ORIGINAL ARTICLE

Previous concussions increase risk of mental health disability in college athletes

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ARTICLE INFO

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ABSTRACT

Background and Aim: Mental health concerns, particularly anxiety and depression, are leading causes of disability in young adults. Identifying pre-existing conditions that place individuals at-risk for mental health disability may enable health-care providers to increase patient outcomes with early interventions and condition management.

Methods: Student-athletes were grouped by self-reported mental health disability status during pre-season baseline physicals. During the pre-season baseline assessment, student athletes completed the post-concussion symptom scale, hospital anxiety and disability scale, short-form 12 survey, and health history questionnaire. A logistic regression was performed to examine the predictive value of previous concussion history, anxiety, and/or depression mental health disability status.

Results: Student-athletes with a previous concussion had a 46% higher risk for mental health disability. Higher PROM anxiety and depression scores were associated with a 1.29- and 1.19-times higher risk of mental health disability, respectively.

Conclusion: The previous concussion history placed collegiate student-athletes at higher risk for mental health disability. Further, student-athletes that had higher anxiety and depression PROM scores were more likely to have self-reported diagnosed mental health disability. Health-care professionals working with collegiate student-athletes can identify pre-existing conditions that may put a student-athlete at higher risk for mental health disability.

Relevance for Patients: The present study identifies previous concussion history and prior mental health diagnoses places individuals at higher risk for the future mental health disability. Identification of these individuals during routine health screenings may improve overall health outcomes.

1. Introduction

Concussions are common among adolescent and young adult athletes, with 1.6–3.8 million injuries occurring during sport and recreation annually in the United States [1]. While concussions may be treated physically, they may pose a prolonged and bigger threat to the mental health of those affected [2,3]. Changes in glutamatergic signaling may be responsible for the increased comorbidity in concussion and mental health. Changes to the neurometabolic cascade or changes in metabolite levels in the brain may result in difficulty meeting the energy demands and lead to behavioral impairment over time. The pathophysiological changes to the brain's chemistry can further create heightened risk of mental disability such as depression or anxiety [4].

Adolescent athletes with a concussion history are more likely to experience depression and to be at higher risk for exhibiting factors consistent with suicide completion (i.e.,

feeling hopeless sad, suicidal ideations, suicide attempt, and suicide attempt treated by nurse/doctor) [5,6]. However, these mental health risks are not limited to the post-injury time frame. Pre-morbid mental health disability has been identified as a risk factor for worse outcomes following concussion [7]. Therefore, millions of student-athletes are potentially exposed to mental health challenges each year due to concussion, and still limited research exists to explain the relationship between concussions and mental health.

Patient-reported outcome measures (PROMs) are validated questionnaires to determine patient experiences and perception of their condition [8]. Health-care providers frequently use mental health-related PROMs in clinical settings [9]; however, implementation and continued use require support and effort from patients, providers, and researchers [10]. Health-care providers that utilize PROMs are able to identify health-related quality of life measures, mental health disorders, and social factors that may influence recovery and affect the student-athlete post-injury which may otherwise be unidentified [10,11].

Collegiate student-athletes have been identified as having similar rates of mental health disabilities than non-athletes [3,12,13]. However, student-athletes reporting of mental health problems may be limited for various reasons (e.g., stigma and pressure from coaches/teammates/fans). In addition, how student-athletes reporting of mental health at baselines changes due to personal factors (e.g., medical history) have not been previously identified in a collegiate population. Therefore, the purpose of this study was to determine if self-reported mental health disability (i.e., yes/no) is associated with scores within baseline concussion measures (i.e., mental health questionnaires, health history) in collegiate student-athletes.

2. Methods

Collegiate student-athletes were recruited from 2016 to 2019 during their routine annual preparticipation concussion baseline testing. After providing informed consent approved by the institutional review board, student-athletes were included in the study if they were between the ages of 18 and 35 years old, were participating on a club sport team, and completed a health history questionnaire and relevant PROMs ($n = 404$). Student-athletes were excluded and removed from analysis (i.e., list-wise deletion) if they did not provide complete health history information or fully complete the PROMs ($n = 71$). Of the 333 student-athletes included in the study, 283 student-athletes did not self-report a mental health disability and 50 (15%) did self-report.

2.1. PROMs

PROMs included the post-concussion symptom scale symptom evaluation, the hospital anxiety and depression scale (HADS), and short form 12 (SF-12). The symptom evaluation consisted of 22 symptoms rated from 0 (i.e., none) to 6 (i.e., severe) [14]. The HADS includes anxiety and depression subsections with each question rated on a Likert scale [15], while the SF-12 had 12 questions with a mental and physical component [16]. All PROMs

were continuous measures, with higher scores on the symptom evaluation and HADS denoting poorer outcomes and lower scores on the SF-12 indicating worse disability.

2.2. Data analysis

Demographic data were calculated for all variables of interest to describe the student-athletes. Continuous variables (i.e., age [years], number of previous concussions, PROM scores) are presented as means and standard deviations. Sex, a categorical variable, is presented as percentages of the total population. We modeled the unadjusted relationship between the predictors of the previous concussion history (continuous variable, number of concussions), HADS anxiety (continuous variable), HADS depression (continuous variable), SF-12 MCS (continuous variable), SF-12 PCS (continuous variable), and primary predictor of self-reported mental health disability. We then created a logistic regression model to calculate odds ratio and 95% confidence intervals of the relationship between the predictors of interest and the outcome. Using a backwards logistic regression model, the predictors kept in the final model were the previous concussion history, HADS anxiety, and HADS depression. The predictors were statistically significant ($P < 0.05$) and leaving the additional PROM scores in the model caused issues with collinearity and did not increase the variance explained by the model. All analyses were performed with R (R Core Team 2019) [17].

