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Effectiveness and implementation of the BokSmart Safe Six injury prevention programme

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SUMMARY

Rugby is an international sport played in over 100 countries at a professional and amateur level. Rugby is particularly popular in South Africa, with over 468 000 players in 2016 and ranked fifth in fifteens and first in sevens rugby. The large injury incidence and severity of injuries in both senior and youth rugby shows the need for injury prevention strategies. As a consequence intervention programmes have been developed in the major rugby playing countries. In South Africa, South African Rugby's safety programme, BokSmart, designed the BokSmart *Safe Six* exercise-based injury prevention programme ("*Safe Six*") for this injury prevention purpose. The programme incorporates six targeted exercises as a warm-up for rugby players. The effectiveness of the *Safe Six* programme was assessed in this thesis using the "Sequence of Prevention" Model. Specifically the objectives of this thesis were to determine 1) the extent of the injury problem in South African youth rugby players; 2) how effective exercise-based injury prevention programmes are in collision sports; and 3) the effectiveness of the *Safe Six* on injury risk profiles.

Extent of the Injury Problem in South African Youth Rugby Players

Two studies were conducted. One study quantified injuries of players attending the South African Rugby (SA Rugby) Youth week tournaments, and the other study monitored injuries in under-16 level teams competing over a season. The youth week study was conducted at tournaments (about a week in duration) over six years (2011-2016) to determine the injury incidence density (IID) of youth players (under-13, under-16, and under-18 years) and also factors associated with the IID. Time-loss injuries ($n = 494$) were reported over 24,240 exposure hours, with an overall IID of 20 (95% CI; 19 – 22) injuries per 1000 player hours. There was a significantly lower IID in 2013 compared to 2011. Injury risk decreased with increasing age; under-13 and under-16 had significantly higher IID compared to under-18. Tackling (i.e. involving a tackler and ball carrier) was the phase of play at highest risk). The type of injury and location of injury with the highest prevalence were the Central/Peripheral Nervous System (CNS/PNS) and Head/Neck respectively.

In the schoolboy rugby teams, the IID was 29 (95% CI;19 – 39) injuries per 1000 player hours over the season, with an injury burden of 379 (95% CI; 344 – 415) days lost per 1000 player hours. The ball-carrier had a significantly higher IID compared to other events. This finding was different to the tournament study which was conducted over a shorter period. In this study the joint (non-bone)/ligament injuries were the most common type of injury and carried the highest injury burden. The season-long schoolboy IID was similar to previous youth rugby studies, in other countries, however the injury burden was much lower. The South African youth cohort showed similar factors associated with injury for inciting event (the tackle) and injury type (joint (non-bone)/ligament) and location (lower limb) as seen in other studies in both youth and senior players.

Effectiveness of Exercise-Based Injury Prevention Programmes in Collision Sports

A systematic review of studies that have previously implemented an exercise-based injury prevention intervention in collision sports was conducted to determine the effectiveness of such interventions in reducing injury rates. The review included nine studies (a total of 3517 participants), with seven of these showing a significant decrease in injury risk in the population implemented. American Football players had a significant decrease in the injury incidence of ankle sprains following foam pad balance training. Eccentric hamstring curls were also effective in one of the studies in this review. Other effective exercise modalities were neck strengthening, stretching, and landing skills.

Whilst seven studies had positive results, after assessing the quality of the studies, only one of the effective studies was identified as having a high methodological quality. In conclusion, there was evidence that exercise-based injury preventions can be beneficial in reducing injury risk in collision sports, but more studies of high methodological quality are required.

Effectiveness of the *Safe Six* on Injury Risk Profiles in Youth Rugby Players

The final step in the process was to assess the *Safe Six*, which is an injury prevention programme designed by BokSmart to decrease the injury burden in rugby in South Africa. The aim of this study was to determine the effectiveness of the *Safe Six* on injury risk profiles (Functional Movement Screening and Musculoskeletal Screening Assessments) and IID. The cluster-randomised controlled trial (cRCT) was performed over eighteen weeks, using six schools (n = 210 players) in the Western Cape, South Africa to determine the effectiveness of the BokSmart *Safe Six* on injury risk profiles and IID. Three schools implemented the *Safe Six* (intervention), and the other three schools continued as usual (control). All schools were tested pre-season, mid-season and post-season. The *Safe Six* was associated with small significant improvements of the injury risk profiles in the cRCT intervention group youth rugby players.

Conclusions

The BokSmart *Safe Six* was associated with small changes in injury risk profile scores in youth rugby players.

The SA youth rugby cohort had a similar IID to other youth cohorts, with the joint (non-bone)/ligament and CNS/PNS injuries having the highest IID. However, injury burden in the South African youth population was lower than reported in other youth rugby cohorts, indicating injuries to be less severe in under-16 players in South Africa. The systematic review identified only one high-level study that was effective for injury prevention. Eccentric hamstring curls, plyometric exercises and balance training appeared to have prevention qualities.

The youth rugby cohort in South Africa is still in need of an effective intervention, and a neck strengthening component has been associated with reductions in concussion incidences and if added to the *Safe Six*, could potentially increase its effectiveness in reducing IID in particular.