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ACADEMIC AND BEHAVIORAL EFFECTS IN ATHLETES: A COMPARISON OF TRAUMATIC BRAIN INJURY AMONG ADOLESCENTS

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Abstract:
Depression is a common post-concussion symptom. The depressive symptoms and its effects seemingly appear to be more long term, with some patients still reporting three months to nine years' post-concussion. School apathy post head trauma can negatively influence prognosis and essentially make the condition worse. Student disruptions post head trauma will result in an inability to reason, problem-solve, set goals, self-monitor, initiate or inhibit response behavior, and effectively execute purposeful behavior. The current investigation examines the effects of traumatic brain injury (TBI) among school-aged athletes (ages 13- to 18-years-old) compared to same-aged athletes who did not have a diagnosis/history of TBI. A Multivariate analysis and *t*-test are utilized to address the self-reported data in relation to students' feelings, disruption, and school apathy with and without head trauma. It is expected that the results will show adverse effects in those student athletes who had reported head trauma when examining their feelings, disruptions, and school apathy when compared to those student athletes without head trauma.

Keywords: tramatic brain injury, concussions, perceptions of education

Introduction

According to the Centers for Disease Control & Prevention (CDC; 2015), over 2.5 million cases of traumatic brain injuries (TBIs) were reported in hospitals throughout the United

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States in 2010. TBIs are relatively common and a potentially life-threatening injury among children and adolescents; this risk is perhaps most hazardous for student-athletes. Yet, due to the internal nature of the injury, and the failure of athletes to report concussive symptoms to the proper authorities, many concussions and cases of TBI go undiagnosed. Estimated casualties amongst athletes have ranged from 300,000 (Marar, Mcilvain, Fields, & Comstock, 2012) to 1.6-2.3 million, with the upper range appearing inflated partially due to the fact that up to half of all concussions may go undiagnosed (Bailes, 2009).

Literature concerning high school athletes has suggested potentially longer recovery times among adolescents (Lovell et al., 2003). Fortunately, many of these concussions appear to be considered mild in nature (Mobayed & Dinan, 1990). However, more severe concussions have a tendency to be marked by particular symptoms that may include prolonged fatigue (Mollayeva et al., 2014), sleep disturbances (Kostyun, Milewski, & Hafeez, 2014), headaches and migraines (Kontos et. al, 2013), anterograde amnesia (Colins et al., 2003), retrograde amnesia, and loss of consciousness (Dougan, Horswill, & Geffen, 2014). Even in non-concussed depressed patients, research has suggested impairment during certain cognitive abilities, such as search and recall (Isley, 1994).

A lesser-common side effect following concussions among school-aged children is depression (Chrisman & Richardson, 2014). Depression is estimated to occur in approximately 180,000 of all concussed Americans (Kontos, Covassin, Elbin, & Parker, 2012). Heightened levels of depressive symptoms and emotional disturbances have been reported among athletes who have experienced one or more concussions; notably, athletes have been found to be most common reporters of concussions and related symptoms (Roiger, Weidauer, & Kern, 2015).

At this time, there can be no conclusive stance taken to suggest that experiencing depressive symptoms results from sustaining a concussion or TBI. Researchers cannot rule out alternative factors regarding the elicitation of depressive symptoms as school-aged youth, especially student-athletes in this age group, may experience undue pressures there from parents, coaches, peers, and often the athlete himself to return to play (Kroshus, Garnett, Hawrilenko, Baugh, & Calzo, 2015); this can adversely lead to further psychological stress and negative perceptions of an athlete's self-image and/or quality of life (Kissick & Johnston, 2005).

Risk factors or predictors of post-concussion depression symptoms (PCDS) have been identified. These include the individual(s) being of a younger age, having a personal or family history of psychological concerns, a history of previous or current substance use or abuse, and/or lower education levels of the patient and his/her family. One notable category that has not been commonly investigated includes sports-related factors.

