Concussions and Symptoms

Not a lot of people know that concussions are serious. Concussions, mild traumatic brain injuries (TBI), are the largest epidemic of any neurological disease. There are over 5 million concussions sustained a year in the US. After a concussion the brain goes through a metabolic crisis. Nerve cells “are not getting the energy they need, ‘the brain is starving’” (LeBlanc, 2012). The metabolic crisis can cause “headaches, confusion, concentration problems, memory issues, sensitivity to light and noise, irritability, sleep problems, dizziness, anxiety, and depression” (LeBlanc, 2012). Many people ignore these symptoms but that is dangerous. A concussion is not just a headache. About half of all people with a TBI are affected by depression within the first year after an injury and two thirds are affected within seven years. Wouldn’t you want to avoid a higher probability of depression and missing work or school?

Knowing how sex differences affect the likelihood of concussions and symptomatology (a set of symptoms that come with a medical condition) will help people prevent these terrible symptoms and life disruptions. Conventional wisdom says avoid/prevent injuries especially, brain injuries. So, wouldn’t a parent want to know if their daughter had a higher chance of a concussion and worse symptoms than males? People want to know their risk for diabetes so why not, a possible debilitating brain injury? Therefore, research in sex differences is needed. Many athletes do not report concussions in fear of losing playing time, so if a female athlete knew that if they got a concussion they would be out much longer than expected, they might think twice before doing something that could put them in harm when they don’t need to. This research will also help doctors come up with a better individualized program that can focus on specific
symptoms that will be the most problematic. This research will not only help athletes but the general public as well. As a person is at risk for a concussion almost every second of their life, one fall or car accident could cause them harm. Education on concussions is key and can dramatically change the outcome. Like most topics the more you know the better off you are.

A number of TBI researchers have come to the consensus that females sustain concussions at a higher rate than males. It has been largely accepted that sex differences are factors in the involvement and the severity of an injury. Despite the numerous studies where females have higher concussion rates, this is still a proposed consensus as more research is needed to make it a cold hard fact. Examples are by Tatyana Mollayeva MD, PhD, Graziella El-Khechen-Richandi, MSc, Angela Colantonio, PhD (2018): “Sex & Gender Considerations in Concussion Research”. All these authors currently work at the University of Toronto studying brain injuries.

Another study is by Tracey Covassin, PhD from the Department of Kinesiology at the University of Michigan, Ryan Moran, PhD from the Health Science Department at the University of Alabama, R J Elbin, PhD the Director of the Office for Sport Concussion Research at the University of Arkansas (2016): “Sex Differences in Reported Concussion Injury Rates and Time Loss From Participation: An Update of the National Collegiate Athletic Association Injury Surveillance Program From 2004-2005 Through 2008-2009”. They studied 1,385,786 females and 1,750,602 males in the NCAA over a 5 year period (Covassin, Moran, & Elbin, 2016). Their study is credible because they used a large population, over a long period of time and used athletes that had concussion awareness. The sports they studied were, men’s and women’s soccer, basketball, ice hockey, lacrosse, baseball/softball (Covassin, Moran, & Elbin, 2016).
Another study is by Katie Lariviere, MD, from the Department of Neuroscience, Carleton University, Ottawa, Canada, Samantha Bureau PhD, from the Department of Neuroscience, Carleton University, Cameron Marshall MD, from the Complete Concussion Management in Toronto Canada, and Matthew R Holahan, PhD, a professor in the Department of Neuroscience, Carleton University (2020): “Interaction between Age, Sex, and Mental Health Status as Precipitating Factors for Symptom Presentation in Concussed Individuals”. Lariviere, Bureau, Marshall, and Holahan (2020) conducted a study in order to better understand how “age, gender and certain comorbid conditions (depression, anxiety, behavioral disorders, learning disabilities) affect the symptoms of concussions” (Abstract). Their study consisted of 4,865 participants, the fixed factors were age, and sex (Lariviere, Bureau, Marshall, & Holahan, 2020). Participants that “did not self-identify as having one of the 4 mental health issues were the control group (3,288 participants)” (Lariviere, Bureau, Marshall, & Holahan, 2020, Abstract). By using a large population and a control group they made their study credible.

These three studies like all studies involving concussions run into the problem that the concussions and symptoms are self-reported, as there is no test to determine this definitively. In the medical world it can take decades of research for scientists to be able to make a definite claim, so because all the authors stated that more research is needed they reinforced their credibility.

