

The Effects of Concussions regarding Memory Retention



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Introduction and Purpose

In the field of Kinesiology, physical injuries pertaining to movement are often at the forefront of discussion. However, concussions are usually not discussed as often, despite their potentially damaging effects that can have a significant neurological impact. This study aims to show the aftereffects of concussions as related to memory retention. In order to determine the neurological impact of concussions on one's memory, I chose to collect data from California State Polytechnic University, Pomona athletes through an online survey that included several memory assessments. This project pieces together responses and data gathered from student athletes to show the lasting effects of this type of injury, as well as acknowledging the perceptions and notions felt by the participants surrounding the topic of concussions. By further examining the issues associated with concussions, I want to change people's mindsets in regard to this particular brain injury and to ultimately gain more knowledge surrounding this subject matter. My goal for this project is to ensure that this type of brain injury is taken seriously. I anticipate this spurring further discussion, so that more can be done to help those affected by concussions.

Background Information

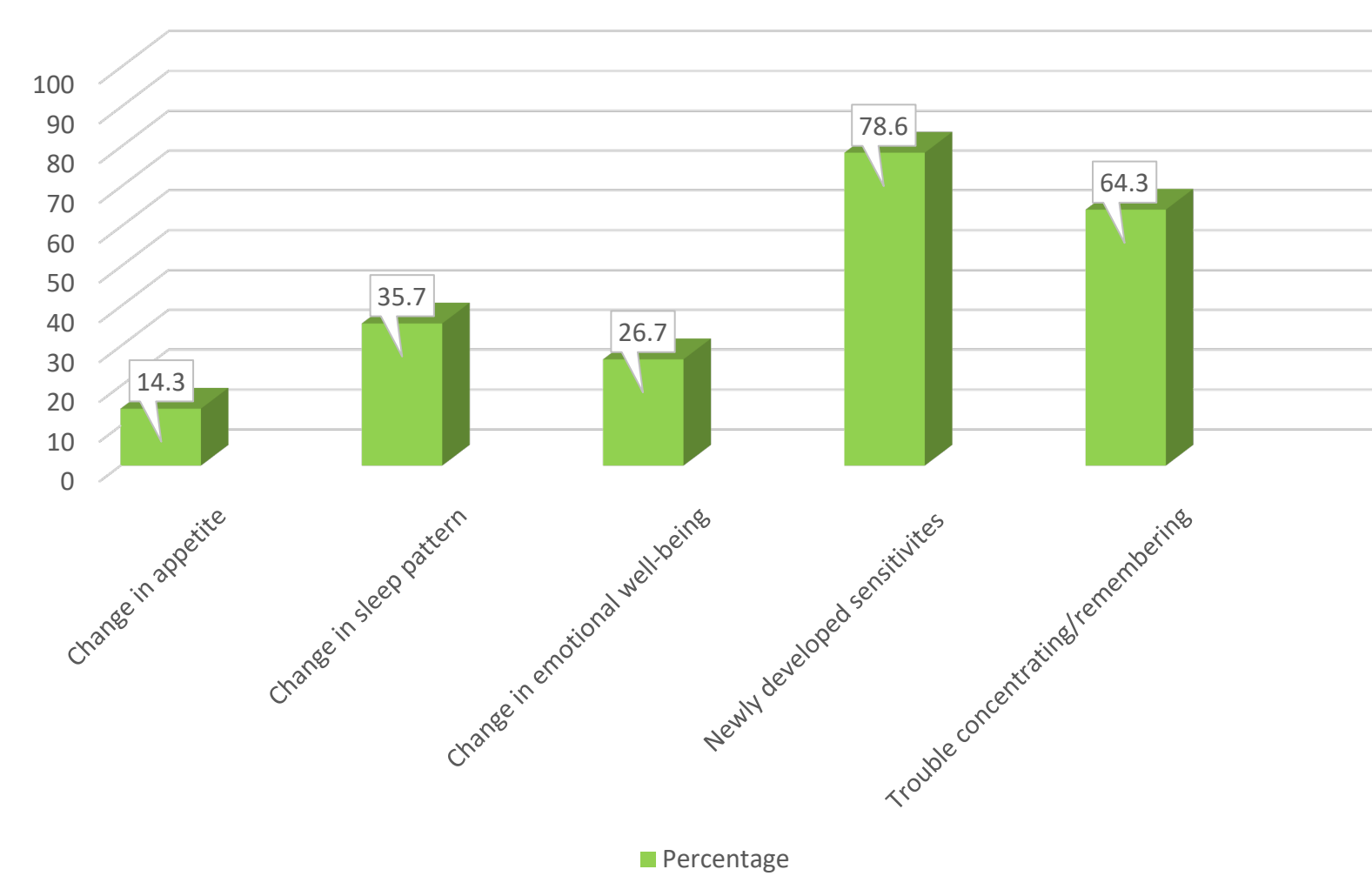
