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Original paper

# Evaluation of RugbySmart: A rugby union community injury prevention programme

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**Abstract**

RugbySmart, a rugby union injury prevention programme, was launched in New Zealand in 2001. It was compulsory for all coaches and referees to complete RugbySmart requirements annually in order to continue coaching or refereeing. After 5 years of implementation the programme partners, Accident Compensation Corporation and New Zealand Rugby Union, evaluated RugbySmart to determine its effectiveness in reducing injuries. The purpose was to evaluate the effect of RugbySmart on reducing injury rates per 100,000 players and resulting injury prevention behaviours. The RugbySmart programme was associated with a decrease in injury claims per 100,000 players in most areas the programme targeted; the programme had negligible impact on non-targeted injury sites. The decrease in injury claims numbers was supported by results from the player behaviour surveys pre- and post-RugbySmart. There was an increase in safe behaviour in the contact situations of tackle, scrum and ruck technique.


*Keywords:* Injury; Prevention; Rugby; Sports; RugbySmart; Behaviours

## 1. Introduction

The RugbySmart programme, a joint project between the Accident Compensation Corporation (ACC) and the New Zealand Rugby Union (NZRU), was implemented at the start of the 2001 rugby season (March 2001). Both ACC and NZRU contribute to the annual implementation of RugbySmart, investing in the development and delivery of the RugbySmart resources and workshops for coaches and referees. As ACC provides for the cost of rehabilitation and replacement of income it predominantly desires a reduction in the number of injuries while the NZRU wants to make the game a competitive, safe and popular sport.

RugbySmart was designed to systematically reduce the number and severity of injuries in community rugby by providing evidence-based information about injury risks and injury prevention strategies to coaches and referees. Although the strength of evidence available regarding specific risks and the efficacy of recommended practices varied widely, efforts have been made throughout the programme to update information as better evidence became available. Information was delivered to coaches and referees via video presentations combined with active participation in workshops; these were supported initially by printed materials, and subsequently by Internet resources. The number of workshops for the approximately 10,000 coaches and 2000 referees varied from region to region, reflecting differences in coach and referee numbers between more and less heavily populated areas.

Coaches were chosen to be the primary group to which RugbySmart was delivered, with the expectation that they would influence player behaviour.[1] The decision to target coaches was made on both pragmatic and evidence grounds. Firstly, delivering RugbySmart to approximately 10,000 coaches presented significantly less of a challenge than delivering it to over 130,000 players, which was consid-

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ered unfeasible. Secondly, rugby coaches have been identified by both players and coaches in New Zealand as having an important role in the communication of injury prevention information and attitudes to player safety.[2] In addition referees, who play a major role in preventing avoidable injuries during matches, were targeted by NZRU.[2] To enforce the annual compulsory nature of RugbySmart for all levels of the game from under-6 grade to senior adults, rugby teams are audited and withdrawn from competition for non-compliance of their coach or a representative in attending annual workshops. Referees who did not complete RugbySmart were not assigned matches.

RugbySmart involves coaches and referees participating in a workshop setting with focus around the RugbySmart video. The video is produced to assist consistent delivery of the injury prevention messages throughout the country. The video and other resources can be taken home by coaches after the workshop. The emphasis given to different areas has varied from year to year, with the greatest attention given to physical conditioning, technique (specifically tackling and scrummaging) and injury management. Other areas covered have included warm-up/cool-down, protective equipment (specifically mouthguards in contact situations)[3] and injury reporting.

While RugbySmart has helped to achieve a reduction in serious scrum-related spinal injuries[4] the aim of the current review was to provide a more detailed evaluation of RugbySmart in terms of the effect of RugbySmart on reducing injury rates (ACC injury incidence data combined with NZRU participation data) and resulting behaviours (ACC survey data). Currently there is little information available as to what a worthwhile change in injury rate or injury prevention behaviour for sport may be for a population-based study as there are few large prospective population-based studies in the literature.[5] This paper addresses the need for a prospective intervention study of sufficient size that can provide evidence of the effectiveness of a specific injury prevention programme.

## 2. Methods

Injury data were collected by ACC, a New Zealand government taxpayer-funded monopoly. The coverage by ACC provides compensation for injury costs including medical treatment, income replacement, social rehabilitation and vocational rehabilitation, and ancillary services such as transport and accommodation. A claim is made when a person seeks medical treatment from one of the 30,000 registered health professionals throughout New Zealand. When making a claim, information about the injury is collected using a standard form to ensure levels of consistency for data analysis, i.e. the registered health professional makes the diagnosis. The claim is then filed with ACC and details entered into a central database. There is no disincentive for making a claim; people are not discriminated against, risk-rated, or penalised for the number of claims made. The guarantee of personal injury coverage is offset by the restriction in ability to sue for personal injury (except in rare circumstances for exemplary damages).

