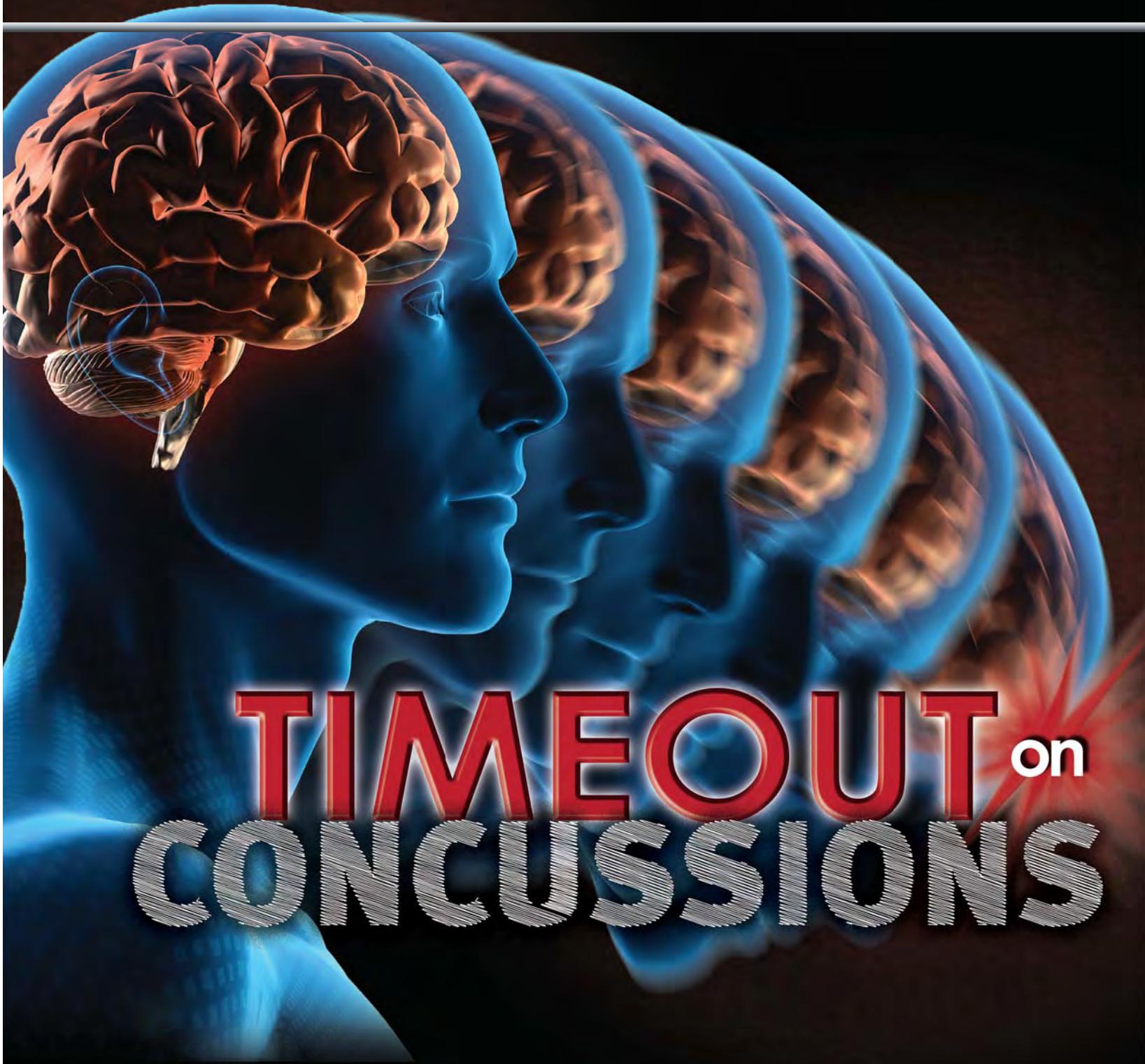


MEDICINE | PUBLIC HEALTH

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FALL 2012



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Traumatic Brain Injuries CAN HAVE LASTING EFFECTS

Nothing quite compares to the energy, excitement, and enthusiasm of a high school football game in Kansas.

