

RCRG e-Magazine

Issue 4 (Sept) 2016



Rugby Codes Research Group (RCRG)

Mission: Holistic advancement of practice within the rugby codes via applied research.

Aims:

- Bring together expertise that integrates areas of sport research (injury prevention, strength & conditioning, sport technology, coaching, psychology, physiology, performance analysis, leadership, management).
- Offer leading edge design and development solutions to rugby organisations, teams and players around the world.

The RCRG e-Magazine provides a means of communicating advances in evidence-based knowledge and its practical application to the wider support network of rugby codes.



**AUT SPORTS PERFORMANCE
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for hosting the publication of this e-Magazine.

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WELCOME TO THE RCRG E-MAGAZINE

Welcome to issue 4 of the Rugby Codes Research Group (RCRG) e-Magazine (previously known as the RCRG newsletter). The aim for the RCRG e-Magazine is to communicate advances in evidence-based knowledge and its practical application to the wider support network of rugby codes. In this issue we provide an update of rugby codes research projects by members. We look forward to your continued work to improve performance and reduce risk of injury in the rugby codes. As founder of the RCRG, I have edited four issues of the RCRG newsletter/e-Magazine. I have enjoyed discussions with contributors and learning more about the rugby codes. I look forward to reading the 2017 issue that will be collated and edited by our next RCRG e-Magazine editor Associate Professor Nic Gill. Nic brings a wealth of research and practical application of research knowledge to our RCRG.

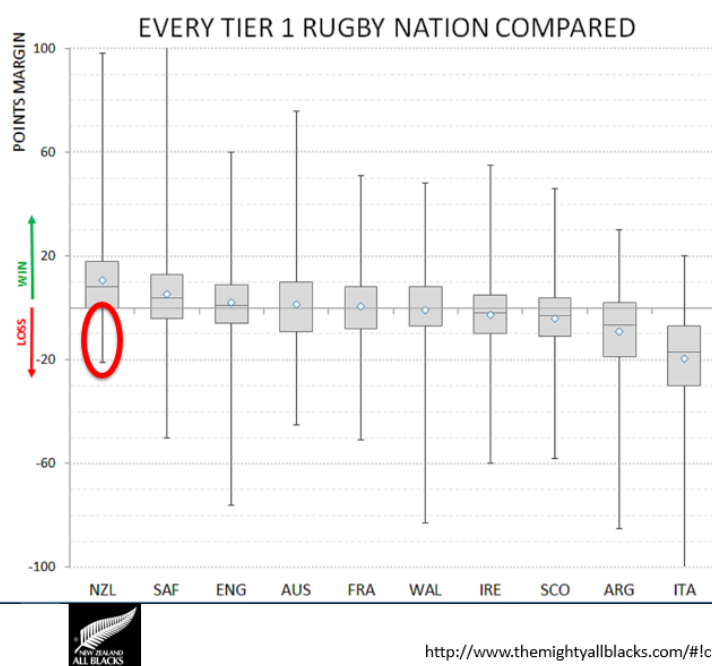


Professor Patria Hume (Editor 2012-2016)

Wise words from wizard Gilly on practical application of research into rugby performance

Associate Professor Nicholas Gill is the All Blacks Strength & Conditioning Coach, and an AUT Associate Professor who has supervised numerous student theses focused on rugby. As outgoing editor of the RCRG e-Magazine, I asked Gilly (the name his colleagues call him) as in-coming editor – “Given how great All Blacks are... what are the key research findings that you have used to help them?” Here are Gilly’s words of wisdom ☺.

“We use information and research to guide best practice within the All Blacks and have done for over a decade. Over the years, numerous studies and findings have helped us make various decisions and help us implement specific processes to continue to raise the bar in physical preparation and performance. A study we completed over a decade ago definitely helped us educate players and staff on the importance of recovery (*Br J Sports Med.* 2006;**40**:260-263). To this day, the various modes of recovery are “foundations” of the physical program of the All Blacks. Indeed, a plethora of research contributes to the performance philosophy of the All Blacks but some recent research on instantaneous feedback (*J Strength Cond Res.* 2011;**25**[1]:87-93), and the quantification of training / collision load (*Br J Sports Med.* 2008;**42**[3]:198-201) have specifically helped us make better decisions with our coaches and players. We collect a lot of information in the All Blacks and we do a lot of research and trend analysis. The big question is always “how will this information impact at the coalface and help us win?”



Associate Professor Nicholas Gill PhD, All Blacks Strength & Conditioning Coach. +64 27 488 8699 | Nicholas.Gill@nzrugby.co.nz



Associate Professor Nicolas Gill (Editor 2017-2018)

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RCRG HISTORY

The Rugby Codes Research Group (RCRG) was established in February 2009 based on the prior work in rugby related research of Professors Patria Hume and Will Hopkins and their postgraduate students – specifically Dr Ken Quarrie, Dr Simon Gianotti and Dr Doug King. Injury prevention and strength and conditioning were the original focus areas, with expansion into coaching, psychology, performance analysis, management and business in 2015. This exciting integrated approach means that knowledge across research areas is combined allowing effective holistic advancement of practice within the rugby codes.

The RCRG includes members from undergraduate to professorial level and national and international collaborators. The RCRG members includes epidemiologists, biomechanists, physiotherapists, medical doctors, emergency nurses, academic researchers and educators, students, coaches, players, and administrators.

Past RCRG e-Magazines available on the RCRG website <https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes> outline activities of the RCRG:

[Rugby Codes Research News - Issue 3 - June 2015](#)

[Rugby Codes Research News - Issue 2 - October 2014](#)

[Rugby Codes Research News - Issue 1 - August 2013](#)

RCRG CO-LEADERS AND ROLES

The RCRG co-leaders work together to help achieve the aims of the RCRG:

- Professor Patria Hume (Founder of RCRG, AUT Professor Human Performance, Biomechanist, Kinanthropometrist, Injury prevention specialist, Injury epidemiologist)
- Associate Professor Lesley Ferkins (AUT staff, Sport Leadership & Management specialist)
- Associate Professor Nic Gill (All Blacks Strength & Conditioning Coach, AUT staff)
- Dr Doug King (AUT SPRINZ Research Associate, Biomechanist, Kinanthropometrist, Injury Prevention specialist, Injury epidemiologist)
- Dr Matt Brughelli (AUT staff, Strength and conditioning specialist, Biomechanist)



Specific roles and responsibilities within the RCRG include:

- RCRG membership: Associate Professor Lesley Ferkins (Chair), Professor Patria Hume, Dr Doug King
- RCRG postgraduate liaison: Associate Professor Lesley Ferkins
- RCRG e-Magazine editor: 2012-2016 Professor Patria Hume; 2017-2018 Associate Professor Nic Gill
- RCRG grants: Dr Matt Brughelli (Chair), Associate Professor Lesley Ferkins, Dr Doug King
- RCRG web coordinator: Katie Dee (AUT SPRINZ research officer)
- RCRG media liaison: Susannah Dalton (AUT media), Ian Long (NZR)
- RCRG liaison with NZ Rugby: Dr Ken Quarrie (NZR), Associate Professor Nic Gill, Associate Professor Lesley Ferkins
- RCRG liaison with NZ Rugby League: Dr Simon Mayhew (NZRL), Professor Patria Hume, Dr Doug King

We welcome suggestions for areas of focus and leaders of initiatives.

RCRG MEMBERS

We encourage new RCRG members. Please download a RCRG member profile from <https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes> to become part of the RCRG, or contact katie.dee@aut.ac.nz to be placed on the RCRG e-Magazine distribution list. If you have not yet provided a profile, please do, so we can highlight your rugby research related activities.



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Some of the
SPRINZ student
RCRG members

CURRENT MEMBER REMINDER: download a RCRG member profile from <https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes> and send to katie.dee@aut.ac.nz.

RCRG MEMBER NEWS

Professor Patria Hume awarded the ISBS 2016 Geoffrey Dyson award

Professor Patria Hume received the ISBS 2016 Geoffrey Dyson Award in Japan. The International Society of Biomechanics in Sports (ISBS) Geoffrey Dyson Award recognizes sport scientists who, throughout their professional careers, bridge the gap between biomechanics research and practice in sport. It is the most prestigious award of ISBS because it is a recognition of individuals who embody and carry out the primary purposes of the Society. During the award speech Patria summarized many rugby code projects conducted with collaborators, and highlighted the recent World Rugby/NZ Rugby/AUT NZ Rugby health project findings. RCRG member Professor Gareth Irwin, as the current ISBS President, introduced Patria's speech at the conference in Tsukuba in July, and presented her the glass trophy for the award.



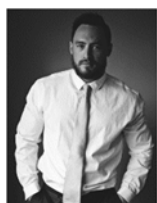
Professor Gareth Irwin





Professor Patria Hume during her Geoffrey Dyson award lecture in Tsukuba, Japan, in July 2016.

ACC Sports Collaboration Group rugby codes update



Isaac Carlson and Natalie Hardaker from ACC lead the Sports Collaboration Group involving representatives from New Zealand Rugby, Netball New Zealand, New Zealand Rugby League, AUT's Sports Performance Research Institute New Zealand (SPRINZ) and AUT's National Institute of Stroke and Applied Neurosciences (NISAN). The Sport Collaboration Group is 'Working together to provide leadership in injury prevention and management issues relevant to sport and recreation'. National guidelines on concussion have been distributed.

The SportSmart Warm-Up materials have been updated and were launched on 7th September 2016. The ACC warmup is based on football's "FIFA 11+" with sport specific adaption. This allows transfer of basic information between sports which is useful for playing rugby union, rugby league and rugby sevens. We engaged both elite and community players to help deliver the message of training and games starting with warm-up. All Blacks players are respected by coaches and players at community level and can provide aspirational messages. People attending courses can identify directly with community players and coaches. Sony Bill Williams is an elite athlete for the All Blacks and also league. In the SportSmart warm-up videos you can see how we use him and other elite athletes as role models for best practice.



In teaching warm-up we focus on correct technique. In squatting it is important to have correct mechanical alignment for basic movements. The lateral jump exercise is a progression once correct squat technique has been gained. Appropriate progression of skill to more explosive movement is important. Whether it is junior players or elite, progression of skill, taking into account muscle growth and fatigue, coordination, and level of fitness, are all important when selecting exercises. Ensuring a variety of exercises to avoid boredom and increase compliance to training is also important.

Dr Simon Mayhew leads the new NZ Rugby League Medicine and Safety Advisory Group

Dr Simon Mayhew was appointed the first NZRL Medical Director in June 2016. The NZRL Board thanked the previous medical and sports science advisory group members, and appointed a medical and safety advisory group that liaises with Simon on a more regular basis. Members of the new group are Dr Stewart Walsh (Orthopaedic Surgeon at Starship and sports orthopaedics in private), Dr John Mayhew (Warriors team doctor), Professor Patria Hume (Biomechanist, Kinanthropometrist, Injury Prevention specialist), Dr Doug King (Rugby codes researcher, Injury Prevention specialist, Emergency Nurse), Hamish Craighead (Physiotherapist - Kiwis and Warriors physiotherapist, BPE), Byron Thomas (HPSNZ, MPE).

RCRG media

AUT's Susannah Dalton and NZR's Ian Long help the RCRG members respond to media questions around the rugby codes research we conduct. Contact sdalton@aut.ac.nz or ian.Long@nzrugby.co.nz for help with media. Researchers should be aware that media can gain access to your email and other forms of communications through official information act requests (e.g. the articles about the NZ Rugby Health study by Dylan Cleaver of the NZ Herald).



The launch of the UK Rugby Health study received a lot of media attention such as BBC Sport website, Capital FM radio, Made in Leeds TV, Wales Current Affairs programme, Irish radio, 'League Express' national rugby paper feature, Sunday Times and Telegraph national newspapers.