It can be difficult to conceptualize the damaging effects of concussions since it is a neurological injury and is not predominantly visual, therefore the possibility of them being more detrimental increases. When discussing the topic of concussions, Dr. Cardeno from EDGE PT, said, "People tend to focus on what they can see, but just because you can't see an injury doesn't mean there isn't anything happening. Since you can't see it, concussions can often have more of a damaging impact than other physical injuries." Although a multitude of signs and symptoms have been attributed to concussions over the years, one could argue that perhaps the most alarming effect is the impact on memory retention. Concussions are considered a mild traumatic brain injury (mTBI) and it has been shown that some degree of memory loss is common in any type of TBI. Concussions account for at least 75% of all traumatic brain injuries according to the National Center for Injury Prevention and Control (Binder, 2003). Both short and long-term memory have been shown to be affected, however, long-term memory is not as easily affected. Research shows that memories and information that is frequently accessed becomes much stronger and easier to recall (Cherry, 2019). In addition, long-term memory is filtered through the hippocampus and stored in various areas of the brain depending on the specific type of information. Short-term memory however is impacted more because it is stored in the frontal lobe of the brain. It has been shown that the frontal and temporal lobes are the two most affected sites in TBI's due to their relatively close location to the front of the skull, where most concussion trauma occurs (Kelly, 2018).

