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CHAPTER 6

EVALUATION OF THE EFFECTIVENESS AND IMPLEMENTATION OF THE BOKSMART *SAFE SIX* INJURY PREVENTION PROGRAM: A STUDY PROTOCOL

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Abstract

Background

The injury burden in rugby union ('rugby') is high. While exercise-based injury prevention programmes have successfully reduced injuries in other sports such as football, there is minimal research on this topic in rugby union. The aim of this paper was to evaluate the effectiveness and implementation of an exercise-based intervention (BokSmart *Safe Six*) in junior rugby players that aims to reduce the injury risk profile and burden of injury.

Methods

Fourteen to sixteen-year-old junior rugby players in two geographically separated locations in South Africa over the 2017 rugby playing season will be recruited. A cluster-randomized controlled trial where the teams are allocated to groups that either; (i) have a coach-delivered exercise intervention in their warm-up (BokSmart *Safe Six*), or (ii) continue with their warm-up 'as usual' (control group). Injury risk profiles will be assessed through musculoskeletal screening on all players performed at the beginning, middle and end of the trial. Epidemiological measurements include injury surveillance at all matches and training sessions, and exposure to the various warm-up exercises (including BokSmart *Safe Six* exercises). Behavioural determinants of coaches will be assessed through standardised theory of planned behaviour questionnaires and focus groups before and after the intervention.

Outcome measures

Comparison in injury risk profiles and burden of injury between the intervention and control groups. Changes in the behavioural determinants of coaches.

Background

The benefits of physical activity (for both health and well-being) are widely accepted,[1, 2] however, physical activity levels are still low. This lack of physical activity has created a public health burden, and therefore, due to its numerous associated benefits, physical activity has been promoted within society.[2, 1] Physical Activity (PA) promotion may have led to an increase in sporting participation, and therefore by extension, also in rugby union. An increase in PA and sporting participation, has also coincided with an increase in sports-related injuries.[3, 4] This increase in sporting injury-risk needs to be addressed. Hence, for amateur rugby union in South Africa, the development and evaluation of the BokSmart *Safe Six* exercise-based intervention.

Rugby union

Rugby union (hence referred to as 'rugby') is an international sport played in over 100 countries at professional and amateur levels and is particularly popular in South Africa, which has over 468 000 players (as of 2016).[5, 6] Rugby became a professional sport in 1995. Following this there was an increase in physical demands on the players.[7]

The sport of rugby is played by two teams, consisting of 15 players per team on the field at one time.[7] A rugby match is 80 minutes in duration at adult level, but youth rugby can be 70 minutes,[8] 60 minutes (U16) or 50 minutes (U13) depending on the age-group (SA Rugby Union tournaments). It must be noted that there is also another form of rugby known as "rugby league" which differs from rugby union, in that there is no line-out. There are only thirteen players per team and the ball is played immediately after each tackle.[9] In league, there is also no contest in the scrum.

Rugby is characterised by intermittent high intensity bouts of exercise and bodily collisions (known as tackles). Therefore, the requirements of each position result in varying physiological and anthropometrical differences between players. [10, 7, 11-15] The ballistic nature and high force- and momentum-generating movements occurring in rugby are associated with a high injury risk and require skill to be performed safely and effectively.[16, 17, 11, 18]

Given the contact nature of rugby, the injury incidence in senior rugby players is high, 81 (95% CI 63 – 105) injuries per 1000 match hours and 3 (95% CI 2 – 4) injuries per 1000 training hours,[19] in comparison to other sports (for instance men's collegiate soccer in the United States was 19 injuries per 1000 match hours).[20] Lower limbs are at greatest risk for injury, followed by the upper limbs, head and trunk. In terms of severity (time lost due to injury), the lower limb, followed by the trunk and head/neck area are reported to be the most severe.[19] In South African youth rugby the average injury incidence was 22 injuries per 1000 player hours, across age group tournaments.[21]

Every injury is also accompanied by an associated medical treatment cost, and as such, as the incidence increases so does the financial burden on both the player, their family and society.[22] The average financial burden on an injured player in South African youth rugby tournaments is high and is estimated at US\$731 per injured player.[23] Based on this information, it can be stated that the burden of a rugby injury in South Africa is high and as such prevention programmes are necessary.