Ken Quarrie wrote a commentary that appeared in the Sunday Start Times on 4th September at:

<http://www.stuff.co.nz/sport/rugby/opinion/83867218/what-nz-rugby-understands-about-concussion-and-what-we-want-to-find-out>

Rugby, head blows and health: this is what we've found

The latest study reinforces the need for more research, writes NZ Rugby senior scientist Ken Quarrie.

The issue of concussion in contact sport has rightly received a great deal of focus over the past few years.

When New Zealand rugby and World Rugby approached AUT in 2012 to commission a study of retired rugby players, research examining health issues among former sportspeople was largely limited to American Football. We're now seeing a range of research being carried out across many sports.

At the time the project was intended to involve data from 600 former players using web-based data collection, and 75 former players using laboratory based data collection. Recruitment was difficult at the time.

Given increased media and player and public awareness of concussion issues, recruitment would likely be much easier if the study was conducted now.

Players' health outcomes were compared for 100 professional rugby players, 195 community rugby players and 65 non-contact elite sports players, with the potential impact of head injuries and long-term health outcomes being one focus of the study.

AUT's experience and world-leading research techniques were invaluable. Participants in the study undertook a variety of tests, including the CNSVS test. This test is designed to be used in conjunction with a neuropsychologist's clinical assessment.

However, it can be used to examine how well groups of people are performing compared to each other and a normative sample from the United States, and as a triage tool to refer people for further evaluation. People who complete the CNSVS test would need to be formally assessed by a neuropsychologist to gain individual feedback of the meaning of the results.

The type of study design we used can't show causality, partly because we don't know whether, or to what extent, the groups of players differed on the measures we used to examine cognitive functions before they played sport. While the differences identified between players who suffered repeated concussions and those who didn't are concerning and require closer examination, the effects on the whole were small. Scientifically we need to remain circumspect about how confident we can be that the differences we observed will hold among other study groups, or exist in the wider population.

A single study rarely provides definitive answers to the research question at hand – science tends to work in a cumulative manner.

Although we study samples of people, and look at the effect in the sample, what we need to know is whether the effect exists in the wider population. We use statistical techniques to help make inferences about the likelihood of the effect actually being present beyond the study group.

The results of multiple studies build an evidence base upon which people can have increasing confidence that the effect being studied is likely to exist beyond the sample groups that have been studied. The AUT researchers, and NZ Rugby, are working independently with other groups internationally to gather more evidence.

Keeping an open mind scientific-

cally is a different thing from not accepting the potential implications of the study.

Both World Rugby and NZ Rugby have recognised that there is a potential link between playing contact sport and some forms of dementia for a number of years, and are acting according to the 'precautionary principle'.

In other words, even though we don't know for sure whether such a relationship exists based on the available scientific evidence, we are acting as though it does.

We are trying to manage and minimise risks associated with concussions by raising public awareness of the injury, implementing injury management practices that reduce risk, and conducting further research into the issue.

As evidence continues to emerge, we will continue to take all reasonable steps to protect the health and well-being of participants.

What we know from the NZ Rugby Health study is that it met its aims of describing areas of potential benefit or concern. It was envisaged that the "snap-shot" in time of the study design would provide information that could be used to design prospective studies.

The NZ Rugby Health study has been an important first step in our understanding more about the likely long term effects of playing rugby.

So, in conclusion, while it doesn't look like playing rugby is associated with profound impacts on cognitive function in general, former players as a group performed slightly worse than non-contact players on several of the tests used. In addition, slightly more players than would have been expected if there were no issues, scored at very low levels on some variables.

The important next stage is to do the responsible thing and find out more about the issue, including, for example, whether dementia rates among former players differ

from those among non-players. While rugby is already working on this, we're not alone in doing so. Increased research, increased education and increased focus to remove the risks of head knocks in contact sports around the world will benefit us all.



Jordan Tautua of the Crusaders is checked by team doctor Rob Robinson after a head knock last year. GETTY IMAGES

RUGBY CODES PROJECT UPDATES

Dr Doug King - Concussion and impact studies for rugby codes

Dr Doug King PhD² (yes he now has two PhDs) continues to lead numerous national and international studies investigating injuries in the rugby codes. Doug is flying to Wales on 12th Oct to meet coaches and researchers, including for the first time Professor Conor Gissane after 15 years of collaborative research!

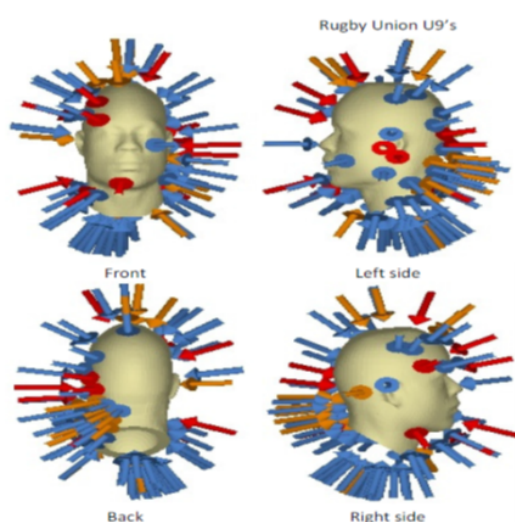
Doug's rugby codes related publications since the last RCRG e-Magazine include:

- King, D. (2015). *Sports-related concussions in New Zealand amateur rugby union and league: Identification, assessment and impact forces involved* (PhD). AUT University, Auckland.
- King, D., Hume, P. A., Gissane, C., & Clark, T. (2016). Measurement of head impacts in a senior amateur rugby league team with an instrumented patch: Exploratory analysis. *Sports Medicine*.
- King, D., Hume, P. A., Gissane, C., & Clark, T. (2016). Semi-professional rugby league players have higher concussion risk than professional or amateur participants: A pooled analysis [SPOA-D-15-00416R2]. *Sports Medicine*, 9. doi:10.1007/s40279-016-0576-z
- King, D. A., Hume, P. A., Carlson, I., Lammas, J., Kwon, B., & Mayhew, S. (2016). *Rugby League ACC injury claims 1st January 2011 To 31st December 2015: Report to NZ Rugby League Board*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology.
- King, D., Hume, P. A., Gissane, C., Brughelli, M., & Clark, T. (2016). The influence of head impact threshold for reporting data in contact and collision sports: Systematic review and original data analysis. *Sports Medicine*, 46(2), 151-169. doi:DOI 10.1007/s40279-015-0423-7
- King, D., Gissane, C., Hume, P. A., & Flaws, M. (2015). The King–Devick test was useful in management of concussion in amateur rugby union and rugby league in New Zealand. *Journal of the Neurological Sciences*, 351(1-2), 58–64.
- King, D., Hume, P. A., Gissane, C., & Clark, T. (2015). *Sports-related concussions in rugby league: The magnitude of the problem and evidence for impact assessment. A report for the National Rugby League and the New Zealand Rugby League*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology.
- King, D. A., Hume, P. A., Gissane, C., & Clark, T. (2016). Similar head impact acceleration measured using instrumented ear patches in a junior rugby union team during matches in comparison with other sports. *Journal of Neurosurgery: Pediatrics*, 18, 65–72. doi:DOI: 10.3171/2015.12.PEDS15605



Prof Conor Gissane

Xpatch impact biomechanics in rugby



15 impacts to head per game per player

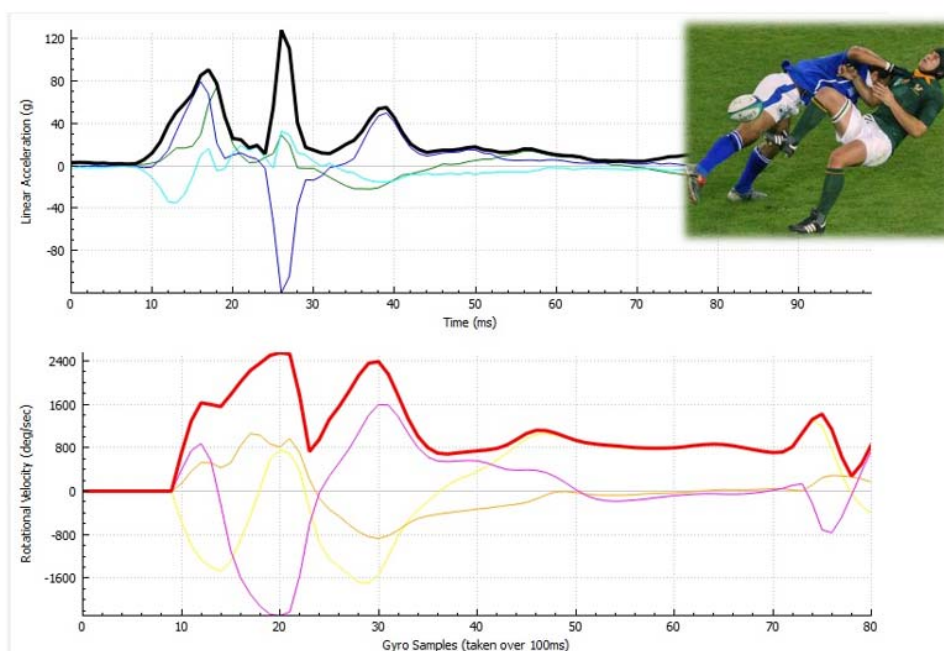


During the 2015 season 14 players from an under-9 yr. old rugby union team were monitored with instrumented behind-the-ear triaxial XPatches. This technology allows us to visualise the position and magnitude of the impacts. Over four games, the junior players suffered an average of 15 impacts to their head per game. Only one impact was greater than 95g, however, 121 impacts were greater than 5500 rad/s². Monitoring rugby players' head impacts with triaxial accelerometers in behind-the-ear patches and mouthguards has shown that the size and frequency of impacts in rugby were greater than most other sports.



Concussions – 98g (82-115) linear; 5,776 rad/s² (4,583 -6,969 rad/s²) rotational acceleration.

King, D.A., Hume, P.A., Gissane, C. & Clark, T.N. (2016). Similar head impact acceleration measured using instrumented ear patches in a junior rugby union team during matches in comparison with other sports. *Journal of Neurosurgery: Pediatrics*. doi: 10.3171/2015.12.PEDS15605



These impact traces were recorded on an Australian rugby player who sustained a right cheek impact during his first tackle of the game. He had loss of consciousness for ~20 sec. The algorithm provided a 96.6% risk of concussion. Advances in technology are helping us to help sport answer their questions.