Methods and Procedures

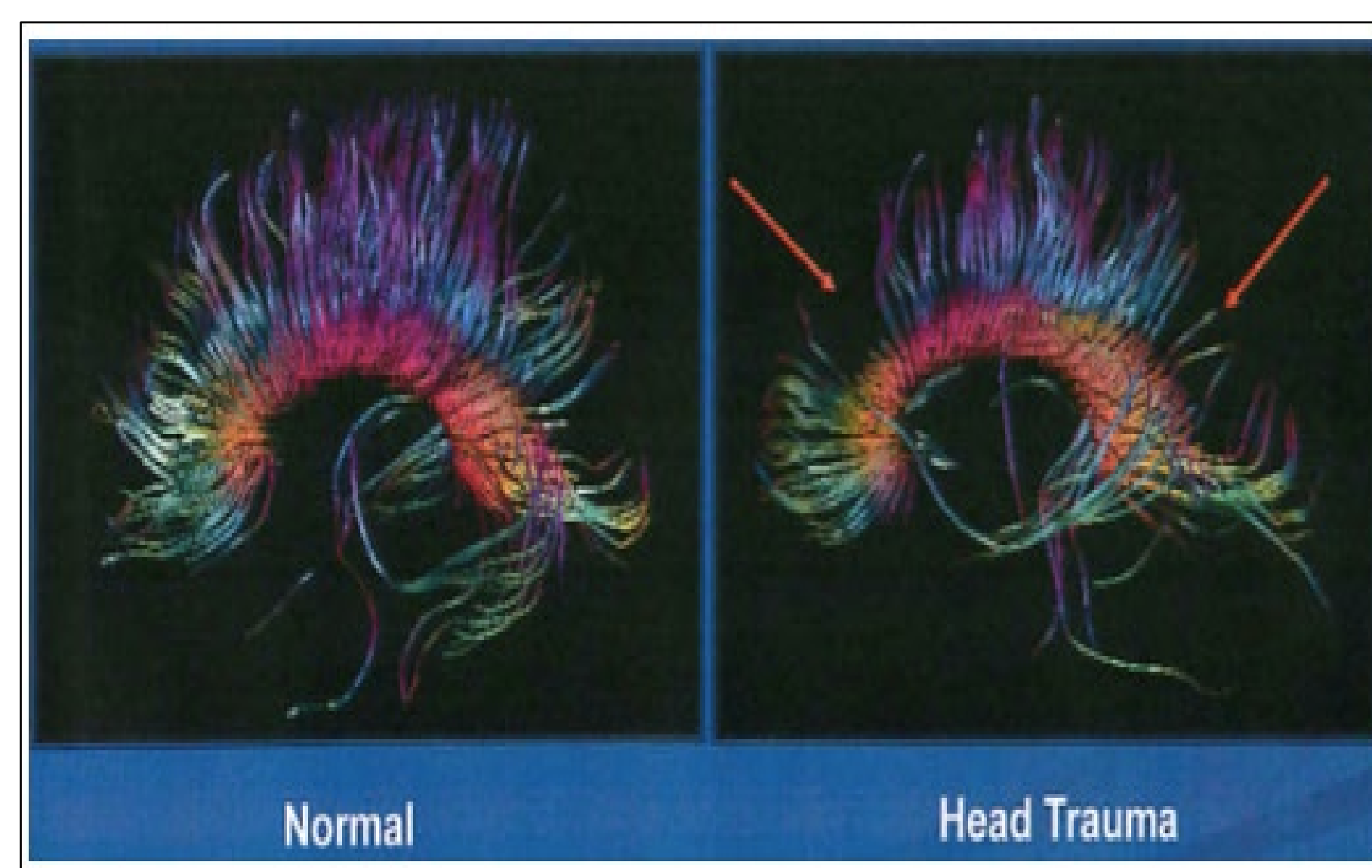
An analysis of concussion data was collected from a group of student athletes at Cal Poly Pomona. The student athletes were between the ages of 18 and 21. They were digitally sorted into two main groups based on whether they had a documented/perceived concussion or not. An online assessment was created via google forms to gather information regarding concussions and memory retention. The survey and assessment were both anonymous regarding personal data. The initial part of the online forum consisted of questions pertaining to thoughts regarding concussions and the perceptions surrounding this type of injury. A long-term and short-term memory assessment was also included in the survey. The long-term assessment required participants to list as many of the fifty states as possible within a six-minute time limit, entirely from recall. The short-term memory assessment consisted of a variety of pictures that disappeared after one minute. After the time had expired, the test subjects were asked to recall specific details about these images in a questionnaire format. In conclusion, the data gathered from the questionnaire and assessments were analyzed and cross examined with one another to determine the results.

