was that there are considerable performance benefits to be gained from knowing your sweat rate, sweat content, how, when and with what to rehydrate. As an easy rule, if you use your morning weight, thirst and urine color as basic guiding indicators, you can stay on top of your hydration needs.

Dr. Casa, with the help of many of his assistants and PhD students, is publishing a book in early 2018, “Sport and Physical Activity in the Heat,” as a full resource for serious athletes, coaches, trainers, sports medicine practitioners, kinesiologists, concerned about performance in hot conditions.

“Since we do not currently have an accurate wearable technology that can provide real-time assessment of hydration status, it is essential for high-level athletes to have an understanding of factors that influence sweat rate (amount of fluid/electrolytes lost in a given amount of time in a given environmental conditions at a given intensity),” Casa said. “This knowledge can allow an athlete to train hydration replacement and develop an appropriate race-day strategy.

“We will eventually have an accurate real-time wearable for hydration status that athletes can perpetually monitor so tweaks can be made—although lab data would still establish the general plan. But until that time, the lab work helps establish a plan and race-day thirst, environmental changes, intensity, pre-event hydration, and etc. need to be considered to make hydration decisions.”

UPCOMING EVENTS

Collaborative Solutions for Safety in New Jersey Meeting
April 13th, 2018
NY Jets Training Facility

Korey Stringer Institute Board Meeting & 7th Annual Fund Raising Gala
May 10, 2018
NFL Headquarters , New York, NY

National Heat Safety Awareness Day
May 25, 2018

American College of Sports Medicine Annual Meeting
May 29th-June 2nd, 2018
Minneapolis, MN

Collaborative Solutions for Safety in Louisiana Meeting
June TBA

National Athletic Trainers’ Association Clinical Symposia & AT Expo
June 26th-29th, 2018
New Orleans, LA

National Strength and Conditioning Conference
July 11th-14th, 2018
Indianapolis, IN

Sport Analytics Innovation Summit/Wearable Tech in Sport Summit
July 19th-20th, 2018
San Francisco, CA

Falmouth Road Race and Medical Conference
August 19th
Falmouth, MA

ACSM Conference on Integrative Physiology of Exercise
September 5th-8th
San Diego, CA

Ragnar Relays
October 5th-6th
Wawayanda, NJ

International Conference on the Physiology and Pharmacology of Temperature Regulation
October 7th-12th
Split, Croatia

Collaborative Solutions for Safety Meeting in Washington D.C.
October 26th, 2018
Arlington, VA

Marine Corps Marathon Medical Symposium & Medical Tent
October 27th and 28th, 2018
Arlington, VA
From my early days in high school, I always wanted to be an athletic trainer. Interestingly though, my high school never employed an athletic trainer so I’m not really sure who or what pointed me in this direction. I can remember going to professional basketball games with my friends and while they waited afterwards in the parking lot to get photo opportunities with their favorite players, I ran to the surprised athletic trainer. My undergraduate years took me through an internship program at Trenton State College (TSC, now The College of New Jersey). Being enrolled in their Health and Physical Education curriculum, there wasn’t much formal education in athletic training. As a result, the foundation of my knowledge relied on rolling up my sleeves and practicing the trial and error method. After four years, I graduated with a major in Health and Physical Education and a minor in MacGyverism. Understanding the importance of theory before implementation, I continued my graduate studies in the accredited program at Old Dominion University (VA) and my first emergency medical experience came while serving on the medical staff for a triathlon in Virginia Beach. I was hooked.

