match. Non-locomotor activities contributed least to total match load for attacking positions (GS, GD and WA) and most for defending positions (GK, GD and WD). Specifically, C produced the greatest jogging load, WA and WD accumulated the greatest running load, while GS and WA accumulated the greatest shuffling load. WD and C accumulated the greatest guarding load, while WD and GK accumulated the greatest off-ball guarding load.

Discussion: All positions exhibited different contributions from locomotor and non-locomotor activities, towards total match load. Additionally, the same activity can have different contributions towards total match load, depending on the playing position. These findings have implications for design training programs that are specific to playing positions. The methodology used in this study provides valuable information about how the variety of activities performed by an athlete contribute to their total match load. This approach could be used in other sports to provide greater detail about the demands of specific playing positions.

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Real-time prediction of internal load during cricket fast bowling

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Background: Traditionally, workload monitoring in fast bowling has involved counting the amount of deliveries bowled and obtaining the sessional rating of perceived exertion (RPE). However, the latter fails to provide real-time information on how well a fast bowler is responding to the external load. Delivery RPE has been trialed to counter this limitation. However, delivery RPE requires frequent reporting from a fast bowler after each ball; rendering this variable impractical to collect during training and competition. Therefore the purpose of this investigation was to explore an automated method of predicting delivery RPE, and compare this to the actual delivery RPE reported by fast bowlers during an assessment.

Methods: Fourteen amateur fast bowlers (age 22.5 ± 5.5 years) completed two fast bowling assessments on separate occasions, 4–7 days apart. The assessment comprised forty “match-intensity” deliveries, four “maximal-effort” deliveries, and four “slower-ball” deliveries, aimed at five different targets. Ball release speed and accuracy were measured for each delivery. Delivery RPE was also obtained by asking the bowler “how hard was that delivery out of 100%?” Following the first bowling assessment, a linear regression equation was used to predict delivery RPE in the second assessment. The accuracy of the prediction was evaluated by comparing the predicted delivery RPE with the actual delivery RPE reported each ball from the bowler in the second assessment. The mean difference between predicted and actual delivery RPE was calculated in conjunction with 90% confidence intervals for each bowler.

Results: The between-bowler analysis revealed a mean difference of −0.5 ± 1.0 percentage points in predicted delivery RPE from actual delivery RPE. The within-bowler analysis indicated a relatively large range in the ability to predict delivery RPE, with a mean difference of −9.2 ± 1.2 percentage points in one bowler, compared to −0.3 ± 0.7 percentage points in two bowlers.

Discussion: In amateur fast bowlers, ball release speed may be used to predict delivery RPE, and therefore a real-time measure of internal load during fast bowling. Fatigue during a bowling spell may be indicated when a fast bowler repeatedly and unintentionally delivers below a predicted RPE threshold. Coaches may be able to use such an approach to better control bowling workloads and reduce injury risk in amateur fast bowlers.

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Training load prior to injury in professional rugby league players

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Background: Throughout the 2015 National Rugby League (NRL) season 82% of athletes sustained an injury, with 40 injuries per 1000 playing hours resulting in a missed match. Although many sustained injuries are attributed to physical collisions, a considerable amount (~25%) are classified as non-contact related and can be termed “preventative”. Inappropriate prescription of workloads can influence injury rates, therefore, it is important to carefully plan and prescribe training to reduce injury risk. This study examined the efficacy of various training load (TL) measures in identifying injury risk in rugby league.

Methods: TL and injury incidence data (soft-tissue, non-contact) were collected from 46 professional rugby league players throughout the 2015 NRL season. Externally-TLs were quantified using global positioning system technology, including total distance (TD), high-speed distance (HSD) and acceleration/deceleration load (AccDec Load) by athlete playing position. Seven, 14 and 21-day moving averages, 7-day exponentially-weighted moving averages (EWMA) and acute:chronic ratios (7:28 days) were calculated, and injury state indicated. Data were classified as pre- and in-season. Linear mixed models determined variations in TL measures between injured and non-injured athletes, with effects described using magnitude-based inferences.

Results: Large variances in all TLs were identified within and between positions for injured and un-injured athletes, particularly during pre-season, resulting in mostly unclear differences. During pre-season, non-substantial differences in HSD EWMA existed between non-injured backs and injured forwards (ES = 0.12; 90% confidence limits ±0.10), with trivial differences between injured and non-injured backs for HSD (ES = 0.07; ±0.07) and Acc/Dec Load (ES = 0.03; ±0.07) over seven-days. In-season, non-substantial differences over seven, 14 or 21 days were observed within positions for injured and un-injured athletes. Trivial differences existed throughout the in-season for both positions for acute:chronic and EWMA for injured and non-injured athletes. Specifically there were trivial differences (ES < 0.02) in TD, HSD and AccDec Load between injured and un-injured backs as well as injured and un-injured forwards for EMWA and acute:chronic, respectively.

Discussion: The risk of injury in rugby league is multifactorial. Large between and inter-individual variations in TL prior to injury implicates practitioners in accurately determining TL injury risk factors, indicating that the relative contribution of TL to injury is different to each athlete. Trivial differences between injured and un-injured athletes suggests that neither the acute:chronic or EMWA are sufficient in injury risk identification. Additional methods such as RPE which account for training loads from other