Results

Reported post-concussion effects

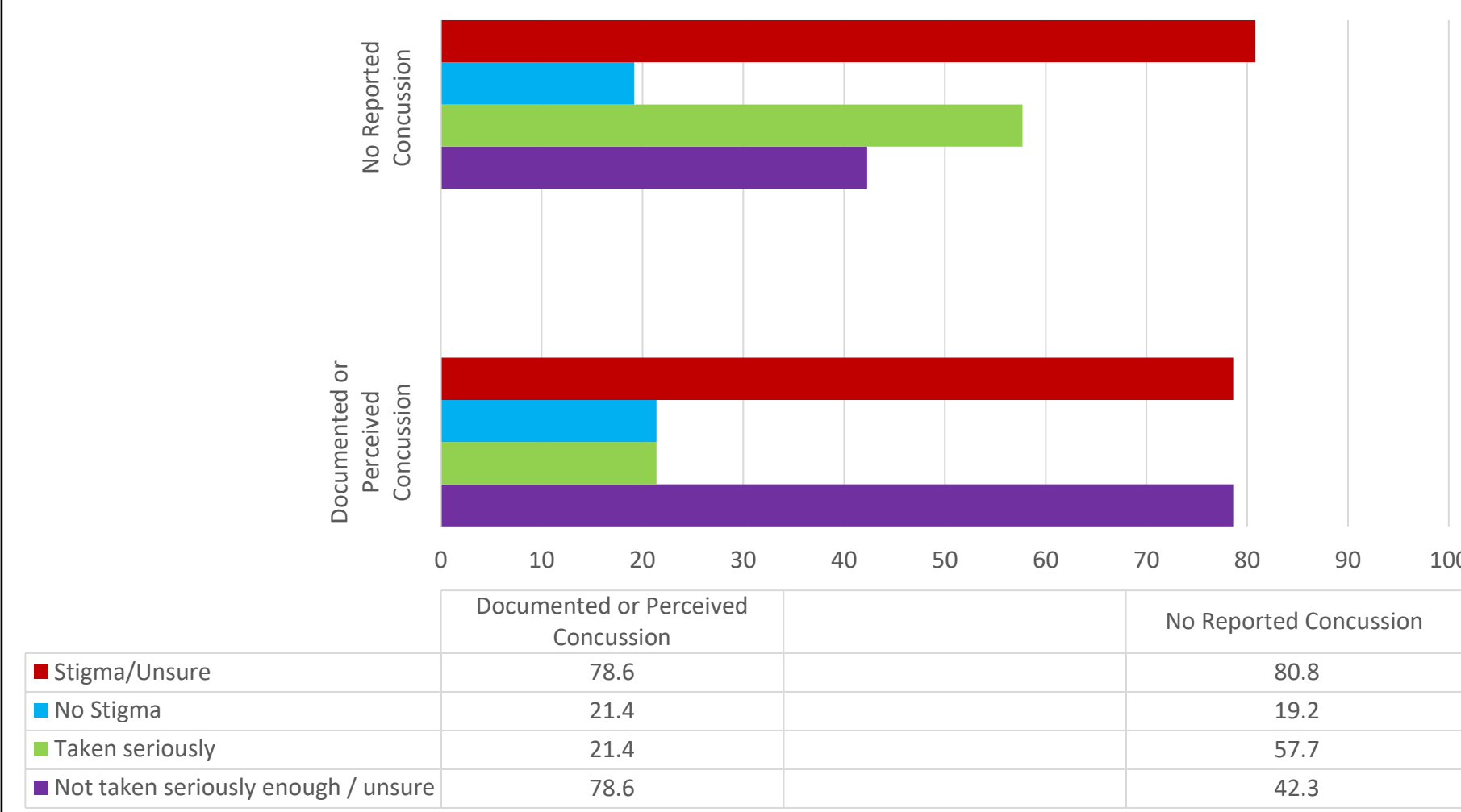


*All participants who have been perceived or documented to have experienced a concussion, reported that they experienced some sort of post-concussion effect. Participants were able to select all concussion aftermath symptoms that applied to them. The two changes that had the highest recordings included newly developed sensitivities and trouble concentrating or remembering things, which can be linked directly to memory retention.