R cheek by nose. LOC ~20 sec. 1st tackle of game

PLA(g) = 53.3; PRA(rad/s²) = 13,648. HITsp = 96.4; RWEcp = 0.9662 (96.6% risk of concussion)

Papers accepted for publication:

- Measurement of the head impacts in a sub-elite Australian Rules football team with an instrumented patch: Exploratory analysis – Doug King, Mark Hecimovich, Trevor Clark, Conor Gissane *Int J Sport Sci Coach*
- Head impacts in a junior rugby league team measured with a wireless head impact sensor: An exploratory analysis *J Neurosurg Ped*

Papers submitted for publication:

- Measurement of head impacts in a senior amateur rugby league team with an instrumented patch: Exploratory analysis – Doug King, Patria Hume, Conor Gissane, Trevor Clark. *Sports Medicine*
- Head impact monitoring and ocular pursuit testing reveals concussive events missed by standardized protocols in senior amateur rugby union in Australia – Adrian Cohen, Doug King, Alan Pearce. *J Neurosurg*
- Prevalence of suspected and medically diagnosed concussion in junior-level community-based Australian Rules Football – Mark Hecimovich, Doug King. *J Paediat Child Health*

Projects on the go:

- Women's rugby league head impacts – Doug King, Patria Hume, Conor Gissane, David Kieser
- Comparison women's and men's rugby league head impacts – Doug King, Patria Hume, Conor Gissane, David Kieser
- Sub-elite and Junior Australian Football League head impacts and the identification of concussion with the King-Devick test – Mark Hecimovich, Doug King
- Head impacts in semi-professional rugby league – Andrew Gardner, Doug King
- Head impacts in a semi-professional Australian rugby union competition – Adrian Cohen, Doug King, Alan Pearce



Projects under development:

- Head impacts in a professional rugby union team over a season of matches – Liz Williams, Doug King, Patria Hume, Conor Gissane, David Kieser
- The recovery and stress of participation in a professional rugby union competition – Liz Williams, Doug King, Patria Hume, Conor Gissane, David Kieser

- The identification of concussion in a professional rugby union team with a saccadic reading tool - Liz Williams, Doug King, Patria Hume, Conor Gissane, David Kieser
- Neurosensory changes in professional rugby union players over a season of competition matches – Liz Williams, Doug King, Patria Hume, Conor Gissane, Mark Tommerdahl, David Kieser
- Neurosensory changes in amateur rugby union players over a season of competition matches – Doug King, Patria Hume, Conor Gissane, Mark Tommerdahl
- Use of the King-Devick Eye tracker in the assessment and management of concussion – Doug King, Patria Hume, Conor Gissane
- Use of the recovery-stress questionnaire for the management of concussion symptoms and the return to participation process – Doug King, Patria Hume, Conor Gissane
- Development of a concussion assessment tool for use in Emergency Departments and General Practice for the identification and management of concussion – Doug King, Patria Hume

Dr Elizabeth Bradshaw - Head gear impact studies

Project title: Head impact biomechanics after a shoulder charge collision in rugby

Principal investigator: Dr Elizabeth Bradshaw (Australian Catholic University)

Co-investigators: Prof. Patria Hume (Auckland University of Technology)
Dr Doug King (Auckland University of Technology)
Dr Brett O'Connell (Australian Catholic University)

Associate investigators: Dr Simon Mayhew (National Rugby League)
Dr Paul Bloomfield (National Rugby League)

Research assistants: Mr Sufian Talip (Australian Catholic University)
Ms Jayde Lewis (Australian Catholic University)

Acknowledgements: Australian Catholic University (student internship funding)



What is the project about? This research project investigates the effectiveness of head gear in reducing impact loads during a shoulder charge (tackle) to the head. In rugby league this action would be considered a dangerous contact (spearing), which is why we have selected it to test head gear. In this study we would like to test your shoulder charges. An upper body model with and without head gear fitted on the head will be used as your opponent. The model can be lowered or raised to the ideal height for you to shoulder charge. We would also like to determine the measurement agreement between the gold standard laboratory tool for measuring impact accelerations (wired triaxial accelerometer) and the field tool (wireless inertial sensor). The wireless inertial sensor will be the xPatch (below) from X2 Biosystems in Seattle, USA. The project will be conducted at the Australian Catholic University in Melbourne.

Intended manuscripts include:

- Bradshaw, E., Hume, P. A., King, D., Bloomfield, P., & Mayhew, S. et al. *The quantification of the relationship between impact acceleration magnitude and rugby league head gear absorption effectiveness.*
- Bradshaw, E., Hume, P. A., King, D., Mayhew, S., & Bloomfield, P. et al. *Efficacy of protective headgear in rugby league: A biomechanical investigation.*

For further information contact Dr Elizabeth Bradshaw Elizabeth.Bradshaw@acu.edu.au.



Dr Sarah-Kate Miller - Psychology and social aspects of New Zealand Rugby League Academy players

New research is starting with NZRL to understand and improve the holistic development (psychology and social aspects) of New Zealand Rugby League Academy players aged 15-18 years. Coaching support for Maori and Pacific Island players is being examined by the coaching research group led by Dr Skate Millar. A recent study of rugby league players found that self-drive and balance are characteristics of a successful senior elite rugby league player. These characteristics are developed through experience, family, and over time, not necessarily coaches and support staff. Therefore, new ways of coaching and interacting with players is needed. For further information contact Dr Sarah Kate Millar sarahkate.millar@aut.ac.nz.



Professor Patria Hume et al. - World Rugby/NZR/AUT NZ RugbyHealth project

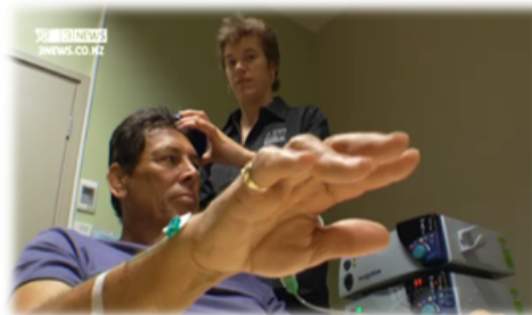
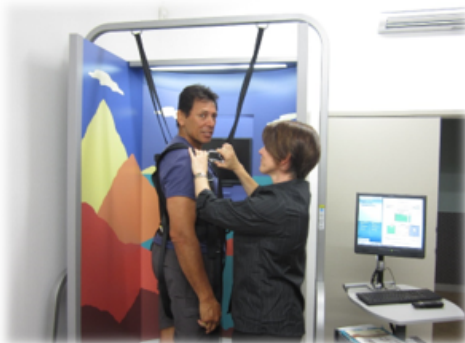
Project members: Patria Hume¹, Ken Quarrie^{2,1}, Gwyn Lewis³, Alice Theadom⁴, Martin Raftery⁵, Scott Brown¹, Stephen Marshall^{6,1}, Denise Taylor³, Rosamund Hill⁷, Ian Murphy², Matt Brughelli¹

¹Sports Performance Research Institute New Zealand, Auckland University of Technology; ²New Zealand Rugby; ³Health and Rehabilitation Research Institute, Auckland University of Technology; ⁴National Institute for Stroke and Applied Neurosciences, Auckland University of Technology; ⁵International Rugby Board; ⁶Injury Prevention Research Centre, University of North Carolina; ⁷Auckland Hospital

Overview: The New Zealand RugbyHealth project (*NZ RugbyHealth*) was funded by World Rugby, New Zealand Rugby, and Auckland University of Technology in 2012. The NZ former rugby players had more injuries resulting in hospitalisation, more concussions, more general health issues including cardiovascular issues currently, more arthritis, more hazardous alcohol drinking behaviour, performed worse on neurocognitive tests, and had altered cortical motor excitation and inhibition, than the non-contact sport comparison group. The neurocognitive (CNSVS) study part of the project, published last month in the *Sports Medicine* journal, showed that players who experienced one or more concussions during their career were less able to understand and process information quickly, to make rapid decisions, to switch attention between tasks and to track and respond to information over long periods of time.

The project examined the long term health effects of playing rugby. We focused on general health and neuropsychological health using online tests and balance and brain excitability using laboratory tests. A series of questions on health topics including injury, playing history, general well-being, psychological health and medical conditions were completed. Former rugby players had a greater proportion of injuries during sport including concussions, and currently more arthritis, hazardous alcohol use, and a wider range of health issues than non-contact sport players. Elite and community level rugby players showed similar results. This project is in the final stages of completion with two journal articles published to date.

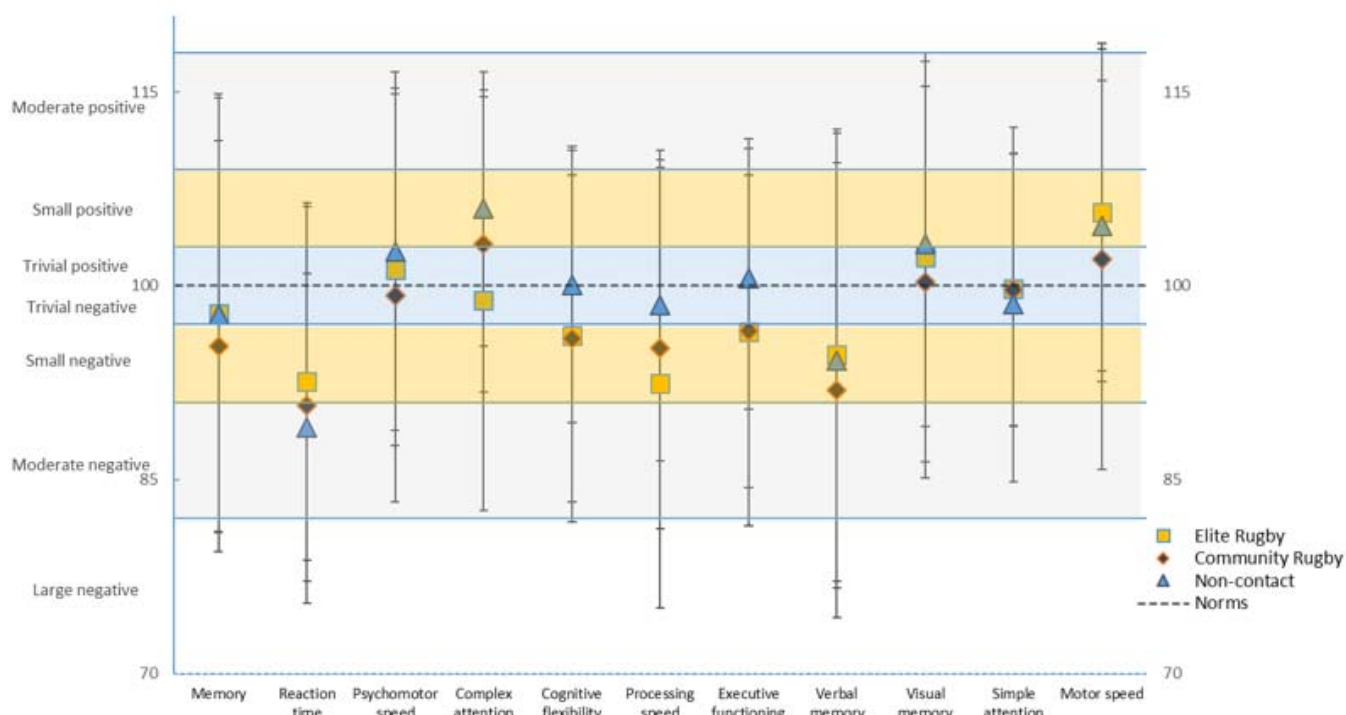
What is the health status of retired rugby athletes compared with retired non-contact sport athletes?



The first paper in the series of studies in the RugbyHealth project has been published:

- Hume, P. A., Theadom, A., Lewis, G., Quarrie, K., Brown, S. R., Hill, R., & Marshall, S. (2016). A comparison of cognitive function in former rugby union players compared to former non-contact sport players and the impact of concussion history. *Sports Medicine*, 12. doi:10.1007/s40279-016-0608-8 [IF=5.579].