Prevention of rugby injuries

This notable injury incidence in both seniors and youth rugby, shows the need for injury prevention strategies.[18] However, Freitag *et al.* (2015), have gone further to state that most prevention programmes for rugby have yet to be evaluated and therefore their effectiveness in preventing injuries is unknown. [24] Examples of such interventions are SmartRugby and RugbySmart of Australia and New Zealand, respectively.[25, 26] Within South Africa, the South African Rugby Union (SA Rugby) developed BokSmart, a program promoting evidence-based techniques for playing both safe and effective rugby, and the management of both injured and uninjured players.[27] The implementation of BokSmart and RugbySmart have both been associated with a reduction in catastrophic injuries. With the implementation of BokSmart's prevention strategies there has also been an increase or improvement in targeted injury prevention behaviours in players.[28-30]

These nationwide prevention strategies targeting primarily coaches and referees have therefore been shown to be effective. Strategic law changes, such as those implemented by SA Rugby within the scrum, have also shown positive signs in preventing injuries.[17] Law changes affect the dynamics of the game, whereas techniques taught to players to prevent injuries and improve performance, have minimal if any, impact on the nature of the game.

Tackle technique is consistently associated with both injury and performance, and the teaching and prescription of tackle technique is an important component in nationwide prevention programmes.[31, 16, 32, 14, 33] Hendricks *et al.* (2010) illustrated how the shoulder tackle, as opposed to the arm tackle and jersey tackle, is the most effective and safest tackle for rugby players to execute. Also, a leg drive in the tackle has the potential to reduce injury risk and increase the success of the tackle.[14]

Furthermore, physical fitness and lack of conditioning of players has been linked to injury risk. Training to prepare the players for the demands of the game has become an important part of a rugby team's preparation for the season. Cohort studies in rugby league have shown that players with a heavier body mass, poorly developed intermittent high intensity running, poor upper body strength, and low maximal aerobic power have an increased risk of sustaining a contact injury.[34, 9] There is conflicting data on speed, with one study showing that faster players have a higher injury risk,[34] whilst another study claimed the opposite.[9] Many of these physical characteristics can be developed in the gym to prepare the players for the movements and demands of rugby.

Rationale for components of an effective exercise training programme

Sport-specific weight training, whether it be body weight or gym-based training, high intensity training and training changes of direction, have been associated with a decrease in hamstring injuries in Australian football players. [35] Hamstring injuries are a common injury in rugby. An exercise-based intervention was found to reduce hamstring injuries in senior professional

rugby union.[36] Brooks *et al.* found that the group who had performed static stretching, a regular strengthening program, and Nordic hamstring curls, sustained a lower incidence of injuries, compared to the group who had only performed their regular strengthening program.[36] Another study with a similar design showed comparable results in Australian football players.[37]

Balance training is a training component associated with a decrease in ankle sprains. Using single limb balance on a foam pad, American football players had a decreased incidence in non-contact ankle sprains.[38] This study emphasises the need for balance training in players participating in contact sport.

Measuring an effective training programme

The Functional Movement Screen (FMS) is a screening tool of seven reliably assessed movements, which are scored out of a possible accumulated total of 21 points. A person who scores less than or equal to 14 in this assessment has a proven moderate prediction (54%) of a non-specific time-loss injury, i.e. any injury where the athlete will miss at least one training session and/or match fixture due to the injury.[39, 40] The FMS has a moderate to good inter-rater and intra-rater reliability for novice assessors, making it an accessible assessment tool to use at any level.[39] Using the FMS to predict injury, allows for a control trial to be performed over a shorter period, as one can measure the change in outcome of this measure, even if the actual number of injuries during that period is minimal. For example, positive changes in the FMS and musculoskeletal assessments following corrective programmes have been shown in footballers and martial arts after seven and eight-week interventions respectively.[41, 42]

The BokSmart Musculoskeletal Screening Assessment was compiled by content experts using evidence-based assessments to provide an injury risk profile for a rugby player. Some tests are associated with injury risk using a range of movements for specific muscle groups. This is important as FMS does not always account for this, but these factors do contribute to injury risk. active knee extension is one test in the assessment that has been associated with an increased risk of a hamstring injury of up to 18% in a football player.[43]

Similarly, the sit and reach test has been associated with an increased risk of hamstring injuries.[44] Results from the FMS and Musculoskeletal Screening Assessment will jointly be described as the injury risk profile from now on.