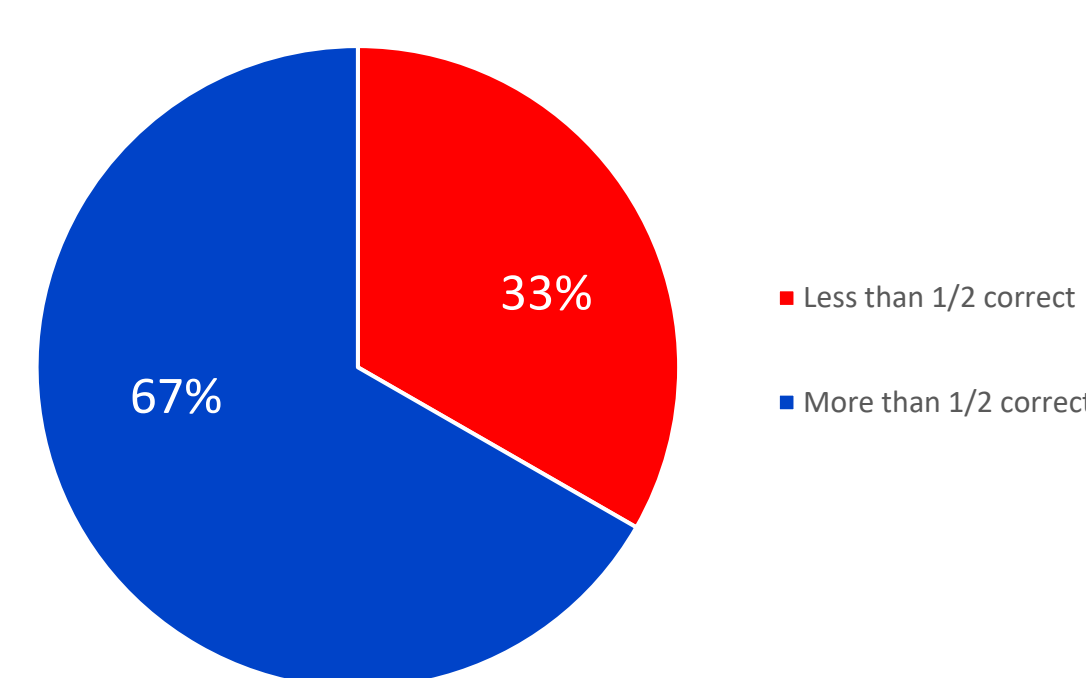
*This Diffusion Tensor Imaging (DTI) scan of the brain shows the damage caused by a concussion. This MRI technique focuses on the axon terminals of the corpus callosum in the brain and helps to identify when axonal damage has occurred (Abdrabou & Kabbani). The left image shows a normal brain scan, as opposed to the right where a significant loss of axonal tracts has occurred, due to a concussion. The medical protocol for handling concussions consists of an initial neurological examination which includes examination of vision, hearing, coordination, reflexes, and balance. A cognitive test can also be performed by the medical provider post-concussion, which assesses memory and concentration. Lastly, depending on the perceived severity of the concussion, a brain imaging test such as the DTI, a traditional MRI, or even a CT scan may be recommended, so that more information can be provided in relation to the severity of the neurological damage (Mayo Clinic, 2020).

Concussion Perceptions (%)



