SPORTS PERFORMANCE
RESEARCH INSTITUTE, NEW ZEALAND
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"Rugby Codes Research News"

Communicating advances in evidence-based knowledge and its practical application to the wider support network of rugby codes.

Issue 3 – June 2015

AUT SPRINZ at AUTM

Rugby Codes Research Group (RCRG)

AUT MILLENNIUM

SPORTS PERFORMANCE
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Welcome to issue 3 of the Rugby Codes Research Group (RCRG) newsletter. In this issue we provide an update of rugby codes research projects including two programmes of World Rugby research we have led, the work on the national concussion policy, and current projects for which we are seeking funding. We highlight some of the media attention our colleagues and their research has gained. We look forward to your continued work to improve performance and reduce risk of injury in the rugby codes.

Professor Patria Hume (Editor)

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AIM OF RCRG NEWSLETTER

To communicate advances in evidence-based knowledge and its practical application to the wider support network of rugby codes.

RCRG MEMBERS

We encourage new RCRG members. Please contact Patria to become part of the RCRG, or to be placed on the RCRG newsletter distribution list.

AUT staff, SPRINZ research associates and postgraduate students: Professor Patria Hume, Dr Doug King, Dr Chris Whatman, Dr Matt Brughelli, Kelly Sheerin, Dr Sarah-Kate Millar, Associate Professor Duncan Reid, Dr Alice Theadom, Associate Professor Gwyn Lewis, Associate Professor Denise Taylor, Susannah Dalton, Dr Anna Lorimer, Dr Lesley Ferkins, Dr Ken Quarrie (NZRU), Dr Victor Lopez (USA Rugby), Professor Stephen Marshall (USA), Dr Stephen Kara (Blues Rugby), Isaac Carlson (ACC), Natalie Hardaker (ACC), Dean Watkins (NZRL), Gareth Irwin (Cardiff Met Uni), Frank Bourgeois II, James de Lacey, Richard Swinbourne, Jan Reynecke, Caleb Dobbs, Alex Ross, Albert Chang, Kim Simperingham, Lee Bridgeman, Scott Brown, Professor Mike McGuigan, Professor John Cronin, Dr Craig Harrison, Dr Travis McMaster, Kevin Sheehy, Dr Stephen Reay, Professor Enrico Haemmerle.

Collaborators: Tony Iro (NZRL), Mark Plummer (Blues), Dr Rosamund Hill (Auckland Hospital), Dr Ralph Maddison (Uni of Auckland), Samantha Marsh (Uni of Auckland), Dr Grant Searchfield (Uni of Auckland), Dr Adrian Cohen (NeckSafe Ltd, Uni of Western Sydney), Ed Mlinek (X2 Biosystems, USA), Jason Thibado (X2 Biosystems), Professor Brendan Burkett (Uni of Sunshine Coast), Dr Simone Oehler (Otto Bock), Prof Wayne Derman (Sport Science Institute of South Africa), Dr Karen Hind (Leeds Beckett Uni UK), Prof Richard Aspden (Institute of Medical Sciences, Uni of Aberdeen), Dr Theocharis Ispoglou, (Leeds Beckett Uni), Dr Katalin Pauley-Takacs (Leeds Beckett Uni), Dr Answorth A. Allen (Hospital for Special Surgery, New York), Dr Robert Cantu (Emerson Hospital, USA), Dr Richard (Shen-Ying) Ma (Missouri Orthopaedic Institute, Columbia), Mark Plummer (Blues Rugby), Dr Yaodong Zhu (China).

RCRG MEDIA

AUT's Susannah Dalton helps our team respond to media questions around the rugby codes and the research we conduct. Contact Susannah on sdalton@aut.ac.nz if you need help with media. Some recent media we have been involved with is outlined. ***IMPORTANT NOTE: The text or images from the media publications are reproduced without express permission for educational purposes only in this newsletter.***

Rugby and concussion

There has been a lot of media around the issue of rugby and concussion. The work of Dr Doug King has been featured several times with the articles in the *American Journal of Sports Medicine* and the *Journal of Neurological Sciences* being discussed. The work of the Sport Collaboration Group in developing the national concussion guidelines also gained media attention.

