

THE IMPACT OF HEAD INJURIES

The Impact of Head Injuries on Behavior: Examining the Correlations Between Head Injuries and Recklessness, Aggression, Apathy, and Relationship Strain

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Abstract

This study aimed to examine the potential correlations between various severities of head injury and behavioral changes resulting in aggression, recklessness, apathy, and relationship strain.

There were 50 participants, 27 males and 19 females, between the ages of 18 and 55. A 45-question online survey was completed by the participants, with questions examining history of head injury, an inquiry about diagnosis of ADHD/ ADD, and four behavior indexes—aggression, recklessness, apathy, and relationship strain. The following was hypothesized: participants with an extensive history of head injury are more likely to regularly exhibit aggressive behaviors, reckless behaviors, apathetic behaviors, and relationship strain than those who have little to no history of head injury. For each index, the correlational matrices discovered a p -value higher than .05, resulting in statistically insignificant correlations that were often weak and negative.

Diagnosis of ADHD/ ADD was found to be irrelevant to the results of this study directly linked to the participants of this study. The results of this study signify no direct correlation between history of head injury and all four indexes of behavior. Limitations included missing data causing a hole in the interpretation as well as the recommendation for future research to elaborate the symptoms and side effects of head injuries and behaviors examined.

Keywords: head injury, aggression, recklessness, apathy, relationship

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It is a well-known habit of our agency to protect the brain from injury, beginning in infancy and failing to waive throughout adulthood. It may seem rather obvious as to why one must do everything to prevent head injuries and traumatic brain injuries [TBIs hereinafter] throughout their life, though there are other reasons for doing so that are left unconsidered because of unintentional ignorance. Head injuries of any severity can be damaging to the brain in a multitude of ways. More severe injuries can cause a variety of physical and mental disabilities. Often overlooked is the damage that can be caused to the brain by repetitive, consistent, and/ or frequent minor head injuries. Those injuries are casually dismissed because they are so normalized as a part of society and a part of life, such as “motor vehicle accidents, sports injuries, assaults, and bicycle injuries” (Bazarian et al., 2005; Faul et al., 2010; Langlois, Rutland-Brown, & Wald, 2006; Rutland-Brown et al., 2006, as cited in Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019). Long-term side effects that arise following a head injury are sometimes subtle, adaptable, and if noticed by others, an uncomfortable concern to address: anti-social behavior and cognitive function deficits – both of which indirectly impact relationships.

Following a head injury, many individuals reported experiencing changes in their cognitive function as well as developing behavioral abnormalities. Because it is uncommon for individuals who have endured less severe head injuries to seek professional medical attention, the long-term effects of such trauma can go undocumented and even unnoticed (Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; Allen, Interian, Reddy, Rodriguez, & Myers, 2025). Head injuries and TBIs are especially detrimental to children, adolescents, and young adults during their development, and they have been linked to future implications with cognitive

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function, emotional intelligence, and conduct (Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; Carr, Hall, Eisenbarth, & Brandt, 2024).

Both children and adults have been found to experience such enduring consequences. Studies have shown that head injuries and TBIs cause loneliness, antisocial behavior, lower self-esteem, impulsivity, apathy, disorganization, nervousness, anxiety, social disinhibition, and aggression (Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; Allen, Interian, Reddy, Rodriguez, & Myers, 2025; Filipcikova et al., 2024; Walling, Meehan, Holtzworth-Munroe, & Taft, 2012). These changes to one's behaviors and mental health influence their overall conduct in a multitude of settings, i.e., relationships, academics, and contact with the criminal justice system. For instance, it has been reported that college students who have suffered a head injury struggle with learning and studying, time management, and concentration (Allen, Interian, Reddy, Rodriguez, & Myers, 2025). Other research has shown evidence that more severe head injuries can cause post-traumatic stress disorder (PTSD) following the psychological disruption of exposure to a traumatic event or series of events (Sinopidis et al., 2023). Additionally, among that population and others, difficulties with motivation, emotional regulation, and social cognition have been observed (Filipcikova et al., 2024). Social cognition is a catch-all phrase that refers to the cognitive and emotional processes that allow one to have communication skills, emotional perception, theory of mind, empathy, self-awareness, and self-control (Filipcikova et al., 2024; McMillan, Aslam, McGinley, Walker, & Barry, 2025).

