



Investigating Disparities in High School Athletes' Attitude Toward Concussion and Predictors of Continuing Play

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# Investigating Disparities in High School Athletes' Attitude Toward Concussion and Predictors of Continuing Play

## Abstract

**Objective:** Studies related to attitudes of concussion have been growing in athletic populations. While racial and socioeconomic disparities exist in knowledge and awareness of concussion, it remains unclear the effect of disparities on attitudes of concussion and reporting behaviors. The purpose of this study was to examine racial and socioeconomic disparities on attitudes towards concussion and the decision to remain in play with a suspected concussion.

**Design:** This cross-sectional study included 577 athletes between the ages of 13-19 ( $16.0 \pm 1.2$ ) years from 14 high schools. Participants completed a knowledge and attitudes instrument assessing general attitudes of concussion using 7 Likert-scale attitude questions followed by 2 additional questions assessing the decision to continue play while symptomatic. Differences in attitudes of concussion between race and socioeconomic school type were examined using independent t-tests. A multivariable linear regression model was utilized to determine which demographic factors were associated with athletes' attitude scores. Multivariable logistic regression models were utilized to determine what demographic variables were associated with athletes' continuation of play in a practice or a game.

**Results:** Differences in attitude scores between race were observed, with black athletes demonstrating lower scores than white athletes ( $p=.04$ ) and sex (OR: 0.59, 95% CI [0.36,0.96],  $p=.03$ ) were, with females less likely to remain in a practice than males. Further, race and socioeconomic school type were not significantly associated with remaining in a game; however, attitude (OR: 0.97, 95% CI [0.95,0.99],  $p=.01$ ) and sex (OR: 0.56 95% CI [0.35,0.90],  $p=.02$ ) were, with females less likely to remain in a game than males.

**Conclusions:** Disparities exist between race and socioeconomic school type on attitude of concussion. Black athletes and athletes attending Title I high schools had poorer attitude scores compared to white athletes and athletes attending non-Title I schools. Race was significantly associated with lower concussion attitude scores. The poorer, yet moderate concussion attitude scores suggest concussion education efforts be concentrated towards closing the disparity gap. Further, addressing concussion attitudes would likely also help to shift athletes' decisions to remain in a practice or game while symptomatic.

## Keywords

concussion attitudes, health disparities, high school athletes, reporting behaviors, public health

## Cover Page Footnote

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## **Investigating Disparities in High School Athletes' Attitude Toward Concussion and Predictors of Continuing Play**

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### **ABSTRACT**

**Objective:** Studies related to attitudes of concussion have been growing in athletic populations. While racial and socioeconomic disparities exist in knowledge and awareness of concussion, it remains unclear the effect of disparities on attitudes of concussion and reporting behaviors. The purpose of this study was to examine racial and socioeconomic disparities on attitudes towards concussion and the decision to remain in play with a suspected concussion.

**Design:** This cross-sectional study included 577 athletes between the ages of 13-19 ( $16.0 \pm 1.2$ ) years from 14 high schools. Participants completed a knowledge and attitudes instrument assessing general attitudes of concussion using 7 Likert-scale attitude questions followed by 2 additional questions assessing the decision to continue play while symptomatic. Differences in attitudes of concussion between race and socioeconomic school type were examined using independent t-tests. A multivariable linear regression model was utilized to determine which demographic factors were associated with athletes' attitude scores. Multivariable logistic regression models were utilized to determine what demographic variables were associated with athletes' continuation of play in a practice or a game.

**Results:** Differences in attitude scores between race were observed, with black athletes demonstrating lower scores than white athletes ( $p < .01$ ), representing poorer attitudes toward concussions. Individuals from Title I schools had lower attitude scores compared to individuals from non-Title I schools ( $p < .01$ ). Race was significantly associated with attitude score ( $p = .02$ ) after adjusting for sex and socioeconomic school type. Race and socioeconomic school type were not significantly associated with remaining in a practice; however, attitude (OR: 0.98, 95% CI [0.95, 0.99],  $p = .04$ ) and sex (OR: 0.59, 95% CI [0.36, 0.96],  $p = .03$ ) were, with females less likely to remain in a practice than males. Further, race and socioeconomic school type were not significantly associated with remaining in a game; however, attitude (OR: 0.97, 95% CI [0.95, 0.99],  $p = .01$ ) and sex (OR: 0.56, 95% CI [0.35, 0.90],  $p = .02$ ) were, with females less likely to remain in a game than males.