Following graduate school, I spent one year in a secondary school until being wooed by the 9 to 5, no weekends, no standing in the rain, life of the clinical athletic trainer. However, 365 days later I found myself working weekend tournaments in the rain of spring and heat of summer. Also, I joined the medical staff of the NYC Marathon which I am still a part of to this day. November marks my 30th year with them. It took me four years to face the truth that I was meant to be out in the field. An impromptu interview led to my current role as athletic trainer of 27 years at Ewing High School, Ewing, New Jersey. Being their first athletic trainer permitted me the opportunity to design an athletic training room, develop an athletics’ emergency action plan and implement an athletic health care program overseeing 23 different sports. Upon entering a profession, one usually wonders what impact, if any, will be made along the way. Will I take the easy way out? Just go through the motions and collect a paycheck at the end of the week? In 2004, my mentor from TSC showed me a copy of the newly-released NCAA Heat Acclimatization Guidelines. Although great for the collegiate athlete, these guidelines struck a nerve with me at the secondary school level. After all, the largest population of athletes are found at my level yet they had no means of protection from exertional heat illness. So, while serving concurrently on the NATA Secondary School Athletic Training Committee (SSATC) and National Federation of State High School Association Sports Medicine Advisory.
Committee (SMAC), I chaired a sub-committee to develop heat acclimatization guidelines for secondary school athletics. In 2008, Dr. Douglas Casa contacted me to co-chair a task force with him. Our mission: to assemble a multidisciplinary team of experts to polish the heat acclimatization guidelines and prepare them for publication and release in June 2009. In April 2010, the Korey Stringer Institute (KSI) was established and Dr. Casa offered me a position on their Medical and Science Advisory Board. Since then, I have continued to work with the KSI staff on promoting the heat acclimatization guidelines, educating the public on exertional heat stroke, and helping to implement policies to prevent sudden death in athletics.

Getting policies adopted may be an arduous task. With any attempts at making new policy changes comes push back by coaches and old school parents. I experienced this in New Jersey while promoting the heat acclimatization guidelines. However, after 2 years of delivering formal presentations to the state SMAC, New Jersey became the first state in the country to adopt them in May of 2011.

I have always believed that secondary school athletic trainers have a responsibility to maintain a safe environment for their student-athletes. It’s important to highlight the areas in which your state is deficient. Start by requesting an invitation to present best practices at state athletic association and SMAC meetings and present solutions to these deficiencies. I’ve found that most often resistance to change is due to ignorance, so education should be stressed at the grassroots level. Let’s face it, when playing sports we all want to win. But when parents sign the consent to permit their son or daughter to participate in interscholastic athletics, they expect the athletic trainer, the school in which they attend, and the state athletic association to ensure that health and safety is held at the highest regard. The state association creates the policies, the high school implements the policies and the athletic trainer ensures that they are enforced.

Since my early days with KSI, one particular incident keeps replaying in my mind, which I often share with others. Someone from the media stated to me, “We have approximately eight million students participating in athletics across the country. Having only one die isn’t a bad ratio”. My reply, “Mathematically speaking….no that isn’t bad…..unless it’s your son or daughter. Try explaining that rationale to a parent who drops off their child at practice in the morning unknowing they will never see them again”.

Through my involvement with and influence from KSI, on the state level I’ve spearheaded the heat acclimatization guidelines, developed cold weather guidelines, introduced limited contact hours for football practice, and served as a contributor for the New Jersey Department of Education Opioid Fact Sheet. On the national level, I was responsible for securing and overseeing an athletic training staff of 100+ for the Special Olympics USA Games. A borderline black flag heat wave came through at mid-day for a few hours. Knowing my experience and affiliation with KSI, Olympic officials met with me as I guided them with WBGT readings allowing for appropriate accommodations in order to continue competition. Finally, I’ve been fortunate for the opportunity to be included as co-author for several NATA position statements, promote KSI mission through various media outlets, serve on the NFL Athletic Trainer Grant Review Committee, and participate in a WBGT educational video produced by Kestrel Heat Stress Trackers. My favorite story occurred 2 years ago at the TCS NYC Marathon. Prior to the start, the various medical disciplines in our tent provided informal introductions followed by shop-talk of our expertise.
Two hours later, a runner passing us was suffering from an apparent onset of exertional heat stroke. While a few medical professionals argued to cover her with blankets to prevent shock, the chief physician instructed them to follow my lead since I had the most experience in the area of heat illnesses. A rectal temperature showed 106 degrees F. With no immersion tub available, she was packed chest to toe in ice bags. Eventually, core temperature dropped below 100 degrees and she became coherent.