Life's demands go unnoticed until the damage caused by head injury comes to fruition, proving near-impossible dismissal. Continuing to work and/ or participate in furthering one's education following a sustained head injury can be associated with worsening symptoms (Riese et al., 1999). Mental fatigue, though often eclipsed by physical fatigue, remains difficult to

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measure because it is not easily observed or quantified (Riese et al., 1999). To do so, one must observe the injured individuals' mental stamina in relation to everyday tasks that would not normally cause irritability, distraction, fatigue, and headaches (Riese et al., 1999). Because the mental fatigue goes unnoticed, coping mechanisms for stress, discomfort, and pain increase (Riese et al., 1999). Unfortunately, those coping mechanisms have a high likelihood of furthering the psychological and physiological damage already obtained by the head injury. Examination of these symptoms is valuable to the development of treatment for head injury and is recommended to be included in future research.

It is valuable, however, to note that these behaviors and changes in personality can be exhibited without experiencing a head injury of any severity. Many mental health conditions allow such behaviors and changes to manifest, mimicking the side effects of a head injury. The most common of all, Attention Deficit Hyperactivity Disorder [ADHD] and Attention Deficit Disorder [ADD]. ADHD is strongly associated with the same conduct problems exhibited by those who have sustained a head injury and should be controlled in studies examining such (Carr, Hall, Eisenbarth, & Brandt, 2024). The present study will include such consideration, especially as a limitation for correlation between head injury and the behaviors and perceptions being measured.

Damage to one's social cognitive abilities presents an opportunity for the procurement of conduct problems. Following a head injury, increases in impulsiveness, aggression, apathy, and criminality have been known to occur (Allen, Interian, Reddy, Rodriguez, & Myers, 2025; Carr, Hall, Eisenbarth, & Brandt, 2024; Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; McMillan, Aslam, McGinley, Walker, & Barry, 2025; Walling, Meehan, Holtzworth-Munroe, & Taft, 2012). Impulsive behavior can be defined as acting without forethought and conveying an inclination

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for spontaneity and recklessness in addition to lack of control and disorganization (Allen, Interian, Reddy, Rodriguez, & Myers, 2025). Apathy refers to the absence of empathy, which is inherently associated with anti-social behavior and criminality. It is said that “the prevalence of head injury is high in people involve in crime and that offending cannot be easily explained by environmental factors alone” (McMillan, Aslam, McGinley, Walker, & Barry, 2025). Additional research has attributed adolescent head injury as a predictor for substance use and severity of offending, including mention of previous research finding that male offenders with history of head injury had more convictions and more violent offense history (Williams et al., 2010, as cited by Loomis, Sonsteng-Person, Jagers, & Osteen, 2022). These traits also influence one’s social relationships because of the disconnect between social cognition and empathy in conjunction with impulsive and aggressive behaviors.

Coinciding with the above, the conflicts most common in relationships following a sustained injury are not limited to emotional and mental. Physical contributions to disagreements are just as common as a result of heightened aggression and recklessness. It was found that 61% of men who had been referred to an intimate partner aggression treatment program had history of head injury (Rosenbaum & Hoge, 1989, as cited in Walling, Meehan, Holtzworth-Munroe, & Taft, 2012). Such behaviors will be included when measuring aggression in the present study.

A study that observed the physical side effects of head injuries and TBIs, including treatment, testing, and monitoring, pointed out the blaring truth that psychosocial consequences endure even after noticing improvement of physical symptoms (Hu, Fan, Chang, & Chen, 2013). It has been pointed out by multiple sources that minor head injuries remain undiagnosed and untreated a majority of the time. If the opposite occurs, it not only reduces the risk of further physical damage, but also the damage done to an individual’s mental health.

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To make that possible, the diagnostic criteria of head injuries, concussions, and TBIs must be examined and altered to increase inclusivity and chance of discovery. Since most examinations for head injury vary per person and per severity, all symptoms must be considered, including but not limited to headaches, numbness, visual disturbances, difficulty concentrating, changes in behavior or beliefs, increase in anxiety and depression symptoms, restlessness, impatience, and intolerance (de Souza et al., 2023). It is equally worthy of noting that many side effects of a head injury overlap with side effects and symptoms of mental health disorders, such as ADHD, dementia, cognitive learning disabilities, personality disorders, etc. (de Souza et al., 2023). As awareness grows among researchers and clinicians, there is increasing motivation to examine individuals with head injuries for personality changes, recognizing their importance in shaping treatment plans (Kurtz, Shealy, & Putnam, 2007). One of the many reasons for which an individual may avoid seeking treatment is to remain eligible for participation in certain activities, such as team sports (de Souza et al., 2023). The present study aims to examine that correlation by including many athletes in the participant population, as it is known that many of those athletes have sustained head injuries and continue to participate in their sport whether the injuries have been reported, diagnosed, and treated.