In communities across the state, players suit up and take the field for their evening of glory under the Friday night lights. Students, parents, and fans fill the stands. The cheering can be deafening; the school spirit thrilling.

Brandon Streeter lived for these nights.

On Oct. 22, 2010, the high school senior put on his red and white Rose Hill High School uniform and took the field as he had done so many times before. As a wide receiver, he knew he would take hard hits only to jump back up and into the game. What he wasn't prepared for — this would be his final football game and the last time he would ever play sports.

Approximately 1.6 to 3.8 million sports- and recreation-related traumatic brain injuries occur in the United States each year. And during the last decade, emergency department visits by children and adolescents increased 60

percent, according to the U.S. Centers for Disease Control and Prevention.

The severity of a concussion — when the brain bounces around, hitting the inside of the skull — can vary. Until 2011, there was no specific medical protocol as to how student athletes with concussions should be treated, other than waiting for their symptoms to clear. Should they sit out the remainder of the game? A week? The rest of the season?

Concussions can be difficult to diagnose because they can't be seen on a CT scan. In addition, many people don't even know when they have suffered one, leaving physicians to estimate countless more concussions are sustained than reported. And when concussions aren't properly diagnosed and given time to heal, young athletes can experience additional brain trauma from a second injury that can be life-changing or even deadly.

It took only one Kansas physician to experience one head injury at one local high school football game to set the wheels in motion to create the Kansas Sports Concussion Partnership, an online resource that provides functional concussion assessment tools for student athletes, parents, coaches,

and physicians.

Two years ago, James Gilbaugh, M.D., attended a Friday night high school football game. The punt returner took a solid hit from two players on the opposing team.

"You're just cringing as you're watching it," he said. Two of the boys were knocked unconscious. As one struggled to his feet and walked off the field, he collapsed again. "Clearly those are signs of significant concussions."

A "blow out game," Dr. Gilbaugh left in the third quarter. He was even more shocked to read in the next day's newspaper that at least one of the players re-entered the game in the last quarter.

Dr. Gilbaugh, a urologist and a Medical Society of Sedgwick County (MSSC) board member, recognized the public health significance of letting injured athletes return to play. He made sure the issue was on the board's agenda the following week.

"It was disturbing to me to see a kid who had a concussion actually put back in the same game," he said.

Brandon was an athlete since starting football in third grade. Every season was dedicated to a sport —



Partnership works to establish concussion protocol for student athletes.
kansasconcussion.org

Brandon Streeter moments after his last concussion, photographed by his father.

concussions aren't diagnosed. Any hit that can jostle his brain, no matter how small, could mean a coma or even death.

Thanks to Dr. Gilbaugh's attention, the MSSC submitted a resolution to the Kansas Medical Society (KMS), calling for physician engagement when a student athlete is suspected of having a sports-related head injury. It passed unanimously, and became a KMS initiative.

At the same time, Travis Francis, then-president of the Kansas Athletic Trainers Association, worked with Mark Stovak, M.D., a KU School of Medicine-Wichita clinical associate professor and a sports medicine physician, to draft state legislation, which passed in April 2011. The new law: **If a student athlete is suspected of having a head injury, the athlete cannot re-enter practice or play without being evaluated by a licensed physician, either an M.D. or D.O.**

"Within 18 months of this event that started with concern expressed from an individual physician, we now have a state law," said Jon Rosell, Ph.D., executive director of the MSSC, which

continues to provide support and leadership for the cause.

From there, the MSSC, through sponsorship of the KMS, launched the Kansas Sports Concussion Partnership (KSCP), made up of physicians from across the state, including Dr. Grelinger, who serves as KSCP chair, and many KU School of Medicine-Wichita faculty. The group continually updates its website with new information.

Brandon sustained his first concussion in seventh grade.

"It was kick off; I tackled the guy, and I got up dizzy," he recalls. "I stumbled off the field and just started to fall over. I fell over and passed out."

