



Washington State University
College of Education, Sport and Human Sciences

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Will defend the Thesis on

Date: May 18, 2026

Time: 10:00 A.M.

Pullman Campus: Physical Education Building (PEB) Room 103

Faculty, students and the general public are encouraged to attend

Title:

SEX-BASED DIFFERENCES IN CARDIAC RISK INDICATORS & PERCEIVED STRESS AMONG TRIATHLETES

Chair: Christopher Connolly

Purpose: To investigate if sex differences exist in cardiac risk indicators including relative time in heart rate zones with an emphasis on high heart rate zones (zone 4 and 5) and heart rate variability (HRV) experienced during Ironman triathlon competition. Pre-competition perceived stress scores were also assessed for sex differences and the scores' potential influence on measured in-competition cardiac indicators was analyzed.

Methods: Participants (N=26; 9 females; ages 23-69 years) were used to assess sex differences within in-race cardiac risk indicators as well as overall perceived stress scores and its two subscales; perceived helplessness and lack of self-efficacy. A Welch's t-test was used to assess sex differences regarding in race-average HRV and overall perceived stress scores, follow-up analysis of covariance (ANCOVA) was conducted to control for covariates, race distance and age. Multivariate analysis of variance (MANOVA) was used to evaluate sex differences in relative time spent in heart rate zones. Linear regression was utilized for investigating the relationship between overall perceived stress scores and in-race averaged HRV, with multiple linear regression for the two subscale scores. In terms of perceived stress scores relationship with relative time in heart rate zones, multivariate linear regression was used. Follow-up regressions were run with respect to sex as a moderator for potential sex differences. Secondary exploratory analysis on experienced HRV reductions and baseline HRV was also conducted. Results: No significant sex differences were found in terms of in-race average HRV and relative time spent in heart rate zones. Though descriptively, males spent a greater total time in high heart rate zones and spent significantly more time in zone 4 than females. Overall perceived stress scores and its subscales revealed no significant sex differences; however, females showed a higher average overall perceived stress score and increased score in the lack of self-efficacy subscale. No significant relationship was found between pre-competition perceived stress scores and relative time in heart rate zones, with or without sex as a moderator. Overall perceived stress had no significant relationship with in-race average HRV, however its subscale, perceived helplessness was found to have a small significant relationship with in-race HRV present in females. Female participants had a similar baseline HRV to males but face marginally higher reductions in HRV during competition, though not statistically significant.

Conclusion: Marginal sex differences appear in cardiac risk indicators and perceived stress scores among Ironman triathletes but remain statistically non-significant at this point. Females appear to face greater reductions in their HRV and higher perceived stress scores. Males tend to face a greater percentage of their race in high heart rates zones than their female counterparts. Perceived helplessness significantly influenced experienced in-race HRV only within female triathletes. Further investigation is needed given the small sample size and the study's pilot status; these results should be interpreted with consideration of present limitations.