The majority of the research on sex differences and concussions is dominated by sport-related concussions, but Mollayeva, El-Khechen-Richandi, and Colantonio (2018) took a wider approach, and focused on concussions in sports, work, older adults, and intimate partner violence events. They found like many scholars before, that in “sex comparable sports females had a greater incidence rate of concussions” (Mollayeva, El-Khechen-Richandi, & Colantonio, Sports-
Related, 2018) and using CDC data saw that “in adults 65 to 84 years old, females had a higher rate of concussions than males” (Mollayeva, El-Khechen-Richandi, & Colantonio, Older Adults, 2018). Similarly, Covassin, Moran, and Elbin (2016) found in their study “Female athletes sustained a higher rate of concussion and, in all sports except lacrosse” (p. 189). One of the reasons why males had higher concussion rates in lacrosse is because men’s lacrosse is a contact sport while women’s lacrosse is a non-contact sport. Covassin, Moran, and Elbin (2016) also found that in their study “of 5 sex comparable sports females had a 1.40 times higher overall injury rate (of concussions) than males” (p. 189). Lariviere, Bureau, Marshall, and Holahan (2020) found through their study that sex is a risk factor in concussion rates. Overall, all these authors came to the same conclusion that females have higher concussion rates which was not surprising, because in the concussion world this is largely accepted. Next is, since females have higher rates of concussions, what about severity of symptoms or total symptoms?

All the authors also set out to observe and see if there is a relationship between sex and symptomology. Mollayeva, El-Khechen-Richandi, and Colantonio (2018) found using a questionnaire found that “females had higher mean scores compared to males, 15.56 ± 6.01 versus 13.96 ± 4.67” (Sex-Specific trends). Even though their work did not reveal a significant relationship because the data was not statically significant, Lariviere, Bureau, Marshall, and Holahan still cited and used their work. Lariviere, Bureau, Marshall, and Holahan (2020) found in their study that “individuals that did not have one of the 4 mental health conditions, their symptoms total increased with age and females showed more symptoms and higher severity than males” (Abstract). Their study reported that “75% of male athletes showed a full recovery from their concussion by 3 weeks compared to 42% of females with the median recovery time being 11 days for males compared to 28 days for females” (Lariviere, Bureau, Marshall, & Holahan,
Although not said directly it can be concluded that a longer recovery time for females means more symptoms and/or a higher severity of symptoms. Covassin, Moran, and Elbin’s study also recorded recovery time like Lariviere, Bureau, Marshall, and Holahan. Covassin, Moran, and Elbin (2016) measured recovery time from the date of the injury to the date of full, non-restricted game play and found that in the NCAA “female soccer players (mean = 9.33 ± 8.54 days) took longer to return to participation than male soccer players (6.14 ± 6.15 days)” (p. 192). They also found that amongst basketball athletes “female basketball players (7.40 ± 7.10 days) also took longer to recover from reported concussions that occurred in competitions than did male basketball athletes (5.57 ± 3.39 days)” (Covassin, Moran, & Elbin, 2016, p. 192). A familiar problem came up as there was no other significant data for the 3 sports studied (ice hockey, baseball/softball, lacrosse). This problem of not statistically significant data is not uncommon in the medical world, it can take years for researchers to be able to make a definitive claim. Now that the consensus that females have higher concussion rates and worse symptoms, the question is what causes it? What are the anatomical reasons why females have higher concussion rates?

Common knowledge amongst concussion researchers is that anatomical differences in males and females is a major factor in why females have higher concussion rates and symptom severity. All the authors agree that, differences in neck muscles and head/neck stability is a major reason why (Covassin, Moran, & Elbin, 2016; Lariviere, Bureau, Marshall, & Holahan, 2020; Mollayeva, El-Khechen-Richandi, & Colantonio, 2018). In other words, females have weaker necks than males making them more susceptible to injury. All the authors also believe and propose there is a hormonal factor. Mollayeva, El-Khechen-Richandi, and Colantonio (2018) proposed that “circulating estrogen may elicit a differential pain response in females compared to
males” (p. 193). Similarly Lariviere, Bureau, Marshall, and Holahan (2020) quoted a study; “estrogen serves as a protective factor in males but it exacerbated the injury in females”(D.K. Broshek, T. Kaushik, J. R. Freeman, D. Erlanger, F. Webbe, & J. T. Barth, 2005, Underlying Sex Differences). Further research on why females have higher concussion rates and severity of symptoms may take years as there are not many tests researchers can perform to determine head/neck stability or hormonal factors.

Since these concussion studies rely on self-reported concussions and symptoms and the question how sex differences affect the likelihood of concussions and symptomatology is relatively new, more research is needed. Although some of the data from these studies were found to not be statistically significant, it provided a background and helps show promise. These authors were able to adequately prove there is a relationship, so that means there could be more funding going into this topic. More funding and an established relationship means more researchers creating studies. But we will not know for years if research was worth it. Or if there are better topics that could have been studied. Will sports teams implement baseline cognitive testing for all or for females only? A baseline cognitive allows medical professionals to compare pre and post brain function and balance data. Will sports organizations promote more education, at any level? If you had to have a concussion would you want to experience it as a male or female? And would you want to know if you are at a higher risk for a brain injury?
References