The impact of KSI on appropriate athletic health care at all levels has been immeasurable; however, there is still much work to be done. School by school, city by city, state by state our mission remains the same. Nobel Peace Prize Winner, Dag Hammarskjold states, “Never for the sake of peace and quiet, deny your own experience or convictions”. Regardless of the potential pushback, we must continue moving forward with our mission on behalf of our athletes.

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**Presentations at American College of Sports Medicine (ACSM) Annual Meeting by KSI**

**Wednesday May 31, 2018**

*Symposium*
Douglas Casa: Influence of Alcohol on Hydration Post-Exercise

*Thematic Poster*
Ryan Curtis: The Effect of Sleep Duration on Sleep Quality in Elite Soccer Athletes

*Poster*
Yasuki Sekiguchi: Factors Influencing Hydration Status during a NCAA Division 1 Soccer Preseason
Rachel Katch: Effects of Wrist Cooling on Balance and Cognitive Performance in the Heat

**Friday June 1, 2018**

*Poster*
Gabrielle Giersch: Validity and Reliability of Shirt-based Integrated GPS Sensor

**Saturday June 2, 2018**

*Poster*
Courtney Benjamin: Sleeping Patterns in NCAA D1 Collegiate Athletes: A sex Comparison

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**Presentations at National Athletic Trainers' Association (NATA) Annual Meeting by KSI**

**Wednesday June 27, 2018**

*Committee Session*
Rebecca Stearns and Alicia Pike: Legislators' Perceptions of the Athletic Training Profession

*Poster*
Sarah Attanasio: Athletic Trainer Education Level and Employment Models: The ATLAS Project

**Friday June 29, 2018**

*Rapid Fire Presentation*
Alicia Pike: Organizational Culture's Effect on Injury Treatment Decision Making
Robert Huggins: Organizational and Professional Issues in the Secondary School Setting

*Oral Presentation*
Brad Endres: Epidemiology of Sudden Death in Adult Organized Recreational Sport in the United States, 2007-2016
Could you tell us about yourself?

I believe in the saying “anything worth doing is hard”. As an athletic trainer and exercise scientist by training, my roles as Director of Research and Director of Military and Occupational Safety for KSI, present worthwhile challenges on a daily basis. In this role I manage research studies and operations in our labs. I also facilitate KSI’s partnerships within the military and occupational organizations. As a proud Connecticut native, I have earned my BS in Athletic Training and MS in Exercise Science from the University of Connecticut. I have worked as an athletic trainer at the high school and collegiate level. I also have experience working with athletes all the way from youth to the highest levels of professional sports. In my free time I enjoy mountain biking and woodworking.

Could you tell us about your first involvement/interaction with the Korey Stringer Institute?

My first experience with KSI was as an undergraduate student, when I volunteered to help with a research study in the heat chamber in 2010. Although it was in its infancy, KSI already meant something on campus and in the field of exercise science. It was clear to me that the opportunities afforded to me at KSI would be unparalleled. From that point forward, I was invited to be a part of the team and have happily contributed for the past 8 years.

In what ways has KSI impacted you?

I consider my involvement in KSI an investment, both personally and professionally. I have been able to be a part of projects at KSI which would be impossible anywhere else. This journey has taken me across the country and granted me many opportunities to directly improve the safety of athletes, laborers and warfighters. From helping our Special Forces, to educating athletic trainers, to conducting high-level research, the team at KSI always finds to change the status quo for the better. Even better than the opportunities I have had professionally, the personal satisfaction of being able to do something for the greater good on a daily basis has been an immense pleasure.