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**Conclusions:** Disparities exist between race and socioeconomic school type on attitude of concussion. Black athletes and athletes attending Title I high schools had poorer attitude scores compared to white athletes and athletes attending non-Title I schools. Race was significantly associated with lower concussion attitude scores. The poorer, yet moderate concussion attitude scores suggest concussion education efforts be concentrated towards closing the disparity gap. Further, addressing concussion attitudes would likely also help to shift athletes' decisions to remain in a practice or game while symptomatic.

**Keywords:** concussion attitudes, health disparities, high school athletes, reporting behaviors, public health

### INTRODUCTION

Concussion remains an omnipresent public health concern, as such, concussion education efforts over the last two decades have aimed to increase athletes' knowledge of concussion and shift unsafe attitudes surrounding concussion. Continuing play with a suspected concussion, resulting in prolonged symptomology or second impact syndrome, can be a consequence of an unsafe attitude toward concussion. Thus, a primary outcome in the advancement of concussion education is to modify attitudes, perceptions and reporting behaviors by increasing understanding and knowledge related to the injury, signs and symptoms, and the psychological and physiological implications of a concussion (Register-Mihalik, Guskiewicz, et al., 2013). The measurement of concussion attitude has psychometrically been more opinion-based regarding how athletes feel about concussions and concussion management, and, a way to gauge athletes' beliefs about the seriousness of concussions (Rosenbaum & Arnett, 2010). Attempts to understand the implications of knowledge and attitudes of concussion have demonstrated that high-school-aged athletes are relatively knowledgeable about signs and symptoms of concussion (Cournoyer & Tripp, 2014; Register-Mihalik, Guskiewicz, et al., 2013; Wallace, Covassin, Nogle, Gould, & Kovan, 2017), however, there is inconsistency in athletes' attitudes and perceptions of concussion (Baker, Devitt, Green, & McCarthy, 2013; Delahunty, Delahunt, Condon, Toomey, & Blake, 2015; Kurowski, Pomerantz, Schaiper, & Gittelman, 2014; Mrazik, Perra, Brooks, & Naidu, 2015; Register-Mihalik, Linnan, et al., 2013). While research has shown that increased concussion knowledge and more favorable concussion attitudes have had a positive effect on reporting in high-school-aged athletes (Kurowski et al., 2014; Register-Mihalik, Linnan, et al., 2013), there are demographic disparities that exist which may influence overall scores in concussion knowledge, attitudes and reporting behaviors among different groups.

Studies investigating concussion knowledge and key demographic factors of race and socioeconomic status (Donnell, Hoffman, Sarmiento, & Hays, 2018) have demonstrated disparities. White high school athletes have been shown to be more knowledgeable than African-American high school athletes about concussion and associated signs and symptoms (Wallace, Covassin, & Moran, 2018). Furthermore, African-American athletes with access to an athletic trainer were more knowledgeable of concussion than African-American athletes without access to an athletic trainer (Wallace, Covassin, & Moran, 2018). Moreover, income level disparities are linked to access to concussion education and adolescent athletes from families of higher income levels are twice as likely to have learned what to do if they have a concussion (Donnell et al.,

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2018). These findings are also supported by previous work that discovered high school athletes with access to an athletic trainer have higher concussion knowledge than those without access, further highlighting the potential socioeconomic disparities, as many low-income schools in urban communities may not have funding available to employ an athletic trainer (Wallace, Covassin, Nogle, et al., 2017). Despite these differences, there is a dearth of literature on racial and socioeconomic disparities on concussion attitudes and it remains unclear the role race and socioeconomic disparities have on concussion attitudes.

Attitudes are explained as important factors that are directly related to behaviors that may influence outcomes, as well as the person's evaluation of those outcomes, both positively and negatively (Fishbein, 1975). For example, if an athlete has less safe (negative) perceptions of the dangers, as well as short and long-term consequences of concussion, meaning the athlete believes the dangers and consequences are minimal, the athlete may be less likely to report their symptoms or injury. Conversely, if athletes have more safe (positive) attitudes related to concussion, believing that concussions are to be taken seriously and cautiously, the athlete may be more likely to report concerns related to signs and symptoms or dangers of playing with a concussion. Positive concussion attitude is specifically defined as having a higher or safer belief that a concussion is a serious injury or a medical concern and perceiving that reporting a concussion injury is a positive behavior (Register-Mihalik, Guskiewicz, et al., 2013). Recent investigations into attitudes of concussion in high-school-aged athletes revealed positive attitude scores were directly associated with decreases in the proportion of athletes who continued to participate in sport while remaining symptomatic from a concussion (Register-Mihalik, Guskiewicz, et al., 2013).

