THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF PSYCHOLOGY

THE EFFECTS OF PERSONALITY ON CONCUSSION RATES

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ABSTRACT

Concussion is a major issue in today's society with somewhere between 1.6 and 3.8 million concussions reported each year as a result of sports and other physical recreational activities. The effects of concussion vary widely, but can have harmful consequences both in the short term and later in life. Therefore, determining risk factors for concussion is important for improving both prevention of concussions and return to play decisions. Research on concussion and personality is somewhat sparse, and personality has not been investigated as a risk factor for concussion. The current study sought to determine whether personality at baseline testing was related to concussion history or rate of return for post-concussion testing. Using 736 college-aged athlete participants, a negative correlation was found between scores on Openness from the NEO and number of previous concussions at baseline. No statistically significant correlations were found between the Big Five personality traits at baseline and the rate of referral back for testing after a subsequent injury. These findings may suggest that individuals with lower scores on the openness personality trait may be at higher risk for concussion.

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INTRODUCTION

Concussion has become an increasingly salient issue in society today as evidenced by the amount of time and resources devoted to research and media coverage on the issue. One specific facet of this research is sports-related concussion. It is estimated that between 1.6 and 3.8 million concussions are sustained each year in the U.S. due to sports and recreation (Langlois et al., 2006). Concussion is defined by the second International Conference on Concussion in Sport as, "a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces," and often results from blow to the head or the body that results in transmission of force to the head (McCrory et al., 2005).

According to one study analyzing population statistics in Canada, concussion risk is related to age, gender, and sports involvement. With regard to age, children (aged 0-14) are most likely to sustain concussion, followed by young adults (aged 15-34). Adults (aged 35+) were the least likely to sustain this type of injury. Males and females report similar rates of concussion, except in the young adult age group, where males show a much higher rate. The study also showed that the majority of concussions were sport-related, especially in the young adult group, where more than 85% were related to sports (Gordon, Dooley, & Wood, 2006).

 These concussions can have both short and long term effects on the individual experiencing them. Among the short term symptoms of concussion are headache, amnesia, irritability, slowed reaction times, problems with sleep, and concentration problems (McCrory et al., 2009). For most individuals, these symptoms resolve by a

week post-injury (McCrory et al., 2005). However, it has been found that it takes longer for adolescent athletes to recover to baseline than for young adults (Zuckerman et al., 2012).

While long-term effects have been harder to identify, some effects have been observed. For one, having one concussion makes it more likely that an individual will sustain subsequent concussions (Collins et al., 2002). Individuals who experience two or more concussions show long-term deficits in attention, concentration, processing speed, and mental flexibility similar to individuals who have recently received a concussion, even when they do not have physical symptoms (Moser, Schatz, & Jordan, 2005). Further, concussion has been linked to later psychological dysfunction such as depression (Chen et al., 2008). Given the relatively high distress that these injuries potentially cause and their short and long-term consequences, a better understanding of which individuals are more likely to sustain concussions would be useful in order to better prevent, diagnose, and treat concussions.

Research linking personality factors to concussion is a small but growing subsection of concussion literature. Most of the research done to date has examined personality change as a result of concussion (Middelboe et al., 1992) and how personality factors can affect recovery rates and symptom experience (Bailey et al., 2010; Karzmark, Hall, & Englander, 1995). There has been no research to date investigating the relationship between personality traits and number of concussions sustained.

In this study, the primary questions of interest regard the relationship between personality and concussion rate. The "Big Five" Personality traits are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Costa & McCrae,

1992). Conscientiousness has been shown to be linked to cognitive functions like impulse control, goal-directedness, planning, delaying gratification, and following norms and rules (Roberts et al., 2004). Therefore, it is conceivable that those individuals who score low on ratings of conscientiousness would be at higher risk of concussion. This could be because a lack of impulse control and planning behaviors may lead student athletes to put themselves into more dangerous situations like committing to dangerous plays or making mistakes that result in injury, thus leading to concussion. Additionally, personality factors could contribute to the type of sport or position that a person plays, which could influence concussion rates.

Given these considerations, I predicted that those athletes with high scores on conscientiousness would have a lower number of concussions at baseline and would also be less likely to return for testing following a subsequent concussion.

The following aims emerged for this study:

Aim #1 - Analyze the relationship between the Big Five personality traits and number of concussions at baseline.

Aim #2 - Analyze the relationship between Big Five personality traits and post-concussion testing for a subsequent concussion.

