

"I didn't plan on becoming the voice of female brain injury, in fact, for decades, I hid my 25 concussions from friends and even my family. Only after seeing how many other women were suffering in silence, did I come to believe that females with brain injuries ARE the invisible patients within "the invisible injury..."

Katherine Snedaker, LCSW, is executive director of PINKconcussions. In 2013, Katherine founded PINKconcussions, a nonprofit focused on female concussion from sports, abuse, accidents, and military service. She has produced three international summits on Female Brain Injury in 2016 and 2017, hosted at Georgetown University Medical Center, the Palo Alto VA Healthcare System and the 2017 IBIA World Brain Injury Congress. She is a researcher, educator, and advocate who speaks and presents internationally on female concussion research along with her own personal story of brain injury.

MY CONCUSSIONS

I have suffered 25 concussions since I was sixteen and learned quickly just not to mention the weeks of headaches to doctors who had no understanding of my experience.

My first concussion occurred when, as an inexperienced 16-year old driver, I rear-ended a car and then two cars hit me from behind. Then three years later, I was a passenger in a high-speed crash in a 1969 convertible Corvette. At the hospital, the doctors told me I was lucky to walk away with "just a concussion." As I went through my 20's and 30's, I just seemed to keep hitting my head every 2-3 years in my wonderfully, active life playing sports, wrestling with my dogs or keeping up with my three very active sons. I would hit my head, and have a headache and foggy feeling for 4-6 weeks, then feel fine again.

Somewhere along the line, I just learned that people didn't have much compassion for concussions, and I stopped letting anyone know when I was hurt. I saw doctors each time they happened but no one told me much other than, just rest.

Starting in my 30's, I noticed I often forgot the names of common household items and will say "put the thing in the thing" or I just call everyone "sweetie" (awkward when it is the plumber!). I would make mistakes often when it came to my memory and it became obvious to my family and friends. Over the years, I have felt ashamed, embarrassed and alone when my deficiencies were visible to other people. I learned to hide and just count the weeks until my headaches went away.

MY JOURNEY TO CONCUSSION EXPERT

But in 2008, everything changed when my ten-year old son suffered a series of concussion which forced him to miss almost a year of school. The doctors could not explain why a soccer ball blow to the head at school recess had erased my son's upbeat personality and his ability to read more than a few sentences at a time. So, I started to learn everything I could about concussion and sought out concussion experts, called researchers and attended scores of medical professional conferences to find an alternative to the isolating prescription of "rest until symptoms cleared".

I quickly became "the concussion mom" to call for answers and found myself educating more and more families each month. There seemed to be a deep gap between local doctors' diagnosis of a concussion and families' knowledge and coping skills on how to help their child heal from a concussion. The schools also seemed to lack an understanding of how best to integrate a child still healing back into the classroom.

My quest to help my own child had now expanded to wider and wider circles of need. I went on to found several concussion education websites, support groups and organizations to educate sports, schools and community groups on a larger scale. I also co-founded and worked in concussion clinics and began to speak across the country at government, civic and sports events. As medical social worker by profession and a mother of a child who had Post-Concussion Syndrome, I had the unique prospective of being a patient, caregiver and professional challenged by concussion.

The National Football League (NFL) recognized me in July 2012 as an expert in youth sport concussion and invited me to the NFL Headquarters in NYC to present my concussion program to them, and invited me to meet with other top experts in the concussion field. I met NFL Commissioner Roger Goodell several times and was able to share my ideas with him.

During this time, I helped start a concussion clinic in our city and then worked at a second clinic to revise how they managed their concussion patients. While working in the clinics and helping families as a volunteer advocate, I began to see a pattern where the girls and women took longer than the males to recover and seemed to suffer more symptoms and more complicated recoveries.

In 2013, I was diagnosed with breast cancer and while home during my months of chemotherapy and radiation therapy, I began to research the limited studies on female brain injury.

FOUNDING PINK Concussions

In my search of the scientific literature, I found research dating back as the early as 2000's, that clearly shows females, in general, tend to:

- Sustain more concussions than their male counterparts in sports with similar rules;
- Experience or report a higher number and severity of symptoms than males;
- Have longer duration of recovery than males;

So, I built a website called PINK Concussions where I posted the sections of concussion research that applied to women. While first I founded PINK Concussions to be an information hub of the past research, I would daydream during my chemo treatments that PINK Concussions could inspire others to improve the research, medical care and community support for females with brain Injury including concussion #pinkTBI.

And I was frustrated that, while the research shows females may have different injury rates, symptoms and rates of recovery, the medical community did not and still to this day don't have any gender-specific guidelines, protocols, or resources for females with concussions. Most medical professionals do not even think to inform their female patients about these gender differences.

We all know that women and men are not biologically the same. While this seems obvious – even a small child knows the difference – the medical field has had a long history of ignoring sex differences except when it comes to the “bikini areas.”

Animal testing, human drug trials, and patient symptom lists are most often gathered from research on males and results are applied to both sexes. For example, after issuing generic medical advice based on male heart attacks, doctors had to double back to publish female-specific data when women's symptoms or responses to drugs were not the same. The traumatic brain injury (TBI) field, including concussion, is no different.

There has been very little research focused on female brain injury. In studies that included both men and women, investigators found striking differences in the sexes, even when the differences were not the focus of the original study. And while science has not yet concluded exactly why these differences occur, the differences cannot be explained away or ignored altogether.

Until very recently, the reproductive cycle of females in both humans and lab animals has been cited as the main reason to exclude females from studies. Researchers argued that these changes distort the results. However, these chemical differences may unlock the mystery of how to heal brain injuries.

How do female and male brains differ?