2nd January - Horsetalk.co.nz (ACC concussion guidelines)

The headline was "New push to reduce sports-related concussion. The online link is http://horsetalk.co.nz/2015/01/02/new-push-reduce-sports-relatedconcussion/#axzz3QYJhKmoM. The article stated that "sports related concussion claims have cost New Zealand's Accident Compensation Corporation (ACC) $76 million in the past four years, with new injury prevention initiatives being introduced to reduce the harm from head injuries… ACC has been working with four National Sports Organisations to implement injury prevention initiatives. The Sports Collaboration Group – New Zealand Rugby, New Zealand Rugby League, New Zealand Netball and New Zealand Football working closely with AUT University's Sports Performance Research Institute New Zealand (SPRINZ) – was formed to work together to provide a leadership platform to address issues related to sport.

March – NZ Rugby World Magazine (concussion)

Prof Patria Hume represented the RCRG in a two page article in the New Zealand Rugby World magazine (Using the top two inches. New Zealand Rugby World 1stXV 2015 Special Issue. 2015 March:28-9).

CONCUSSION

USING THE TOP TWO INCHES

Professor Patria Hume of AUT University responds to questions on the issue of head injury and concussion in sport.

Professor Hume is a leading expert in sports injury prevention and sport performance biomechanics, and is an active researcher in the field of sports induced head injury and its consequences.

NZRW: Presumably the medical fraternity has a reasonably deep and full understanding of how, say, the knee operates and is affected by injury. How much information in comparison would you say is known about the brain and how it responds to injury?

PH: Our knowledge of concussion is expanding all the time. What is known is that concussion is a form of traumatic brain injury. You don't need loss of consciousness to have suffered a concussion, and losing consciousness – or being 'knocked out' – only occurs in around one out of every 10 concussions.

Impacts to the head – either directly or via the body being impacted – can also cause what is known as 'sub-concussive' injuries, with no witnessed concussion signs or symptoms. Sub-concussive injuries can result in subtle signs of concussion that are often not identified or reported, and may have cumulative long-term effects. However we need clinical research to confirm this, which is indicative of the fact that there is still much to be learned about concussion, in comparison to what is known about many other injuries.

NZRW: How much research has AUT University been able to conduct on brain injuries and concussions?

PH: AUT University staff and postgraduate students have conducted research on traumatic brain injury through AUT's National Institute for Stroke and Neurosciences and AUT's Sports Performance Research Institute New Zealand.

Numerous studies have been conducted by Professor Valery Feigin, Dr Alice Theadom PhD, Dr Doug King PhD, and others at AUT University. Research has spanned topics such as the incidence and outcomes of traumatic brain injury; identification of concussions via tests such as the SCAT3 and King Devick; monitoring of impacts through instrumented mouthguards and ear patches; the long term effects of mild traumatic brain injuries in children and adults; the impact of sustaining multiple injuries; the incidence of sports related brain injuries in the community; novel treatments for improving outcomes in people who have experienced a traumatic brain injury; the WR/NZR/AUT RugbyHealth project; and more.

NZRW: What has been the nature of that research and on whom has it been conducted?

PH: These studies have involved various research methods and sample groups, including all levels of rugby players.

DOUBLE HIT

In the case of the recent WR/NZR/AUT RugbyHealth project, which I led alongside a team of national and international collaborators, the study described differences and similarities in general health, neuropsychological health, balance, and brain excitability. It compared retired elite rugby union players in New Zealand, retired community level rugby union players and retired non-contact sport players.

NZRW: Was specific research conducted to help determine the best practice concussion protocols for this year?

PH: The world benchmark Zurich consensus concussion guidelines were used to form the New Zealand Rugby Community Concussion guidelines.

Rugby protocols also reflect ACC's best practice advice for National Sports Organisations. ACC's Sport Collaboration Group, consisting of various medical and sporting organisations, used their combined knowledge of research evidence and current best practice to develop the ACC concussion guidelines.

