In the land of 10,000 innovations, visionaries from the greater MSP region are changing the way sports are played.

Trend: Concussion Research

Concussions are a major topic in contact sports, especially football, from youth leagues all the way up to the pros. Several leaders in the field have established themselves in Minnesota, and are working together to have a positive impact on players, kids and society.

Uzma Samadani, neurosurgeon and researcher, Hennepin County Medical Center
Francis Shen, professor of neurolaw, University of Minnesota
Prevent Biometrics, tech startup
launching an impact-sensing mouthguard

"Ten years ago, not a single state had a law on youth sports concussions. Today, all 50 states have laws, but how many kids get a concussion in a given year? We can't even guess. I looked and said, we have an opportunity for a statewide effort. This is our best shot at bringing these ideas out of the ivory tower and into policy."
- Francis Shen

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Prevent Biometrics

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For all the blaring headlines about concussions in football and other contact sports, you might be surprised to learn that there is one critical piece of information all the experts are missing: How many concussions do players experience, and what does it mean to have one?

Even at the top levels of pro sports where resources are greatest those answers are murky, and for school and youth sports programs there is little more than guesswork. Add to that the mysterious nature of concussions overall, both in terms of understanding how they happen and how they impact people in the short and long term, and the need for new approaches in the field of concussion research and prevention becomes apparent.

As Minnesota gears up to host the Super Bowl in February 2018, it is fitting that some of the most advanced thinking and innovation around concussions is happening right in the area.

While each of the local leaders in concussions approach the topic from a different perspective, the qualities that make the Twin Cities a good place to conduct this work apply to all: a robust academic community, support and funding for research, a history of med-tech and medical innovation, and a large and active population.

USING “THE EYES AS A WINDOW TO THE BRAIN”

Dr. Uzma Samadani came to Hennepin County Medical Center (HCMC) in 2015 with a mission: To study brain injuries in an entirely new way.

Dr. Samadani, a neurosurgeon, came to Minneapolis after eight years in New York, where she worked for the Veterans Administration helping soldiers who had suffered blast injuries. “One of the things that interested me was a lack of objective measures for brain injury,” she said. “A major focus of my work is to develop a way to tell not only if a person has a concussion, but what kind.”

Not all brain injuries are created equal. Some of the variables include whether the head rocked or spun; at what force; whether there was a collision, blast or whipping motion; where the injury occurred; and other factors as well individual to each patient.

In sports, sideline physicians have a series of tests and often look at player’s eyes to help with diagnosis. Dr. Samadani’s work takes that judgment call and applies scientific rigor to it: Sophisticated eye-tracking software monitors the subject’s eyes and can tell from a variety of variables whether the patient has a concussion.

“We can get an instant readout if there is swelling in the brain, high pressure in the skull,” she said. The software compares measurements against universal norms – there is no need to record a baseline for the patient. The hope, she said, is to take the type of system in her lab and develop a device or even a program that can run on hand-held devices and provide coaches and physicians with a tool to objectively understand what is happening.

“Our goal is to prevent, classify and treat all brain problems, and do it early,” she said. HCMC gives her the opportunity to do so as it combines a large research program with a Tier 1 trauma center in the middle of a large metro area: “I get to see a lot of head injuries,” Dr. Samadani noted.

A SENSOR FOR EVERY SKULL

Prevent Biometrics is a Twin Cities-based company that has created a product that offers the possibility of getting motion sensors attached to the skull of every athlete. “There have been attempts to put sensors in helmets, and headbands, and connect them to the skin,” said Steve Washburn, co-founder and CEO. “But all of those things move independently of the head. The teeth are a part of the skull, so with a mouthguard, we have a direct connection.”

Prevent Biometrics grew out of concussion research funded by the National Institutes of Health that originated at the Cleveland Clinic. As the researchers sought to bring their product to market, the patented technology was made a part of Prevent Biometrics, which has spent years solving many of the technical and manufacturing challenges and figuring out how to get it into the hands of players in a way that is useful.

These challenges included miniaturization of sensors, batteries and transmitters into something that could be worn comfortably; figuring out how to manufacture them cost-effectively at scale; and coming up with algorithms that could turn the raw data captured by accelerometers into an accurate picture of what happened inside a player’s head.

The second challenge is in the system’s use: developing the data infrastructure that could capture the information coming from sensors; building apps and APIs to get information into the hands of coaches.
and medical professionals in a useful form; and working up a business model and partnerships that could make it viable.

This year, some Minnesota high schools will be equipped with near-final models of the mouthguard for a final series of tests before the it goes to market.

A MAJOR CENTER IN THE EMERGING FIELD OF NEUROLAW

For an individual, concussions are a health issue; but they are fast becoming a legal issue for society as well. From lawsuits on behalf of pro players to writing legislation that guides youth sport coaches, the trend has helped give impetus to the new field of neurolaw.

One of its leading practitioners and researchers, Dr. Francis Shen, has established his neurolaw lab at the University of Minnesota, one of only a handful of such labs in the nation and the only one to reside in the law school rather than the medical school.

"It's not a single topic, it's a lens," said Dr. Shen, comparing it to the well-known intersection between economics and law and between history and law. Understanding how the brain works – or doesn’t – can have significant legal impacts, as seen in cases that need to determine culpability or responsibility when there is dementia, mental illness, or brain damage.

"I think there is tremendous benefit from sports, including contact sports," Dr. Shen said. "On the other hand, you have individuals who are not following a reasonable standard of care." In the field of sports, determining that standard and how it is applied is one of the major goals of neurolaw, Dr. Shen said.

"Ten years ago, not a single state had a law on youth sports concussions," Dr. Shen noted. "Today, all 50 states have laws, but how many kids get a concussion in a given year? We can’t even guess. The states require education on concussions, and certain protocols like when to pull a kid from a game, but what's really happening? I looked and said, we have an opportunity for a statewide effort. We’re slowly building the social infrastructure” to write more specific and helpful laws.

In Minnesota, that out has meant bringing together leading minds from academia, medicine, law and government. "It is a lot like a startup," Dr. Shen said. "It’s interdisciplinary." The strength of those fields in Minnesota has been an asset, he says. Significant brain health and concussion research is happening at HCMC, the Mayo Clinic, and the University of Minnesota, which Dr. Shen notes has some of the world’s best and most powerful brain-imaging equipment.

The area also boasts several large law schools and government sponsors, who have invited Dr. Shen to speak to the legislature and act as an advisor. In addition to mentoring the U of M's first neurolaw grad student – the degree is a combined JD and Ph.D. – Dr. Shen also speaks nationally on neurolaw, and has been recruited to teach on the subject at schools outside Minnesota as well.

As the field of neurolaw matures, Dr. Shen hopes it can be used to create policies that protect all athletes while recognizing the benefits of sport. "My world is to take this science and figure out the implementation," he said. "This is our best shot at bringing these ideas out of the ivory tower and into policy."