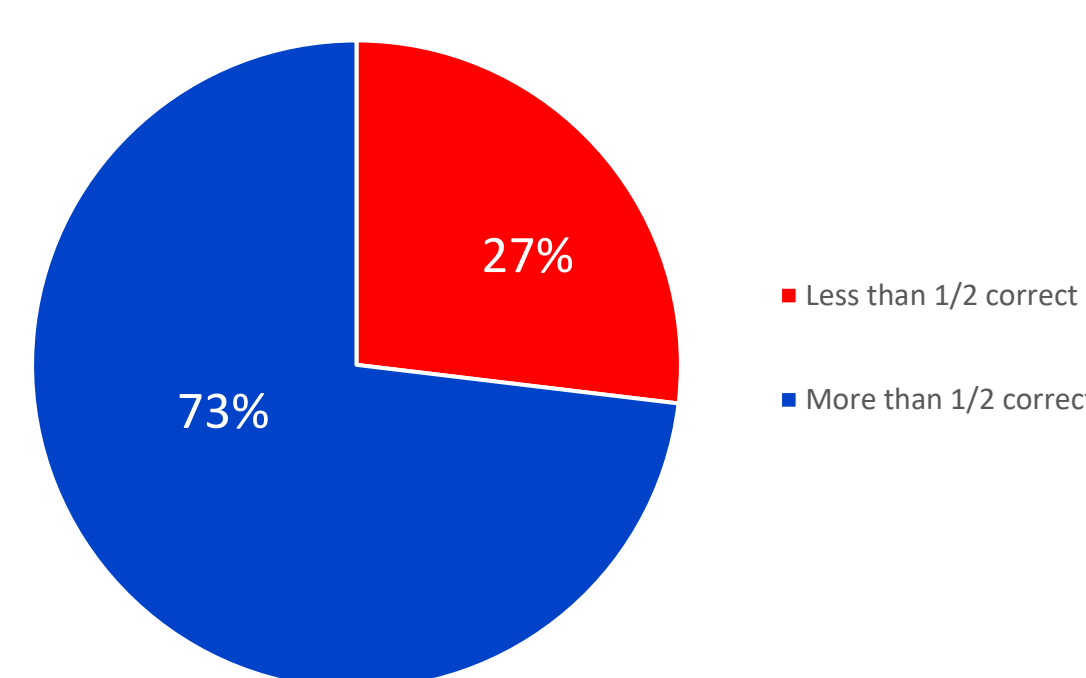
*The participants were divided into two main groups based on whether they have experienced a concussion or not. The majority in both categories reported that there was a stigma surrounding concussions, especially when compared to more noticeable injuries, or were unsure when asked about it. An overwhelming amount of participants in the documented or perceived concussion category reported feeling that this type of injury is not being taken seriously enough or were unsure when they thought about it. However, the majority of those who have never experienced a concussion felt that this injury is addressed with enough significance as any other injury.

Short-term Memory Assessment Results (Documented/Perceived Concussion Group)