NZRW: What would you say are the key learning priorities for medics/scientists in regard to the brain and brain injuries?

PH: The early diagnosis of concussion is a key issue for medics. The best management of concussion is also a priority, including identifying the appropriate period of rest and ensuring a graduated return to activities such as work, school and sports. In addition, we still don't know enough about the long term problems associated with brain injuries.

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CONCUSSION

NZRW: Is it fair to say that every time a concussion research project is completed it significantly changes the thinking around the best protocols to manage it?

PH: Research seeks to improve our understanding and management of particular conditions, and concussion is no different. As new knowledge is acquired, our advice on the best management approach changes accordingly. There is still a long way to go with concussion knowledge and new developments in assessment, management and rehabilitation are frequently emerging.

NZRW: Can you, in the most basic terms, explain what happens to the brain when it is concussed?

PH: A concussion is like a sprain of the ankle or a blow to the arm with a heavy object, in that it stretches the tissue and, in some cases, can cause bleeding of varying degrees. The result is a sprain or a bruise/contusion, and this needs time to heal.

A bruised arm or a sprained ankle clearly need time to heal, but unlike these injuries we cannot see the results of a concussion – they are concealed from us within the head and people often don't know the signs and symptoms, such as dizziness, confusion, headache, visual disturbance, fatigue and forgetfulness.

Traumatic head injuries

A concussion occurs when a blow to the head results in the brain slamming against the skull.

Impact — Shift

Concussion: Brain collides with skull, which can cause bruising, torn tissues and swelling.

Symptoms: Headache, dizziness, confusion, nausea, difficulty hearing and seeing, lack of concentration

Second impact syndrome: When a player who is not fully recovered from a concussion suffers a second blow to the head, it can be fatal.

Skull — Blood flow — Brain swells

Massive swelling of brain — Cuts off flow of fresh blood to brain

SOURCE: American Academy of Neurology, U.S. Centers for Disease Control and Prevention, KRT — State Journal

GRAY MATTERS
Don't ever take risks with the brain.

LONG BREAK

NZRW: Is there any part of the head that you have found to be more regularly struck in rugby?

PH: Our research has indicated that impacts to the side of the head are most common in senior amateur rugby union, as measured with instrumented ear patches. This was found to be similar in senior amateur rugby league and junior rugby league.

NZRW: Have you found there is any part of the head that is more likely, if struck, to lead to a concussion?

PH: No, at present there isn't enough data to clearly indicate whether impacts to certain parts of the head are more likely to lead to concussion.

NZRW: What have you discovered happens to the brain if someone continues to be rugby active before they have fully recovered from a concussion?

PH: Players with an active concussion – one that has not fully recovered – are at a higher risk of suffering another concussion. In rare cases this can result in second impact syndrome, where the person may experience lifelong symptoms or could ultimately die as a result of the second impact to the head.

NZRW: What, if anything, has your research led you to believe could happen to people who have suffered multiple concussions during their playing career?

PH: At this time there is no conclusive link between concussion and long term neurological disorders such as Alzheimer's and chronic traumatic encephalopathy (CTE). A number of associations have been proposed internationally however, and need to be the focus of further research.

The WR/NZR/AUT RugbyHealth project has described some of the long term health outcomes for retired players who sustained multiple concussions during their playing career and also supports the need for more research into this area.

NZRW: In the interests of being clear for our audience – is there any research to suggest that wearing a scrum cap can minimise the likelihood or potential severity of a concussion?

PH: No. Scrum caps can be beneficial for preventing wounds to the head where they cover and protect the ears, but there is no conclusive published evidence that wearing a scrum cap minimises the likelihood of a concussion.

NZRW: Again, in the interests of being clear for our audience – is there any research to suggest that wearing a mouth guard can minimise the likelihood or potential severity of a concussion?

PH: No. There is evidence wearing mouthguards can reduce the incidence of injuries to the teeth, but there is no conclusive evidence that this extends to concussion.