This paper outlines the aims, objectives and methods of the trial to evaluate the effectiveness and implementation of the BokSmart *Safe Six* exercises in youth rugby players, as an injury prevention programme. This study has been designed in accordance with the CONSORT statement.[45]

Research Aims and Hypotheses

The present BokSmart *Safe Six* study aims to:

1. Evaluate the effectiveness of the BokSmart *Safe Six* exercise program on injury rates and injury risk profiles of Under 16 male rugby players prior to and after using the BokSmart *Safe Six*
2. Evaluate how the BokSmart *Safe Six* exercises are being implemented within the school context, while examining aspects of exercise quality, including fidelity
3. Determine the barriers and facilitators to the implementation of the BokSmart *Safe Six* in the schoolboy rugby setting

Specific hypothesis is:

1. Injury risk profiles will be reduced as a result of the implementation of the BokSmart *Safe Six* exercise intervention.

BokSmart *Safe Six* intervention

After identifying injuries associated with the highest burden in rugby,[19] the BokSmart *Safe Six* intervention was designed. The BokSmart *Safe Six* programme was officially launched in 2014 as a freely available resource. The targeted areas of injury prevention are the knee, hamstring, lower limb, ankle and shoulder, which are most commonly injured and are associated with the greatest injury severity. [19] The BokSmart *Safe Six* exercises are designed to specifically target these high-risk areas of the body to increase strength, joint stability, balance and control,

with the overall goal of reducing the rate and severity of injury. In particular, they were designed to optimise implementation, and also in communities who were lacking resources: i.e. they can be performed any place, any time, without requiring any equipment or facility, and are of short enough duration that it does not interfere with regular training. The exercises were also designed to be included as part of the regular team warm-up. However, BokSmart has yet to actively implement the BokSmart *Safe Six* intervention nationally.

Trial design and study arms

Trial design

Schoolboy rugby teams will be randomly assigned to either the BokSmart *Safe Six* intervention or the control group using a toss of a coin.

Control arm: control group

The control group will be required to film their warm-up routines 'as per usual' at every practice for analysis, to determine if they are performing any of the intervention exercises that would need to be included in the statistics as a confounder. Beyond the filming of warm-up sessions, the control teams will not receive any special instructions. It must be noted that the BokSmart programme has disseminated knowledge of the BokSmart *Safe Six* exercises widely; the exercises are freely available on the website. Therefore, contamination cannot be prevented.

Intervention arm: BokSmart *Safe Six* exercises

The intervention group will be required to incorporate the BokSmart *Safe Six* exercises designed by BokSmart into their warm-up routine.

To keep it simple and practical, and easy to remember, there is no progression of exercises over the period of the intervention.

RCT Methodology

The study is a cluster-randomised controlled trial, evaluating the exercise programme in the field, over a single playing season. A cluster-randomised design allows for a field-based intervention to decrease the chances of

contamination between the groups. Additionally, a cluster design is applicable, as the intervention will need to be implemented at a team level, and not at an individual level, allowing for each team to be a cluster. Rugby is the sport that has been chosen as it has the highest injury incidence and severity, and therefore, is a priority sport for an injury prevention intervention.

The monitoring of injuries and the collection of exposure and adherence data used in this trial will be similar to those used in previous football studies;[46, 38, 35] and conform with the definitions and data collection procedures outlined in the rugby consensus statement.[47] The study will also include an evaluation of adherence to the intervention, and the determinants of behaviours of the coaches regarding the implementation of the intervention.[48-50]

Each school is considered a cluster, and multiple teams will be recruited from a single school to decrease the number of clusters required to achieve sufficient statistical power. The clusters in the intervention group and control group will be stratified geographically to avoid contamination and knowledge of the intervention.