Individuals who experience a head trauma resulting in a TBI can experience somatic symptoms (e.g., headaches, stomachaches), cognitive difficulties (e.g., memory loss), sleep disturbance, and altered mood. These types of symptoms affect academic performance and the ability to perform at their maximum potential (Iadevaia, Roiger, & Zwart, 2015). Surveys of students reporting head trauma state that anywhere from 27% to 90% of students' report trouble doing and/or finishing their homework (Wasserman, Bazarian, Mapstone, Block, & Van Wijngaarden, 2016). Students may require a brief absence from school post-TBI, temporarily altering their ability to keep up with their school curriculum (Ransom, Vaughan, Pratson, Sady, McGill, & Gioia, 2015). Notably, lower standardized test scores were correlated increased difficulty returning to school, such that the lower students' standardized test scores were, the more difficulties they experienced once they have returned to school (Baker et al., 2015).

Jones, Robinson, and Larwin (2015) found that students who have sustained a TBI, especially those who were received special education services related to their TBI, have reported strong feeling of association with their schools. However, a sense of apathy toward school and schoolwork has been found to be a common result of sustaining a TBI (Jantz & Coulter, 2007). Apathy in this context refers to the development of positive teacher and/or peer interaction, acceptance of limitations, controlling anger, and appearing to be apathetic. The degree of apathy can negatively influence prognosis and increase the extent of the condition. An individual's lack of self-monitoring, self-correcting, self-regulating may cause students to become inflexible and ridged or easily frustrated or anxious when things do not go as planned resulting in disruptive behaviors (Jantz & Coulter, 2007). While post-concussion recovery times vary for each individual, impaired academic performance, emotional regulation, and behavior self-management may persist for undetermined periods of time, resulting in a need for collaboration among service providers to align their efforts for serving those who have sustained a concussion or TBI (Iadevaia, Roiger, & Zwart, 2015).

In conducting interviews with adolescent student-athletes, researchers have identified four components related to post-concussion quality of life for these adolescents: significant effect of symptoms; feelings of frustration; influence on school attendance and activities; and nature of interpersonal and team relationships (Iadevaia et al., 2015, p. 1182). Further, it was noted that greater post-concussion symptoms resulted in greater functional impairments and impacts on quality of life (Iadevaia et al., 2015). To address these concerns, various service providers, such as school-based professionals and related clinicians have worked to provide services on a continuum of care for school-age students who have sustained concussions and TBIs (Glang et al., 2015; Hotz, 2014). Focusing on student-athletes at the high school level, one study implemented a county-wide initiative

that sought to improve data tracking, preventative efforts, and monitoring of students who have sustained a concussion (Hotz, 2014), while another implemented an online concussion training system for students and their families (Glang et al., 2015). Results of the latter study suggest that easily accessible references provides knowledge and application strategies for post-concussion management, as well as resources for referrals when warranted (Glang et al., 2015).

Due to findings that approximately one-third of students-athletes experience difficulties returning to school following a sports-related concussion (Baker et al., 2015), other studies have focused on school-based professionals' and related service providers' perceptions of strategies and accommodations for serving students who have sustained TBIs or concussions. Notable school-based professionals and clinicians in the literature have included school principals (Heyer, Weber, Rose, Perkins, & Schmittauer, 2015), school nurses (Weber, Welch, Parsons, & Valovich McLeod, 2015), and school-serving athletic trainers (Kasamatsu, Cleary, Bennett, Howard, & Valovich McLeod, 2016; McGrath, 2010; Williams, Welch, Parsons, & Valovich McLeod, 2015).

Due to the paucity of research on comparison groups of athletes who have not suffered a TBI, the purpose of the current study is to examine the effects of TBI on school-aged (13- to 18-years-old) athletes compared to school-aged athletes who have not sustained a TBI. It is hypothesized that there will be a significant relationship between both academic and behavioral factors when compared with head trauma. Further, it is expected that there will be significant correlations when examining students' reported feelings, disruptions, and school-related apathy in relation to whether they have sustained head trauma versus never having sustained a head trauma. With the addition of this research, there will be ample evidence regarding how head trauma adversely affects academic and behavioral performance of school-aged athletes.