Aim: This study investigated differences in cognitive function between former rugby and non-contact sport players, and assessed the association between concussion history and cognitive function. **Methods:** 366 former players (mean $\pm$ SD age 43.3 $\pm$ 8.2 years) were recruited from October 2012 to April 2014. Engagement in sport, general health, sport injuries and concussion history, and demographic information were obtained from an on-line self-report questionnaire. Cognitive functioning was assessed using the online CNS-vital signs neuropsychological test battery. Cohen's d effect size statistics were calculated for comparisons across player groups, concussion groups (one or more self-reported concussions versus no concussions) and between these groups with CNS-vital signs age-matched norms (US norms). Individual differences within groups were represented as standard deviations. **Results:** The elite rugby group (n=103) performed worse on tests of complex attention, processing speed, executive functioning, and cognitive flexibility than the non-contact sport group (n=65), and worse than the community rugby group (n=193) on complex attention. The community rugby group performed worse than the non-contact group on executive functioning and cognitive flexibility. Compared with US norms, all three former player groups performed worse on verbal memory and reaction time, rugby groups performed worse on processing speed, cognitive flexibility and executive functioning, and community rugby group performed worse on composite memory. The community rugby group and non-contact sport group performed slightly better than US norms on complex attention, as did the elite rugby group for motor speed. All three player groups had greater individual differences than US norms on composite memory, verbal memory and reaction time. The elite rugby group had greater individual differences on processing speed and complex attention, and the community rugby group on psychomotor speed and motor speed. The average number of concussions recalled per player was greater for elite rugby and community rugby than non-contact sport. Former players who recalled one or more concussions (elite rugby 85%, community rugby 76%, non-contact sport 23%) had worse scores on cognitive flexibility, executive functioning, and complex attention than players who did not recall experiencing a concussion. **Conclusions:** Past participation in rugby, or history of concussion, were associated with small to moderate neurocognitive deficits (as indicated by worse CNS-vital signs scores) in athletes post retirement from competitive sport. A greater proportion of former rugby players than expected (i.e. non-normal distribution) showed deficits in composite memory, verbal memory, and reaction time, in addition to processing speed and complex attention for elite rugby, and psychomotor speed and motor speed for community rugby.



CNS-VS RugbyHealth scores - Normative sample score is 100 $\pm$ 15

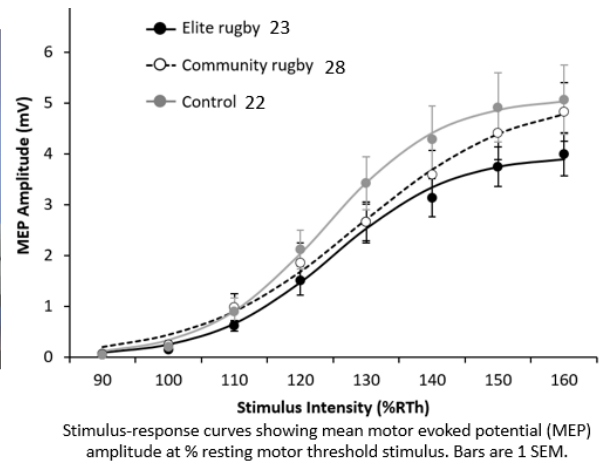
The second paper in the series of studies in the RugbyHealth project has been accepted for publication:

- Lewis, G. N., Hume, P. A., Stravric, V., Brown, S., & Taylor, D. (2016 in press,). NZ Rugby Health study: Motor cortex excitability in retired elite and community level rugby players. *New Zealand Medical Journal*.

Aims: Rugby union is a high contact sport in which players frequently experience brain injury. Acute brain injury is associated with altered corticomotor function. However, it is uncertain if long-term exposure to rugby is associated with any alterations in corticomotor function. The aim of the study was to assess measures of corticomotor excitability and inhibition in retired rugby players in comparison to retired non-contact sport players. **Methods:** The design was a cross-sectional study with three groups of retired athletes: elite rugby (n=23), community level rugby (n=28), and non-contact sport control (n=22). Assessments of corticomotor excitability were made using transcranial magnetic stimulation. **Results:** Resting motor threshold was significantly higher and long-interval intracortical inhibition was greater in the elite rugby group compared to the control group. Participants in the two rugby groups had sustained significantly more concussions than the control group. **Conclusions:** We provide some evidence of altered corticomotor excitation and inhibition in retired elite rugby players in comparison to retired non-contact sport players. Given the absence of findings in the community rugby group, who had experienced a similar number of concussions, the association with previous brain injury is unclear.

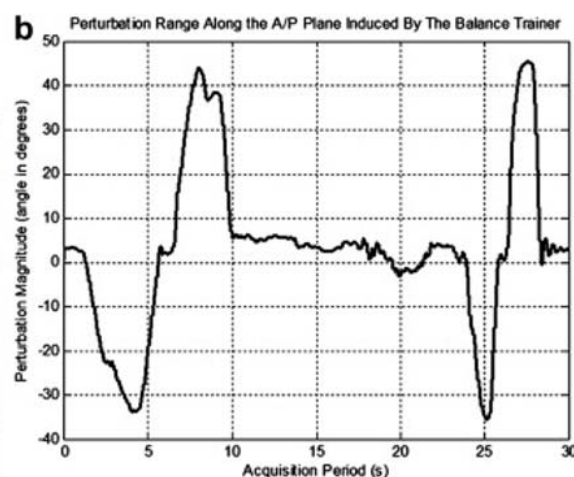


Transcranial magnetic stimulation assessed corticomotor excitability



- Long-interval intracortical inhibition was increased (reduced MEP size), reflecting dysfunctional GABA_B receptor-mediated inhibition, in ER cf C.
- Resting motor threshold was elevated, reflecting reduced excitability, in ER cf C.

altered cortical motor excitation and inhibition in retired elite rugby players



Changes in balance via centre of gravity, ground reaction forces and body position during exercises were measured in the fourth study. Players with no self-reported concussion had better balance than retired players with one to three self-reported concussions for the unilateral eyes open balance score. We have just started a replication of the project studies in the United Kingdom with the addition of bone health measures.

For further information contact Professor Patria Hume patria.hume@aut.ac.nz.

Worse balance in retired players with 1-3 concussions than no concussions.

Associate Professor Ferkins et al. – AUT SRIF RCRG expansion programme

The overall goal of the Rugby Codes Research Group (RCRG) expansion programme is to generate new knowledge for rugby codes performance (union and league). This is occurring via technology solutions for injury prevention, player welfare/access, and new knowledge in rugby governance and access to leadership through the rugby system. The five funded projects and leaders are:



1. Rugby Governance (Associate Professor Lesley Ferkins)
2. Neck Strength (Dr Matt Brughelli)
3. Rugby Prosthetics (Professor Patria Hume and Professor Brendan Burkett)
4. Rugby Participation (Associate Professor Lesley Ferkins and Katie Dee)
5. UK-NZ Rugby Health (Professor Patria Hume and Dr Karen Hind)

Progress on these projects was outlined in a report to AUT:

- Ferkins, L., Hume, P. A., Dee, K., Brughelli, M., King, D., Burkett, B., & Hind, K. (2016). *Rugby codes research group SRIF mid-year progress report – July 2016: Report to AUT Research and Innovation Office* Sport Performance Research Institute New Zealand: Auckland University of Technology.

Project 1. Rugby Governance explores ownership in sport. Specifically, this project has been designed to offer high profile sport organisations in New Zealand and beyond, a much needed evidence base to determine if, why, how, and what changes are needed in regards to ownership and governance models. Very little research has been undertaken to support alternative options for sport ownership and governance as sport organisations seek to grapple with the dynamic forces of commercialisation and professionalisation of sport around the globe. Beginning with a focus on rugby, New Zealand's most high profile sport, the overall objective of this project is to answer the questions, what are the motivations, experiences, and impacts of changes to rugby ownership and governance design? The more specific questions are: A) What are the perceived drivers of change in ownership? Why have various design options been chosen? B) What were/are the perceived motivations and experiences of each investor (i.e., private, Provincial Union)? C) What are the perceived governance related issues and impacts of ownership changes in rugby union (i.e. what changes, when ownership changes)? D) How might the above inform future governance and ownership design in sport? **Project group members:** Associate Professor Lesley Ferkins, Mark Cameron, Trevor Meiklejohn, Katie Dee, Gaye Bryham, Tracy Molloy, Associate Professor Coral Ingley (AUT), Professor David Shilbury (Deakin University), Dr Ben Corbett (Loughborough University).



Project 2. Neck Strength has the objective to design and develop a machine for assessing isometric cervical strength in athletic populations to answer the question, does cervical strength influence the risk of concussion in sport? Cervical strength has long been proposed as a potential preventive strategy for reducing the risk of concussions as well as the severity of subconcussive blows to the head. Reliable means of assessing isometric cervical strength are essential for further understanding of relationships between cervical strength and non-structural brain injury. Enora is the research officer on the AUT SRIF RCRG grant developing a neck strength testing device for rugby players. Enora has enrolled in a PhD at AUT with Dr Matt Brughelli, Dr Doug King and Professor Patria Hume. Her PhD is investigating head impacts and neck strength in female rugby players to identify risk factors for concussion. **Project group members:** Dr Matt Brughelli, Dr Doug King and Professor Patria Hume (AUT).



Project 2. Rugby Prosthetics has the objective to design and produce a rugby specific prosthetic for amputees to answer the question, will a new prosthetic potentially enable participation by athletes with a disability? The World Rugby Regulation 12 currently prohibits the use of prosthetics during rugby for fear of injury to the wearer and other players. Advances in technology including "Quick change pole", adjustable joints/blade technology mean that solutions matched to the individuals and sports requirements should be available allowing integration of athletes with an amputation into rugby. **Project group members:** Professor Brendan Burkett (University of Sunshine Coast), Professor Patria Hume, Chris Whittington (AUT).



Project 4. Rugby Participation. This collaborative project with New Zealand Rugby aims to explore motivations, constraints, and experiences of Pacific Island participation in coaching, refereeing, administration, and leadership roles in rugby. This study focuses specifically on the perspectives of a number of Pacific Island rugby community members who contribute in a range off-field/non-playing roles. This research leverages off an existing project examining the views of Pacific Island families of junior and senior players' participation in off-field/non-playing roles in rugby. This research project has been designed specifically to help New Zealand Rugby determine why this issue exists, and what can be done about it, aligning directly with New Zealand Rugby's second strategic focus - *More players and more communities participating*. There are a number of other sporting codes dealing with



similar participation concerns and the information derived from this study will be relevant and applicable to other sports. **Project group members:** Associate Professor Lesley Ferkins, Katie Dee, Dr Mike Naylor, Gaye Bryham.



Project 5. UK Rugby Health. The **overall objective** of this project is to expand the NZ Rugby Health research project (Radio NZ, 2015, also see <http://www.sprinz.aut.ac.nz/interdisciplinary-research/rugby-codes>) to the UK, in order to gain a larger sample size to answer the question, what is the impact of rugby on players' health following retirement from sport? A sub study on musculoskeletal health and body composition will be incorporated to understand the increased risk of arthritis identified in the New Zealand study. **Project group members:** Dr Karen Hind, Ian Entwistle, Dr Lisa Gannon, Dr Peter Francis, Prof Patria Hume, Assoc Prof Gwyn Lewis, Dr Alice Theadom et al.