There are two major categories of claims made to ACC, moderate to serious injuries claims (MSC) and minor claims. In the 2005/2006 financial year (July–June) there were 58,264 rugby claims costing ACC $NZD40,385,034. MSC represented 7.4% (4384) of the number of claims, but 77.9% ($NZD31,472,702) of the cost for 2005/2006. For this review we focused on MSC, rather than minor claims, to evaluate RugbySmart because of the high relative cost of MSC and the greater level of information collected. For evaluation of its prevention programmes, ACC also uses MSC rather than minor claims.

The injury sites that RugbySmart targets represent approximately 65% of the new rugby MSC and 73% of the cost to ACC in the 2005/2006 financial years. Specifically:

- Neck/spine (including neck/back of head/vertebrae, upper back/spine, back/spine and lower back/spine) contributing 4.2% in number and 5.4% in cost;
- Shoulder (including clavicle/blade) contributing 19% in number and 20% in cost;
- Knee contributing 25% in number and 31% in cost;
- Leg (upper and lower, excluding knee and ankle) contributing 6.4% in number and 7.1% in cost; and
- Ankle contributing 10% in number and 9.1% in cost.

A specific type of injury that has received attention is concussion. In this paper we focused on injury sites rather than diagnosis (such as concussion). Head injuries in general (e.g., injuries to the face, scalp, eye, ears and nose) were not specifically targeted, but a concussion-specific initiative was introduced in 2003/2004. This initiative was implemented through RugbySmart; a decrease in concussion MSC was observed and is reported elsewhere.[6]

Injury claims were extracted from the ACC database on 4th September 2006 and were classified by date of injury. This extraction date allowed for injuries that may have occurred late in 2005 to be included. Typically the New Zealand community rugby season occurs between March and August. There could still be players yet to seek treatment for their injury, but this is not likely, and if there are any outstanding claims, the number will be small. Since the inception of ACC in April 1974, there has been no time limit on when someone can make a claim to ACC.

To report the effect of RugbySmart using claims data, we have presented the rate of injury claims per 100,000 players per year. Player numbers were provided by the NZRU player registration system. Before 2001, player numbers were estimated from a combination of registered players and number of teams enrolled in competitions. From 2001 onwards, numbers were taken solely from the NZRU player registration database. Although the player registration system used by NZRU was changed at the start of 2001,[3] the same year as RugbySmart was implemented, this was the baseline for

the purposes of measuring the impact RugbySmart had on MSC.

A goal of NZRU was to increase the number of people playing rugby. Assuming no change in injury rate, an increase in playing numbers that occurred would increase the absolute number of MSC to ACC.

A central part of the RugbySmart programme was using coaches as a medium to impart information in the RugbySmart workshops to players. To evaluate if this strategy of targeting coaches was successful, we surveyed adult players (males over 19), to determine if information from the RugbySmart programme was being disseminated to them. In 1996–1998 and 2005, ACC undertook surveys of self-reported behaviour of players. The effects of the RugbySmart programme were determined comparing responses from 2005 with the 1996–1998 data (noting that there were differences in methodology between the 2005 and 1996–1998 surveys). Table 1 shows the main variables collected in each survey and the survey participant characteristics.

In the surveys conducted in 1996–1998 (all pre-RugbySmart intervention) the rugby development officers (RDO's), of which there was at least one in each of the 27 regions, each visited three randomly selected clubs. RDO's surveyed no more than five players from each club (player self-completed survey forms). The response rate to individual survey questions varied from 30–82% with an average response rate per question over the 3 years of 64% (see Table 1).

The 2005 survey repeated some questions related to safe tackling, rucking and scrumming technique from the 1996–1998 surveys. Some methodological changes occurred between the surveys; typical over such a time period due to

Table 1
Characteristics of the self-reported behaviour surveys undertaken in rugby union in 1996–1998, 2001 and 2005