METHODS

Participants

The inclusion criteria for concussed participants would be a medical diagnosis of a concussion within the past six months to one year. The inclusion criteria for the non-concussed participants would be no prior medical diagnosis of a concussion. The student surveys were gathered from the Add Health National Database and involved a nationally representative sample of 299 students, 13-18 years of age. A total of 110 participants indicated that they did not have a head trauma (n = 110). Thirteen individuals responded that they did have a head trauma (n = 13).

Instrumentation

The National Longitudinal Study of Adolescent to Adult Health (Add Health, 2016) is a longitudinal study of youth ranging from grades 7-12 in the United States. Add Health links survey data on respondents' social and psychological well-being with related data on the family, school, friendships, and peer groups. This provides exclusive ways to study how social environments and feelings in youth are associated to health, education, and achievement. The study information can be located at http://www.cpc.unc.edu/projects/addhealth

Procedures

The factors studied in this research are students' disruptions, feelings, school apathy, and head trauma. These factors were computed by taking the mean value across a number of individual items that each participant responded in the ADHealth (2016) battery of inventories.

The factor of *students' feelings* (Feelings) was constructed using these items: HAPPY AT YOUR SCHOOL, BOTHERED BY THINGS, HAD THE BLUES, TROUBLE KEEPING MIND FOCUSED, FELT DEPRESSED, TOO TIRED TO DO THINGS, HOPEFUL ABOUT THE FUTURE, LIFE HAD BEEN A FAILURE, FEARFUL, HAPPY, FELT LONELY, and LIFE NOT WORTH LIVING.

The factor of *student's disruptions* (Disruptions) was constructed using these items: TROUBLE GETTING ALONG WITH TEACHERS, TROUBLE PAYING ATTENTION, TROUBLE GETTING HOMEWORK DONE, and TROUBLE WITH OTHER STUDENTS.

Lastly, the factor of *students' school apathy* (School Apathy) was constructed using these items: FREQUENT EXCUSED ABSENCE FROM SCHOOL, and FREQUENT SKIPPED SCHOOL.

Results

The descriptive statistics of the factors – Feelings, Disruptions, School Apathy and Head Trauma for all individuals included in the current investigation are presented in Table 1.

Table 1: Descriptive Data and t-test results

	No Head Trauma		Yes Head Trauma		
	Mean	**SD**	**Mean**	**SD**	***t***
School Apathy	0.950	0.960	0.923	1.552	.089
Negative Feelings[1]	0.738	0.330	0.576	0.105	4.244*
Disruptions	0.884	0.549	0.423	0.438	2.708*
GPA	2.079	.732	2.026	.726	0.242

Note: The "1" indicates that an adjustment was made due to violation of homogeneity of variance prior to conducting the t test analysis. * Indicates significant results at the α<.05 level.

In addition to the descriptive data, Table 1 provides the outcomes from *t* tests comparing the responses from students in each group (head trauma or no head trauma) on the three constructed factors. Results indicate significant differences on the Feelings and the Disruptions factors, but not on the Apathy factor or on student GPA.

A zero-order correlation was conducted to assess the appropriateness for the multivariate analysis. The results of this analysis are presented in Table 2.

Table 2: Correlation of School Apathy, Disruption, and Feelings Factors

Variable	1	2	3	4	5
(1) School Apathy	.	.705**	.308**	.413**	.459**
(2) Disruptions		.	.249**	.165**	.241**
(3) Negative Feelings			.	.154**	.038

Note: * indicates $p < .05$; ** indicates $p < .01$.

Since there were significant correlations found between the three constructed factors, a Multivariate Analysis of Variance was performed to examine more precisely the impact of students with head trauma across the related factors. Results indicate that when these correlated factors are considered simultaneously, the results indicate that there is a significant difference across the two groups, $F(3, 119) = 3.173$, $p = .027$. These results indicate that the differences in reporting across the three significantly correlated factors are significant, however, it is the students who have not experiences a head trauma that are endorsing the apathy, negative feelings, and disruptions more highly relative to the students who experienced a head trauma. While sampling might explain these findings, the results suggest that student which experience head trauma can have experiences similar to those of their peers who have had not head traumas.