Literature explaining the relationship between race, socioeconomic status and continuation of play with a suspected concussion is lacking. However, negative trends related to concussion disclosure and reporting have been observed in high school athletes, and athletes have continued participating in sport while still symptomatic from a concussion (Register-Mihalik, Valovich McLeod, Linnan, Guskiewicz, & Marshall, 2017). The vast inconsistencies in attitudes and knowledge may further explain why upwards of 50% of concussions have been suspected to go unreported (McCrea, Hammeke, Olsen, Leo, & Guskiewicz, 2004; Wallace, Covassin, & Beidler, 2017; Wallace, Covassin, Nogle, et al., 2017). Despite educational interventions, common reasons for not reporting a suspected concussion have remained consistent over the last fifteen years and include not thinking the injury is serious or indeed a concussion, not wanting to leave a game, not wanting to let teammates down, and not wanting to be perceived as weak by coaches and teammates (Kroshus, Baugh, Daneshvar, & Viswanath, 2014; Kroshus, Garnett, Hawrilenko, Baugh, & Calzo, 2015; Kroshus, Kubzansky, Goldman, & Austin, 2015; McAllister-Deitrick, Beidler, Wallace, & Anderson, 2020; McCrea et al., 2004; Register-Mihalik, Linnan, et al., 2013; Wallace, Covassin, & Beidler, 2017; Wallace, Covassin, & Moran, 2018).

It has been noted that attitudes may not just be based off of personal and internal influences, but may be driven from external influences such as an athlete's school, team, family or social environment (Kerr et al., 2014; Kroshus et al., 2014; Register-Mihalik, Linnan, et al., 2013). Therefore, it is imperative to understand the influence of demographic factors, such as race and socioeconomic disparities, on attitudes of concussion and continuation of play with a suspected concussion in high-school-aged athletes. The purpose of this study was two-fold. First, this study attempted to determine racial and socioeconomic differences in general concussion attitudes among high school athletes. Moreover, this study aimed to determine if attitude, race (black or

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white) or socioeconomic school type (Title I or non-Title I) predicted whether or not an athlete continued to participate in a practice or game despite experiencing suspected signs and symptoms of concussion.

## **METHODS**

### Participants

The population of interest for this study was comprised of high school athletes between the ages of 13-19 years. Athletes from 14 schools located within two metropolitan areas in the state of Michigan were recruited to participate. Male and female athletes enrolled in the study had to be a participant on the official roster of one of the following sport teams to be eligible for the study: football, girls' and boys' basketball, wrestling, volleyball, gymnastics, cheerleading or boys' soccer. These sport teams were chosen because they were the only sports that were offered at all 14 schools recruited to participate. Participants were not excluded for any pre-existing learning disabilities, attention disorders, or any previous history of concussion. Participants were only excluded if they were not enrolled in one of the previously discussed sports.

Out of the 14 schools, nine were classified as urban, Title I schools and five were in suburban communities that did not have a Title I status. Title I school status was used as the socioeconomic status school type variable for participants. Because Hollingshead index criteria, including maternal and paternal incomes, work status, and educational history would be too difficult to collect from a high school population (high potential high-school-aged athletes are unfamiliar with specific details of parent/guardian's income and educational history), the federal Title I school status classification was chosen by the study team. Federal Title I status given to schools indicates a higher percentage in attendance of students living in poverty and in communities of the lowest socioeconomic status. The vast majority of students attending Title I schools qualify for federal free-and-reduced lunch plans.

### Instrumentation

A single survey served as the primary instrument used for the study. The general concussion attitude construct used on this instrument was created by Register-Mihalik and colleagues (Register-Mihalik, Guskiewicz, et al., 2013). The attitude and reporting criteria used for this study was initially collected as part of a larger study, of which the instrument included five sections that comprised of athlete demographics, knowledge of concussion, self-awareness of concussion, reporting behaviors, and general attitude toward concussion. A total of five demographic questions were included in the survey comprising of race, age, sex, grade in school, and sport. Athlete general attitude of concussion was assessed through a series of seven 7-point Likert scale questions (1= not serious/important, 4 = moderately important, 7= very serious/important). It is important to know that metric median score of 4.0 did not comprise of an indifferent attitude, such as 'neither agree or disagree', rather a moderate attitude. See Table 1 referencing the seven questions. The instrument was tested for face validity by content experts and the Cronbach  $\alpha$  calculated for attitude construct was 0.80, thus the instrument was determined to be valid and reliable (Register-Mihalik, Guskiewicz, et al., 2013). General attitude of concussion scores were calculated by summing athletes' responses to the 7-Likert scale questions. General attitude scores could range from 7-49 and higher scores indicated a more positive or advantageous general attitude toward concussion. Advantageous attitude indicated that athletes' viewpoint on

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concussion was more safe or serious. The final two questions of the survey gauged an individual's continuation of play by asking each athlete if he/she ever continued to play in a game or practice even though he/she was experiencing signs and symptoms of concussion. Continuation of play in a practice and continuation of play in a game were separate binary (yes/no) questions.