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AUT MILLENNIUM

14th January - Radio Sport (concussion and impacts)

The headline was "Auckland University of Technology researcher Doug King speaks about studying the impact of head and body knocks in rugby, a study published in the *American Journal of Sports Medicine*." The interview discussion was ~15 minutes on the study.

4th February - The Star (concussion and impacts)

The headline was "Study reveal big hits". The article stated "It has always been clear to anyone watching that rugby can be a brutal game to play… The study, conducted by Drs Doug King, Patria Hume, Matt Brughelli and Conor Gissane, at the Auckland University of Technology and published in *The American Journal of Sports Medicine*, has found the size and frequency of the impacts were greater than in most sports previously studied."

The Star (Christchurch), Christchurch
04 Feb 2015, by Andrew Voerman
General News, page 32 - 492.00 cm²
Suburban - circulation 71,644 (--W-F--)
ID 368797143

Study reveals big hits

By Andrew Voerman

IT HAS always been clear to anyone watching that rugby can be a brutal game to play.

At rucks, and in scrums and mauls, players collide with each other over and over again, often taking hits that make viewers shudder.

Now, for the first time, we have a sense of how big those hits actually are, with the publication of an academic study into head impacts suffered by a Wellington club side over the course of a recent season.

The study, conducted by Drs Doug King, Patria Hume, Matt Brughelli and Conor Gissane, at the Auckland University of Technology and published in *The American Journal of Sports Medicine*, has found the size and frequency of the impacts were greater than in most sports previously studied.

It has been published at a time when the issue of concussions and the head impacts that cause them looms large over sport.

When Crusaders captain Kieran Read missed several weeks of Super Rugby and two All Blacks tests after suffering a concussion last year, his condition became the subject of a national discussion as to how they are diagnosed and treated, and what they mean for players' well-being. In amateur competitions, mandatory stand-down periods are enforced for players who suffer one.

The study involved 38 players from the Hutt Old Boys Marist premier men's side, with whom Dr King was involved as a medic. During the 2013 season, they wore mouthguards fitted with accelerometers specially designed by Seattle company X2Biosystems, allowing the researchers to measure the linear and rotational acceleration experienced as a result of each impact.

During the season, which spanned 19 games, 20,687 impacts greater than 10g were recorded, with an average linear acceleration force of 22g.

By way of comparison, a pilot completing a roll in an F-16 fighter jet is exposed to 9g, albeit over a longer period of time, while a car crash at 65kph is about 35g. The largest force felt by a player in this study was 164.9g.

Forwards (13,340) received more impacts than backs (7347) – a significant difference, even when the extra player up front is accounted for.

First-five eighths suffered the most impacts per match (117), while second-fives and centres suffered the least (32). Players in the latter two positions, as well as hookers, were exposed to the largest force per impact (27g; 26g for second-fives).

Players in the study suffered an average of 77 impacts to their heads per game, or 1379 per player per season, more than previous studies had found in American high school football (16-29 per game, 520-625 per season) and American college football (9-13 per session, 414-1400 impacts per season).

The impacts had a higher average force (22g) than had previously been found in youth football (15g), but were similar to those found in high school football (21-26g), some college football (18-27g), and lower

• Turn to page 31

Big hits on footy field revealed

• From page 32

than those found in girls' soccer (25-63g), some college football (32g) and professional American football (60g).

Previous analyses of American football teams had established an injury tolerance level for concussion of 95g or 5500 rad/s². This study recorded 181 impacts greater than 95g, and 4452 greater than 5500 rad/s², although the relevance of those numbers is unclear, given the differences between the two codes, particularly the use of helmets.

Dr King said the two concussions observed during the study both occurred following impacts less than 95g, demonstrative of the indistinct relationship between the force of impacts and whether or not they result in injuries.

He said that this study was only the first of many that needed to be done, if we are to get a clearer picture of the effects of head impacts in the sport – it only focused on one team, playing one style of rugby, at one level, for one season.

"We need a lot more studies at various levels to be able to start to come up and say this is what's going on on the tooty field."

