Evaluation of Educational Intervention on Concussion Knowledge and Behaviors in High School Athletes

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ABSTRACT

Purpose: Evaluate the effectiveness of the Barrow Brainbook (BBB) concussion education program as a tool to increase concussion knowledge among Arizona high school athletes and to modify attitudes and behaviors regarding concussion.

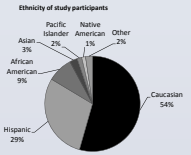
Methods: A cross sectional study of Arizona high school athletes utilizing a 31 question multiple-choice de-identified survey. Attitude, knowledge, and behavior questions, as well as sport and level of participation were analyzed using the Wilcoxon Rank Sum test. Means between students who had participated in BBB and those who had not were analyzed using a two-way ANOVA. Linear regression was used to determine if there was a relationship between number of years since completing BBB and concussion knowledge.

Results: Surveys were distributed to 382 student athletes with 363 of those being completed. 224 students participated in BBB (62%). Knowledge and behaviors regarding concussion were not statistically significant when comparing students who had and had not participated in BBB. Those who participated in BBB scored more poorly on questions regarding attitudes about concussion than those who had not ($p=0.033$). Subsequent two-way ANOVA testing showed that students who sustained a concussion scored worse ($p<0.01$) while completing BBB did not significantly affect attitude ($p=0.399$) when history of a concussion was brought in to the analysis. 90 students (25%) reported sustaining a concussion. Football and varsity level participation were significant for a higher mean number of concussions ($p<0.05$, $p<0.05$). There was no relationship between time since taking BBB and concussion knowledge (R^2 was 0.007).

Conclusions: In this study, there was no evidence to show that participating in the BBB program improved concussion knowledge, attitudes, or behaviors. Number of years since taking BBB was not a good predictor of concussion knowledge. Students who played football and participated at a varsity level were significantly more likely to sustain a concussion. Sustaining a concussion was associated with a higher attitude risk sum score.

Significance: This is an evaluation of an educational tool specifically designed for adolescents that demonstrated no statistically significant change in increasing knowledge or modifying attitudes and behaviors in a population of high school athletes in Arizona.

Key Words: Barrow Brainbook (BBB), concussion, educational intervention



PURPOSE AND BACKGROUND

The purpose of this study is to evaluate the effectiveness of the Barrow Brainbook program, a mandatory educational intervention for Arizona Interscholastic Association (AIA) member high school athletes in Arizona, in increasing concussion knowledge and modifying attitudes and behaviors related to concussion.

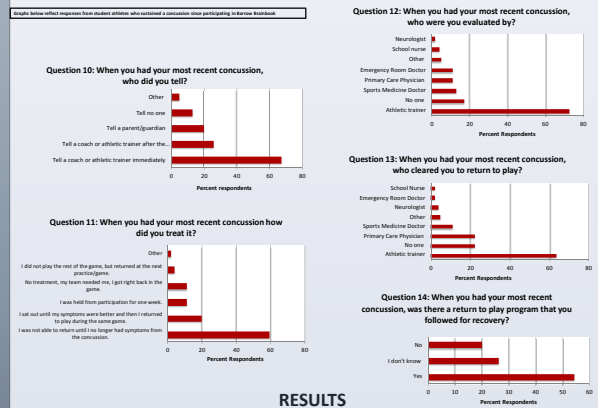
Sport related concussions affect nearly 300,000 young Americans yearly and account for 8.9% of all high school athletic injuries[1]. Appropriate concussion management includes immediate removal from play and rest until a full evaluation can be performed by a qualified healthcare professional[2]. If an athlete does not cease participation after a head injury, continued play can lead to prolonged recovery, coma, or death. An estimated 900 deaths occur nationally every year due to sport and recreational traumatic brain injuries[3].

The importance of concussion knowledge and safety in sports led to the development of multiple educational interventions. The BBB program, created by the Barrow Neurological Institute in 2011, is a web based learning tool. Designed specifically for high school athletes, it provides information on how to prevent, recognize, and respond appropriately to concussions. Students must score at least 80% on the BBB program posttest to be eligible to participate in AIA sponsored high school sports in Arizona.

The first aim of this project was to evaluate the effectiveness of the BBB educational program in providing student athletes with concussion knowledge. The second aim was to evaluate the effectiveness of this program in promoting appropriate concussion related attitudes and behaviors in student athletes.

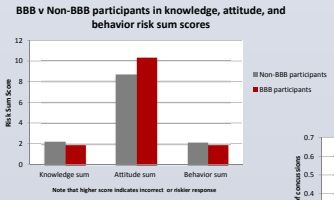
METHODS

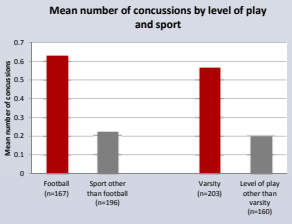
This is a prospective cross sectional study of Arizona high school and incoming 8th grade student athletes, including students who have and have not participated in the BBB program. The study instrument is a multiple-choice de-identified survey with 31 questions addressing demographics, sport participation, concussion history, knowledge, attitudes, and behaviors. The students who had sustained a concussion since taking BBB also answered questions about when their concussion occurred, reporting their concussion, if they stopped playing immediately, who cleared them to return to play, and whether there was a return to play program that was followed for recovery. Surveys were administered at high school sports physicals from 2014 to 2015. Knowledge, attitude, and behavior was analyzed by weighting responses to give overall score based on degree of risk. Sums of attitude, knowledge, and behavior sections, as well as sport and level of participation were analyzed using the Wilcoxon Rank Sum test. For significant results, two-way ANOVA testing was used. Linear regression was used to compare years since taking the BBB program with knowledge sum.