**Table 1: General Attitude of Concussion Questions**

1. Rate on a scale of 1-7 how serious you think it is when you experience a headache and dizziness following a blow to the head or body.
2. Rate on a scale of 1-7 how important you think it is not to participate in physical activity (game or practice) when experiencing signs and symptoms of concussion.
3. Rate on a scale of 1-7 how important you think it is to be informed about how concussions happen.
4. Rate on a scale of 1-7 how important you think it is to be informed about how concussions can be prevented.
5. Rate on a scale of 1-7 how important you think it is to be informed about what to do if you have a concussion.
6. Rate on a scale of 1-7 how important you think it is to report possible concussion symptoms to a medical professional (doctor, athletic trainer, etc.) or your coach.
7. Rate on a scale of 1-7 your level of agreement with the following statement: In general, athletes are under-educated (don't know enough) about concussions.

**Procedures**

Institutional Review Board approval was obtained from Michigan State University. Schools and districts were first contacted via email, and then a follow up telephone call. After all school and district approvals were obtained, contact with either the athletic trainer (AT) or athletic director (AD) was made at each school prior to the start of the study. All communication with each school was directed through the AT or AD. The AT and AD also served as the liaison for any communication with coaches and parents.

Upon approval at each school, school information forms were completed at each school by a designated school contact (either AT or AD) serving as the research contact. School information forms included the AT, AD, and school contact information. The AT and AD helped to arrange dates to distribute parent consents and collect survey responses. The principal investigator attended most parent meetings and all survey distributions at each school. Survey distribution and completion took place at each school during each competitive sport season (Fall, Winter, Spring). All meetings were performed using a standardized script to ensure similar instructions for all participants. ATs and ADs were not present during survey completion.

Parental consent forms were required to be signed and returned for an athlete to participate. On the same date of survey distribution, participant assent was obtained prior to the athlete completing the survey. All athletes at each school had the opportunity to voluntarily participate. The instrument was a one-time administered paper and pencil survey that took participants approximately 10-15 minutes to complete. Participants were allowed to skip questions and were able to withdraw at any time.

**Statistical Analysis**

General descriptive (i.e., means, standard deviation, frequencies) and inferential statistics were used to summarize all demographic data, general attitude of concussion scores, and self-reporting remaining in a practice or game with a suspected concussion. Further, chi-square

calculations were conducted to determine the distribution of participants by race and socioeconomic school type, socioeconomic school type and sex, race and sport, and by race and sex. Chi-square calculations were also conducted to identify the proportion of athletes who indicated remaining in a practice or game, by race and socioeconomic school type. Independent samples t-tests were conducted to examine racial and socioeconomic school type differences in general attitude toward concussion. Racial differences were examined between black and white athletes and socioeconomic school type differences were examined between athletes attending Title I and non-Title I schools. A multivariable linear regression analysis was completed to determine how factors (race, sex, school type) independently explained attitude scores. To assess the association of race and socioeconomic school type on remaining in a practice or remaining in a game with a suspected concussion, separate univariable logistic regression analyses were completed. Following, adjusted analyses using a multivariable logistic regression model was used to investigate if demographic factors (race, socioeconomic school type, sex) or attitude were associated with remaining in play in a practice setting after sustaining a suspected concussion. Finally, a multivariable logistic regression model was used to investigate if demographic factors (race, socioeconomic school type, sex) or attitude were associated with remaining in play in a game setting after sustaining a suspected concussion. For each logistic regression model, the outcome variable was either remaining in a practice (yes/no) or remaining in a game (yes/no). Collinearity diagnostics were conducted, primarily to address the severeness of collinearity of the independent variables of race and socioeconomic school type. The variance inflation factor (VIF) calculated was 2.7, and it is suggested that a VIF value below 4 is not of concern (O'Brien, 2007). Statistical analyses were set a priori  $p \leq .05$ . All analyses were conducted using the Statistical Package for the Social Sciences version 26 (SPSS: IBM).