Under doctor's orders, Brandon took a week off. During this time, he never gave much thought to the frequent headaches he experienced. He always suffered from them, and the ailment runs in his family. He even considered headaches after games normal.

It was a year later that his headaches became more severe.



The concussion-causing hit that ended Brandon Streeter's football career, photographed by his father.



Athlete's Symptoms		<input type="checkbox"/> Male <input type="checkbox"/> Female
SCORE Card		Date of Birth _____
Sports Concussion Observation Recognition & Evaluation		Date of Injury _____
KSCP		Sport _____
Kansas Sports Concussion Partnership		Position _____
www.KansasConcussion.org		Primary Care Physician _____
This SCORE Card may be filled out each time you are evaluated for a concussion. Karen can require a physician's authorization to get you back in the game.		Parent/Guardian signed
Symptom Evaluation		
How do you feel? Score the symptom if it is present. Scale from 0 (none) to 5 (worst).		
1 Headache		Exams Date _____
2 Pressure in head		Exam Date _____
3 Neck pain		Exam Date _____
4 Nausea or vomiting		Exam Date _____
5 Dizziness		Exam Date _____
6 Blurred vision		Exam Date _____
7 Balance problems		Exam Date _____
8 Sensitivity (light)		Exam Date _____
9 Sensitivity (noise)		Exam Date _____
10 Fatigue or low energy		Exam Date _____
11 Don't feel right		Exam Date _____
12 Feeling slowed down		Exam Date _____
13 Feeling like a fog		Exam Date _____
14 Difficult concentrating		Exam Date _____
15 Difficulty remembering		Exam Date _____
16 More emotional		Exam Date _____
17 More irritable		Exam Date _____
18 Sadness		Exam Date _____
19 Nervous or anxious		Exam Date _____
20 Drowsiness		Exam Date _____
21 Unconscious		Exam Date _____
22 Trouble falling asleep		Exam Date _____
For athlete use only:		
Total # of Symptoms (22 max.)		
Symptom Severity Score (1-22 max.)		
Total Balance Errors (30 max.)		
Total Cognition Score (24 max.)		
This athlete is symptom free and has normal exams. I authorize her/him to start "Warm Up for Return".		
Name _____ Date _____ Signature _____		
Go to Score Card to start your "Warm Up for Return."		

They continued, as did Brandon in sports. Two years later, he and a teammate collided during a tackle.

"He was subbing as quarterback in that game (against Kingman) and when he came to, he went over to Kingman's side and everybody was looking at him," said his mom, Karen. "That's when we knew something was wrong."

Brandon can recall several games and hits when he didn't feel right but never sat out. A concussion during his senior year of high school would be the most devastating.

For more than 10 years, Carol Johnson, M.D., has attended every home football game for Sunrise Christian Academy, monitoring players for signs of concussions and other injuries.

As the team's physician, she's thankful for the KSCP guidelines.

"They're nice because they're so concrete," said the KU School of Medicine-Wichita clinical associate professor and family medicine physician who has benched football players and cheerleaders. "(The KSCP) is very important because concussion symptoms can be subtle and you have to do the neurologic test and it requires some expertise to interpret."

Because concussions are difficult to diagnose and many people don't know they have them, the KSCP provides a variety of guidelines on its website. The athlete's guide, for example, lists signs and symptoms that can be observed by the player as well as others, what happens when a concussion is reported, what to do in the event of one, and when to see a doctor.

Guides tailored to parents, schools, coaches and athletic trainers, as well as physicians are also included, and a

Concussions aren't isolated to football. Overall, the activities associated with the greatest estimated number of traumatic brain injury-related emergency room visits are:

and then I, all of a sudden, collapse," he said. "I remember waking up on the sideline, super dizzy. The ground was floating around me."

"I knew something was bad then." A few weeks later he suited up for what would be the last game he'd ever play. A simple tackle left him unconscious on the field, his legs twitching. Once he regained consciousness, he jumped up, ready to play. That's when the team's athletic trainer pulled him out.

Concussions are a biomechanical injury to the brain, which depolarizes brain cells, explained Dr. Grelinger.