Female and male brains are not the same. In fact, researchers have discovered approximately 100 differences between the brains of men and women. These differences can be seen in the structures, activity, chemistry, and even blood flow in the brain.

- Brain Structure refers to the actual physical parts of the brain, how they are designed, and their size and mass. Women often have a larger hippocampus, the memory center of the brain. They tend to have verbal centers on both sides of their brains, while men tend to have verbal centers on the left side of the brain only.
- Brain Processing refers to how the brain is used or its function. Men's brains utilize nearly seven times more gray matter for activity, while women's brains utilize nearly 10 times more white matter. This gray-white matter difference between the sexes may explain why women are better multitaskers or global thinkers, while men excel in highly task-focused projects.
- Blood Flow and Brain Activity refers to the rate the blood flows throughout the brain and delivers glucose, the energy source that powers brain activity. A female brain has more natural blood flow at any given moment than a male brain.
- Chemistry between male and female brains also differs. Both sexes process the same brain chemicals but to different degrees and through sex-specific body-brain connections.

WHAT HAPPENS IN THE BRAIN DURING A CONCUSSION?

When a brain is concussed, there is a chain reaction of chemical changes in the brain, or what scientists call "chemical cascade." This chemical cascade affects the chemistry, blood flow, and activity in the brain. This chemical cascade was discovered using lab animals (animal models) and only male lab rats were used.

When a concussion occurs, the brain's demand for energy (glucose or sugar) increases by about 150 percent; however, the brain's ability to deliver the required glucose drops to only 50 percent of normal. The difference between the energy supply and demand results in the symptoms and cognitive problems seen after a concussion.

HOW DO FEMALE AND MALE BRAINS DIFFER AFTER A CONCUSSION?

Since female and male brains differ in structure, activity, chemistry, and blood flow, it stands to reason that an alteration in any one of these, or any combination of these, would manifest differently in women and men.

Researchers studying data from sports medicine and the military are still today discovering the role these differences play. Sports medicine is not the only place where gender differences play a role, but researchers can compare injury rates in sports where the rules are the same for both sexes. For example, soccer is a sport where the game has the same rules for men and women, whereas hockey and lacrosse do not.

Recent data suggest that in sports with similar rules, female athletes sustain more concussions than their male counterparts. In soccer, female players are almost twice as likely to sustain concussions as male players.

“In addition to soccer, basketball and softball athletes are also at a greater risk for a concussion than their male counterparts,” says Tracey Covassin, Ph.D., AT, Director of the Sports Concussion Laboratory at Michigan State University. “Female athletes may be at a greater risk for concussion due to an increase in angular acceleration at the neck, female hormones, decreased neck strength and mass, or ball-to-head size ratio in soccer athletes.”

Female athletes experience or report a greater number and severity of symptoms and a longer duration of recovery than male athletes in several studies. At first this difference was attributed to women being more honest or forthcoming about their injuries. This view of female athletes is slowly being reconsidered as studies prove that women are not just more vocal about their pain. Women are being injured at higher rates than men and truly experience more symptoms.

The United States Military is also finding that brain injuries in soldiers vary in general from males to females. When Dr. Odette Harris, Director of the Defense Veterans Brain Injury Center and Director of Brain Injury in the Department of Neurosurgery at the Stanford University School of Medicine, compares her results to those of previous researchers, she finds significant differences between women and men. Her findings show that females have more severe symptoms at higher rates than the general population of veterans with TBI.

Female soldiers are more likely to suffer from post-traumatic stress disorder (PTSD), cognitive disorders and impairments, depression, anxiety, and substance abuse than the average male veteran with TBI, according to Harris. Females are also more likely to suffer from multiple symptoms, such as depression and chronic pain, which makes diagnosis and treatment more difficult.

There is also emerging research on women injured in domestic violence or intimate partner violence (IPV). This very much-needed research may uncover a very large TBI population that has previously been overlooked.

“The incidence and prevalence of IPV-related TBI are just beginning to be understood,” says Gwen Hunnicutt, Ph.D., Associate Professor and Director of Graduate Study (Sociology) at the University of North Carolina at Greensboro, “...aside from the very serious health consequences of TBI, individuals who experience IPV-related TBI may experience significant functional implications in daily life, which also places an individual at risk for sustaining another TBI. Because a mild TBI may affect decision-making abilities, concentration, and judgment, it may be difficult for an individual with mild TBI symptoms to extract themselves from a violent situation or seek help.”

Now that the research pieces are coming together, gender differences in brain injury are emerging. Last year marked a new dawn of the recognition of female brain injury when PINKconcussions' International Summit on Female Concussion and TBI took place in late February at Georgetown University, Washington, D.C.

Females of all ages, races and social-economic status suffer concussions or head injuries. The circumstances vary from the infant shaken to silence her cries to the toddler who falls off the playground slide, the teen athlete who slams her head defending her goal, the college student who bangs her head while drinking at a party, the woman who is concussed from the blow from violent partner or from the force of her car hitting a tree, the soldier who is injured in the line of duty, to the grandmother who slips unsteady on her tile bathroom floor. There are many ways for a female to injury her brain, but what is truly shocking is that the injuries she sustains are different because she is a female.

They are amongst us everywhere... in sports, in our schools, in our military, in our jails, in our churches and in our homes. It is time to see women with brain injuries and help bring healing.

It was my belief that every female with a concussion deserves a doctor who practices with gender-specific consideration for her symptoms, her acute care and her recovery plan. Her journey back to health can be helped by the correct diagnosis, gender-specific care, education, and the proper support systems at home, school or work.

The missing link is not some drug or test or scan, we know our brains are injured. What we need is education, empowerment and connection with others like ourselves.