| Year of survey | 1996 (pre-RugbySmart) | 1997 (pre-RugbySmart) | 1998 (pre-RugbySmart) | 2005 (post-RugbySmart) |
|---|---|---|---|---|
| *n* | 203 | 135 | 216 | 571 |
| Compliance: main response to individual questions in each survey per year (range) | 57% (30–2%) | 67% | 68% | 83% (56–100%) |
| Selection criteria and administration | RDO's visited three randomly selected clubs. Five players randomly selected from each club were surveyed. Self-completion forms | RDO's visited three randomly selected clubs. Five players randomly selected from each club were surveyed. Self-completion forms | RDO's visited three randomly selected clubs. Five players randomly selected from each club were surveyed. Self-completion forms | Random sample with no more than 4 players from one team at games |
| Size | 10 page A4 booklet | 10 page A4 booklet | 10 page A4 booklet | Double sided A4 questionnaire |
| Player characteristics | Male players over the age of 19 years | Male players over the age of 19 years | Male players over the age of 19 years | Male players over the age of 19 years |
| Level of rugby played | Senior amateur club | Senior amateur club | Senior amateur club | Senior amateur club |
| Example of variables collected | Basic demographics—questions including forward or back position | Same as 1996 | Same as 1997, except did not ask if player was forward or back and 7 questions on Alcohol and Rugby | Basic demographics—5 questions including forward or back position |
| | Activities undertaken at practice—1 questions with 5 parts | | | Attitudes towards key strategies of injury prevention—1 question with eight parts |
| | Activities undertaken at games—1 questions with 5 parts | | | I.C.E. knowledge and behaviour—13 questions |
| | Mouthguard use 1 question | | | Activities undertaken at practice—1 question with 6 parts |
| | Pre-season training—7 questions | | | Injury prevention information 1 question with 9 parts |
| | Pre-season training guides—5 questions | | | Roles in injury prevention 1 question with 3 parts |
| | Injury management and reporting—8 questions | | | Mouthguard use 1 question |
| | Knowledge of ACC advertising material—5 questions | | | Training guides—2 questions |
| | | | | Rating of injury prevention information mechanisms—1 question with 9 parts |

refinement of questions (see Table 1). While there were a number of areas explored in the various questions, we chose to focus on the parts that were used by both ACC and NZRU to evaluate RugbySmart and were key in determining continual involvement.

To examine the linear trend in claim rate per 100,000 players from 2001 to 2005, a simple Poisson regression model was developed using the GENMOD procedure in SAS (version 9.1, SAS Institute, Cary, NC). Estimated changes in claim rates were calculated as percentage changes along with 90% confidence intervals (CI) over the 5-year period.[7] We considered a worthwhile decrease in claim rates to be $\geq$10% (0.90) on the rationale that this would represent a noticeable decrease in injuries for both health service providers and individuals playing the sport. This met the goals for the programme for NZRU and ACC. To determine the effect for self-reported behaviour, we have presented the percentage of responses (90% CI) for each category.

## 3. Results

Table 2 presents the injury rates per 100,000 players by rugby season. The season is concordant with the calendar year in the southern hemisphere. The injury rates in 2005 in general decreased compared to 2001 for targeted injuries and dental claims; however, non-targeted areas did not decrease by 2005. There was a worthwhile effect for targeted MSC but not for non-targeted MSC.

When rates for specific injury sites were analysed and grouped by similar sample sizes, some sites that were targeted, such as the knee, neck/spine and leg (excluding knee and ankle), had decreased by 2005. Although ankle injuries were targeted, the change in claim rates was negligible. Shoulder injuries fell just short of the threshold for a worthwhile effect. Injury sites that were not targeted, however, did not decrease—for example, foot/toe injury claim rates increased over the evaluation period. The rate of increase for one non-targeted injury site, finger/thumb/hand/wrist exceeded the 10% (0.90) threshold.

The 2005 survey data on practice behaviour and injury management supported the change observed in injury sites reported in Table 2. Behaviour at practice as reported by players (see Table 3) showed worthwhile effects for safe tackle, safe ruck, safe scrum and cool-down when comparing 2005 with 1996–1998. The only behaviour area that did not show an effect was warm-up which had already achieved 100% in 1998 and was 98% in 2005.

Table 2
Changes in ACC rugby moderate to serious injury claim rates from 2001 to 2005

| Injury site | Rate per 1,000,000 players | | | | | Five year trend in injury rate (90% CL) |
|---|---|---|---|---|---|---|
| | 2001 | 2002 | 2003 | 2004 | 2005 | |
| Neck/spine[a] | 122 | 106 | 108 | 110 | 93 | 0.77 (0.62–0.97) |
| Shoulder[a] | 473 | 455 | 486 | 496 | 412 | 0.91 (0.82–1.01) |
| Knee[a] | 675 | 654 | 623 | 583 | 565 | 0.79 (0.72–0.87) |
| Leg (excluding knee and ankle)[a] | 175 | 154 | 182 | 166 | 137 | 0.81 (0.68–0.97) |
| Ankle[a] | 244 | 261 | 273 | 262 | 243 | 0.99 (0.86–1.14) |
| All[a] | 1689 | 1629 | 1671 | 1616 | 1449 | 0.85 (0.81–0.91) |
| Finger/thumb/hand/wrist[b] | 376 | 385 | 399 | 369 | 342 | 0.89 (0.79–1.00) |
| Arm/elbow[b] | 153 | 169 | 161 | 168 | 156 | 1.01 (0.84–1.21) |
| Head/face/eye/ear/nose[b] | 131 | 124 | 141 | 153 | 142 | 1.20 (0.98–1.46) |
| Chest/abdomen/pelvis[b] | 83 | 86 | 93 | 80 | 79 | 0.91 (0.71–1.17) |
| Foot/toe[b] | 26 | 36 | 34 | 44 | 54 | 2.29 (1.57–3.34) |
| All[b] | 770 | 800 | 828 | 815 | 773 | 1.01 (0.93–1.09) |

[a] Targeted body site—moderate to serious claims.
[b] Non-targeted body site—moderate to serious claims.