Sample Size

The sample size calculation was calculated using a Functional Movement Screening (FMS) score as the outcome measure of interest for the following sample size calculation:[42]

$$C=1+(\sum_{\alpha_2}+\sum_{\beta})^2[\pi_0(1-\pi_0)/n+\pi_1(1-\pi_1)/n+k^2(\pi_0^2+\pi_1^2)]/(\pi_0-\pi_1)^2$$

C= number of clusters, \sum_{α_2} (95%) = 1.96, \sum_{β} (90%) = 1.28, π_0 (mean FMS score of control) = 14.8, π_1 (mean FMS score of intervention, based on 30% increase) = 19.2, n (players per cluster) = 40, k (inter cluster coefficient of variation) = 0.2.

Therefore, to determine a statistically significant change in FMS risk profiles at the 95% confidence level, we would need 4 clusters (schools) in each of the control and intervention groups respectively, with a minimum of 40 players in each arm; i.e. a total of 160 players in the control group and 160 players in the intervention group.

Recruitment

The eight schools that will be targeted for this study all compete in the top school league in the targeted Province, the Western Province Rugby Union's School

Premier League or Division, and are of a comparable standard and socioeconomic status, therefore, ensuring that the cohort is as homogenous as possible. The eight schools are divided geographically into the Stellenbosch/Paarl region and the Southern Suburbs region, with four teams in each region. The regions will be randomly assigned to the control and to the intervention group. These eight schools are all rugby-playing high schools and the players included in this study will be representatives of the 2017 Under 16 A or B schoolboy rugby squads (aged 14 or 15 years as of the 1st of January). All players must be injury-free for at least six-months prior to testing. Each school will therefore contribute a minimum of 40 players to the study. The level of rugby is of a high level, and these eight schools produce many of the players for the age-group provincial teams. The school's medical resources on match day are standardised by BokSmart protocols [51] and ensure that there is always medical support available. All schools have access to at least a physiotherapist for their players if necessary, and therefore in the case of injuries a diagnosis is available. The eight teams will be recruited for the 2017 rugby season, and will be monitored over eighteen weeks of rugby, approximately sixteen matches in total, running from April to August. The schools will be approached through their headmaster, head of sport, head of rugby and head Under 16 rugby coach to participate in the study. Once the school has confirmed their participation, any player selected for the initial squad will be eligible to participate and will be recruited through the school. Written assent from the player, written consent from the parent (in the case of a non-day boy, telephonic consent from the parent and then written consent from the housemaster) and written consent from the coach will be required for each participant before the study begins. This is in accordance with the South African ethical regulations and government requirements.

Blinding

True blinding is not possible in our study, as the control arm will not be receiving an intervention, however, they will not be aware of the 'true' purpose of the trial, as they will be informed that we are studying their warm-ups and how these are associated with injury rates. The intervention group cannot be blinded either, as they will be aware that they are performing the BokSmart *Safe Six* exercises and recording injury rates. The geographical separation is critical to the study design to minimise contamination of the intervention and control groups.