6th February - New Zealand Herald (concussion and impacts)

The headline was "Study puts figure on big rugby hits." The online link is **http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11397376**.

The article stated "Doctors measure our national sport's head-impact toll… An AUT University study also found rugby players received three times more knocks to the head in one game than American football players. The study was done by Drs Doug King, Patria Hume, Matt Brughelli and Conor Gissane and published in *The American Journal of Sports Medicine*."

New Zealand Herald, Auckland
06 Feb 2015, by Natalie Akoorie And Christ Star

General News, page 18 - 310.00 cm²
Metro - circulation 146,119 (MTWTF--)

ID 369510619

Study puts figure on big rugby hits

Doctors measure our national sport's head-impact toll

Natalie Akoorie and **Christchurch Star**

Rugby players take greater impacts to their heads during a game than an F-16 fighter pilot performing a roll . . . but less than someone in a car crash.

An AUT University study also found rugby players received three times more knocks to the head in one game than American football players.

The size and frequency of the impacts suffered by a Wellington club side in one season were greater than in most sports studied.

The study was done by Drs Doug King, Patria Hume, Matt Brughelli and Conor Gissane and published in the *American Journal of Sports Medicine*.

It comes amid national debate on the diagnosis and treatment of concussed players. At an amateur level, stand-down periods are mandatory for concussed players.

For the study, 38 senior players from Hutt Old Boys Marist wore mouthguards fitted with accelerometers to measure the pressure on the head after impact.

During the 2013 season, which spanned 19 games, 20,687 impacts greater than 10g – 10 times the force of gravity – were recorded, and the average force was 22g.

An F-16 pilot completing a roll is exposed to 9g over a longer period of time, while a car crash at 65km/h is about 35g. The largest force felt by a player in the study was 164.9g.

Forwards (13,340) received more impacts than backs (7347). First five-eighths – in the backs – had the most impacts per match (117).

Their fellow backs at second five and centre suffered the least (32) but – with hookers – were exposed to the largest force per impact.

Players had an average of 77 impacts to their heads each game, or 1379 a season, more than previous studies have found in American high school football (16 to 29 a game or 520 to 625 per season) and American college football (nine to 13 a game or 414 to 1400 a season).

Analyses of American football teams had established an injury tolerance level of 95g.

The New Zealand study recorded 181 impacts greater than that, though the relevance is not clear as American football players wear helmets.

Dr King said that two concussions observed during the study occurred after impacts under 95g, showing the indistinct relationship between the force of impacts and whether they resulted in injuries.

He said the study was only the first of many that needed to be done if New Zealand was to get a clearer picture of the effects of head impacts in rugby, because it focused on only one team at one level, for one season.

"We need a lot more studies at various levels to be able to say 'this is what's going on on the footy field'."

First-fives such as Dan Carter take the most knocks.

7th February - Otago Daily Times (concussion and impacts)

Otago Daily Times, Dunedin
07 Feb 2015

General News, page 12 - 194.00 cm²
Metro - circulation 55,000 (MTWTFS-)

ID 369975875

Dr Doug King's article published in *The American Journal of Sports Medicine* was again commented on with a comparison of rugby players experiencing greater G-forces to their heads during a game than an F-16 fighter pilot performing a roll but less than someone in a car crash. Rugby players received three times more knocks to the head in one game than American football players.

Rugby head impacts studied

CHRISTCHURCH: Rugby players experience greater G-forces to their heads during a game than an F-16 fighter pilot performing a roll — but less than someone in a car crash.

An AUT University study also found rugby players received three times more knocks to the head in one game than American football players.

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"We need a lot more studies at various levels to be able to say 'this is what's going on on the footy field'." — *Christchurch Star/New Zealand Herald*

20th March - Washington Post (concussion and impacts)

The headline was "Rugby's having an NFL moment as concussions bring legal scrutiny". The online Link is http://washpost.bloomberg.com/Story?docId=1376-NLI4GD6S972E01-4B2V5GC9RVIQFDFPQECBCE0AUO. The article stated "Millions of television viewers knew Wales winger George North had lost consciousness when he flopped to the ground after banging his head trying to stop England from scoring in their opening match of rugby's 6 Nations tournament… Doug King, a sports injury epidemiologist at the Auckland University of Technology in New Zealand, used accelerometers placed in the mouthguards of 38 rugby players in a study published in *The American Journal of Sports Medicine* in December."