Dr Karen Hind et al. - UK Rugby Health study

The major UK study into the long-term health effects of playing rugby was launched by Leeds Beckett University on 15th September 2016. The research led by Dr Karen Hind at the Carnegie Research Institute of Leeds Beckett, with researchers at the Auckland University of Technology (Prof Patria Hume, Assoc Prof Gwyn Lewis, Dr Alice Theadom) and the University of Aberdeen, will examine links between concussions, wellbeing, neuropsychological, neurocognitive and neuromuscular health in retired rugby union and rugby league players across the UK. The project will also explore muscle, bone, joint and cardiometabolic health in the former players. We are hoping to recruit as many men as possible over the age of 30 years who have been formerly involved in rugby union and/or rugby league either as a professional, semi-professional or as an amateur. Speaking about the study, Dr Karen Hind, Senior Research Fellow at Leeds Beckett, said: "There are many benefits for those playing rugby, but we all know that there are risks involved. What we need further information on is the extent to which playing rugby affects players over the longer term - for better or worse. Our project will examine links between prior concussions and current neuropsychological health, and prior injuries and current musculoskeletal health. We have previously found vertebral fractures in 1 out of 3 current professional players so we will be exploring this in retired players. We need people to enrol regardless of how they are getting on - whether they are happy and healthy or having difficulty with any aspect of their lives. We also need people who haven't taken part in rugby post school so that we can compare findings. The results of the UK project will be combined with results from the recently completed NZ RugbyHealth project to strengthen confidence in the findings." Professor Patria Hume says "The extension of the NZ RugbyHealth study to the UK Rugby Health study is important to determine whether there are similar findings in players outside of New Zealand. Given the NZ RugbyHealth study found more self-reported arthritis and cardiovascular issues in the former rugby players, the clinical assessments of the UK players for neuromuscular, bone, joint and cardiometabolic health will provide detail of current health in these areas. The NZ RugbyHealth study assessed rugby union players, while the UK Rugbyhealth study will also include rugby league former players. To take part in the UK project, there are two online questionnaires to complete – one neurocognitive (CNSVS) test and one which explores general health. The clinical assessments take place at Leeds Beckett University and include bone, joint and body composition evaluation by state-of-the-art dual energy X-ray absorptiometry (DXA), strength and neuromuscular assessments and a cardiometabolic examination by blood test and electrocardiogram (ECG). We are grateful to the Carnegie Research Development Fund, Auckland University of Technology SRIF Fund, Biosense, Natus and Tekscan for providing support to this project. We now need people to take part. There is a £350 cash prize draw for respondents with several runner's up prizes'. Details on how to take part in the research can be found at www.leedsbeckett.ac.uk/ukrugbyhealth. The project has a facebook and twitter page (@ukrugbyhealth) and is listed on ResearchGate so others can follow the progress.



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Ian Entwistle - Neuromuscular function and musculoskeletal health in retired rugby players

Ian is enrolled in a PhD at Leeds Beckett University, UK with Dr Karen Hind, and Dr Lisa Gannon, and Dr Peter Francis. Professor Patria Hume is on the PhD advisory team. Ian's PhD is investigating neuromuscular function and musculoskeletal health in retired rugby players. Ian will use data collected during the UK-NZ Rugby Health study for his PhD.



Mike Hopkinson - Neck strength and spine and neck injury prevention in rugby union and league

Mike Hopkinson is enrolled in a PhD at Leeds Beckett University, UK with Dr Karen Hind, Dr Athanassios Bissas, Dr Sarah Clarke, Dr Peter Francis. Professor Patria Hume, and Dr Doug King are on the PhD advisory team. Mike's PhD is investigating neck strength and spine and neck injury prevention in rugby union and league.

Dr Sayumi Iwamoto et al. - Keio University Rugby and Blues Rugby research project

Project title: The relationship between injury frequency, performance and body composition in rugby players

Principal investigator: Dr Sayumi Iwamoto siwamoto@toyo.jp Toyo University

Co-investigators: Prof Patria Hume phume@aut.ac.nz AUT SPRINZ, ISAK4
 Dr Kagawa Masaharu masaharuk@hotmail.com Kagawa Nutrition University, ISAK3
 Dr Kazuko Ishikawa-Takata kazu@nih.go.jp National Institute of Health and Nutrition, ISAK3
 Mr Chihiro Ohta rugbyphysical@gmail.com Keio University Rugby club
 Mr Dave Shaw nutrition@daveshaw.co.nz NZ Blues Rugby Medical Team Nutritionist
 Dr Stephen Kara Stephen.Kara@theblues.co.nz NZ Blues Rugby Medical Team Doctor

Project outline: Rugby requires high levels of physical fitness (strength, speed, agility and intermittent endurance). Body composition is one of the physical fitness elements that affects physical performance. Body composition has been noted as a risk factor for injury. The aim of the study is to investigate the relationship between injury frequency, performance and body composition in Japanese rugby players. The world standard methods of the International Society for the Advancement of Kinanthropometry (ISAK) will be used, and the new International Olympic Committee endorsed ultrasound technique (US) for subcutaneous fat measurement. In addition, smoking habits, injury history and physical fitness test results are already collected by the Japanese team and will be provided for the analysis of the relationships between body composition, injury and performance. The characteristics of the rugby players will be compared with data from the Blues rugby players collected as part of their usual annual training and monitoring programme. Data from the Blues will be provided as de-identified data from Dr Stephen Kara, and David Shaw, to Professor Patria Hume for the Japan-NZ country analysis. Data from the Japanese data collection will be provided by Dr Sayumi Iwamoto to Professor Patria Hume for the Japan-NZ country analysis.



Study research data collection team.



Prof Patria Hume during measurement of Keio University Rugby players.

John Paul Alder - Meaning and sensemaking in high performance sport

Thesis title: Meaning and sensemaking in high performance sport: Managing change in the high performance unit of a national sports organisation.

Supervisors: Dr. Lynn Kidman^{1,2}, Dr. Tom Patrick³ and Dr. Lesley Ferkins^{1,2}. ¹Sports Performance Research Institute New Zealand (SPRINZ), Auckland University of Technology, Aotearoa New Zealand; ²School of Sport & Recreation, Auckland University of Technology, Aotearoa New Zealand; ³Nation Sports Medicine Program, Aspetar, Qatar.

For further information contact john.alder@aut.ac.nz.



Dr Victor Lopez Jr – U.S. Rugby 7's injury

Director, Rugby Research and Injury Prevention Group, Inc.

The Rugby Research and Injury Prevention Group (RRIPG), affiliated with Hospital for Special Surgery, have been working hard to complete the team's three abstracts to submit to the IOC World Conference on Prevention and Injury & Illness in Sport in Monaco (<http://www.ioc-preventionconference.org/>).

The series of papers will present injury rate data for U.S. Rugby-7s:

- **U.S. Rugby-7s: The American experience with a growing amateur collision sport.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Patria A. Hume, Robert C. Cantu, Christian Victoria, Erica D. Marcano and Answorth A. Allen.
- **Concussive injuries in an amateur emerging U.S. collision sport: Rugby-7s.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Laurel SD Myers, Nisha S. Nadkar, Patria A. Hume, Robert C. Cantu, Christian Victoria and Answorth A. Allen.
- **Risk factors involved with contact and non-contact injuries in U.S. Rugby-7s.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Patria A. Hume, Robert C. Cantu, Christian Victoria, Samuel Haleem, Jessica Delallo, and Answorth A. Allen.
- **Injuries in American youth Rugby-7s: An emerging adolescent collision sport.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Patria A. Hume, Robert C. Cantu, Christian Victoria, Sophie. C. Queler, and Answorth A. Allen.

Two other studies will be submitted for publication:

- **Match injuries in U.S. Rugby-7s U-19 tournament players: A 5-year epidemiological study.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Patria A. Hume, Robert C. Cantu, Christian Victoria, Sophie Queler and Answorth A. Allen.
- **Application of an injury surveillance tool for an emerging Olympic collision sport Rugby-7s: The U.S. experience with the RISE rugby report in a developing market.** Victor Lopez Jr., Richard Ma, Meryle G. Weinstein, Patria A. Hume, Robert C. Cantu, Christian Victoria, and Answorth A. Allen.



RRIPG Academic Conference with Anatomy Prof. Pasquale Razzano, Dr Lopez, Christian Victoria (NYU-MPH) and the 2016 summer interns.



At the USA Sevens, Las Vegas Invitational team. Dr Lopez, Dr Jessica DeLallo of Tulane School of Medicine, Professor Erica Marcano, Long Island University, Department of Athletic Training, C Victoria (NYU-MPH) and the other athletic trainers/research data collectors.



Dr Kent C. Doan, University of Colorado, Orthopedics, collecting data at 2016 USA Rugby National Club 7-a-side championships.

The team are also beginning preparations for abstracts to be submitted to the following academies: AOSSM, ACSM and AMSSM, and ISAKOS. The pictures of Victor and his team at several events over the U.S.

For further information contact Vlopezjr@rugbyinjury.org.



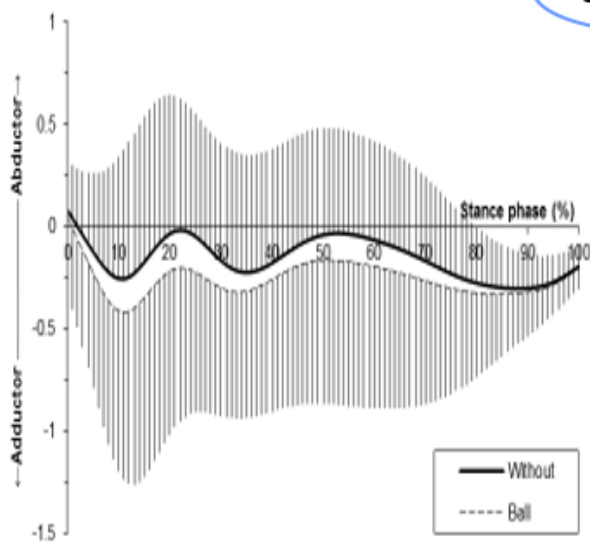
**RUGBY RESEARCH
& INJURY PREVENTION GROUP, INC.**

Scott Brown - Lower-extremity symmetry and ACL injury

Scott Brown scott.brown@aut.ac.nz has submitted his PhD “Does lower-extremity symmetry matter for anterior cruciate ligament injury risk in male rugby union athletes?” He attended conferences (ECSS, and ISB) to present work from his PhD to gain feedback on his thesis chapters. Scott’s supervisors are Dr Matt Brughelli, Prof Patria Hume, and Assoc Prof Thor F Besier. The synopsis of Scott’s research is “In rugby, injuries to the anterior cruciate ligament (ACL) are frequent and severe. These potentially career-ending knee injuries often occur during dynamic single-leg movements, such as sidestepping. Differences between the two legs (asymmetry), beyond that of ‘normal’ levels (symmetry), may be a precursor to injury. The purpose of this thesis was to discover if symmetry affects ACL injury risk in male rugby athletes. Laboratory-based tools were used to measure the differences in strength, balance, sprint and sidestep ability between legs and between positions of academy-level male rugby athletes. Normative values, symmetry scores and a discussion of assessment components and training recommendations were provided. Additionally, a new model for assessing ACL injury risk was proposed to help guide the progression of ACL injury prevention strategies in rugby athletes. The answer to the thesis question was yes; Asymmetry in the legs may potentially increase ACL injury risk and negatively affect performance in strength- and speed-dominated situations in rugby athletes. Luckily, the findings of this thesis provide valuable and positive insight into strategies that may lessen ACL injury risk through targeted strength training.”



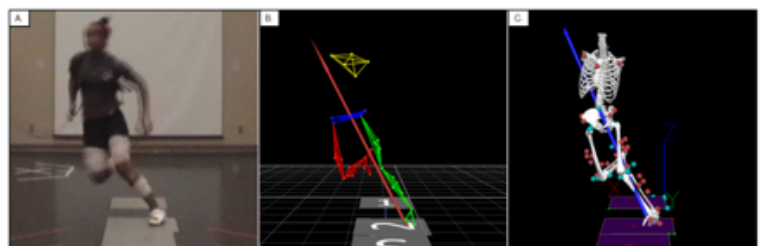
Screening to identify rugby players at risk of lower limb injury



Knee abductor moment (Nm/kgm) with and without a ball during the stance phase of sidestepping



As it happened: All Blacks v England by Kris Shannon. Photograph: 7 June 2014. APN New Zealand Limited. Web: http://www.nzherald.co.nz/sport/news/article.cfm?c_id=4&objectid=11269721. 9 June 2014.