METHODS

Participants

736 college aged student athletes participated in the study. Their mean age was 18.54 with a range of 17 to 24. 76% were male and 24% were female. The sample was comprised of 74% Caucasian American, 19.8% African American, 1% Hispanic and Asian American, 3% Multiracial, and 1.2% of other ethnicity identifying individuals. The sports that the athletes played were 31.9% football, 10.6% men's soccer, 10.1% women's soccer, 2% wrestling, 8.6% women's lacrosse, 14.1% men's lacrosse, 9.4% men's ice hockey, 3.7% women's basketball, 6.8% men's basketball, and less than 1% played each baseball, softball, rugby, swimming, cheerleading, tennis, volleyball, and women's ice hockey. Participants were tested during the summer before their freshman year, in most cases, as they entered into one of Penn State's athletic programs, as part of the Penn State Concussion Program.

Tests and Procedure

All subjects signed inform consent forms approved by the Institutional Review Boards of the Pennsylvania State University prior to participating in the study, and all study procedures complied with the Health Insurance Portability and Accountability Act and Institutional Review Board Standards. Athletes and controls were given a two hour battery of neuropsychological tests including both the NEO personality inventory and the PHIQ. By using the NEO Personality Inventory (NEO) (Costa &McCrae, 1992), we

aimed to analyze how each of the participant ranked on the Big Five personality traits. After we know how each athlete scores in terms of personality, we can plot their scores on each personality trait against the number of concussions that they have had as found on a Previous Head Injury Questionnaire (PHIQ). The PHIQ defines concussions by two criteria: First, there must be a blow to the head or the head must be jarred by a blow to the face, neck, or torso. Second, one of more of the following symptoms must be observed after the blow: Loss of consciousness for <1 minute, amnesia for <30 minutes, confusion, dizziness/balance problems, nausea/vomiting, sleep difficulties/drowsiness, sensitivity to light/noise, difficulty concentrating/remembering, irritability/nervousness/sadness, headache/numbness/tingling, or feeling slowed down/fatigued. Individuals were tested one-on-one using paper-and-pencil tests. Responses were based on their discretion, though we emphasized that they should be as honest as possible. All data were reliability checked and entered into a database by research assistants working for the Penn State Concussion Program. Trait totals were calculated for the Big Five personality traits from the NEO.

Participants were excluded from analysis if they did not answer all questions on the NEO or if they were missing demographic information. Outliers in the number of concussions reported on the PHIQ were also controlled for with people listing more than 7 (3 individuals) excluded.

RESULTS

Pearson correlations were analyzed between each of the Big Five personality traits and the number of previous head injuries sustained by the athlete (Tables 1). A significant correlation ($r = .11$, $p < .01$) was found between Openness and number previous head injuries sustained.

Table 1. Number of previous head injuries correlated with the Big Five personality traits

	Conscientiousness	Agreeableness	Openness	Extraversion	Neuroticism
Number of Previous Head Injuries	-.049	-.002	-.109*	.037	.018

* = significant at .01 level

Figure 1 shows a graphic representation of the relationship between Openness and number of previous head injuries with a trend line included.