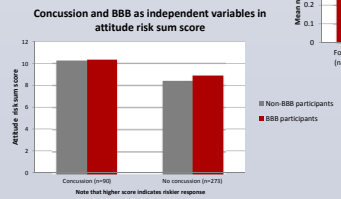


RESULTS

Surveys were distributed to 382 student athletes with 363 of those being completed. 224 students participated in BBB (62%). 90 students (25%) reported sustaining a concussion. Students who participated in BBB demonstrated higher risk sum scores regarding attitudes about concussion over those who had not participated in BBB ($p=0.033$). A two-way ANOVA test evaluating concussion and BBB participation as independent variables demonstrated that more of the variability in the increased attitude risk sum score was due to sustaining a concussion ($p<0.01$) rather than BBB participation ($p=0.399$). Knowledge sum between students who had and had not taken BBB was not significant ($p=0.086$). Behavior risk sum was also not significant between the two groups ($p=0.177$). A greater mean number of concussions was found for athletes who played football over those who did not play football ($p<0.05$) and for athletes who played at the varsity level ($p<0.05$). There was no statistically significant linear relationship between knowledge sum and years since taking BBB ($R^2 = 0.007$).







CONCLUSIONS

The purpose of an educational intervention is ultimately to promote a positive change in behavior. One aspect of this study was directed at students that sustained a concussion after taking BBB to evaluate if they engaged in appropriate concussion management. The majority of students reported their concussion to a coach, athletic trainer, or parent. However, 13% (n=6) did not report a suspected concussion to anyone. In addition, 17% (n=8) of students were not evaluated by any health professional after their injury. Only 59% (n=27) of student athletes that sustained a concussion were not able to return to play until they were asymptomatic. 11% (n=5) had no treatment, and a surprising 20% (n=9) of students were allowed to return to play in the same game when they reported that their symptoms were better. This is concerning given that repeat injury in close proximity to a previous injury puts the athlete at risk of more severe symptoms and prolonged recovery[4].

In comparing concussion knowledge, attitudes, and behaviors between students that had taken BBB and students who had not, there was no significant difference. In addition, there was no relationship between concussion knowledge and years since taking BBB. Furthermore, students who played football and participated at a varsity level were significantly more likely to get a concussion. Sustaining a concussion was associated with riskier attitudes regarding concussion management, although it is unclear whether students with riskier attitudes are more likely to engage in practices leading to head injury or whether having a concussion leads to riskier behaviors in the future.

These findings are reflective of similar studies showing that educational interventions are not as effective as hoped in changing attitudes and behaviors[5]. Although providing information on how to prevent, recognize, and manage concussions is important, this study did not demonstrate that BBB increases knowledge regarding concussion identification and management. There was also no significant difference between participants and non-participants in changing attitudes or behaviors of athletes regarding sport related concussion.

Education is likely only a small, but necessary piece of modifying behavior in student athletes. The unfortunate reality is that athletes are not changing their behavior. Other factors that likely contribute are teammates' and coaches' perceptions of concussions and coaches' expectations of their players. A new direction of concussion education should be focused on changing the culture in sports.

LIMITATIONS

Several limitations of this study are related to recall bias, inherent in survey based studies. Students that did not remember taking BBB likely reported that they did not participate. This study was a de-identified study without a clear way to verify athletes who did not participate in BBB. We suspect that BBB participation was underreported by student athletes as this educational program has been required for participation in AIA sponsored high school sports since 2012. The large number of non-participants was not expected and underreporting could have a significant impact on the results of this study. Additionally, student athletes commonly confuse computerized baseline concussion testing with BBB, which could lead to misclassification of participants. Another bias could have occurred if a student was unsure if they did or did not sustain a concussion. These students responded 'maybe' and were placed into the concussion group.

Another limitation of this study is the lack of concussion management questions for non-BBB participants who sustained a concussion. Questions regarding evaluation and treatment of concussion were directed only to students that had taken BBB. Due to the mandatory participation requirement, it was not expected in the initial study design to have a large number of student athletes in the non-BBB group. Including questions regarding the management of concussions to all participants would have allowed a comparison of BBB participants to non-participants, which would have been a valuable analysis.

An additional limitation is with the population of students. Although the sample of students that participated was demographically representative of Arizona state high schools in terms of ethnicity, this was not a randomized sample. High schools were chosen based on availability of sports physical days, agreement with athletic administrators, and sports schedules.

REFERENCES

1. Noble JM, Hesdorffer DC. Sport-related concussions: A review of epidemiology, challenges in diagnosis, and potential risk factors. *Neuropsychol Rev*. 2013.

2. Alla S, Sullivan SJ, McCrory P, Hale L. Spreading the word on sports concussion: Citation analysis of summary and agreement, position and consensus statements on sports concussion. *Br J Sports Med*. 2011;45(2):132-135.

3. Conder RL, Conder AA. Sports-related concussions. *N C Med J*. 2015;76(2):89-95.

4. Harmon KG, Drezner JA, Gammons M, et al. American medical society for sports medicine position statement: Concussion in sport. *Br J Sports Med*. 2013;47(1):15-26.

5. Kurowski, B. G., Pomerantz, W. J., Schaiper, C., Ho, M. and Gittelman, M. A. Impact of preseason concussion education on knowledge, attitudes, and behaviors of high school athletes 2015