## RESULTS

Participants were 577 high school athletes, aged 13-19 years ( $16.02 \pm 1.22$ ). Table 2 outlines all demographic data. Chi-square analyses revealed significant differences between socioeconomic school type on race (i.e., black athletes attended Title I schools significantly more than white athletes and white athletes attended non-Title I schools significantly more than black athletes;  $X^2 = 349.38$ ;  $p < .01$ ). Chi-square analyses revealed significant differences between socioeconomic school type groups on sex ( $X^2 = 44.28$ ,  $p < .01$ ), with males representing significantly more of the Title I school students. Similarly, significant differences were found between race groups on sport ( $X^2 = 113.33$ ,  $p < .01$ ) and sex ( $X^2 = 72.49$ ,  $p < .01$ ) with significantly more black athletes being male participating in football and boys' basketball. There were significantly more white athletes participating in volleyball and soccer.

**Table 2: Participant Demographics (n=577)**

	n (%)
Sex	
Male	417 (72.3%)
Female	159 (27.6%)
School Type	
Title I	367 (63.6%)

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Non-Title I	210 (36.4%)
<b>Race</b>	
White	205 (35.5%)
Black	372 (64.5%)
<b>Sport</b>	
Football	313 (54.2%)
Volleyball	79 (13.7%)
Boys' Basketball	68 (11.8%)
Girls' Basketball	49 (8.5%)
Boys' Soccer	25 (4.3%)
Wrestling	10 (1.7%)
Girls' Soccer	9 (1.6%)
Cheerleading	9 (1.6%)
Gymnastics	7 (1.2%)
Other	7 (1.2%)
<b>Grade</b>	
9 <sup>th</sup>	103 (17.9%)
10 <sup>th</sup>	146 (25.3%)
11 <sup>th</sup>	146 (25.3%)
12 <sup>th</sup>	178 (30.8%)

Concussion Attitudes:

An independent samples t-test revealed significant differences between race groups (black vs. white) on attitude scores ( $t_{(516.44)}=4.50$ ;  $p<.01$ , 95% CI [2.14,5.46]). Black athletes reported significantly lower attitude scores ( $36.22\pm 11.33$ ) than white athletes ( $40.02\pm 8.68$ ). Significant differences between athletes in non-Title I, suburban schools versus Title I, urban schools were also noted on attitude scores ( $t_{(496.24)}=-3.18$ ;  $p<.01$ , 95% CI [-4.49,-1.06]), with athletes in non-Title I schools scoring significantly higher ( $39.34\pm 9.41$ ) than athletes in Title I schools ( $36.56\pm 11.13$ ). See Table 3 for the means and totals for demographic differences in attitudes. In an attempt to account for potential sex and socioeconomic school type differences between groups, a multivariable linear regression analysis was used to assess the predictive power of race, sex, and socioeconomic school type on attitudes towards concussions. The overall model was significant ( $F=7.09$ ;  $p<.01$ ) with the absolute value of the standardized coefficient for race ( $\beta=.16$ ) being greater than for sex ( $\beta=.09$ ), and socioeconomic school type ( $\beta=.02$ ), suggesting race accounted for a greater amount of the variability in attitude scores. Moreover, race was the only significant variable ( $p=.02$ ) in the model (Table 4).

**Table 3: Athlete General Attitude Means and Totals**

Question	Total Mean (SD)	Black Athletes Mean (SD)	White Athletes Mean (SD)	Title I Mean (SD)	Non-Title I Mean (SD)
1	4.96 (1.66)	4.87 (1.74)	5.12 (1.50)	4.92 (1.71)	5.02 (1.58)
2	5.34 (1.76)	5.16 (1.80)	5.66 (1.64)	5.18 (1.78)	5.62 (1.68)
3	5.87 (1.48)	5.69 (1.60)	6.17 (1.18)	5.76 (1.56)	6.05 (1.30)
4	5.84 (1.53)	5.62 (1.65)	6.22 (1.22)	5.67 (1.61)	6.14 (1.33)
5	6.04 (1.48)	5.83 (1.61)	6.41 (1.12)	5.88 (1.57)	6.31 (1.26)
6	5.94 (1.45)	5.72 (1.57)	6.33 (1.11)	5.73 (1.56)	6.29 (1.15)
7	4.95 (1.72)	4.92 (1.74)	5.00 (1.69)	4.97 (1.71)	4.93 (1.73)
<b>Total</b>	37.57 (10.61)	36.22 (11.33)	40.02 (8.68)	36.56 (11.13)	39.34 (9.41)

