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Simulating association between training load and injury using the acute: chronic workload ratio and Bayesian methods in youth football.

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Simulating Association Between Training Load and Injury Using the Acute:Chronic Workload Ratio and Bayesian Methods in Youth Football

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Introduction/Purpose

Previous research has examined the relationship between relative workload and injury, where acute training load is expressed in relation to chronic training load using simple ratio scaling(1) or non-linear models including the exponentially weighted moving average (EWMA)(2). Research has demonstrated that higher relative workloads are associated with greater injury risk(3); however, statistical models generally report non-intuitive statistics such as odds ratios and as a result the practical consequences of increased player loading remain unclear. Here we combine training and injury data collected in youth football with a predictive simulation approach to model the number of injuries sustained across a range of seasonal workloads.

Methods

Data were collected from 15 elite Scottish youth football players (age:15.38 ± 0.38, stature:177.74 ± 7.91, body mass:66.42 ± 7.91) across an 8-month period. Training load was assessed using sRPE (training mins x RPE) with acute and chronic workload ratios (ACWR) calculated using an EWMA approach previously described (2). Injury information was classified by the club physiotherapist. Multilevel Bayesian logistic regression models with informative priors (assuming positive relationship between relative workload and injury) were fit to the data. Posterior samples of 106 were obtained for all parameters and used to simulate seasonal injury count for a 20, 40 and 80% increase in sessional ACWR.

Results

Fourteen injuries were recorded over the season with incidence of injury equal to 5.8 injuries per 1000 hrs. Mean ACWR across the season was equal to 0.85 ± 0.50. Bayesian 50% highest posterior density intervals for number of seasonal injuries were equal to 13(11-17) for the actual ACWR data collected; 14(11-18) for a 20% increase in ACWR; 15(13 - 20) for a 40% increase in ACWR; and 18(14 - 24) for a 80% increase in ACWR.

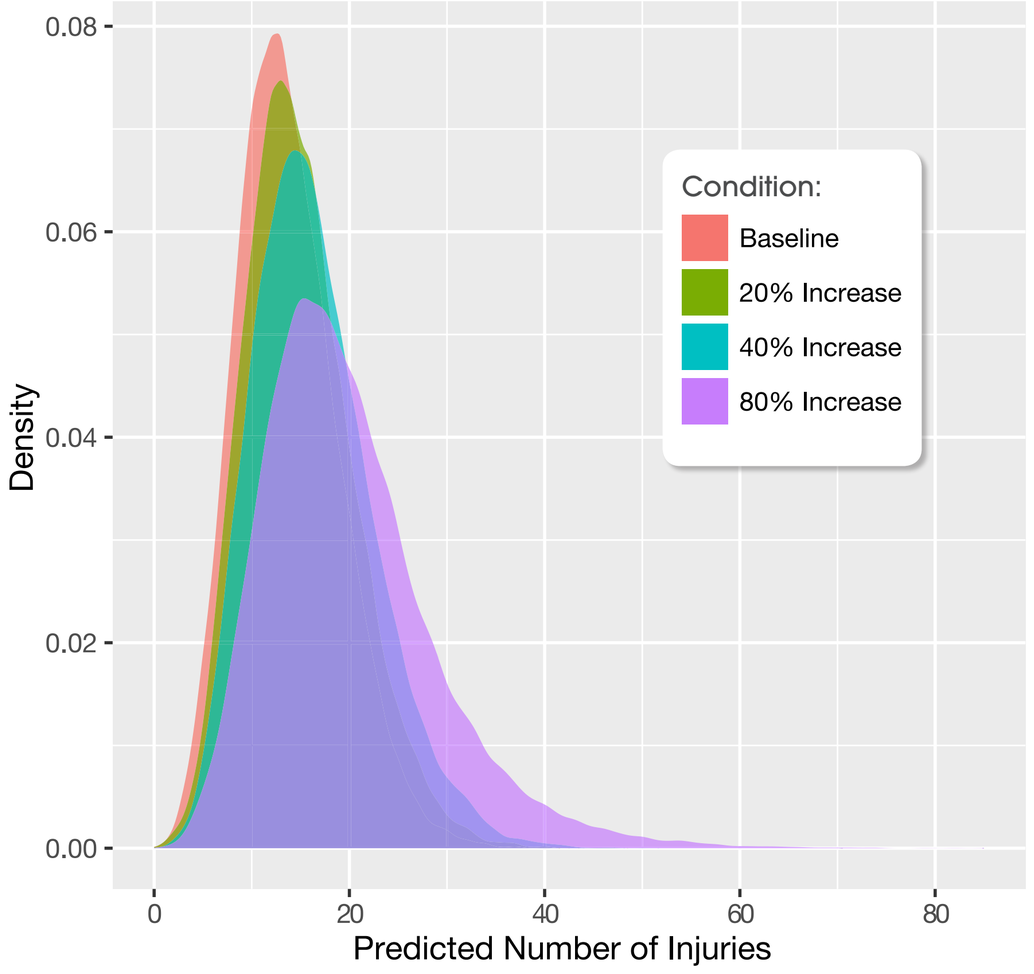

Figure 1: *Probability density of seasonal injuries*

SIMULATION	MODE	25% CREDIBLE INTERVAL	50% CREDIBLE INTERVAL
Baseline	13	12 – 14	11 - 17
20% Increase	14	12 - 15	11 - 18
40% Increase	15	14 - 17	13 - 20
80% Increase	18	16 - 20	14 - 24

Table 1: *Credible intervals of seasonal injuries*

Practical Applications/Conclusions

The results of this simulation study indicate that a 20 to 40% increase in sessional ACWR is expected to result in an additional one to two injuries per year for a youth football team. However, the potential range of total injuries per season was found to increase with greater ACWR values. More complex models accounting for factors such as increased risk of injury during prolonged periods of high player workloads, training and player related covariates, combined with larger data sets, are required for more robust injury estimates.

References

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