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Examining Gender Bias in the Sport Concussion Assessment Tool 3 (SCAT3): A Differential Item Functioning Analysis in NCAA Sports

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Abstract : As a consequence of sports-related concussions, female athletes have been documented as reporting more symptoms than their male counterparts, in addition to incurring longer periods of recovery. However, the role of sex and its potential influence on symptom reporting and recovery outcomes in concussion management has not been completely explored. The present aims to investigate the relationship between female concussion symptom severity and the presence of assessment bias. The Sport Concussion Assessment Tool 3 (SCAT3), collected by the NCAA and DoD CARE Consortium, was quantified at five different time points post-concussion. N= 1,258 NCAA athletes, n= 473 female (soccer, rugby, lacrosse, ice hockey) and n=785 male athletes (football, rugby, lacrosse, ice hockey). A polytomous Item Response Theory (IRT) Graded Response Model (GRM) was used to assess the relationship between sex and symptom reporting. Differential Item Functioning (DIF) and Differential Group Functioning (DGF) were used to examine potential group-level bias. Interactions for DIF were utilized to explore the impact of sex on symptom reporting among NCAA male and female athletes throughout and after their concussion recovery. DIF was significantly detected after B-H corrections displayed in limited items; however, one symptom, “Pressure in Head” (-0.29, p=0.04 vs -0.20, p =0.04), was statistically significant at both < 6 hours and 24-48 hours. Thus, implies that at < 6 hours, males were 29% less likely to indicate “Pressure in the Head” compared to female athletes and 20% less likely at 24-48 hours. Overall, the DGF suggested significant group differences, suggesting that male athletes might be at a higher risk for returning to play prematurely (logits = -0.38, p < 0.001). However, after analyzing the SCAT 3, a clinically relevant trend was discovered. Twelve out of the twenty-two symptoms suggest higher difficulty in female athletes within three or more of the five-time points. These symptoms include Balance Problems, Blurry Vision, Confusion, Dizziness, Don’t Feel Right, Feel in Fog, Feel Slow Down, Low Energy, Neck Pain, Sensitivity to Light, Sensitivity to Noise, Trouble Falling Asleep. Despite a lack of statistical significance, this tendency is contrary to current literature stating that males may be unclear on symptoms, but females may be more honest in reporting symptoms. Further research, which includes possible modifying socioecological factors, is needed to determine whether females may consistently experience more symptoms and require longer recovery times or if, parsimoniously, males tend to present their symptoms and readiness for play differently than females. Such research will help to improve the validity of current assumptions concerning male as compared to female head injuries and optimize individualized treatments for sports-related head injuries.

Keywords : female athlete, sports-related concussion, item response theory, concussion assessment
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