In New Zealand rugby, knee ligament injuries are also frequent and severe. Collaboration with New Zealand Rugby franchise team the Blues, and New Zealand Rugby League team the Warriors, enabled Scott Brown to conduct functional screening of rugby players using isokinetic dynamometry, balance and cutting movement assessment to help identify risk of ACL or hamstrings injury. Three-dimensional kinematics and kinetics of lower limbs of 18 elite rugby players were recorded during maximal effort 45° sidestepping manoeuvres with and without a ball. Sidestepping with a ball resulted in greater knee adductor moments during weight acceptance than without a ball. The implications are that sidestepping with a ball may result in greater knee injury risk. Biomechanics evaluation for athletes in sport therefore need to include the implement/ball to ensure accurate understanding of movement patterns. Scott’s multidimensional screening protocol will be trialled further to see how effective it is in predicting risk of injury.

Dr Ralph Maddison et al. - RuFIT study

Dr Ralph Maddison (University of Auckland) and Dr Elaine Hargreaves (University of Otago) are involved in the RuFIT Study. This study aims to adapt the Football Fans in Training intervention (FFIT) which used professional soccer teams in Scotland to deliver a healthy lifestyle intervention to overweight men. In a trial conducted by the University of Glasgow, FFIT resulted in approximately 5 kg weight loss compared to controls. We aim to adapt FFIT for use in New Zealand with Rugby Fans, with the aim to deliver 'healthy' lifestyle change (exercise and nutrition) to facilitate weight loss and a reduction in cardiovascular risk. In Auckland, "Train Like The Blues" is the motto. The feasibility study is funded by the Health Research Council and a pre-test of the programme in Auckland was supported by the NZRU. If feasible, we aim to conduct a more extensive trial amongst more of the professional rugby organisations. Ralph Maddison is the lead researcher. Samantha Marsh is the study coordinator. Auckland Blues Rugby strength and conditioning staff are providing the training / exercise prescription and implementation while nutritionist Dave Shaw is providing nutritional support and lecture based information. Stephen is providing medical support and lecture based CVD information. In Otago, the study is led by Dr Elaine Hargreaves who is working with the Otago Highlanders. For further information contact Dr Ralph Maddison r.maddison@auckland.ac.nz.

**Kim Simperingham - Wearable resistance training**

Kim's PhD research focuses on enhancing sprint performance in team sport athletes. The central question for the research is: "Can wearable resistance training be used to acutely and chronically enhance sprint-running performance?". The Exogen exoskeleton (www.movementrevolution.com) is a compression-based garment that enables additional weight to be attached to almost any part of the body during almost any sporting movement or training session. Findings indicate that loading equivalent to 3-5% of body mass (BM) attached to Exogen pants during a dynamic speed warm-up or a series of 40 m sprint accelerations appears to be effective at acutely improving subsequent sprint acceleration performance (presented at the Australian Strength and Conditioning Association International Conference on Applied Strength and Conditioning). It was proposed that the mechanism for the improvement might at least partly be the non-verbal cue for improved lower limb sprint mechanics provided by the added lower body loading.



At the International Society of Biomechanics in Sports conference in Japan, Kim presented on the changes in acceleration phase sprint biomechanics with lower body wearable resistance. Moderately loaded wearable resistance (3% BM) resulted in higher horizontal force and horizontal power outputs compared to heavier loading during the acceleration phase. Sprint acceleration biomechanics were minimally affected by loading up to 5% BM.

An additional publication together with co-authors John Cronin and Angus Ross, was accepted into the Sports Medicine journal: 'Advances in sprint acceleration profiling for field-based team-sport athletes'. This systematic review included a summary of the utility, reliability, validity and limitations of radar, laser and non-motorised/torque treadmills for analysing sprint accelerations.

For further information contact Kim Simperingham ksimperingham@gmail.com.



Professor Patria Hume et al. - Japan rugby codes research presentations

Patria collaborated with RCRG members to develop presentations for a visit to Japan as a visiting Professor to Toyo University. Dr Sayumi Iwamoto was joint presenter providing the Japanese translation. They highlighted in several public lectures the work of members of the RCRG such as Dr Ken Quarrie, Dr Doug King, the World Rugby/NZR/AUT projects, and the AUT SRIF RCRG projects.

A big thank you to all who provided summary slides of their research work. References include:

- Hume, P.A., Iwamoto, S., Quarrie, K., Ferkins, L., Kara, S., King, D., Brown, S., Lopez Jr, V., Cross, A., Gill, N., Carlson, I., Hardaker, N., Brughelli, M., Searchfield, G., Burkett, B., Millar, S., Lewis, G., Theadom, A., Taylor, D., Marshall, S., Cronin, J., Hansen, K., Gissane, C., Clark, T., Cantu, R., Hopkins, W., Ishikawa-Takata, K., Masaharu, K., Shaw, D., Keung, S., Kidman, L. (2016, 27th July 2016). Performance and injury prevention research approaches for elite rugby players. In S. Iwamoto (Chair), *Toyo University*. Symposium conducted at the meeting of the Toyo University Professorial Lectures, Tokyo, Japan.
- Hume, P. A., Iwamoto, S., King, D., Millar, S., Zinn, C., Harrison, C., . . . Gibbs, L. (2016, 26th July 2016). Sport science and medicine research support for New Zealand's elite athletes. In S. Iwamoto (Chair), *Toyo University*. Symposium conducted at the meeting of the Toyo University Professorial Lectures, Tokyo, Japan.



RESEARCH SNAPSHOTS

To help showcase your research, please send power point slide summarising your research to [Katie Dee](#).

Examples used for the Japan invited lecture are shown in this e-Magazine.

Key results:

- Forwards sustained much higher contact loads per match than backs, via scrums, rucks, tackles and mauls.
- Mean distance covered per match ranged from 5400 to 6300 m, with backs running further than forwards.
- Differences between positional groups in distance covered at various speeds.
- Amount of play per match varied by position due to differences in rates at which players were substituted.
- Distance covered by players at relatively fast running speeds (>5 m s⁻¹) was higher during international matches than at lower levels of the professional game.



Specific match demands for positional groups need to be considered when managing player workloads.

Dr Ken Quarrie is the Senior Scientist for New Zealand Rugby. He is also an AUT PhD graduate and a SPRINZ Research Associate and member of the RCRG. Associate Professor Nic Gill is the All Blacks Trainer, an AUT staff member and member of the RCRG. With colleagues, they examined the positional demands of international rugby union players. They evaluated actions of 763 players coded from video of 90 international matches played by the All Blacks from 2004 to 2010. Some of the key results are listed on this slide. The conclusion was that specific match demands for positional groups need to be considered when managing player workloads.



Quarrie KL, Hopkins WG, Anthony MJ, Gill ND. Positional demands of international rugby union: Evaluation of player actions and movements. *J Science Med Sport*. 2013;16(4):353-9.





Characterizing and improving physical performance in 7^s rugby

- What are the physical demands of international 7^s?
- What physical qualities characterize the elite 7^s player?
- What is the relationship between physical qualities and 7^s specific match skills?
- How do we improve these physical qualities?



Dr Alex Ross worked within the New Zealand Rugby-7s male program and collected data on the squad to characterize and improve their physical performance for his PhD at SPRINZ. He showed the effectiveness of two power-training programs on sprint speed, mechanical sprint characteristics, and lower body power of the rugby sevens players. Alex completed his PhD in 2015, became the Blues Sport Science manager and recently secured the lead strength and conditioning role for USA rugby.



Ross, A., Gill, N.D., & Cronin, J.B (2014). Match analysis and player characteristics in rugby sevens. *Sports Medicine*, 44(3), 357–367.

Ross, A., Gill, N. D., Cronin, J. B., & Cross, M. (2015) The effects of two power-training programs on the sprint speed, mechanical sprint characteristics, and lower body power of rugby sevens players. *Under review*.



Influences on the physical demands of international women's sevens rugby

Is there a difference in the physical demands of match play in women's rugby sevens between:

- positional groups of forwards and backs
- pool matches and cup matches

Does the score differential influence the physical demands of match play in women's rugby sevens?



Jan Reyneke, as part of his Masters in 2015, worked with the New Zealand Rugby-7s women's program to describe the physical demands of international women's rugby sevens match play. The influence of score differential on the physical demands of international women's rugby sevens match play was also assessed. The outcomes of the study have guided the physical conditioning programmes for the women's sevens rugby team.

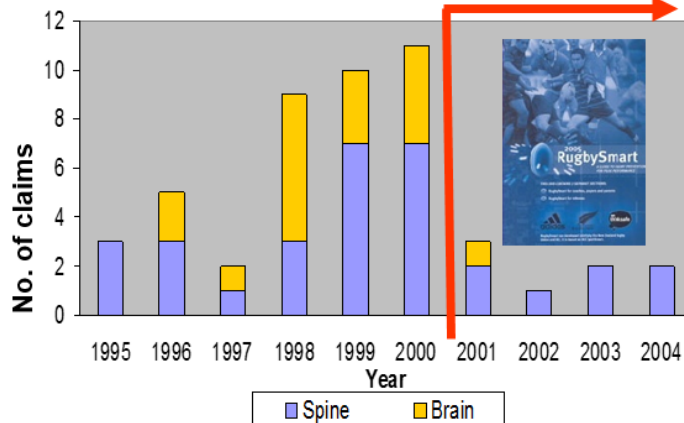
Reyneke, J., Hansen, K., Cronin, J., and Malcata, R. An investigation into the physical demands of international women's rugby sevens match play. Under development.



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RugbySmart education on tackle technique



RugbySmart was introduced in 2001 with a corresponding decrease in the number of severe spine-neck injury claims. Dental injuries also reduced since RugbySmart targets the use of mouth guards and correct tackling technique.



Quarrie, K.M., Gianotti, S., Hopkins, W.G., Hume, P.A. 2007. Effect of nationwide injury prevention programme on serious spinal injuries in New Zealand rugby union. *British Medical Journal*. 334;1150-53.

Sports injury prevention for coaches

sm47472 Module 2 British Journal of Sports Medicine 9/4/08 14:01:31

Topics:

Editorial

Preventing sports injuries at the national level: time for other nations to follow New Zealand's remarkable success

John W Orchard

Imagine yourself reading an editorial in *Traffic Injury Prevention* about the best system for preventing and managing traffic accidents. The editorial suggests that it is wrong for national governments to take an interest in preventing and managing road trauma. It argues that

managing and preventing sports injuries.³⁻¹⁰ However, only one country—New Zealand—has a completely socialised and universal approach to managing and preventing sports injuries; it uses the same template that is used for traffic injuries.¹¹ Have we reached a point where we can



In 2007 we showed the cost effectiveness of SportSmart in reducing injuries. Education programmes focusing on multiple areas can help improve performance and reduce injury risk so players can be the best they can be. The success of the SportSmart injury prevention model was highlighted in an editorial in the *British Journal of Sports Medicine* in 2008 where Dr John Orchard stated that it was time for other nations to follow New Zealand's success. Since this time BokSmart for rugby has been introduced in South Africa, based on RugbySmart. An evaluation of its implementation by James Brown showed a positive effect.



Gianotti, S., Hume, P.A. 2007. A cost-outcome approach to pre and post-implementation of national sports injury prevention programmes. *Journal of Science and Medicine in Sport*. 10(6): 436-46.

Tracking and addressing injuries in rugby union: The Rugby Injury Survey & Evaluation (RISE) Report



RUGBY RESEARCH
& INJURY PREVENTION GROUP, INC.