**Table 4: Linear Regression Analysis of Concussion Attitudes and Demographic Variables**

	B	SE B	$\beta$	t	p
Constant	39.66	2.83			.00
Sex	1.63	1.06	.09	1.54	.13
Race	-3.42	1.49	-.16	-2.30	.02
School Type	-.63	1.44	-.02	-.43	.66

$\beta$ =standardized coefficient

**Continuing Play in Practice or Game:**

Chi-square analyses assessing the proportion of athletes that remained in practice with a suspected concussion by race ( $p=.75$ ) and socioeconomic school type ( $p=.71$ ) were not statistically significant. Further, the proportion of athletes who remained in a game with a suspected concussion by race ( $p=.33$ ) and socioeconomic school type ( $p=.35$ ) were not statistically significant. These data are outlined in Table 5. Univariable logistic regression analyses to assess the association of race and socioeconomic school type on remaining in play in a practice revealed no significant results. Results of the multivariable logistic regression analysis to assess the variables of race, socioeconomic school type, sex, and attitude score on the athlete's self report of continuing play in a practice with a suspected concussion was significant ( $X^2=10.90$ ;  $p=.03$ ). The significant variables in this model that identified whether or not an athlete remained in practice with a suspected concussion were attitude (OR: 0.98, 95% CI [0.95,0.99],  $p=.04$ ) and sex (OR: 0.59, 95% CI [0.36,0.96],  $p=.03$ ) with females less likely to remain in a practice than males. See Table 6 for all regression output. Finally, univariable logistic regression analyses to assess the association of race and socioeconomic school type on remaining in play in a game revealed no significant results. A multivariable logistic regression analysis was used to assess the variables of race, socioeconomic school type, sex, and attitude score on the athletes' self report of continuing play in a game with a suspected concussion. The overall model was significant ( $X^2=14.22$ ;  $p=.01$ ). Further, the only significant variables in the model were attitude (OR: 0.97, 95% CI [0.95,0.99],

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$p=.01$ ) and sex (OR: 0.56 95% CI [0.35,0.90],  $p=.02$ ) with females less likely to remain in a game than males. See Table 7 for all regression output.

**Table 5: Distribution of Athletes Continuing Play in Practice or Game by Race and Socioeconomic School Type**

Question	Total n (%)	Black Athletes n (%)	White Athletes n (%)	Title I n (%)	Non-Title I n (%)
Remained in a Game	162 (29.7%)	102 (29.4%)	59 (29.6%)	98 (28.6%)	63 (31%)
Remained in a Practice	139 (25.4%)	93 (26.8%)	46 (23.0%)	89 (25.9%)	50 (24.5%)

**Table 6: Multivariable Logistic Regression Analysis of Demographic/Attitude Variables and Staying in a Practice with a Suspected Concussion**

Variable	Unadjusted Model OR (95% CI)	Adjusted Model <sup>b</sup> OR (95% CI)
White	Ref	--
Black	1.23 (0.82,1.84)	1.11 (0.57,2.17)
Title I School	Ref	--
Non-Title I School	0.93 (0.62,1.38)	1.21 (0.64,2.30)
Male	--	--
Female	--	0.59 (0.36,0.96) <sup>a</sup>
Attitude (continuous)	--	0.98 (0.95,0.99) <sup>a</sup>

<sup>a</sup> significant at the  $p<.05$  level

<sup>b</sup> adjusted for sex, socioeconomic school type, attitude score

**Table 7: Multivariable Logistic Regression Analysis of Demographic/Attitude Variables and Staying in a Game with a Suspected Concussion**

Variable	Unadjusted Model OR (95% CI)	Adjusted Model <sup>b</sup> OR (95% CI)
White	Ref	--
Black	1.01 (0.68,1.47)	1.00 (0.53,1.89)
Title I School	Ref	--
Non-Title I School	1.15 (0.79,1.68)	0.93 (0.77,2.62)
Male	--	--
Female	--	0.56 (0.35,0.90) <sup>a</sup>
Attitude (continuous)	--	0.97 (0.95,0.99) <sup>a</sup>

<sup>a</sup> significant at the  $p<.05$  level

<sup>b</sup> adjusted for sex, socioeconomic school type, attitude score

## DISCUSSION

This study set out to determine if differences existed between race and socioeconomic status regarding high school athletes' attitudes toward concussions and the role these attitudes and demographic factors play in terms of participating in a practice or game when an athlete is suspected of having a concussion. While previous work in this area found differences in concussion knowledge as it pertains to race and socioeconomic school type (Wallace, Covassin, & Moran, 2018; Wallace, Covassin, Nogle, et al., 2017), this study is the first to investigate race and the socioeconomic classification of high schools that athletes attend to establish an understanding of how important demographic factors affect concussion attitudes and continuation of play in practices and games with a suspected concussion.