Figure 1. Openness correlated with number of previous head injuries
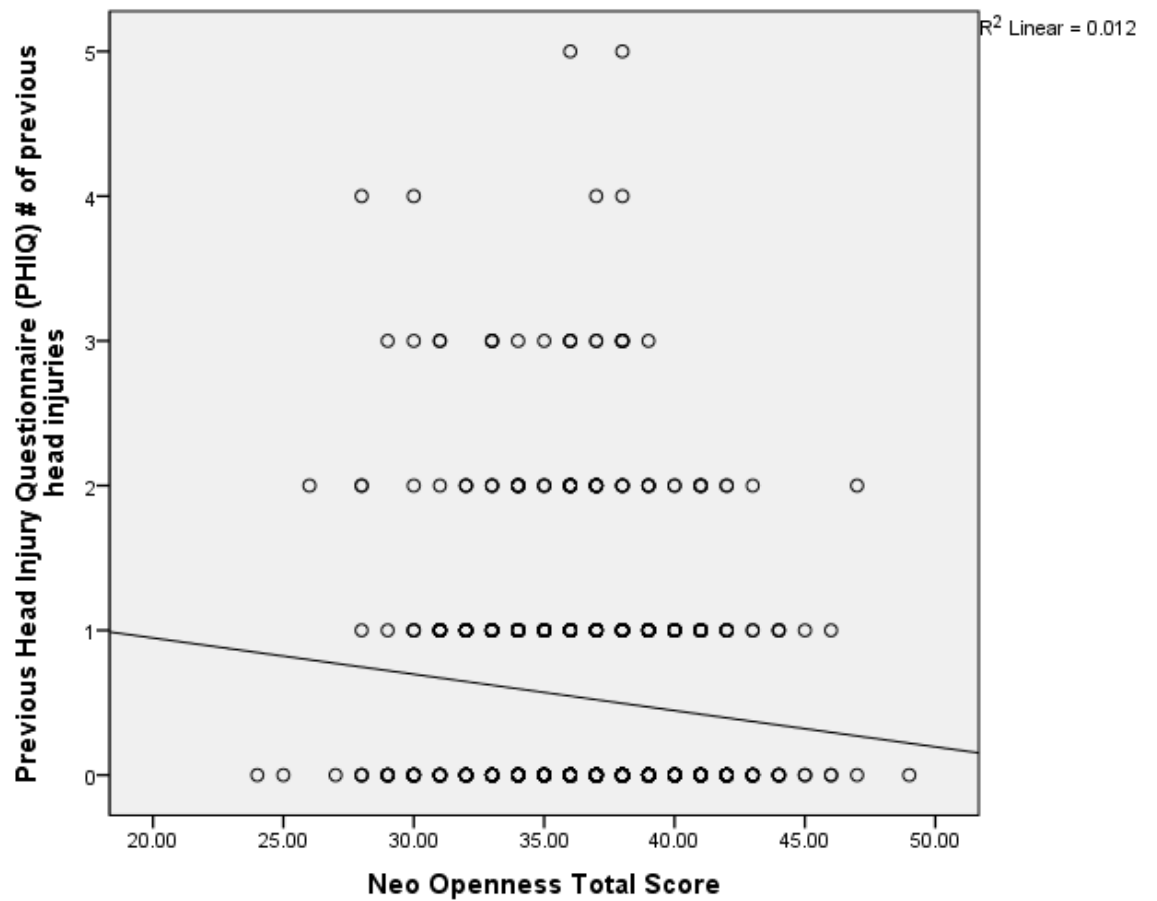
A second set of correlations were performed between each of the Big Five personality traits and whether an individual was referred back for post-concussion testing up until the time of the current study by using an independent samples T-test. No significant correlations were found among these variables.

DISCUSSION

The presented study aimed to analyze the relationship between personality factors and retrospective concussion rates in college athletes. It also, sought to explore the relationship between personality traits and rate of return for post-concussion testing. The hypothesis that low scores on conscientiousness would predict higher retrospective rates of concussion at baseline was not supported. Instead, Openness was found to have a small, but statistically significant negative correlation with the number of previous concussions reported on the PHIQ at baseline. Additionally, it was found that none of the "Big Five" personality traits, as measured by the NEO Personality Inventory, predicted which athletes would return for testing post-concussion.

One issue that may have arisen during the course of this study regards under-reporting of previous concussions on the PHIQ. This measure is a paper and pencil form and can be rather long, and so some participants may have under-represented their history of concussions. Also, a short version of the NEO was used that only consisted of sixty items, and so it may not have been sensitive to all of the nuances of personality that the longer versions address. Further, the rate at which college athletes are referred back to our lab for clinical evaluation may not fully represent the number of student athletes that sustained concussions post-baseline, and, concussions in general tend to be under reported and often overlooked. Finally, the length of time before baseline playing a sport was often much longer than the length of time that the athletes were members of the Penn State Concussion program. This may suggest that if given more time, more concussions would have been sustained and the relationship would have changed.

The results of this study, however, still have important implications. We know that those who reported more previous head injuries tended to be lower on openness. Since concussion is such a pervasive problem, any tool that can be used in their prevention and treatment is useful. Future research should focus its efforts on what puts individuals at risk for concussion and what we can do to further prevent these debilitating injuries from occurring. Longer term studies regarding personality and concussions, not just four or five year spans, might help us to better understand this relationship.

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Education

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Professional Experience

Direct Support Staff Member, *Shared Support Inc.*
May 2012 - August 2012
- Worked one on one with adults with a range of intellectual disabilities
- Assisted behavioral therapists in executing clinical interventions
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- Helped facilitate meetings with family and other staff to develop individualized support plans
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Research Assistant, *The Pennsylvania State University*
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- Part of a team responsible for all aspects of data collection and synthesis
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