To combat such discrepancies in reporting, diagnosing, and treatment of head injuries in team sports, there have been investigations of the comparison of head injuries reported to accident insurance and what can be observed in game and training film (Krutsch et al., 2021). The result of the observations made during these investigations cultivated the realization that footage of training sessions should also be evaluated for discovery of head injury in addition to game footage (Krutsch et al., 2021). Those evaluations are recommended to be made by the team physician as discovered during the game or training on occurrence as well as to be used as a preventative for any future

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head injuries (Krutsch et al., 2021). It can also be inferred that the footage should be reviewed by teammates and coaches alike to broaden the chances of discovery and the development of preventative measures.

While such evidence remains true, there is a duality of symptoms among those who have sustained minor head injuries versus those who have sustained TBIs and injuries to the spinal cord. Those who have experienced the latter have a higher risk of developing the aforementioned psychological effects of brain and spinal cord damage (Raymont & Fleminger, 2022). Furthermore, such psychological effects can manifest as a result of physical injury due to the devastation and pain such an injury can cause rather than or in addition to the initial psychological effects of damage to the brain. For instance, individuals who experience chronic pain and suffering post-injury endure changes to their psyche, including increased aggression, decreased functionality of memory, loneliness, depression, fatigue, and hopelessness (Iezzi, Duckworth, Mercer, & Vuong, 2007). The psychological burden of such injury and chronic pain or disability vary by age, ethnicity, and socioeconomic status as well (Iezzi, Duckworth, Mercer, & Vuong, 2007). This discovery only furthers the push for treatment, both physical and psychological, to be more accessible and widely administered.

The present study aims to understand the effect of head injuries on the development of the following negative behaviors: aggression, recklessness, and apathy, as well as the effects of developing those behavioral traits on one's social relationships. The term head injury refers here to all forms of minor head injuries, traumatic brain injuries, and other physical trauma to the brain reported by the participants. It must be noted that most of the reported head injuries either do not meet the medical criteria for mild or severe TBI nor have they been reported and

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diagnosed by medical professionals. As a result, the participants will be well-informed of this operational definition to ensure consistency in reporting.

The studies mentioned above aided in procuring the following hypotheses for the present study:

H1: Participants with an extensive history of head injury are more likely to regularly exhibit reckless behaviors than those who have little to no history of head injury.

H2: Participants with an extensive history of head injury are more likely to regularly exhibit aggressive behaviors than those who have little to no history of head injury.

H3: Participants with extensive history of head injury are more likely to regularly exhibit more apathetic behaviors than those who have little to no history of head injury.

H4: Participants with an extensive history of head injury are more likely to have strained relationships.

Methods

Participants

Participants were solicited through a social media post on the researcher's personal Facebook as well as the link being shared with the researcher's brother, Noah Barrett, and his partner, Jessie Sprague, students at St. Olaf College in Northfield, Minnesota. Barrett and Sprague were then instructed to share the survey link with their teammates, as they are participants in the college's football and hockey teams. Of the 50 of participants, 27 were males and 19 were females, zero participants identified their gender as non-binary / third gender, and zero participants preferred not to say; however, four participants did not provide data. The ages of the participants ranged from 18 to 55, ($M = 2.50$, $SD = 0.810$). The age group 18-26 was level

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2, and the age group 27-39 was level 3; therefore, the average age fell between those age ranges.

The 18-26 age group was comprised of 23 males and nine females. The 27-39 age group was comprised of two males and three females. The 40-55 age group was comprised of two males and seven females. Race was not a measured demographic as it is irrelevant to the present study.

Measures / Instruments

A 45-question online survey was completed by the participants. The first five questions inquired about their history of head injury, including one question regarding the diagnosis of ADHD or ADD, as such diagnosis can be correlated to how the participants answered the following questions. The rest of the items were grouped by behaviors associated with aggression, recklessness, apathy, and relationship strain – each with 10 items. Head injury was defined as all forms of minor head injuries, traumatic brain injuries, and other physical trauma to the brain reported by the participants.

Responses to all items were given on a 7-point Likert scale ranging from 1-Strongly Disagree to 7-Strongly Agree, including a Neither Agree nor Disagree option. To measure aggression, 10 statements associated with aggressive behaviors were presented. Sample questions remained simple such as “I often raise my voice during verbal disagreements,” and “I tend to break things when I am angry or upset.” This scale demonstrated moderate to excellent internal validity and test-retest reliability ($\alpha = .836$). Recklessness was measured similarly as the 10 statements were associated with reckless, impulsive, and spontaneous behaviors, ranging in severity of risk and danger. Reliability for this index was on the more moderate side ($\alpha = .775$). Ten more statements examining behaviors associated with apathy followed. This index was the most internally reliable ($\alpha = .872$). Relationship tendencies were measured by statements examining one’s ease with creating new relationships as well as maintaining current relationships

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and highlighting adversities within that realm. With a Cronbach's α of .848, this index was also moderate to excellent in regard to internal validity and reliability.