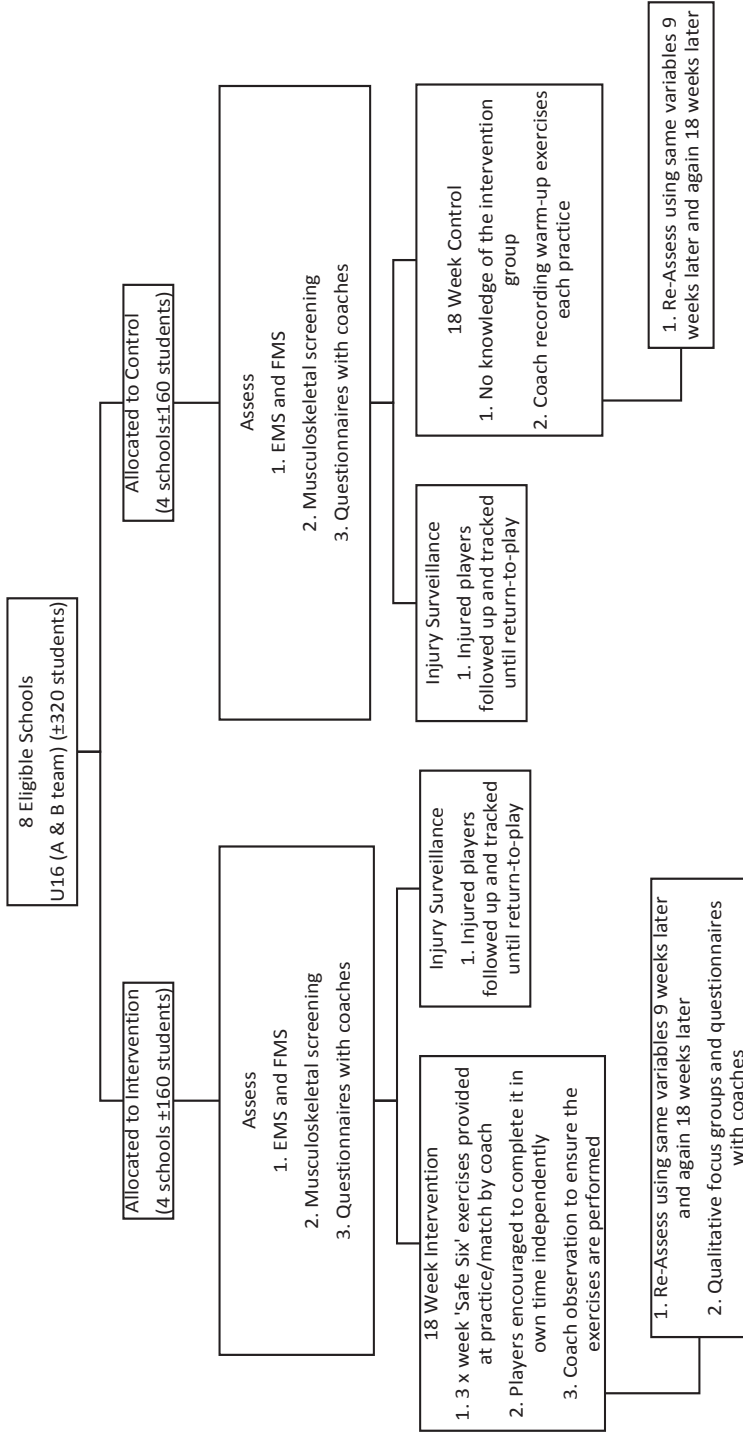


Figure 6.1: Flow diagram of the process of the cluster-randomised control trial using the BokSmart 'Safe Six'

Standardisation of Procedures

Before the trial begins, each school in the intervention group, will go through thorough training of how to implement the BokSmart *Safe Six* exercises. The coaches in the intervention group will be instructed on how to implement the exercises at practices using researcher interaction, booklets and filmed material (DVD's). The coaches will have access to the researcher at all times during the intervention if something becomes unclear. The coaches, as they will be implementing the intervention, will be required to perform the exercises to the researcher's satisfaction before beginning the trial. A "coach" is defined as a coach (i.e. biokineticist, strength and conditioning coach, general coach) who comes into contact with the players at least once a week on average over the season, therefore influencing a portion of their training or match play. Teams may have multiple coaches in which case all coaches will be included in the study

The coaches from both the control and the intervention groups will be given the same exposure (recorded during both training and matches) and adherence report forms, and be briefed on how to film the warm-ups of every practice (in the case of the control group and intervention group) and every time they perform the exercises (the intervention group, to ensure they are not performing another exercise comparable to a BokSmart *Safe Six* exercise to avoid a double dose). The head coach of each team will be the primary data collector for each team, however, he/she will not be responsible for injury data collection.

Injury data collection

The researcher will follow up on every team two days after a match to determine whether any time-loss injuries occurred. A standardised injury data collection form designed by BokSmart will be used to collect data (Appendix I). The injury definitions are aligned to the consensus statement.[47] Following an injury, the researcher will be in contact with the injured player to confirm the injury and obtain the details surrounding the injury. The player will refer the researcher on to their medical practitioner to get a diagnosis of the injury.