	Injuries per 100 players	Head & neck	Upper extremity	Lower extremity	Playing hours	Incidence of injury / 1000 playing hours
AMATEUR Lopez Jr et al. 2012 ¹	3.1	33.3%	31.3%	14.6%	866.4	55.4
AMATEUR TO SUB-ELITE Lopez Jr 2011-13 ²	2.5	20.7%	23.2%	45.1%	3103.3	52.8
NATIONAL PLAYERS Fuller et al. 2010 ³	35.9	4.9%	17.5%	70.0%	979.1	106.2

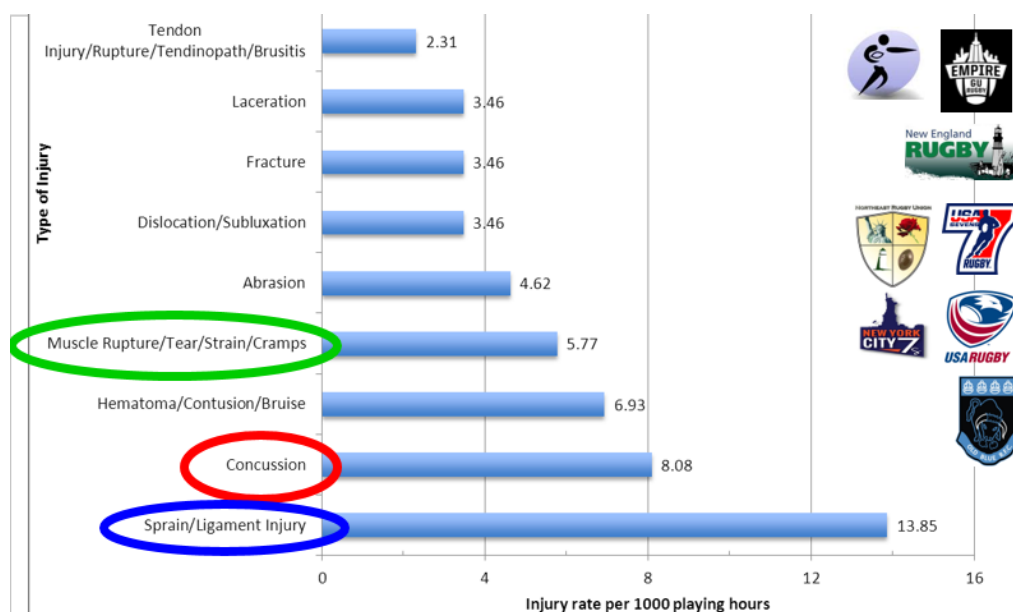


¹ Medical attention/no time off & time-loss injuries, men and women combined. Lopez V, Jr, et al. Profile of an American amateur rugby union sevens series. *AJSM*. 2012

² Unpublished data Men and Women using RISE report with time-loss injuries at the Northeast Territorial Union. Lopez Jr 2011-13.

³ International men rugby sevens with Time-loss injuries. Fuller CW, et al. Epidemiological study of injuries in international Rugby Sevens. *CJSM*. 2010

Data from 2010 to 2014 from Dr Victor Lopez's RISE injury surveillance system for rugby in North America provides detailed injury mechanism information for men's and women's rugby sevens. The incidence of head and neck injuries is over six times that of Sevens World Series players. This raises the question whether this issue is exclusive to North America or is it symptomatic of developing rugby markets in general? The study has shown the importance of having country specific injury and performance information collection systems as each country is in a different state of development for sport science, medicine and coaching support for athletes and coaches.



Profile of an American Amateur Rugby Union Sevens Series

Victor Lopez Jr.,^{*} DO, Gregory J. Galano,[†] MD, Christopher M. Black,^{**} MPH, Arun T. Gupta,[§] MD, Douglas E. James,^{||} BA, Kristen M. Kelleher,[¶] ATC, and Answorth A. Allen,^{***} MD
Investigation performed at the Hospital for Special Surgery, New York, New York

2012 AJSM



Dr Victor Lopez has published one of the first papers on Rugby-7s utilizing the international consensus statement of definitions and methods to conduct rugby union studies. He found concussions in Rugby-7s were the second most common injury, similar to the rates found by Fuller et al. BJSM's 2013 study on concussions in both formats of rugby. The elevated head/neck and upper extremity injuries must be addressed in the U.S. given the rates are higher compared to international male Rugby-7s players. The high ligament sprain rate also needs to be addressed.

Match and training injuries per season

51% mild (<8d), 36% moderate (8-28d).

74% match-related (73% contact), 26% training-related (79% non-contact).

Year	2006	2007	2008	2009	2010
Number of matches	13	14	13	13	13
Number of match injuries	35	23	28	34	30
No of match injuries per match played	2.6	1.6	2.1	2.7	2.3
Match injuries / 1000 player hours	130.8	82.1	107.7	134.6	115.4
Mean match injury duration	23.3	34.1	6.8	23.5	10.1
Number of training injuries	18	5	10	12	9
Training injuries / 1000 training hours	11.1	2.9	7.4	7.4	4.1
Mean training injury duration	9.8	18	23.6	32.3	23.9



Kara, S. Epidemiological injury data from Super 14 Rugby Union – An observational study over 5 years (2006-2010).



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Dr Stephen Kara is the Blues medical doctor, and completed a Masters' thesis degree with Professor Patria Hume and Professor Will Hopkins at SPRINZ. He tracked match and training injuries for the Blues team over five years. 36% of injuries were moderate in severity with 8 to 28 days of time loss. Three quarters of the injuries were match-related. It is important to note that 79% of the injuries in training were non-contact injuries compared with 73% contact injuries for matches. Injury risk was increased due to an increase in exposure from more ball-in-play time, more running and more contact events, and longer periods of activity within a match.

Practical application of findings

1. Different injury rates due to differences in game specifics / training specifics
 - drives our pre-season S&C programme
 - functional specific running based programme (GPS monitored)
 - players running 6km per game (speeds vary between position)
 - coach involvement in skill execution and breakdown of drills
2. Different positions at different risks
 - Midfield Backs – Shoulder / Neck strengthening (*match-related contact*)
 - Outside Backs – Hamstrings / Calves / Groins (*training-related non-contact*)
 - Tight Forwards – Lower Back = Core / Technique in gym (*training-related non-contact*)
 - Neck strengthening / Calf / Hamstring
 - Loosehead Prop: Ankle / Knee vs. Tighthead Prop & Hooker: Calf / Ankle / Knee
 - Inside Backs – Hamstrings (*non-contact*)
 - Kickers – Adductor / Kicking Rehab
3. Generic rehabilitation based on injuries causing most time loss
 - Knee / Shoulder / Hamstring / Calf

The practical application of the findings led to changes in conditioning and training programmes taking into account positional differences. For example, the tight forwards have more emphasis on low back and core technique training in the gym given their training related non-contact injuries. For example, better lifting technique was needed during strength and conditioning sessions.



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Mouthguard impact biomechanics in rugby

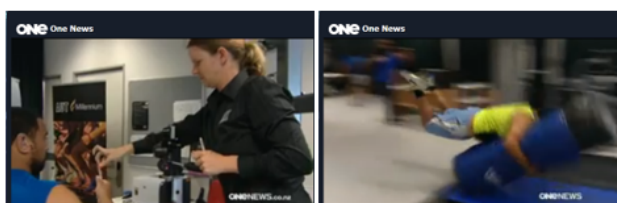
- 38 premier men's rugby players average 77 head impacts >10g per game. 1,379 per player per season of 19 games. Average of 22g.
- Concussion injury tolerance = 95g or 5500 rad/s². Our players had 181 impacts >95g, and 4452 impacts >5500 rad/s².



King, D., Hume, P.A., Brughelli, M., & Gissane, C. (2014). Instrumented mouthguard acceleration analyses for head impacts in amateur rugby union players over a season of matches. *American Journal of Sports Medicine*. 43(3): 614-624.

Dr Doug King has been monitoring players head impacts using instrumented mouthguards. For example, he reported that during a season of 19 games for rugby players using instrumented mouthguards, 20,687 impacts greater than 10g were recorded, with an average linear acceleration force of 22g. Players suffered an average of 77 impacts to their heads per game, or 1,379 per player per season. Previous analyses of American football teams had established an injury tolerance level for concussion of 95g or 5500 rad/s². We recorded 181 impacts greater than 95g, and 4452 impacts greater than 5500 rad/s². However, the two concussions occurred following impacts less than 95g, showing that the relationship between impact force and injury is not clear. Player characteristics are likely moderating factors in injury risk.

Hearing aids for Deaf rugby players



Dislodged BTE with the earmould still in place.



Hearing aids/simulated aids in-situ. A) BTE. B) Soft ITE. C) Hard ITE. D) Universal fit ITE.

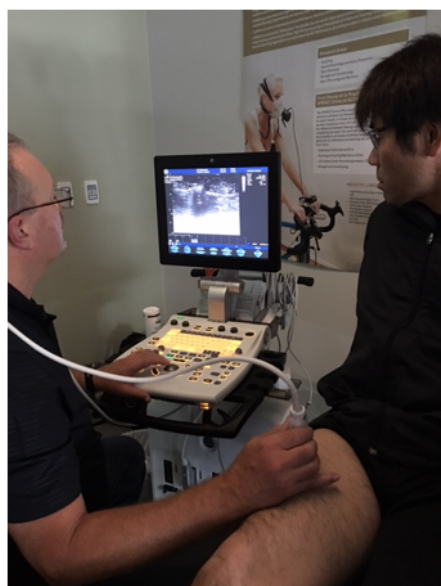
Hearing aids used in rugby should be:

- Custom made of soft plastic materials to house hearing aid electronics
- Full concha type with helix or cymba lock for good retention
- Impact resistant
- Waterproof
- Resist acoustic feedback
- Be easily cleaned or have anti-microbial properties
- Be affordable because of risk of damage or loss

Searchfield GD, Hume PA, Kobayashi K, Shekhawat GS, Arulda-san M, Brown S et al. IRB Protective Equipment Project: Feasibility testing of the fit and comfort of four hearing aid designs for rugby. Auckland: SPRINZ, Auckland University of Technology, New Zealand. 2014.

A project conducted for World Rugby was the development of hearing aid prototypes for deaf rugby players. We tested deaf rugby players in the SPRINZ laboratory tackling with the new prototypes to select the best characteristics for a rugby specific hearing aid.

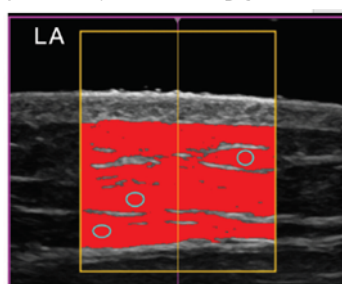
Rugby body composition in NZ and Japanese players and performance and injury implications



- Keio University Rugby club
- Auckland Blues Rugby club



- Dr Sayumi Iwamoto, Toyo University ISAK3
- Dr Kagawa Masaharu, Kagawa Nutrition University, ISAK3
- Dr Kazuko Ishikawa-Takata, National Institute of Health and Nutrition, ISAK3
- Prof. Patria Hume, AUT SPRINZ, ISAK4
- Dave Shaw, NZ Blues Rugby Medical Team Nutritionist
- Dr Stephen Kara, NZ Blues Rugby Medical Team Dr



New ultrasound algorithms are allowing us to monitor rugby players body composition more accurately so we can measure the effectiveness of our strength and conditioning and nutrition interventions. The current collaborative project between SPRINZ, the Blues, and Keio University in Japan, will examine the relationship between injury frequency, performance and body composition in rugby players.

Sport Leadership & Management

Mixed ownership in New Zealand Super Rugby

- New, innovative approach to ownership and investment of NZ Super Rugby entities
- Private (commercial) and NZ provincial union (non profit) investors
- Qualitative study with 10 in-depth interviews with investors
 - What are motivations of investors?
 - How is it working?
 - What changes are needed?
- Implications for governance of entities (board composition, independence from ownership, board decision making)
- Insights for other Super Rugby entities (Australia, South Africa, Argentina, Japan).
- Implications for ownership models across different sports.

With professional sport there has been an increase in sport science research and use of sport science information and services. Other areas are now being developed. For example, our sport leadership and management research group are investigating mixed ownership models for New Zealand Super Rugby.