DISCUSSION

According to the examined data, one can conclude that those student athletes with head trauma versus those student athletes with no reported head trauma were not adversely affected in the areas of their feelings, disruptions, and school apathy. These findings are consistent with Jones, Robinson, and Larwin (2015), however the non-significant finding contradicts the findings of Jantz & Coulter, (2007). This difference could be due to the impact of time and repeated trauma on those who experience head traumas (Bailey, 2009).

The time since injury is unknown for the data in the current investigation. While based on a limited sample, the reported data and statistical analysis do not support the original hypotheses. Based on the findings of the current investigation, the students in the

head trauma endorsed the factors at a lower level relative to the non-head trauma group, indicating less negative feelings, less apathy, and fewer disruptions in their school experiences. This could reflect time, as indicated above, or appropriate supports for students receiving this type of injury.

Recommendations for the Future

Studies that involve the self-reporting of participants should present a caution to the reader. One should take this type of data as a case by case basis as the manifestations of such factors like reported feelings, disruptions, and school apathy can be different even among those individuals with a TBI at similar times; each individual is going to self-report differently than the next. This type of research did not take into account for those students who were receiving specific interventions for their TBI as those interventions could have adversely affected the presented data, in particular, school apathy. In addition, teachers should be more cognizant of TBI manifestations and should not misinterpret them for intense, emotional behaviors or dismiss them within the student's developmental context. Lastly, the current investigation does not take into account when the student experiences the head trauma. Time can have a considerable impact on the students functioning post a head trauma.

References

1. Bailes, J. (2009). Sports-related concussion: What do we know in 2009—A neurosurgeon's perspective. *Journal of the International Neuropsychological Society, 15*, 509-509.
2. Baker, J. G., Leddy, J. J., Darling, S. R., Rieger, B. P., Mashtare, T. L., Sharma, T., & Willer, B. S. (2015). Factors associated with problems for adolescents returning to the classroom after sport-related concussion. *Clinical Pediatrics, 54*(10), 961-968.
3. Chrisman, S., & Richardson, L. (2014). Prevalence of diagnosed depression in adolescents with history of concussion. *Journal of Adolescent Health, 54*, 582-586.
4. Collins, M., Field, M., Lovell, M., Iverson, G., Johnston, K., Maroon, J. & Fu, F. (2003). Relationship between postconcussion headache and neuropsychological test performance in high school athletes. *The American Journal of Sports Medicine, 31*(2), 168-173.
5. Centers for Disease Control and Prevention. (2015, January 12). *Injury Prevention and Control: Traumatic Brain Injury*. Retrieved from http://www.cdc.gov/