19th April - 3 News (concussion and impacts)

Study: Six in seven rugby concussions unreported

By Emma Jolliff
Reporter

Sunday 19 Apr 2015 6:08 p.m.

Dr Doug King was interviewed on 3 News on Sunday 19th April regarding concussion rates and the need for a stand-down period in rugby. Here's the link – Study: Six in seven rugby concussions unreported. (http://www.3news.co.nz/sport/study-six-in-seven-rugby-concussions-unreported-2015041917#ixzz3bB9F5gmE)

"A concussion researcher who helped the New Zealand Rugby League develop a mandatory stand-down policy of three weeks says rugby union should have one too, at all levels, but it doesn't. His research found that for every one concussion reported in the rugby codes, six go undetected. The Chiefs' Ben Afeaki has retired at the age of 27, citing fears about the damage repeated concussions were doing to his brain. There's been controversy over the Highlanders' Josh Hohneck returning to the field so quickly after being knocked out during their win against the Crusaders. "I was horrified, absolutely horrified," says researcher Doug King. "It frightens me that's being shown out there because kids mimic what they see on TV." In an article published in the *Journal of Neurological Sciences*, Mr King says concussion is more prevalent than we think. "For every one concussion that you see we identified, there were six concussions that were not seen and were not being reported." The results took him by surprise. Mr King tested more than 100 Wellington premier rugby and league players over three years using what's called a saccadic reading test, which he calls his number-one tool. Players do a baseline reading pre-season and again after the games. "Over three seconds in delay we identify as being a concussive-type injury and refer them on for medical opinion." It's estimated 35,000 head injuries occur in New Zealand each year, and 21 percent of those are sports-related. What Mr King wants to see is a mandatory stand-down period before players return to the game, "anywhere between 21 and 28 days, or even longer depending on the symptoms of the individual". The New Zealand Rugby League has implemented just that. "We currently have a mandatory stand-down for players over the age of 16 of 21 days," says Dean Watkins, NZRL Medical Council chairman. "For players under the age of 16 it's 28 days." But rugby union doesn't have the same rules at professional level. New Zealand Rugby says it uses world-best practice when it comes to concussion. It has a stand-down period of three weeks after a concussion at junior level, but at professional level team doctors can give clearance for what they call a graduated return to play. They said tests on Hohneck showed no concussion at the time, or since. Mr King is now doing research on concussions in children under the age of 11."

Rugby athlete development, sideline behaviour, networking opportunities, physical conditioning and more

14th January - Papakura Courier, and 15th January - Manukau Courier (Rugby USA exchange)

The headline was "Young mentor tackles US". The article stated "Rugby and New York are worlds apart but one AUT South graduate is taking the best of our national sport to the Big Apple. Takanini resident Talima Fruean is off on an AUT InterNZ international scholarship to work with youth development programme Play Rugby USA. The Bachelor of Sport and Recreation graduate will spend 12 weeks with the Manhattan-based organisation using rugby to mentor kids in low socioeconomic areas."

8th May - Rotorua Weekender (BSR graduate)

08 May 2015
Rotorua Weekender, Rotorua Bay of Plenty
Section: General News • Article type : News Item • Audience : 23,199 • Page: 15
Printed Size: 160.00cm² • Market: NZ • Country: New Zealand • ASR: NZD 365
Words: 217 • Item ID: 404673419

The benefits of networking opportunities in the AUT Bachelor of Sport and Recreation degree were outlined in an article focused on Matty Axtens.

Networking key for sport graduate

It might seem strange that the first job Steamers player Matty Axtens got after completing a Bachelor of Sport & Recreation was with Basketball New Zealand. But employment outcomes after completing this degree range far and wide due to the diverse skills learnt along the way.

