



Player Fact Sheet: World Rugby/NZ Rugby/Auckland University of Technology RugbyHealth project

Thank you for participating in the World Rugby/NZ Rugby/Auckland University of Technology RugbyHealth project. Your contribution has allowed us to assess the benefits, and some areas of concern, related to long-term physical and psychological health effects of playing elite rugby (ER), community rugby (CR), and non-contact sport (NC) (i.e. cricket and hockey).

Key findings from the project studies were:

1. Retired players (elite rugby, community rugby and non-contact sport) who completed the survey reported better health, were more likely to be in long-term relationships, generally had higher incomes, and were less likely to smoke cigarettes when compared to New Zealand males in general.
2. Retired rugby players had more injuries during their sporting lives when compared with non-contact players.
3. Retired rugby players reported current higher levels of osteoarthritis and cardiovascular issues when compared with retired non-contact sport players.
4. Retired rugby players drink more alcohol during a drinking session but have fewer drinking sessions per week when compared with retired non-contact sport players.
5. Retired elite rugby players compared to non-contact sport players had more variability, and performed slightly worse on some, but not all, measures of cognitive ability (i.e. brain function) in the neuropsychological test used in this research.
6. Regardless of sport played, retired players who reported four or more concussions during their sporting careers, compared to retired players who did not report a concussion, reported more injuries during sport, more hospitalisation for injury, lower ratings for current health, and more health concerns in the last 12 months.
7. Regardless of sport played, retired players who reported four or more concussions during their sporting careers, compared to retired players who did not report a concussion, performed worse on some, but not all, measures of cognitive ability in the neuropsychological test used in this research.
8. Regardless of sport played, retired players who reported one to three concussions during their sporting careers, compared to retired players who did not report a concussion, had worse results on one of five balance tests.
9. Regardless of sport played, there were no clear differences between the concussion groups for marital status, hours worked per week, income, arthritis, medication use, mental health issues, sleeping patterns, frequency of alcohol use, current smoking levels, and current physical activity levels.
10. Assessment of brain excitability (i.e. the function of connections between brain cells) in the laboratory revealed no clear differences for analyses by retired player groups (elite rugby, community rugby or non-contact sport) or by concussion groups (those who reported concussions versus those who did not report concussions during their playing careers).

Key recommendations are:

1. Sports should focus on improving targeted injury prevention programmes (such as NZ's RugbySmart) and injury management programmes for injuries leading to the greatest morbidity. For rugby this focus should be on arthritis and concussion as leading causes of morbidity.
2. Sports should focus on improving concussion awareness, management (immediate and follow-up) and prevention programmes.

3. Education on the harmful effects of excessive alcohol ingestion should be a core inclusion in all sports education programmes.
4. In addition to identifying the injury risk associated with sport, the potential benefits to general and neuropsychological health from sports participation should be highlighted.
5. The impact of concussion on long-term balance, cognitive brain function and long-term musculoskeletal and cardiovascular health in athletes requires further targeted research.

Project methods

This project, which began in October 2012 and was completed in March 2015, involved a total of 485 participants – 131 retired elite rugby (ER), 281 retired community rugby (CR) and 73 retired non-contact (NC) sport players.

The four individual studies within this one project were:

Study A – General health assessment (485 participants: ER=27%, CR=58%, NC=15%)

Study B – Neuropsychological health assessment (366 participants: ER=28%, CR=54%, NC=18%)

Study C – Balance assessment (75 participants: ER=32%, CR=40%, NC=28%)

Study D – Brain excitability assessment (76 participants: ER=32%, CR=37%, NC=32%)

The study provides a snapshot of the current physical and neuropsychological health of retired rugby, cricket and hockey players. The majority of rugby players in the study began playing senior rugby in the 1980 and 1990s. Most of the elite rugby players finished playing at an elite level in the 1990s and 2000s, and most of the community players finished playing in the 2000s and 2010s. The nature of the game of rugby has changed over time (for example we now see larger, faster, stronger players, experiencing greater impacts in tackles), as has the awareness of medical issues (such as concussion), and the availability of sideline medical assessment and better treatment of players' injuries. Therefore the nature of long-term health effects from rugby may change over time.