6. Dougan, B., Horswill, M., & Geffen, G. (2013). Do injury characteristics predict the severity of acute neuropsychological deficits following sports-related concussion? A meta-analysis. *Journal of the International Neuropsychological Society, 20*, 81-87.
7. Glang, A. E., Koester, M. C., Chesnutt, J. C., Gioia, G. A., McAvoy, K., Marshall, S., & Gau, J. M. (2015). The effectiveness of a web-based resource in improving post-concussion management in high schools. *Journal of Adolescent Health, 56*, 91-97.
8. Heyer, G. L., Weber, K. D., Rose, S. C., Perkins, S. Q., & Schmittauer, C. E. (2015). High school principals' resources, knowledge, and practices regarding the returning student with concussion. *The Journal of Pediatrics, 166*(3), 594-599.
9. Hotz, G., Quintero, A., Crittenden, R., Baker, L., Goldstein, D., & Nedd, K. (2014). A countywide program to manage concussions in high school sports. *The Sport Journal.* Retrieved from http://thesportjournal.org/article/a-countywide-program-to-manage-concussions-in-high-school-sports
10. Iadevaia, C., Roiger, T., & Zwart, M. B. (2015). Qualitative examination of adolescent health-related quality of life at 1 year postconcussion. *Journal of Athletic Training, 50*(11), 1182-1189.
11. Jantz, P. B., & Coulter, G. A. (2007). Child and adolescent traumatic brain injury: Academic, behavioural, and social consequences in the classroom. *Support for Learning, 22*(2), 84-89.
12. Jones, B. A., Robinson, L., & Larwin, K. H. (2015). Identification with school and head trauma: Parental perceptions on student's experiences. *International Journal of Evaluation and Research in Education, 4*(3), 112-117.
13. Kasamatsu, T., Cleary, M., Bennett, J., Howard, K., & Valovich McLeod, T. (2016). Examining academic support after concussion for the adolescent student-athlete: Perspectives of the athletic trainer. *Journal of Athletic Training, 51*(2), 153-161.
14. Kissick, J., & Johnston, K. (2005). Return to play after concussion. *Clinical Journal of Sport Medicine, 15*(6), 426-431.
15. Kontos, A., Covassin, T., Elbin, R., & Parker, T. (2012). Depression and neurocognitive performance after concussion among male and female high school and collegiate athletes. *Archive Physical Medical Rehabilitation*, *93*, 1751-1756.
16. Kontos, A., Elbin, R., Lau, B., Simensky, S., Freund, B., French, J., & Collins, M. (2013). Posttraumatic migraine as a predictor of recovery and cognitive impairment after sport-related concussion. *The American Journal of Sports Medicine, 41*(7), 1497-1504.
17. Kostyun, R, Milewski, M, & Hafeez, I. (2014). Sleep disturbance and neurocognitive function during the recovery from a sport-related concussion in adolescents. *The American Journal of Sports Medicine, 43*(3), 633–640.

18. Kroshus, E., Garnett, B., Hawrilenko, M., Baugh, C. M., & Calzo, J. P. (2015). Concussion under-reporting and pressure from coaches, teammates, fans, and parents. *Social Science & Medicine, 134*, 66-75.
19. Lovell, M. R., Collins, M. W., Iverson, G. L., Field, M., Maroon, J. C., Cantu, R…Fu, F. H. (2003). Recovery from mild concussion in high school athletes. *Journal of Neurosurgery, 98*, 295-301.
20. Marar, M., Mcilvain, N., Fields, S., & Comstock, R. (2012). Epidemiology of concussions among United States high school athletes in 20 sports. *The American Journal of Sports Medicine, 40*(4), 747-755.
21. McGrath, N. (2010). Supporting the student-athlete's return to the classroom after a sport-related concussion. *Journal of Athletic Training, 45*(5), 492-498.
22. Mobayed, M., & Dinan, T. (1990). Buspirone/prolactin response in post head injury depression. *Journal of Affective Disorders, 19*, 237-241.
23. Mollayeva, T., Kendzerska, T., Mollayeva, S., Shapiro, C. M., Colantonio, A., Cassidy, J. D. (2014). A systematic review of fatigue in patients with traumatic brain injury: The course, predictors and consequences. *Neuroscience and Biobehavioral Reviews, 47*, 684-716.
24. Roiger, T., Weidauer, L., & Kern, B. (2015). A longitudinal pilot study of depressive symptoms in concussed and injured/nonconcussed National Collegiate Athletic Association Division I student-athletes. *Journal of Athletic Training, 50*(3), 256-261.
25. Wasserman, E. B., Bazarian, J. J., Mapstone, M., Block, R., & Wijngaard., E. (2016). Academic dysfunction after a concussion among U.S. high school and college students. *American Journal of Public Health, 106*(7), 1247-1253.
26. Weber, M. L., Welch, C. E., Parsons, J. T., & Valovich McLeod, T. C. (2015). School nurses' familiarity and perceptions of academic accommodations for student-athletes following sport-related concussion. *The Journal of School Nursing, 31*(2), 146-154.
27. Williams, R. M., Welch, C. E., Parsons, J. T., & Valovich McLeod, T. C. (2015). Athletic trainers' familiarity with and perceptions of academic accommodations in secondary school athletes after sport-related concussion. *Journal of Athletic Training, 50*(3), 262-269.

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