Table 3
Behaviour at practice as reported by players

| Behaviour | 1996 | | | 1997 | | | 1998 | 2005 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fwds (%), $n=105$ | Back (%), $n=96$ | Total (%) (90% CI), $n=203$ | Fwds (%), $n=79$ | Back (%), $n=55$ | Total (%) (90% CI), $n=135$ | Total (%) (90% CI), $n=216$ | Fwds (%), $n=318$ | Back (%), $n=250$ | Total (%) (90% CI), $n=573$ |
| Warm-up | 84 | 84 | 84 (80–88) | 84 | 82 | 83 (78–88) | 100 | 98 | 98 | 98 (97–99) |
| Cool-down | 49 | 48 | 48 (42–54) | 66 | 53 | 61 (54–68) | 67 (62–72) | 78 | 83 | 80 (77–83) |
| Safe tackle | 45 | 46 | 45 (39–51) | 48 | 51 | 49 (42–56) | 56 (50–62) | 84 | 87 | 86 (84–88) |
| Safe ruck | 39 | 40 | 39 (33–45) | 39 | 36 | 38 (31–44) | 41 (36–46) | 69 | 68 | 68 (65–71) |
| Safe scrum | 70 | 50 | 61 (55–67) | 73 | 45 | 62 (55–69) | 59 (54–64) | 93 | 59 | 78 (75–81) |

Fwds: forwards; back: backs.

## 4. Discussion

Educational strategies have been used in a number of public health areas, such as diabetes and cardiovascular disease, to reduce the risk of illness by changing participants' knowledge and consequent behaviours. For example, Kirk et al.[8] reported that exercise consultation was more effective in stimulating exercise behaviour change in the short term than a standard exercise leaflet in people with Type 2 diabetes. Within rugby there has been literature published on injury incidence at both community and professional level of the sport, but few papers have evaluated the effect of injury prevention programmes. The RugbySmart programme provided a unique opportunity to evaluate the impact of an educational strategy for sports injury prevention that was focused at the community level and implemented throughout a country. We are unaware of any other programmes around the world that have combined a nationwide injury prevention intervention with nationwide injury data collection. As well as injury data, surveys of the knowledge, attitudes and behaviours of participants have been conducted, which has permitted the effect of RugbySmart to be evaluated at various levels. While the RugbySmart evaluation has limitations that need to be mitigated, the RugbySmart programme has been designed so that its impact can be continually evaluated.

Analysis of the injury rates per 100,000 players has shown worthwhile reduction in claims for targeted areas, but little impact on non-targeted claims. This provides a useful comparison; if non-targeted areas had decreased at a similar rate to targeted areas then the likelihood of factors other than RugbySmart contributing to the decrease would be higher. This was further supported when injury sites were analysed. In an ideal setting player exposure would have been used to calculate rates. However, we do not believe the exposure has changed markedly over the study period.[4] The cost of determining exposure for community level injury prevention, particularly across an entire country covering multiple grades and competitions would make such regular collection of exposure data prohibitively expensive. The benefit of the ACC system is that claims are collected as its business requirement required by government and as such can be used for analysis of injury prevention initiatives.

The self-reported survey results of players indicated a level of success for the RugbySmart programme in increasing injury prevention behaviour, i.e., the players, led by the coach, incorporated more of the desired prevention behaviours into training and matches. The injury sites targeted (see Table 2) are parts of the body associated with the contact aspects of the game (such as scrums as shown in Table 3) and we presume decreases in injuries to these areas reflect improvements in player technique. The increases in self-reported behaviour are consistent with the material provided in RugbySmart.

In hindsight the evaluation of RugbySmart would have benefited from a baseline established in 2000 just prior to RugbySmart being introduced in 2001, consistent methodologies between studies and not having a change in player registrations in 2001. Inconsistent methodology has been widespread across community intervention programmes. The challenge for the RugbySmart programme is to keep the same methodology for the next 5 years to allow valid comparisons to be made.

In conclusion there has been an observed decrease in injury claims per 100,000 players in areas RugbySmart specifically targeted. This decrease is supported by the improvement in injury prevention behaviour of players.

### Practical implications

- Workshops can be used to communicate injury prevention information on a nation-wide basis.
- Community-focused injury prevention can be successful.
- To increase acceptance of injury prevention information, the content needs to be suitable for the audience with plain language take home messages.
- Plans for evaluation should be built into programme design.

### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jsams.2008.01.002.

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