"I have been able to be a part of projects at KSI which would be impossible anywhere else."
Could you tell us about yourself?

My name is Meg Bosworth and I currently work at the University of Hartford. I did my undergrad work at Central Michigan University and graduate work at UConn. I've spent a majority of my career working with the combination of Men’s Soccer and Baseball at the D1 level. I've also spent time in Australia working as an intern at Murdoch University in the chiropractic classrooms where I taught anatomy and taping labs. I was able to experience Rugby and Aussie Rules football at various levels of competition. Immediately after graduation, I moved to Philadelphia to work at SJU and I gained valuable experience and autonomy that helped further propel my career and love of the profession. I decided to pursue my masters at this point and ended up at UConn. During my time at UConn, I worked at Bloomfield High School. I completed a long, tedious thesis with one of my classmates & dear friends, Rachel Karsto. My class was also the group that helped Doug get his KSI dreams up and running. It was a fun experience to be a part of helping him achieve his goals as well as being a part of someone else’s dream. Upon graduation I took a job at the Coast Guard Academy where I stayed only a year before coming to the University of Hartford. I’m currently in my 6th year here and have opted to begin the transition out of sports medicine by working through a part time MBA program. In the MBA program I hope to end up on the administrative side of athletics or medicine.

Could you tell us about your first involvement/interaction with the Korey Stringer Institute?

When I began at Uconn in 2009, Doug Casa was beginning the development of his brainchild, KSI. My class was fortunate enough to help his dreams come to fruition in the early stages. We spent countless hours in the original, tiny KSI office cold calling high schools around the country trying to see what- if any- heat guidelines they had in addition to protocols regarding EHS. As I stated before, it was really satisfying helping someone get the ball rolling on their goals. I remember sitting in brainstorming meetings and just watching the ideas being thrown around by Doug and witnessing an idea become reality- it was really cool. We were able to be a part of so many aspects too. We sat in meetings about the logo and were able to meet Kelsi and learn about what this all meant to her… It was really incredible to be involved in those early stages.

In what ways has KSI impacted you?

I think that KSI is unique to me in the sense that I remember a time when it wasn’t here. In the years since its inception to the world and its partnerships with several other entities, it’s become a major tool for several kinds of health care professionals and institutes. It’s a place I know that I can always go for information and the latest research. I know that Doug works with the best researchers and uses current practices in all his research to bring us information. I work in a profession where things are ALWAYS changing, because research is always happening. KSI is a place where I feel I can go to get current best practices and the latest information. I’m no longer involved directly in the day to day happenings at KSI, but it’s certainly a special memory of my time spent at UConn.

"In the years since [KSI's] inception to the world and its partnerships with several other entities, [KSI] has become a major tool for several kinds of health care professionals and institutes."
SNAPSHOTS

KSI and CamBak at the UConn Women's basketball game

Dr. Huggins and Laura Marcoux during elite athlete testing

Yuri's KSI present

Medical tent at MCM

Westminster School visits KSI

Yasuki carrying all of the Blaze Pizza Dr. Jardine bought the staff for National AT Month

KSI students putting in a hard day of work!
PHOTOS OF KOREY STRINGER INSTITUTE STAFF AND FRIENDS

Dr. Casa speaks in Falmouth

KSI staff in D.C. for MCM

Dogs of KSI!

Yasuki testing an IronMan, Matt Hanson

Heat Lab grand opening

Yuri’s going away party at KSI

Falmouth Dream Team!

Sweat selfie with Steve Nabity

CamelBak Testing

HBO Take Over

SPRING 2018 43
Kelci Stringer  Founder and Spokesperson of KSI.
James Gould  Chairman, KSI, Chairman, Management One, Korey’s NFL Agent
Mitch Berger  NFL Analyst, Entrepreneur, Philanthropist, Teammate and Friend of Korey
Scott Birnbaum  Chief Marketing Officer, Mission, KSI Corporate Sponsor Representative
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