Every player who is injured will be followed up on a weekly basis until return-to-play to get an accurate severity score of the injury. Each school will also

be visited biweekly, to collect the video footage of the training and player exposure forms. These visits will also ensure regular contact with the schools in an attempt to improve compliance. The results of each match (score) will also be recorded by the coach, as league performance has previously been associated with injury rates in rugby.[52]

Functional movement screening and musculoskeletal assessment outcomes

To determine the injury risk profile of the players, a combination of screening assessments (both functional and musculoskeletal) will be performed on every player. The FMS is the first set of assessments to be performed which consists of seven tests: 1) overhead squat; 2) single leg hurdle; 3) split squat; 4) shoulder mobility; 5) active straight leg raise; 6) stability push-up; 7) rotary stability.[53, 54] The second set of assessments is the EMS (developed at the Sports Science Institute of South Africa), which are tests 1-6 of the FMS and a seventh test: a seated rotation instead of the rotary stability. All of the FMS and EMS tests are scored subjectively using a three-point scale as described previously.[53, 54] Nine musculoskeletal assessments that are incorporated in the BokSmart Musculoskeletal Screening Assessment will be performed: 1) active knee extension (ICC of $r=0.93$ for inter-rater reliability); 2) modified Thomas test (ICC of $r=0.91-0.94$ for inter-rater reliability); 3) active internal and external range of motion of the hip (ICC of $r=0.94$ internal rotation and $r=0.88$ external rotation for inter-rater reliability); 4) ankle dorsiflexion (ICC of $r=0.99$ for inter-rater reliability); 5) sit and reach (ICC of $r=0.97$ for inter-rater reliability); 6) lumbar spine extension (ICC of $r=0.95$ for inter-rater reliability); 7) lumbar forward flexion (ICC for inter-rater reliability is unknown for this test); 8) shoulder internal and external rotation (ICC of $r=0.85-0.99$ for inter-rater reliability);[55] 9) multiple hop test (test-retest reliability was good, ICC of $r=0.91$ left ankle, $r=0.97$ right ankle in unstable, $r=0.87$ in left and right healthy ankles, the test was able to discriminate between healthy and unstable ankles).[56, 44, 57-60] Tests 1, 2, 3 and 8 are tested using a goniometer (in degrees), tests 4, 6 and 7 are tested using a tape measure (centimetres), test 5 is measured using a sit and reach box (centimetres) and test 9 is measured using a stopwatch (seconds). Anthropometrical (sum of four skinfolds, body height and body mass) and maturation status will also be assessed.[61, 62] All of the aforementioned tests will be performed on every player who participates in the study. All of the testing will be performed at the High Performance Center at the Sports Science

Institute of South Africa in Cape Town. The tests will be performed before the trial begins, mid-way through the trial (nine weeks) and at the end of the trial (after eighteen weeks).

Behavioural determinants

A questionnaire assessing behavioural determinants using a five-point Likert scale will be administered to all coaches before the intervention. The questionnaire will be developed using an article that describes the assessment of knowledge acquisition, and a manual for developing theory of planned behaviour questionnaires, which assess not only behaviour, but the intention to perform a behaviour, perceived behavioural control, attitudes towards the behaviour and control beliefs.[63] The construct scores will create “profiles” based on behaviour, habit and intention. Focus groups and a repeated questionnaire will be performed with the intervention coaches after the intervention is completed. The study will assess whether the coaches in the different study groups have different baseline behavioural determinants towards injury prevention programmes. The questionnaires will also determine if there is a change in these determinants of the coaches towards injury prevention in the intervention group coaches after the trial.

Measurement of potential confounders

Despite all study participants being from the same age group, possible confounders include physical/anthropometrical characteristics and maturity status (using body mass, standing height and seated height to predict peak height velocity) which will be collected during the testing.[61] Secondary confounders include injury history, playing experience, playing position and playing level, which will be self-reported. All of the participants will be profiled using those characteristics and therefore these confounders can be considered when analysing the results.

Adherence

This study has been designed to be optimally implemented in community level rugby. The researcher will monitor adherence of the schools using record sheets (hard or electronic copies, depending on the coach preference). These records will then allow for exposure hours to be calculated and a measure of adherence to be determined. The video footage of the warm-up will be collected on a

biweekly basis. The video footage of the intervention group's warm-up will be coded using a five-point Likert scale according to how accurately the exercise routine is performed for every practice.

The study is being performed in the premier league schools where winning is a priority (a decrease in injuries contributes to winning),[52] and therefore the participants in the intervention group will be motivated to implement the injury prevention measures to the best of their abilities.