You should be aware that, in order to identify statistically relevant outcomes from research, a minimum number of participants is required. The number of participants necessary is directly related to the test applied. The balance and brain excitability tests used in these research studies required participants to attend face to face testing in a laboratory using sensitive scientific equipment. The sophisticated technology and the accuracy of testing meant less participants were required to obtain statistically relevant results. In comparison, the participants in the general health study completed an on-line questionnaire, and the participants in the neuropsychological health assessment completed an on-line test. These on-line tests are less sensitive than the laboratory tests so a larger number of participants was needed. Given the methods used, and the participant numbers recruited, the evidence from all four studies is considered indicative and should be interpreted accordingly.

Study A: General health (assessed by the on-line General Health Questionnaire)

There were 485 retired players who participated in this on-line study (ER=129, CR=281, NC=75).

Retired elite rugby players reported more injuries during sport than retired community rugby players and retired non-contact sport players. Retired players who had four or more concussions also reported more injuries during sport than retired players who had no concussions.

All retired sport players (elite rugby, community rugby and non-contact sport) had positive findings compared with New Zealand (NZ) population norms for health rating, long-term relationships, income, cigarette smoking and cannabis use. Data for the NZ population norm group was sourced from New Zealand census data and other national surveys that included males of similar ages, for a range of health and socio-economic indicators.

- A greater percentage of all retired sport players rated their own **health** as good to excellent compared with the NZ population norms (NZ=89%, ER=96%, CR=94%, NC=96%).
- A greater percentage of all retired sport players were married or in **long-term relationships** compared

with the NZ population norms (NZ=72%, ER=92%, CR=90%, NC=88%).

- A greater percentage of all retired sport players had an **income** of more than \$100,000 per annum compared with the NZ population norms (NZ=16%, ER=39%, CR=32%, NC=41%).
- A greater percentage of all retired sport players had lower levels of **cigarette** smoking compared with the NZ population norms (NZ=21%, ER=7%, CR=9%, NC=10%).
- A greater percentage of all retired sport players had lower levels of **cannabis** use during their life compared with the NZ population norms (NZ=52%, ER=43%, CR=34%, NC=43%).

Retired elite and community rugby players had more concussions, arthritis, cardiovascular issues, health concerns and alcohol use concerns, compared with retired non-contact sport players.

- A greater percentage of retired elite and community rugby players had sustained **concussions** than retired non-contact sport players (ER=94%, CR=82%, NC=25%).
- A greater percentage of retired elite and community rugby players reported that they had **arthritis** than retired non-contact sport players (NZ=13-25%, ER=36%, CR=20%, NC=5%).
- A greater percentage of retired elite and community rugby players reported **cardiovascular** issues than retired non-contact sport players (NZ=5%, ER=10%, CR=5%, NC=3%). Cardiovascular issues include high blood pressure, arrhythmias, being/or having been on medication for heart conditions or high blood pressure.
- A greater percentage of retired elite and community rugby players reported current **health concerns** than retired non-contact sport players (ER=44%, CR=41%, NC=31%).
- A greater percentage of retired elite and community rugby players currently drink **alcohol** at hazardous levels/binge drinking (as measured by the AUDIT scale) than retired non-contact sport players (NZ=20%, ER=34%, CR=36%, NC=24%). The consumption of five or more alcoholic drinks per session was greater for retired community rugby (28%) and retired elite rugby (23%) than retired non-contact sport players (14%).
- Elite rugby players had a lower percentage of regular **alcohol** drinking, defined as drinking less than four days a week than community rugby players and retired non-contact sport players (ER=17%, CR=24%, NC=35%).

Regardless of the sport played, retired players who had four or more concussions had increased numbers of injuries during their sporting lives, more hospitalisation for injury, worse ratings for current health, and more health concerns, compared with retired players who reported no concussions during their sporting careers.

- A greater percentage of retired concussed players reported **hospitalisation for injury** than retired non-concussed players (Concussed=61%, No concussion=39%).
- A greater percentage of retired concussed players reported current **health concerns** than retired non-concussed players (Concussed=57%, No concussion=43%).