"Each brain cell is like a little capacitor," he said. "When you sustain a concussion, the cells no longer fire in sequence. They shut down and try to regroup, which can leave athletes dazed and confused. The cells are temporarily offline and if damaged too severely, may never function again."

Inevitably, every person will hit his or her head at some time. With more than 100 billion brain cells, a person likely won't notice a difference when a hundred thousand or so die, he said. It's when a large number of cells are repeatedly injured, such as with multiple concussions, that an irreversible change is noticed by the athletes and those close to them.

"A brain can be compared to a public building and its fire control systems," said Dr. Grelinger, who testified before the Kansas Senate in support of the legislation. "If an injury occurs, there are several mechanisms built in to protect it, such as smoke detectors and sprinkler systems. The brain is no different. Just like a building after a fire, it takes time to clean up and reset all systems. If a second fire occurs before the system is reset, the damage

will be much greater. If a second concussion occurs before the brain is reset through healing, the next injury is frequently much more severe.

"There are laws from preventing me from re-entering my damaged building too early. Now we have a law to prevent athletes from re-entering the game too early. Athletes who return to play too early risk second-impact syndrome. The damage can result in permanent disability or even death."

Because of continuing brain development, younger people are at increased risk for traumatic brain injuries with increased severity and prolonged recovery, according to the CDC. Increasing evidence also shows that repeated concussions, particularly in athletes, can lead to early-onset dementia and similar disorders.

The next morning, Brandon's parents, friends, teachers, and physicians started to notice changes as he began having drastic mood swings and memory problems.

"We would shut the door and because of the noise, he would get irate," Karen said. "He's a very low-key person; he never gets mad. All of a sudden, his personality was very irritable, vacant. He just wasn't there."

Brandon's condition deteriorated. He couldn't remember what was said during conversations or that they even took place.

All the while, he continued having splitting headaches. Moving into football playoff season, he kept his pain to himself.

"I kept lying to the athletic trainers. It wasn't until the day before a game when I finally told the truth that I was having symptoms," he

said. "I didn't know concussions would be as big a deal as they are. I just wanted to play."

His friendships suffered; his grades dropped. The sharp student who signed up for pre-calculus and trigonometry suddenly couldn't remember simple algebraic equations. His math skills plummeted to that of a seventh grader.

"I remember sitting in her (the neurologist's) office crying when she said no baseball because that's my favorite, too. We were devastated. For a year, he couldn't do a jumping jack, he couldn't run," she said of the simple brain movement from those activities that could have resulted in a coma. "They say now if he gets a good hit to the head, there's probably no recovery."

Doctors can't see an injured brain like they can a broken wrist, so in the case of concussions, physicians look for impaired balance, coordination, memory or concentration. The comprehensive guides at kansasconcussion.org detail what physicians need to assess.

"Since we are unable to directly test the brain's protective systems, we rely on physical and mental characteristics that can be tested reliably at the sideline," Dr. Grelinger said. "Finding any damage here suggests the other systems may be damaged as well and the athlete may be at significant risk to return to play."

If Dr. Grelinger finds any evidence of brain impairment, athletes are removed from sports activities until they have had time to heal. Only when they are completely healed, he said, will an athlete have the best chance to adjust should another brain injury occur.

While Brandon will never play contact sports again, the road to recovery is far from over. He doesn't know if he'll ever return to what he was like before the concussions.

He gained 15 pounds from epidural injections from which he suffered multiple side effects, including intense leg pain. And in the past two years, he's relearned math and regained the ability to speak clearly.

Photo by Alissa Futhey

His original college plan is on hold. At the advice of his doctors, he takes only six credit hours while living at home. He hopes to start a full schedule soon, working toward a pre-medical degree, maybe going on to medical school, and becoming a medical missionary.

He knows it will be a long road.

"I would have been more truthful," he admits. "For me, it was always hard to say I was in pain because it made me feel like I was a baby."

"At the time, high school was what was most important. My life was sports. I didn't look forward. High school is only four years of your life ... and now high school is so insignificant ... Definitely get checked, definitely don't lie, and definitely don't try to sneak your way through."

Bicycling Soccer

Playground activities

Basketball Football