'Off-field' participation in New Zealand Rugby: Pacific Island experiences

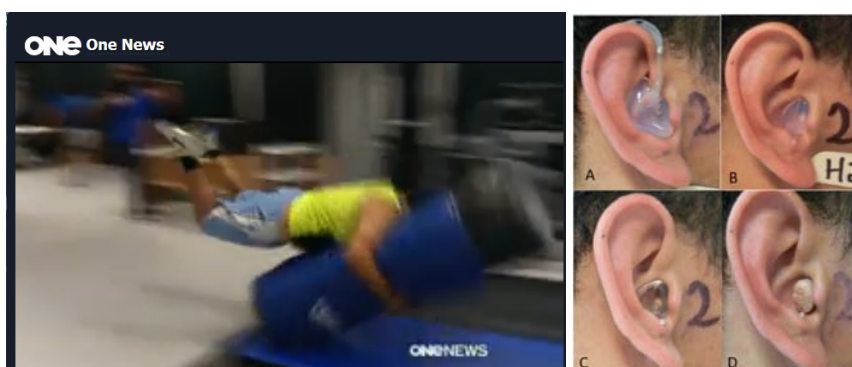
- Exploring barriers and enablers for Pacific Island participation in leadership, administration, coaching and refereeing in club rugby in New Zealand.
- Mixed method approach: focus groups, interviews, survey.



Associate Professor Lesley Ferkins with Katie Dee are leading a project to examine the barriers and enablers for Pacific Island people to participate in leadership and administration of rugby. New Zealand Rugby identified that despite large numbers of Pacific Island rugby players, the number of Pacific Island people participating in rugby leadership, administration, coaching and refereeing is minimal. It is important for rugby's development that clubs and national sport organisations are well led and managed.

PROJECTS FOR WHICH WE ARE SEEKING FUNDING

Rugby Codes Research Group (RCRG) projects	Purpose	Researchers
• Rugby hearing aid: Rugby-specific hearing aid prototype for players that require hearing improvement.	Design and develop a rugby-specific hearing aid prototype for players that require hearing improvement.	Dr Grant Searchfield (University of Auckland), Prof Patria Hume (AUT), Dr Doug King (Wgtn; SPRINZ RA), Dr Stephen Reay (AUT), Dr Roy Nates (AUT), Dr Anna Lorimer (Unitec; SPRINZ RA).
• USA Rugby-7s: Epidemiology app creation	Create an app to help collect data to determine the incidence of injury among U.S. Rugby-7s athletes, according to international standards on injury research in the sport of rugby.	Dr Victor Lopez (USA Rugby), Dr Answorth A. Allen (Hospital for Special Surgery, New York), Dr Robert Cantu (Emerson Hospital, Concord MA, USA), Dr Richard (Shen-Ying) Ma (Missouri Orthopaedic Institute, Comparative Orthopaedic Laboratory, Columbia), Dr Doug King (Wgtn; SPRINZ RA), Prof Patria Hume (AUT).



Searchfield GD, Hume PA, Kobayashi K, Shekhawat GS, Arulda-san M, Brown S et al. IRB Protective Equipment Project: Feasibility testing of the fit and comfort of four hearing aid designs for rugby. Auckland: SPRINZ, Auckland University of Technology, New Zealand. 2014.

AUT RUGBY SPECIFIC PROJECTS/STUDENTS/STAFFING INFORMATION

Katie Dee has collated tables of AUT staff and student rugby specific projects. If you see any missing please contact katie.dee@aut.ac.nz. **RCRG members, if you would like your projects and students to be profiled on the new revised RCRG website, please send details to Katie.**

Rugby specific projects – 2008 to 2016

	Student	Topic	Primary Supervisor	Secondary Supervisor	NSO or Organization collaboration and funding	Current Position
1	Ken Quarrie	Rugby epidemiology	Will Hopkins	Patria Hume	NZ Rugby	Senior Scientist (Injury Prevention & Performance) NZRU
2	Christos Argus	Strength and conditioning	Justin Keogh	Will Hopkins	NZ Rugby	Head of Strength and Power – Brumbies Rugby
3	Aaron Randell	Optimising transference of strength and power adaptation to sports specific performance	John Cronin	Nic Gill	SPRINZ and Bay of Plenty Rugby scholarship	Strength and Conditioning Coach – QE Health Gym
4	Martyn Bevan	Modifying testosterone and cortisol on rugby players	Will Hopkins	Nic Gill	Enterprise and NZ Rugby Union scholarship	Assistant Strength and Conditioning Coach Waikato RFU
5	Daniel Smart	Training and performance in rugby players	Will Hopkins	Nic Gill	Enterprise and NZ Rugby Union scholarship	Assistant Strength and Conditioning Coach Waikato RFU HPSNZ
6	Steve Burden	Hypermobility and injury in Waikato rugby players	Patria Hume	Will Hopkins	Waikato Rugby	
7	Doug King	NZ Rugby League injury prevention	Patria Hume	Peter Milburn	NZ Rugby League	Lead CNS Hutt Valley DHB
8	Simon Gianotti	Sports injury epidemiology	Patria Hume	Will Hopkins	Accident Compensation Corporation. Game Analysis - Horowhenua-Kapiti Heartland team / NZRU injury prevention	Injury prevention strategy manager ACC
9	Teresa Ogden	Time-motion analysis and physiological profile of elite New Zealand touch players during competition	Justin Keogh	John Cronin	NZ Touch Rugby	
10	Trevor Micklejohn (MBus)	The formation, processes and impact of inter-organisational cliques: a study of New Zealand provincial rugby	Geoff Dickson		North Harbour Rugby Millennium Institute of Rugby	Lecturer - Sport
11	Lenalinn Hausen	Rugby World Cup and export leveraging	Geoff Dickson		NZ Tourism Research Institute	
12	Travis McMaster	Methods of assessing, monitoring and improving athletic performance	Nic Gill	John Cronin	NZ Rugby Union & North Harbour Rugby Union	Strength and Conditioning Coach
13	Nick Webb	The relative efficacy of four recovery modalities following professional rugby league competition matches	Nigel Harris	John Cronin	NZ Warriors	Head regional strength and conditioning specialist – NZ Cricket
14	Adam Godfrey	The acute effects of rubber based resistance on repetition and total set kinetics and kinematics during the bench press exercise	Nigel Harris	John Cronin	NH Rugby	Strength and conditioning coach
15	Jan Reyneke	Influences on the physical demands of international Women's Sevens Rugby	Keir Hansen	John Cronin	NZ Sevens – Women. Auckland Rugby. North Harbour Rugby	Strength and Conditioning Coach, P/E Teacher

16	Alex Ross	Physical characteristics and match performance in Rugby Sevens	Nic Gill	John Cronin	NZ Sevens - Men	Sport Science Manager Auckland Blues, then USA Rugby Trainer
17	Keir Hansen	Assessment and training of muscular force and power qualities of the lower limb using traditional and cluster loading	John Cronin	Mike Newton	Worcester Warriors	National Strength and Conditioning Manager HPSNZ
18	Matthew Kritz	Development, reliability and effectiveness of the Movement Competency Screen (MCS)	John Cronin	Patria Hume	NZ Sevens - Women	Director of Strength and Conditioning HPSNZ
19	Nigel Harris	Kinematics and kinetics of strength and power development	John Cronin		NZ Warriors	AUT Senior Lecturer
20	John Alder	Meaning and sensemaking in High Performance Sport: Managing change in the high performance unit of a National Sports Organisation	Lynn Kidman	Tom Patrick Lesley Ferkins	NZRL	Coaching Manager – Coaching and Performance
21	Caleb Dobbs	Comparing the relationship between lower limb power testing in the vertical and horizontal planes of movement and other performance and physiological measures			Waikato RU	Academy Strength and Conditioning Coach
22	Richard Swinbourne	Sleep physiology			All Blacks	Nutritionist
23	Mark Cameron	Mixed Ownership in Super Rugby	Lesley Ferkins	Trevor Meiklejohn	NZ Rugby	CE Auckland Cricket

CONFERENCES TO PUT IN YOUR CALENDAR

International Society of Biomechanics in Sports 2018 conference 10-14th September, AUT City Campus and AUT Millennium

SPRINZ, AUTM and HPSNZ will host the ISBS 2018 conference at AUT City Campus and AUT Millennium. This large international conference hosted by SPRINZ, High Performance Sport New Zealand, and AUT Millennium will raise the international profile of sports biomechanics research, teaching and community service programmes. The conference will have rugby code focused sessions. For further information contact Brigitte van Gils on brigitte.vangils@aut.ac.nz.



SPRINZ 2016 strength and conditioning conference 17-18th November 2016, AUT North Shore Campus and AUT Millennium

The annual SPRINZ 2016 strength and conditioning conference programme is available at <http://www.autmillennium.org.nz/special/sprinz/>.

SPRINZ STRENGTH AND CONDITIONING CONFERENCE

Providing actionable steps for improved Strength and Conditioning practice.

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17-18 NOVEMBER 2016
AUT North Campus + AUT Millennium

PLUS PRE-CONFERENCE IN TALENT DEVELOPMENT
16 November 2016

SPRINZ SMAANZ 2016 conference 23-25th November 2016 at AUT North Shore Campus and AUT Millennium

The Sport Management Association of Australia and New Zealand (SMAANZ) 2016 conference is being hosted by SPRINZ.

SMAANZ 2016



SMAANZ 2016 will be a multidisciplinary conference targeting thought-provoking research within the broad topical areas of management, marketing, and the governance of sport at all levels and in all manifestations.

Having received 118 abstracts, the Sports Performance Research Institute New Zealand (SPRINZ) is looking forward to welcoming speakers from all over the world to Auckland University of Technology, home to the country's largest School of Sport and Recreation, and to Auckland, one of the world's great cities!

REGISTRATION INFORMATION

Full conference registration 23-25 November 2016:

\$700 (early-bird – closes 30 September 2016)

\$850 (late entry)

\$540 student conference rate

\$250 Sport and Recreation Sector Special

All fees are in New Zealand Dollars, and include the conference dinner which is being held on Friday night 25th November at the [Crew Club](#) (excluding Sport and Recreation Sector Special rate).

If you have any questions regarding the conference please contact:

Dr Richard Wright
SMAANZ 2016 Conference Chair
School of Sport & Recreation, AUT University
E: richard.wright@aut.ac.nz
T: + 64 9 921 9999 ext. 7312

Dr Michael Naylor
SMAANZ 2016 Academic Chair
School of Sport & Recreation, AUT University
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**AUT SPORTS PERFORMANCE
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You are invited to the
Sport and Recreation Sector Special
SMAANZ CONFERENCE 2016

Thursday 24 November 2016
8am – 1pm | \$250 | AUT City Campus

- Special guest All Black Keven Mealamu sharing his leadership experience inside the All Blacks
- Sport leadership keynote panel featuring Dave Adams, Professor Brad Jackson, Dr Sarah Sandley, Dr Farah Palmer
- Your choice of workshop on professional or community sport
- The first round of seminar presentations
- Morning tea and lunch

AUT is hosting the Sport Management Association of Australia & NZ (SMAANZ) 2016 conference, an international gathering of passionate university educators and researchers.

For more information see the attached flyer, and to register, please go to:
<https://sprinz.aut.ac.nz/conferences/smaanz-2016>

AUT
RESEARCH & INNOVATION

CURRENT MEMBER REMINDERS:

- ✓ Download a RCRG member profile from <https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes>
- ✓ To help showcase your research, send a power point slide summarising each research project
- ✓ Send details of projects, students and publications to be profiled on the new revised RCRG website – COMING SOON

Send to Katie Dee katie.dee@aut.ac.nz.