Matty travelled the country as one of two part-time assistants on Basketball NZ's 3x3 national tour. He scored the role thanks to the 350-hour industry placement he completed with Tauranga City Basketball, an invaluable component of the three-year AUT Bachelor of Sport and Recreation degree, delivered by Bay of Plenty Polytechnic in Tauranga.

"The next thing I know there was an email and I was offered a job - I definitely got it through networking," Matty says.

Matty, a former student of Reporoa and Rotorua Boys' High School is better known for his rugby prowess than his academic success. He's been captain of the Steamers development squad and helped the Mount Rugby Club win the Bay of Plenty Championships – all while acing his studies.

Bay of Plenty Polytechnic are offering another intake of the Bachelor of Sport and Recreation in July 2015, so make sure you see them at the Rotorua Careers Expo – they can help you find the right pathway to achieve your success.

FORMER Steamers player Matty Axtens is BOP Polytechnic Bachelor of Sport & Recreation graduate.

19th May RadioLIVE (rugby sideline behaviour)

Dr Simon Walters made comments on an under-8 rugby match, which was abandoned after an altercation between parents during the thought leadership programme on RadioLIVE (19 May 2015). Simon believed this incident was an unusual example of parental sideline behaviour, and noted the studies he has done have been consistent across the world. He stated that rugby came out as the most common site of this sort of behaviour, though not significantly worse. He stated that all sports are attempting to address the problem in different ways, but there does not seem to be a 'coherent' approach to any improvement. Sport New Zealand has recently funded a project to be staged in Auckland called 'Good Sport', designed to target these issues with an education framework.

21st March - Bay of Plenty Times (high performance centre)

Associate Professor Nic Gill was highlighted given his role in the development of a new high-performance training centre at Bethlehem in the Bay of Plenty.

21 Mar 2015
Bay of Plenty Times, Tauranga Bay of Plenty
Section: General News • Article type : News Item • Audience : 15,088 • Page: 17
Printed Size: 238.00cm² • Market: NZ • Country: New Zealand • ASR: NZD 692 • Words: 426
Item ID: 385157790

New high-performance centre aims to nurture and retain talent

Although the Bay is a great training environment, retaining top athletes in the region is a challenge, say leading coaches.

"All our home-grown talent and all of our young athletes that have any future in sport are forced to make a decision to leave," says All Blacks head strengthening and conditioning coach, Nic Gill (pictured), who lives in Tauranga.

It is a situation Dr Gill and others hope to remedy with the development of a new high-performance training centre at Bethlehem.

The Aspire Health & Sports Club is due to open in June and will feature a high-performance centre directed by Dr Gill, who has 20 years' experience training athletes around the world.

He says the Bay lacks a quality facility where athletes of international calibre can have all their training needs met in one location.

Of the athletes spoken to for our series profiling the Bay's top sports people, many train overseas or in other centres, including at Auckland's Millennium Institute of Sport.

Many complained about the cost of shifting, battling big-city traffic, and the fact they preferred home to their current training environment.

Dr Gill, in his eighth year working with the All Blacks, says keeping top athletes here makes sense not only in terms of nurturing exciting talent for the region, but because the Bay is the perfect training ground for serious athletes who need to train two or three times a day.

"It's the best place to live. It's far easier to drive across Tauranga to a gym or a running track from a traffic perspective."

As well as a gym, the Aspire facility will feature an indoor running track, 25m heated pool, hot and cold plunge pools for recovery, and a health-focused cafe.

Physios, massage therapists, nutritionists and a podiatrist will be on-site to help athletes with a cohesive approach to training, performance-enhancement, diet and recovery.

"It's very much a one-stop shop," says Dr Gill. "There's nothing like it in New Zealand, not where everything's in one place."

Dr Gill, who has a PhD in exercise physiology and is a senior research fellow at Auckland University of Technology, has based the facility on high-performance centres he has worked in during his international career.

The centre's lead coach will be Dan Ward-Smith, who has a 12-year career as a professional rugby player in England, while the health club director is Marc Patel, who owns Papamoa gym Oceanblue, where several top athletes already train.