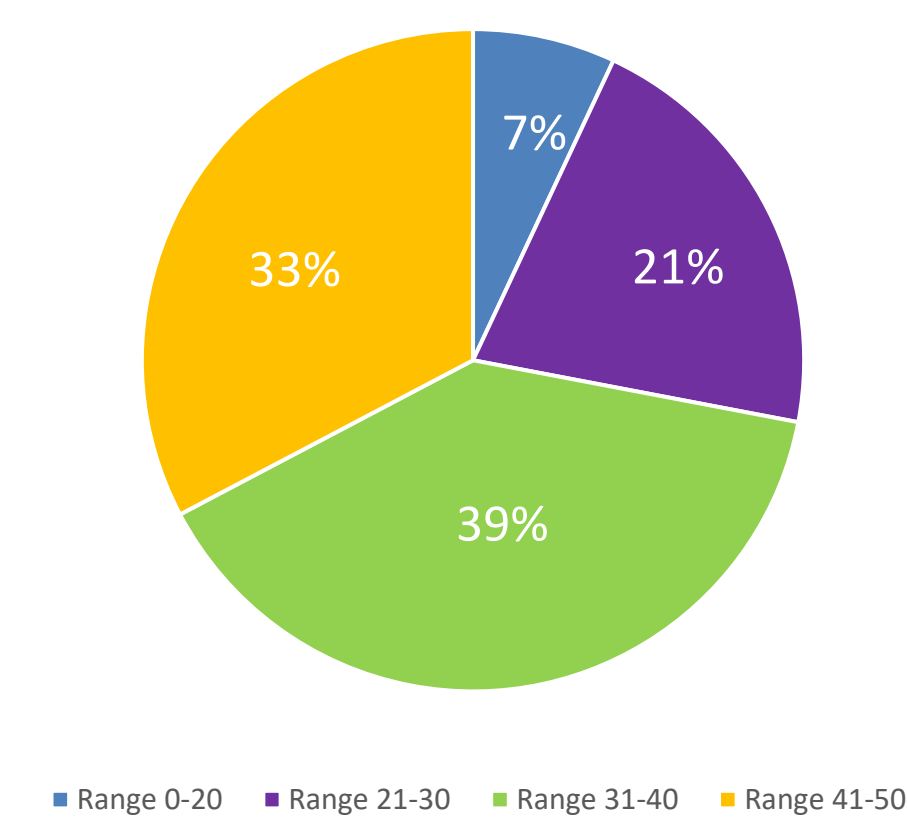


*Short-term memory was analyzed through an online assessment. The results showed that those who have had a perceived or documented concussion scored slightly worse than those who have never had a concussion. The data was cross examined among the two groups and showed that there was an approximate 6% difference in the scores obtained from the short-term memory assessment.

Short-term Memory Assessment Results (No Concussion Group)

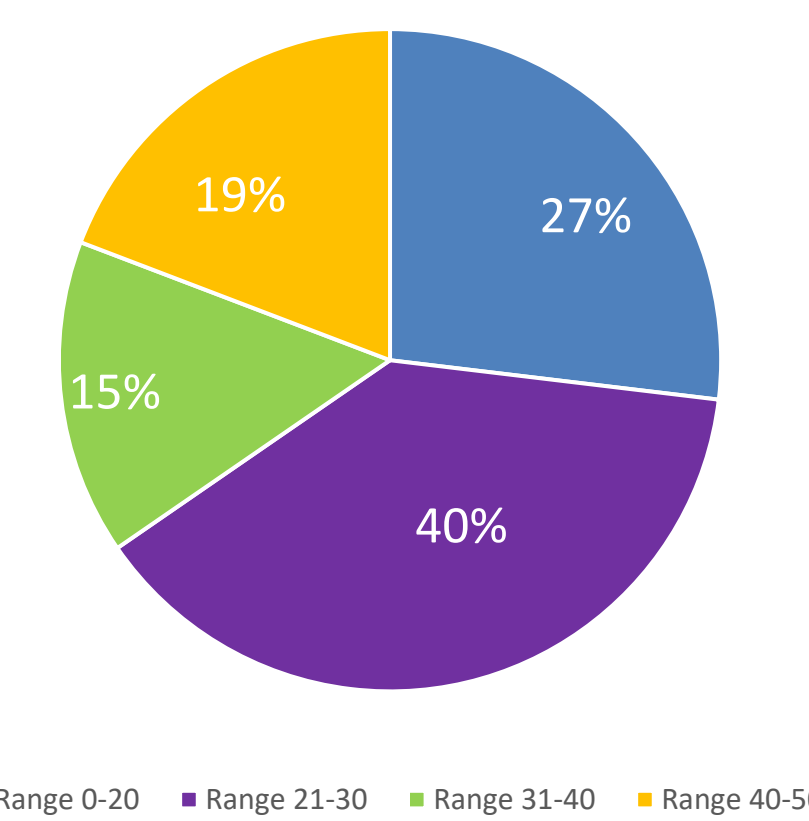


Long-term Memory Assessment Results (Documented/Perceived Concussion group)



*Long-term memory was evaluated and produced a wide range of scores amongst both groups. Ultimately the results were deemed inconclusive, due to the scattered data not presenting any clear findings for this memory assessment. There was no clear data showing that long-term memory was affected among those who have had a perceived or documented concussion.