Analysis

For the injury data, injury rates and corresponding 95% confidence intervals (95% CI) will be calculated for all players as the number of injuries reported per 1000 hours of exposure. The severity of the injuries (missed training/match days) will also be calculated. Further analysis will include the incidence and type of injury (1000 player hours), recurrent versus new injuries (1000 player hours), contact versus non-contact injuries (1000 player hours), positional injuries (1000 player hours), in what quarter the injury occurred (1000 player hours), injury event (1000 player hours) and the protective gear worn during injury (1000 player hours). Severity will be calculated by the time lost per injury, and injury burden then calculated by days lost per 1000 player hours (mean overall injury incidence multiplied by mean absence per injury). All statistical analyses will be performed using the Stata program (StataCorp LP). A χ^2 test (for categorical variables) and either independent t-tests or Mann-Whitney U tests (for continuous variables) will be performed to determine if the groups are comparable at the beginning of the trial. For the testing data (FMS, EMS and Musculoskeletal Screening Assessment), a "mixed between-within subjects analysis of variance (ANOVA)" to compare the two groups over the whole intervention, and then a *post hoc* Bonferroni test will be used to determine if there is a significant change in the scores and at what time point. If there is a significant change, then at that time point a one-way ANOVA will be performed to determine which specific test is different between groups.[47] A Poisson regression will be used to compare the injury rate differences between the control and intervention group. For the adherence data, descriptive statistics will be used to determine in which areas the program is implemented both the best and the worst. A dose response for each BokSmart *Safe Six* exercise will be ascertained by multiplying the Likert scale (quality of exercise) by

adherence over the eighteen weeks. The behavioural determinants data from the questionnaires will be analysed using a Path analysis. The focus groups will be transcribed verbatim, and the common themes grouped using a computer-based thematic analysis. Once this is completed, the barriers and facilitators towards the BokSmart *Safe Six* will be described using frequency analyses.

Project time frame

The following project is being performed over a six-month period during 2017 (April – August).

- January – March 2017: Preparation of data collection material; recruitment of schools; randomisation of schools
- March – April 2017: Baseline testing of players (anthropometrical, FMS, EMS and musculoskeletal); attitudinal surveys of the coaches; training of the coaches
- April – August 2017: Implementation of the exercise intervention; injury surveillance; adherence and exposure data collection; ongoing data entry; video footage of warm-ups analysis
- June 2017: mid-way testing of players (FMS, EMS, musculoskeletal testing)
- September 2017: Final testing of players (FMS, EMS and musculoskeletal); attitudinal surveys and focus groups with the intervention coaches

Outcomes and Significance

Multiple studies have shown that training interventions can have positive effects on injury rates in sports, including rugby.[36, 46] To date, however there are few studies showing effective full-body training intervention programmes within contact sports in real-world contexts. Australia and England have both developed training based interventions for musculoskeletal injuries, and specifically knee injuries.[46, 64] The Australian training programme had low compliance and poor results, however the English study, when adjusted for compliance, was effective in decreasing injury burden, and specifically concussions.[46, 64] General injuries, such as musculoskeletal injuries, may not

be as severe as spinal cord injuries, but are costly and can cause problems for players later in life.

This study is the first of its kind in the South African context. This study will also give current data regarding schoolboy rugby injury incidence over a season in South Africa, and will therefore also contribute to the epidemiological knowledge that is currently unknown. Furthermore, the study will provide insight into whether or not the BokSmart *Safe Six* exercises are effective in decreasing injury risk and injury rates.

The attitudinal data will allow for BokSmart to adjust the programme (if necessary) and increase adherence in future.

If the BokSmart *Safe Six* exercises, performed regularly as a warm-up, prove effective in reducing injuries, the benefits will be far reaching for rugby. The exercises have been developed using knowledge of previous effective programmes and international best-practice, and targets the most commonly injured sites in rugby. As the BokSmart *Safe Six* exercises require minimal education and no equipment to implement, the benefits of these exercises will be transferrable to all rugby-playing countries, including the countries with similar socio-economic challenges to those of South Africa.

This project aims to benefit rugby primarily, but all contact sports alike, through proving that a simple, time efficient and cost-effective injury prevention programme, performed during warm-up decreases injury risk and thus makes the game of rugby a safer sport for all.

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