Procedure

The survey was distributed through Qualtrics, which enabled the inclusion of a consent form prior to participation and ensured that all responses remained anonymous. No personally identifying information was requested, IP addresses were not stored, and all data collected was kept strictly confidential.

Results

Head Injury

The first item inquired about head injuries that resulted in seeking medical treatment at a clinic, hospital, urgent care, or emergency room. The results of this item are as follows: 18 participants said they had sustained such HI and 32 said they had not, with an average of 1.41 head injuries sustained.

The second item inquired about head injuries that were diagnosed as a concussion. The results of this item are as follows: 20 participants said they had sustained a head injury that was diagnosed as a concussion and 29 said they had not, with an average of 1.32 head injuries sustained. There was one participant that had an input of '2' when instructed to select between no or yes; whether this outcome was intentional or a dysfunction caused by Qualtrics is unknown.

The third item inquired about head injuries that were diagnosed as a traumatic brain injury (TBI). The results of this item are as follows: three participants had stated they had sustained a TBI and 46 stated they had not, with an average of 1.00 head injuries sustained.

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Again, there was one participant that had an input of '2' when instructed to select between no or yes; whether this outcome was intentional or a dysfunction caused by Qualtrics is unknown.

The fourth and final item inquired about head injuries that did not require being seen by a medical professional or treatment. The results of this item are as follows: 24 participants reported sustaining such HI and 26 reported they had not, with an average of 5.28 head injuries sustained. These results are a direct call back to the significant research supporting a large discrepancy between head injuries sustained and treatment sought.

ADHD

There was one item that inquired about the participants' diagnoses of either attention deficit hyperactivity disorder (ADHD) or attention deficit disorder (ADD), including the distinct inclusion of any variation of the two. The results of this item are as follows: 10 participants reported they had received a diagnosis and 40 participants reported they had not.

Aggression

It was hypothesized that participants with an extensive history of head injury would be more likely to regularly exhibit aggressive behaviors than those who had little to no history of head injury, though the data is not supportive of this hypothesis. A Pearson correlation indicated no significant relationships between any of the HI_QTY variables and Average Aggression. There was a weak correlation with HI1_QTY and HI2_QTY ($r = -.033$) ($r = -.042$), but because their p -values were so high ($p = .899$) ($p = 0.864$), there is no statistical significance. Data for HI3_QTY was unavailable, so no correlation could be computed. There was a slightly stronger negative correlation ($r = -.313$) shown between HI4_QTY and Average Aggression, but the p -value ($p = .180$) is still greater than .05 so it is not statistically significant. While HI4_QTY was

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the strongest relationship, indicating the possibility of TBIs being correlated to aggressive behavior, the relationship was not strong enough to make such an inference.

Recklessness

Data gathered for hypothesis 1 is also unsupportive, as a Pearson correlation indicated no significant relationships between any of the HI_QTY variables and Average Recklessness. The variable HI4_QTY has the strongest negative correlation ($r = -.269$), though it is not statistically significant ($p = .252$). The relationship between HI1_QTY ($r = .082$, $p = .756$) and Average Recklessness is weak and negative, and HI2_QTY ($r = -.145$, $p = .555$) is weak and negative. HI3_QTY had no data provided, disallowing for interpretation. Once again, HI4_QTY was the strongest relationship though not strong enough to determine a correlation between the two.

Apathy

A Pearson correlation indicated no significant positive or negative relationships between any of the HI_QTY variables and Average Apathy, indicating the data is unsupportive of the third hypothesis. The correlations between HI1_QTY ($r = .027$, $p = .918$), HI2_QTY ($r = .090$, $p = .714$) are weak, and the p -values are all well above .05, indicating no statistical significance. Again, there was no data for HI3_QTY so there is no interpretation available. Variable HI4_QTY shows a slightly stronger negative correlation ($r = -.312$), but it is still not statistically significant ($p = .181$).

Relationship Strain

A Pearson correlation indicated that all relationships between HI_QTY variables and Average Relationship Strain are weak, negative, and non-significant, as all p -values are greater than .05. HI4_QTY does once again have the strongest negative correlation ($r = -.263$) in

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comparison to HI1_QTY ($r = -.079, p = .764$) and HI2_QTY ($r = -.147, p = .548$), though it is still statistically insignificant ($p = .262$). HI3_QTY remains unable to interpret due to the lack of data. The fourth hypothesis was found unsupported as there was no significant correlation found between history of head injury and strained relationships.