3. Results

The non-self-reporting (controls) and self-reporting (cases) athletes did not differ across demographic variables including age t(331) = 1.48, $P = 0.14$ and concussion history t(331) = −1.906, $P = 0.06$), with the exception of sex ($\chi^2(1) = 12.778$, $P < 0.01$). Further student-athlete characteristics, including PROM scores, are outlined in Table 1.

From the logistic regression model, each previously reported concussion was associated with a 46% increase of self-reporting a mental health disability ($P < 0.01$, 95% CI 91.7%, 51.8%). A one-point increase on the HADS anxiety subscale increased the odds of self-reporting a mental health disability by 1.29 times ($P < 0.01$, 95% CI 1.18, 1.41) and 1.19 times ($P < 0.01$, 95% CI 1.09, 1.30) on the HADS depression subscale.

4. Discussion

This study identified that student-athletes with the previous history of concussion or a prior mental health condition were associated with higher risk of current mental health disability. The increased risk for elevated mental health scores for each previous concussion is over 46%. This finding is similar to the previous research conducted in 12–17-year-old athletes, with prior concussion history putting them at 3.3 times higher risk for current depression than those without a concussion history [5].

A prior survey found that approximately 20% of student-athletes reported a mental health disability [12]. In the present sample, only 15% self-reported a mental health disability. Following concussion, depression and anxiety complaints are common [3].

Table 1. Participant characteristics.

Variable	Total (*n*=333)	Group		Statistic	
		Non-Self-Reporting (*n*=283)	Self-Reporting (*n*=50)	*P*-value	Effect Size
Male	220 (66%)	198 (70%)	22 (44%)	0.01*	0.003
Age (years)	20.60 (1.97)	20.67 (1.99)	20.22 (1.79)	0.14	1.96
Previous concussions	0.67 (1.08)	0.63 (1.06)	0.94 (1.15)	0.06	1.08
HADS					
Anxiety subscale	4.95 (3.77)	4.33 (3.27)	8.50 (4.41)	<0.01**	−1.21
Depression subscale	1.97 (3.04)	1.55 (2.34)	4.34 (4.88)	<0.01**	−0.97
HADS total	6.92 (5.49)	5.88 (4.50)	12.84 (6.78)	<0.01**	−1.42
SF-12					
Mental Component	18.72 (1.47)	18.76 (1.40)	18.48 (1.83)	0.21	0.19
Physical Component	13.04 (1.15)	12.98 (1.12)	13.42 (1.28)	0.01*	−0.39
SF-12 total	31.73 (1.97)	31.73 (1.91)	31.70 (2.33)	0.92	0.02

Variables expressed as mean (SD) except male expressed as *n* (%). HADS: Hospital Anxiety and Depression Scale, SF-12: Short Form 12. *Significant at *P*<0.05, **P*<0.001

Student-athletes with prior mental health conditions self-disclosed higher mental health scores during baseline concussion testing. Although these results were statistically significant, the odds ratios are suggestive of further research needing to be done in this area.

The results of this study are similar to the previous research on collegiate student-athletes' attitudes and intention to seek mental health services [18]. Student-athletes with positive attitudes toward seeking mental health services had greater intentions toward getting care [18]. However, stigma surrounding mental health care can be a barrier to many receiving care, with only approximately 10% of those experiencing anxiety and depression seeking care [19,20]. Decreasing stigma (e.g., exposure to mental health disorders, education) has been shown to be an effective way to improve both attitudes and intentions to seek care [21].

PROM use by mental and health-care providers is seen as beneficial for increasing patient outcomes, adding to clinical judgment, and increasing communication, though wide-spread adoption is lacking with only 21.7% of athletic trainers reporting PROM application in their practice [9,22]. Region specific questionnaires were most frequently used, which identify patient perceptions of a particular injury or disease. However, generic measures, like the SF-12, were endorsed by 60% of those using PROMs and give a better overall picture of general and mental health. Identifying pre-injury mental health disabilities may allow for early intervention, better patient outcomes, and implementing individualized treatment and rehabilitation protocols after injury for these student-athletes.

This study is not without limitations. The sample was recruited from a collegiate student-athlete population at one point in their collegiate careers. Changes in mental health may be seen not only across a single academic year but across their time in college. Longitudinal studies capturing clinical data over a longer duration may identify changes in mental health over collegiate careers and as individual situations change (e.g., post-injury, freshman vs. senior year). In addition, both predictive and outcome data were obtained by self-report. Student-athletes may not have been forthcoming about health history or not answered the PROMs honestly. Verifying patient information against available medical records may improve reliability of self-reported information.

5. Conclusion

PROMs are a convenient, time-efficient, and cost-effective method to identify and track individuals' mental health over time and identify potential mental health disabilities. The findings of this study suggest that student-athletes with the previous concussion history and higher PROM scores are more likely to have a history of mental health disability. Health-care professionals can identify baseline medical history for individuals that may be at higher risk for mental health disability and start conversations regarding referrals to other appropriate health-care professionals as necessary.

Acknowledgments

Conflict of Interest

The authors have no conflict of interests to disclose.

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