Sleep Quality and Prevalence of Anxiety and Depression in Young Adults With a History of Concussions

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Background

- Concussions are a growing public health concern, and emerging possible long-term health risks may negatively impact an individual's quality of life.[1]
- With concussions, there can be a diverse multitude of signs and symptoms, but frequent long-term sequelae of concussions including mood disturbances (e.g. anxiety and depression) and sleep disturbances (e.g. difficulties initiating and maintaining sleep) are given less attention.[2]
- Few clinicians include mood and sleep disturbances in their concussion assessment and management plan, therefore potentially placing individuals at risk for prolonged disturbances beyond recovery.

Purpose

- To examine the significance of relationships between sleep quality and the prevalence of mood disturbances in healthy young adults with and without a history of concussions.

Methods

Participants (Table 1)

- 456 young adults between the ages of 18-30 years from 3 universities.
  - Were included if they had concussion history or had no concussion history
- Of the 456, 3 did not consent to study, 47 excluded due to exclusion criteria, and 143 did not complete all the pertinent questionnaires of the study.

Table 1. Demographics for Concussed and Non-Concussed Individuals

Demographic Information	N(%)	*M±SD*
Age: *M±SD* (years)	-	21.6±3.41
Gender: n(%)		
Males	54(22.0)	-
Females	183(74.4)	-
Nonbinary	7(2.8)	-
Other (afab Genderfluid)	1(0.4)	-
Height: *M±SD* (cm)	-	168.17±10.60
Weight: *M±SD* (kg)	-	72.47±17.46

Sleep Questionnaires

Pittsburgh Sleep Quality Index (PSQI)

- 19-item, self-reported questionnaire that assesses a variety of sleep-related behaviors from the past month and takes 5-10 minutes to complete

Insomnia Severity Index (ISI)

- Self-reported sleep questionnaire with 7 items that aim to evaluate sleep difficulties associated with insomnia and takes less than 5 minutes to complete

Anxiety and Depression Questionnaires

State-Trait Anxiety Inventory (STAI)

- Self-reported anxiety assessment that consists of 40 statements, with 20 measuring state and the other 20 measuring trait anxiety

Beck Depression Inventory, Version 2 (BDI-II)

- 21-item self-reporting questionnaire designed to evaluate the level of depressive symptoms present over the two weeks' period in normal and psychiatric populations

Procedures

- Participants were recruited through a convenience sampling at two local universities and word-of-mouth by a remote investigator at a Mid-Atlantic institution.
- Participants who met the criteria completed an anonymous, one-time self-reported online survey administered via Qualtrics consisting of four questionnaires: PSQI, ISI, STAI, BDI-II, and a demographics form.
- Survey Order: Concussion history and medical history exclusion criteria were verified first, then the PSQI was performed followed by the ISI, STAI, BDI-II, and finished with final demographic questions.

Main Outcome Measures

Sleep Outcomes

- Overall sleep quality
- Perceived sleep quality
- Insomnia severity

Anxiety and Depression Outcomes

- State anxiety level
- Trait anxiety level
- Depression level

Statistical Analysis

- All analyses were performed in Mplus 8.0 (Muthen & Muthen) and data were inspected for normality.
- Structural equation modeling (SEM) was used to analyze the relationship of history of concussions, sleep quality, and anxiety and depression
- Data that are not normally distributed were transformed using a log base ten transformation.
- Path analyses were conducted to test the hypothesis of concussion history directly impacting anxiety and depression and determined if sleep quality mediates this relationship.

Results

Model 1: Anxiety Bivariate Correlations between Factors

- A significant correlation existed between number of concussions and PSQI (r=0.22, p<0.01).
- Poor sleep quality scores were significantly associated with trait anxiety (r=0.60, p<0.01)
- Trait anxiety was significantly correlated with body mass index (r=0.13, p=0.04) and age (r=0.20, p<0.01).

Model 2: Depression Bivariate Correlations between Factors

- Number of concussions were significantly correlated with PSQI (r=0.21, p<0.01) and BDI-II global score (r=0.15, p=0.02).
- Poor sleep quality scores were significantly associated with depression (r=0.60, p<0.01).
- Depression levels were significantly correlated with body mass index (r=0.18, p=<0.01) and age (r=-0.17, p=0.01).

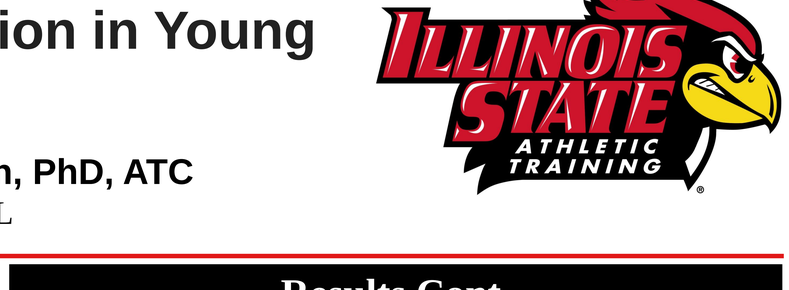
Results Cont.

Anxiety Model Mediation

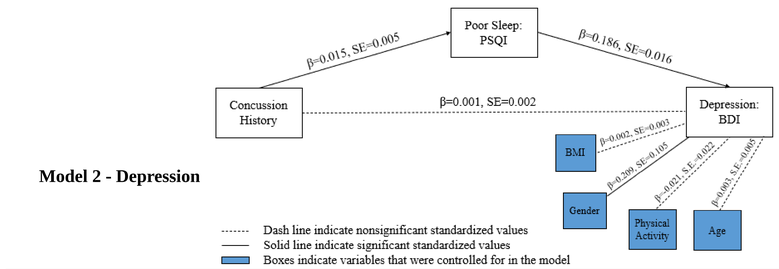
- The hypothesized model accounted for a significant (p<0.05) amount of variance (R2, SE) concussion number (7.9%, 3.4%) and PSQI (37.3%, 5.0%) on trait anxiety.
- Mediation analysis (Model 1), indicated no direct effects of concussion number on trait anxiety (β=-0.001, p=0.480). The number of concussions had a significant effect on PSQI (β=0.019, SE=0.005, p<0.001). The PSQI scores had a significant effect on trait anxiety (β=0.168, SE=0.015 p<0.001). Physical activity significantly impacted trait anxiety scores (β=-0.079, SE=0.023 p<0.001). All other covariates were nonsignificant (p>0.05).

Depression Model Mediation

- The hypothesized model accounted for a significant (p<0.05) amount of variance (R2, SE) concussion number (7.7%, 3.3%) and PSQI (36.6%, 5.0%) on trait anxiety.
- Mediation analysis (Model 2), indicated no direct effects of concussion number on depression (β=0.001, p=0.695). The number of concussions had a significant effect on PSQI (β=0.015, SE=0.005, p<0.001). The PSQI scores had a significant effect on depression (β=0.186, SE=0.016 p<0.001). All other covariates were nonsignificant (p>0.05).



Model 1 - Anxiety



Model 2 - Depression

Conclusions

- History of concussions directly affects sleep quality, which then indirectly affects anxiety and depression in young adults.
- Anxiety, depression, and sleep disturbances should be included in assessment and management of concussion so that these long-term consequences will not negatively affect one's quality of life.

References

1. Harmon KG, Drezner J, Gammons M, et al. American Medical Society for Sports Medicine Position Statement: Concussion in Sport. *Clin J Sport Med*. 2013;23(1):1. doi:10.1097/JSM.0b013e31827f5f93
2. Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. *Br J Sports Med*. 2019;53(4):213-225. doi:10.1136/bjsports-2018-100338