Discussion

The results of this study signify no direct correlation between history of head injury and all four indexes of behavior—aggression, recklessness, apathy, and relationship strain. Despite the overwhelming amount of research attributing head injury to aggression, recklessness, apathy, and relationship strain, among other symptoms, such as antisocial behaviors, social disinhibition, and difficulty concentrating, the present study found no such correlation among its participants (Allen, Interian, Reddy, Rodriguez, & Myers, 2025; Carr, Hall, Eisenbarth, & Brandt, 2024; Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; McMillan, Aslam, McGinley, Walker, & Barry, 2025; Walling, Meehan, Holtzworth-Munroe, & Taft, 2012, Filipcikova et al., 2024). While that discovery is essentially a positive one, it left the hypotheses unsupported and the recommendation for future research to be far more elaborate.

It was also found that there was a distinct abundance of head injuries reported by participants wherein no treatment or professional aid was sought. These results were unsurprising as previous research has indicated that treatment and professional aid are avoided for less severe head injuries (Fullerton, Jackson, Tuvblad, Raine, & Baker, 2019; Allen, Interian, Reddy, Rodriguez, & Myers, 2025). These results had the strongest negative correlation in comparison to the other severities of head injury; however, because it was still statistically insignificant, a distinct correlation could not be confidently made between minor head injuries and the behaviors examined in the four indexes.

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ADHD

The present study is not concerned with a potential correlation between ADHD/ ADD and average aggression, recklessness, apathy, and relationship strain, as the behavioral traits were intentionally developed with existing research in mind—specifically, studies highlighting categorical similarities between the side effects of head injuries and the symptoms of ADHD/ ADD (Carr, Hall, Eisenbarth, & Brandt, 2024). No correlation matrices were run against this data. This inquiry was included in the study as a precautionary measure, in case a substantial number of participants diagnosed with ADHD/ ADD reported increased levels of aggression, recklessness, apathy, and relationship strain despite having no history of head injury. Because that was not the case, the inquiry only holds the value of its distinction rather than its impact.

Limitations & Future Research

The most obvious, and rather unfortunate, limitation of the present study is the results lacking data for HI3_QTY. It is unknown whether this occurred because of a mistake at the fault of Qualtrics, Jamovi, or the author of the present study. The lack of data procured for that variable limited the results by disallowing interpretation of a possible correlation between HI3_QTY, investigating head injuries that were diagnosed as traumatic brain injuries, and the behavioral indexes examined, i.e., aggression, recklessness, apathy, and relationship strain.

The present study did not focus on discovering any correlations between history of head injury and apathetic or anti-social behaviors resulting in criminality. Previous studies have provided insight into the connection between adolescent head injury and potential substance use and the severity of criminal offenses they may have committed (Williams et al., 2010, as cited by Loomis, Sonsteng-Person, Jagers, & Osteen, 2022). Future research would benefit from

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exploring that connection by expanding upon the behavioral indexes of the present study to better examine specific behaviors attributed to substance use and criminality.

Other limitations of this study include the low quantity of participants ($N = 50$), and lack of diversity among the age of participants, as most were within the age range of 18-26 years old. Consistent insignificant findings are often attributed to small sample sizes, so this limitation is not drastic or uncommon. Additionally, there was no distinction made between athletes and non-athletes; although this study was broadened to include all participants with various histories of head injury, it would have been interesting to see how many head injuries were sports related. Furthermore, the data was collected by means of self-report which is notoriously inaccurate to some degree due to the possibilities of socially desirable answering and lapses in one's memory; therefore, it is recommended for future research to possibly procure medical records if the necessity of pure accuracy of diagnosed and treated head injuries is desired.

Finally, to increase the impact of this research on treatment of head injuries, it is recommended that future research include examination of the symptoms of a head injury that occur when an individual continues with their everyday routine, potentially causing worsened or additional symptoms, such as irritability, distraction, fatigue, and headaches (Riese et al., 1999). Obtaining such data could provide support for treatment of all head injuries no matter the severity.

Overall, the data of the present study did not support the four hypotheses made regarding the potential correlations between head injury and aggression, recklessness, apathy, and relationship strain. Nevertheless, this study is important in furthering the research surrounding head injuries and psychological changes that may occur as a result. Additionally, it opens the door to more inquiries and potential facets of examination.

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