The results revealed there were significant differences between black and white athletes and socioeconomic school types concerning concussion attitudes. According to the findings, black athletes reported lower concussion attitude scores suggesting a poorer attitude towards concussion than their white counterparts. The poorer attitude towards concussion among black athletes reflected a moderate attitude. Participants enrolled in urban, Title I high schools had significantly lower concussion attitude scores than their peers at suburban, non-Title I schools. Although the poorer scores indicated moderate concussion attitudes, these results are warning of disparities that exist between communities. Given previous research that has discovered black students at the high school level represent both a large portion of the overall sport participants, and a larger portion of the student body at schools situated in lower socioeconomic areas, black students were also more likely to participate in sports than counterparts at schools situated in higher socioeconomic areas (Pharr & Lough, 2014). Coupled with the notion that young men and women are encouraged to participate in sport for its inherent health and educational benefits that include, hard work, team work, and self-confidence, (Pedersen & Thibault, 2014) the results of this study suggest that emphasis is needed to ensure that athletes in disadvantaged communities gain a better understanding about the severity of a concussion injury, which may aid in the development of more favorable attitudes about concussion.

The findings support the need for involved concussion training interventions in schools and communities with larger populations of black and economically disadvantaged students who may potentially be lacking sports medicine resources and innovative educational tools regarding concussion. Previous research found that knowledge and attitude both positively affected student-athlete reporting of concussive-like symptoms (Kroshus et al., 2014; Register-Mihalik, Guskiewicz, et al., 2013). Both black and Title I high school athletes in this study demonstrated moderate, yet less safe, attitudes towards concussion compared to white, non-Title I athletes. It is quite possible the more moderate attitudes held by black high school athletes, and Title I school sport participants in this study, may be due to a lack of essential concussion education being provided to those athletes. Further, researchers suggest attitudes about concussion influence behavior (Kroshus et al., 2014). Moreover, it is important to note that the majority of black athletes in this study comprised of a large majority of the athletes attending the lower socioeconomic school type schools. Race and low SES often have additive effects among disenfranchised communities lacking necessary resources such as an athletic trainer (Wallace, Covassin, & Moran, 2018), and unsafe attitudes could heighten the under-reporting of concussion signs and symptoms among athletes in underserved black communities. Attitudes are formed by individual experiences, feelings, and beliefs (Shank, 2015). Thus, it is critically important for the well-being of sport

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participants in marginalized communities that concussion material be effectively delivered in an effort to generate more favorable attitudes.

This investigation into demographic disparities related to general concussion attitude demonstrated that race was a stronger predictor of attitude than sex and socioeconomic school type. Focused and concentrated efforts to provide inherent education about concussions tailored for young athletes from marginalized populations could help to improve concussion attitudes and reporting in both practices and competitions. Among athletes in this study, attitude score was a significant predictor of continuing play in a game and practice with a suspected concussion. These results parallel other studies demonstrating a prevalence of non-disclosure related to not wanting to leave a game, (Chrisman, Quitiquit, & Rivara, 2013; Kerr, Register-Mihalik, Kroshus, Baugh, & Marshall, 2016) or not wanting to lose playing time (McCrea et al., 2004; Wallace, Covassin, Nogle, et al., 2017). As the underreporting of concussions continues to be of grave concern for healthcare professionals, providing education for young athletes from diverse, impoverished and low socioeconomic communities with the most current, up-to-date concussion information may aid in creating a safer environment for all sport participants. Moreover, concussion interventions must include innovative pedagogy that incorporates both internal and external motivators of behavior (Register-Mihalik, Linnan, et al., 2013; Wallace, Covassin, & Beidler, 2018), such as Concussion Bingo (Wallace, Covassin, & Beidler, 2018) or a peer-based education program (Ernst & Kneavel, 2020). These attitude disparities encourage a commitment be made to the health and safety of young student-athlete participants from vulnerable communities by safeguarding them with concussion education interventions that simultaneously target attitude and behavior shifts.