Long-term Memory Assessment Results (No Concussion Group)



Discussion

This project was conducted through the Google form platform and consisted of an online survey that included memory assessments. The assessments were conducted by means of anonymity to allow for honest feedback from the participants. This study was no different from any other in the sense that there was the possibility for error. There were two memory assessments that tested long-term and short-term memory. The long-term memory assessment centered around having the participants recall as many of the 50 states as they could from memory within a 6-minute time frame. With the advantages of technology, auto generated answers could have been derived as participants typed in the beginning letters of states from mobile devices. This along with easy access to the internet could have led to higher scores. For the short-term memory assessment, the test subjects were asked to analyze a slide that had multiple images on it for the duration of one minute. After the minute expired, they were instructed to move forward and answer detailed orientated questions regarding the pictures that were previously presented. Although the respondents were asked to move forward and answer questions based on memory, some may have used the back button on their electronic device to assist them with answering. Participants were encouraged by way of instruction to answer to the best of their ability relying solely on their memory and to complete the test as honestly as possible in order for the most accurate data to be generated. For the purposes of this research project, the data collected from assessing various Cal Poly Pomona student athletes served as a good baseline for discussing and analyzing the topic of concussions. The online forum that was distributed allowed participants to anonymously record their answers. When asked to document any post-concussion effects that were experienced, people reported undergoing changes in appetite, changes in their sleeping pattern, changes in their emotional well-being, newly developed sensitivities, and trouble concentrating or remembering. The two most common symptoms recorded were trouble concentrating or remembering, which was reported by 64.3% of the participants, and newly developed sensitivities which was conveyed by 78.6%. The research survey results also showed that an overwhelming 80% of the participants taking the assessment, whether they have had a concussion or not, felt that this type of injury has a stigma surrounding it. Among those who have had a concussion, there was an overwhelming response of feelings that concussions are not taken seriously enough when compared to more noticeable injuries. Two memory assessments were also administered via google forms and examined the impact of concussions on long and short-term memory among participants. In order to cross-examine the research data, the test-subjects were divided into two main groups based on whether they had a documented/perceived concussion or not. The statistics gathered for the long-term memory assessment were scattered and showed no real conclusive data to distinguish between the two groups. On the other hand, the short-term memory assessment proved to be a much better indicator for the neural damage sustained by those who had a concussion, whether it was temporary or long-term. The test results were further sorted on the basis of whether a participant scored less than or more than half of the questions correct on the evaluation. Amongst those who have never had a concussion, the scores showed that 73% of that group scored more than half correct. On the contrary, only 67% of participants in the documented/perceived concussion group got more than half correct. This shows that those who have had a concussion, scored approximately 6% worse than their counterparts on this test. When it comes to memory, information is processed, filtered, and stored in different neurological locations depending on its type. The prefrontal cortex which is found in the frontal lobe of the brain is responsible for short-term memory while long-term memory information is stored in the hippocampus, located in the medial temporal lobe (Stannard, 2018). According to research published by the *American Academy of Pediatrics Journal*, approximately 55% of concussions are comprised of hits to the side, top, and back of the head while the remaining 45% strictly occur to the front of the head. This indicates that in the majority of concussion cases the damage is mainly sustained in the frontal lobe of the brain, which is the area of the brain closest in proximity to the skull which makes it more susceptible to injury, therefore affecting short-term memory (Kerr, et al., 2014). By evaluating this information, one can see how the data gathered from this research project are congruent with scientific evidence.

Conclusion

The damage(s) inflicted by concussions are not always fully known, due to concussions not being physically visible, the individual being unaware of the severity of the injury, and lack of testing protocols. Despite all of that, the data presented helps one to see and better conceptualize the negative impact that concussions can and do have on an individual's neural system. The concussion issue is multidimensional and does not have a simple solution. However, with continual awareness, education, and proper training, more can be done to help those affected by this injury. The dismissive perceptions surrounding concussions and lack of awareness regarding the possible severity of them, is the first thing that must change when tackling this complex issue. It is imperative for people to seek out proper medical care, to better limit the possibility of permanent damage. Although the issues associated with concussions are not going away anytime soon, hopefully this topic will continue to be analyzed and researched, to combat the potential damages associated with this common neurological injury.

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