There were key differences between the three retired sports groups. These included:

1. **Game exposure rates** - Elite rugby players played a significantly larger number of games than the non-contact and the community rugby players:
 - Elite rugby player – 96% played more than 150 games
 - Non-contact – 86% played more than 150 games
 - Community rugby – 67% played more than 150 games
2. **Ethnicity** - A greater percentage of elite and community rugby groups were of Maori and Pacific Islander ethnicity (ER=28%, CR=18%, NC=3%).
3. **Formal school education** - A greater percentage of elite and community rugby groups had no formal school education (ER=7%, CR=5%, NC=1%).

As part of the research, retired players were asked – given what they know now about their health and the risks involved in their sport – whether they would choose to do it all over again if they could travel back in time to the beginning of their sports career. The answer was absolutely. The average rating was 4.6 ±1.1, using a rating scale of 1=no way and 5=absolutely (ER=4.6, CR=4.5, NC=4.7).

Study B: Neuropsychological health (assessed by the on-line CNSVS test)

There were 366 retired players who participated in this on-line study (ER=103, CR=198, NC=65).

Brain function was assessed using the CNS Vital Signs (CNSVS) on-line battery of tests resulting in cognitive domain scores.

Two cognitive domain scores, psychomotor speed and motor speed, were significantly worse for all retired players who reported four or more concussions during their sporting careers. Retired elite rugby players had more variability, and on average performed slightly worse on testing of four cognitive domains (complex attention, cognitive flexibility, processing speed and executive function) compared to the non-contact sport group.

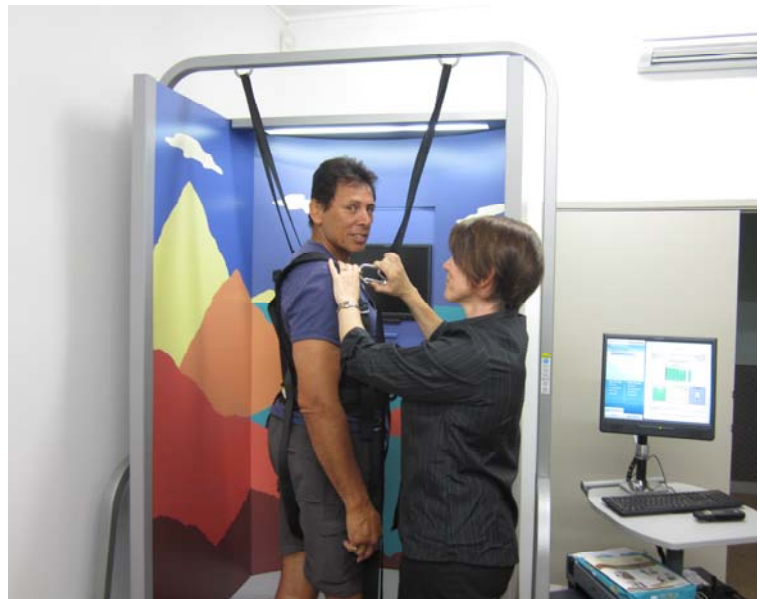
The variability in performance indicates that while most players go through rugby with no adverse effects, others display reduced cognitive function as assessed by the CNSVS test compared to their age-matched peers. The implications of these differences in terms of activities of daily living is currently unknown.

Study C: Balance (assessed by the laboratory dynamic balance tests)

There were 75 retired players who participated in this laboratory study (ER=24, CR=30, NC=21).

Retired elite rugby players had better balance on one of five balance tests (unilateral stance with eyes open) than both retired community rugby players and retired non-contact sport players who had similar balance scores. Retired community rugby players had the same balance scores as retired non-contact sport players.

Regardless of sport, retired players who reported 1-3 concussions during their sporting careers had worse balance scores on one of five balance tests (unilateral stance with eyes open) than retired players with no self-reported concussions.



Associate Professor Denise Taylor assisting project ambassador, retired All Black Buck Shelford, into the balance testing device.

Study D: Brain excitability (assessed by the laboratory transcranial magnetic stimulation tests)

There were 76 retired players who participated in this laboratory study (ER=24, CR=28, NC=24).

There were no clear differences in brain excitability (i.e. function of the brain neural circuits) in retired elite and community rugby players compared to retired non-contact sport players.

There were no clear differences in brain excitability between retired player groups with or without previous concussion.



Dr Gwyn Lewis conducting the brain excitability test on Buck Shelford.