Perhaps another explanation for the more moderate, yet disparate concussion attitudes held by black and Title I school sport participants is rooted in the importance of sport in urban culture. The benefits of sport participation have been well reported, as sport aids in the physical, psychological, emotional, and social development of young women and men (Janssen & Leblanc, 2010; Poitras et al., 2016; Sallis, Prochaska, & Taylor, 2000). Research also asserts that sport helps to perpetuate societal stereotypes that may impact the attitudes of young sport participants, particularly as it relates to the concepts and ideas frequently associated with masculinity; particularly in the black community, black male student athletes have identified concepts such as “toughness,” “strength,” “aggressiveness,” “step up,” and completing challenging tasks as essential components of masculinity (Harris, Palmer, & Struve, 2011). Additionally, researchers have linked Social Comparison Theory to concussion reporting and suggest that individuals likely turn to their comparison group for cues on how to act (McAllister-Deitrick et al., 2020). Thus, if high-school-aged athletes see peers/teammates acting ‘tough,’ about a concussion, they may also associate not reporting a concussion, or playing through the pain of an injury as being ‘tough’ to act in a way consistent with their comparison group. The majority of football athletes and Title I athletes in this study were black males, thus when the aforementioned information is combined with what researchers have defined as an overemphasis of sport in black and underserved communities (Beamon, 2010), it helps to offer another possible explanation for the lower concussion attitude scores held by black and lower socioeconomic school type student-athletes in this study.

Much of the research conducted on concussion knowledge, attitudes and reporting has focused on intrapersonal (sex, concussion knowledge) and interpersonal (others' knowledge/attitudes, external pressure) factors related to non-disclosure compared to

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environmental and policy factors (Kerr et al., 2014). Specifically, mixed modeling methodology demonstrated that athletes who experience pressure from coaches, teammates, parents and fans were more significantly likely to continue playing while experiencing a suspected concussion (Kroshus, Garnett, et al., 2015). The lack of reporting of concussions is a widespread problem within sport and higher among males and former football athletes (Kerr et al., 2016). Our results parallel this previous research as the likelihood of males to remain in a practice or game with a suspected concussion was increased compared to females. However, when looking at the reporting of concussion using the socio-ecological framework, there is a gap that exists in the research investigating environmental (access to concussion prevention materials, sport culture) and policy (concussion legislation) elements of the model (Kerr et al., 2014). Although the demographic factors of socioeconomic school type, and race did not significantly predict whether or not an athlete remained in play while experiencing concussion symptoms, sex did; and, overall 25.4% of athletes reported remaining in play during a practice and 29.7% of athletes reported remaining in play during a game. These results add to the existing narrative of the necessity of educational interventions that address the system and culture within which athletes make decisions about reporting, (Kroshus, Garnett, et al., 2015) markedly in disadvantaged communities.

Although this study sought to develop a better understanding of high school athletes' general attitudes regarding concussion, and continuing in play while potentially experiencing a concussion, it sheds additional light on the health disparities that exist among diverse communities across the United States. Health disparities based on race and socioeconomic status have been well documented (Fiscella, Franks, Gold, & Clancy, 2000; Richardson & Norris, 2010). Previous research has reported racial disparities in concussion knowledge among black high school athletes (Wallace, Covassin, & Moran, 2018); and, according to the results of the current study, concentrated efforts may be needed to also close the disparity gap related to concussion attitude and reporting that exists among communities. Black athletes and athletes attending economically disadvantaged, Title I schools appear to have more subdued attitudes regarding concussion, insinuating there may be a gap in concussion interventions provided to athletes in these communities, as well as negative consequences from lacking access to a health care provider, such as an athletic trainer. Given that previous research has found that black youth tend to experience more severe clinical and functional outcomes after sustaining a brain injury (Haider et al., 2007), it is reasonable to suggest addressing a potential public health issue of concussion-related resources in predominantly urban, black and underserved communities on a larger, national scale.

It is important to note the limitations of this study. First, this study was only conducted within two major cities in one geographic region, thus that must be considered when interpreting and generalizing results. Not all participants completed the survey in the same location. Further, due to the nature of survey instrumentation, there is no guarantee that all participants answered questions truthfully. Lastly, given the differences between group comparisons on sex, efforts were made to control for any sex differences in results.

### CONCLUSION

While the results of this study inform of demographic disparities pertaining to concussion attitude scores, athletes within this study did have a moderate attitude about concussion which is not necessarily a discouraging finding. However, the power of public health education for athletes should not be overlooked or understated in its ability to raise awareness about concussion,

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particularly among black athletes and individuals from lower social economic communities. These disparity differences demonstrate that there is still work to be done and disadvantaged communities could greatly benefit from focused educational interventions to further improve concussion attitudes. Because predominantly black and underserved communities routinely have poorer outcomes following concussion (Haider et al., 2007), and given the findings of the current study suggesting poorer attitudes toward concussions, increased efforts to resource disadvantaged communities with interventions, education and sports medicine personnel to help change the narrative surrounding concussions is recommended to assist in closing disparity gaps.

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