Dr Gill says Aspire has already approached several local high schools, including Bethlehem, Otumoetai and Aquinas colleges, and hopes to provide scholarships to students in the future.

"At the end of the day, what we want is a healthier Tauranga."

8th May - NZ Herald (athlete development)

08 May 2015
New Zealand Herald, Auckland

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AUT SPRINZ research associate Dr Stephen Hollings and AUT Millennium staff member Dr Craig Harrison were both cited in an article on athlete development and the holistic approach to sporting success.

Sporting success not only what happens on the field

Dylan Cleaver

Less than 10 per cent of those who play in NRL under-20s will graduate to first-grade football.

It's a sobering thought.

A fraction of those who attend world youth athletics championships will represent New Zealand at a senior champs or Olympics.

It is why people like Rob Nichol of the Players' Association and former high-profile athlete manager Roger Mortimer see self-identity as one of the hot-button issues in sport.

Mortimer believes too many sports programmes – whether run by franchises, clubs, schools or academies – do nothing to develop the athlete outside of sport.

"The whole sense of identity of the boy or girl, their identity and ego, is around performance in sport," he says. "They only see themselves as a rugby player, cricketer, netballer, triathlete. Sports franchises in general do not give a shit about what happens to the athlete post-career. The scariest thing I see is we have a bunch of kids coming through who see themselves as nothing but rugby players."

Holistic development is seen as crucial, but here's the rub: in research done by Steve Hollings, a former Olympian, on which athletes made the leap to senior ranks, a common factor was a "single identity".

"Those athletes who successfully transitioned admitted that it was difficult to try and manage education, work and training, and chose to make sacrifices in other life domains," Hollings wrote in a paper titled *Why Some Do, Why Others Don't*.

The lesson here is there is no silver bullet for sporting stardom, that much is obvious, but in a wider sense there is no absolute right way – and plenty of wrong ways – to try to get there.

Craig Harrison is director of athlete development at AUT and is trying to change the paradigm for how we identify and develop talent.

"Most people get it wrong," he says. "They are selecting 'talent', which is often biased by Relative Age Effect and maturity levels.

"Once they're in that team or programme, they spend their season working towards outcome goals, not development goals.

"What we need is multiple entry and exit points along the way, but that's difficult because of the way our systems are set up and coaches chase the 'win' rather than focusing on the development of their athletes and instilling great habits."

Harrison, who is married to Silver Ferns defender Anna Harrison, says he feels sorry for parents, who are often placed in difficult situations.

"They see decisions based on outcomes all the time. If they were to say, 'No, we want the programme to be based more around our child's development than winning', they would be going against the norm."

He said one solution for parents would be to ask schools in particular what their sporting philosophy is and what they can expect their child to have achieved by the time they leave.

"If most of them are honest, they'll say, 'Your son will be part of a 1st XV that wins a championship because that's what is important to us'.

"The parents might like that philosophy, or they might want their child to go to a school or club where they aim to use sport to develop the person rather than the short-term 'we'll win on Saturday'."

The old cliche is that sport builds character.

That's wrong, Harrison says, unless the programme allows it.

It is often pointed out how fickle sport is; how the difference between success and failure can be one selector's opinion or an unlucky injury. Indeed, questions are asked all the time as to whether sporting organisations should do more to protect their vulnerable.

Mortimer does not believe so. In many respects, being a sportsperson is no different from being, say, a recording artist. One minute you are flavour of the month, the next, for reasons that are not entirely explicable, nobody thinks you're cool any more.

But athletes, he says, should not view the end of their playing or competing careers as a scrapheap. There's coaching, media, personal training or any number of strands to this ever-growing, intensely complex, entertaining, enriching and frustrating "industry" we call sport.

"It's the nature of sport," he says. "Athletes who don't make it can still have good careers in the industry."

> The scariest thing I see is we have a bunch of kids coming through who see themselves as nothing but rugby players.
>
> Roger Mortimer, athlete manager

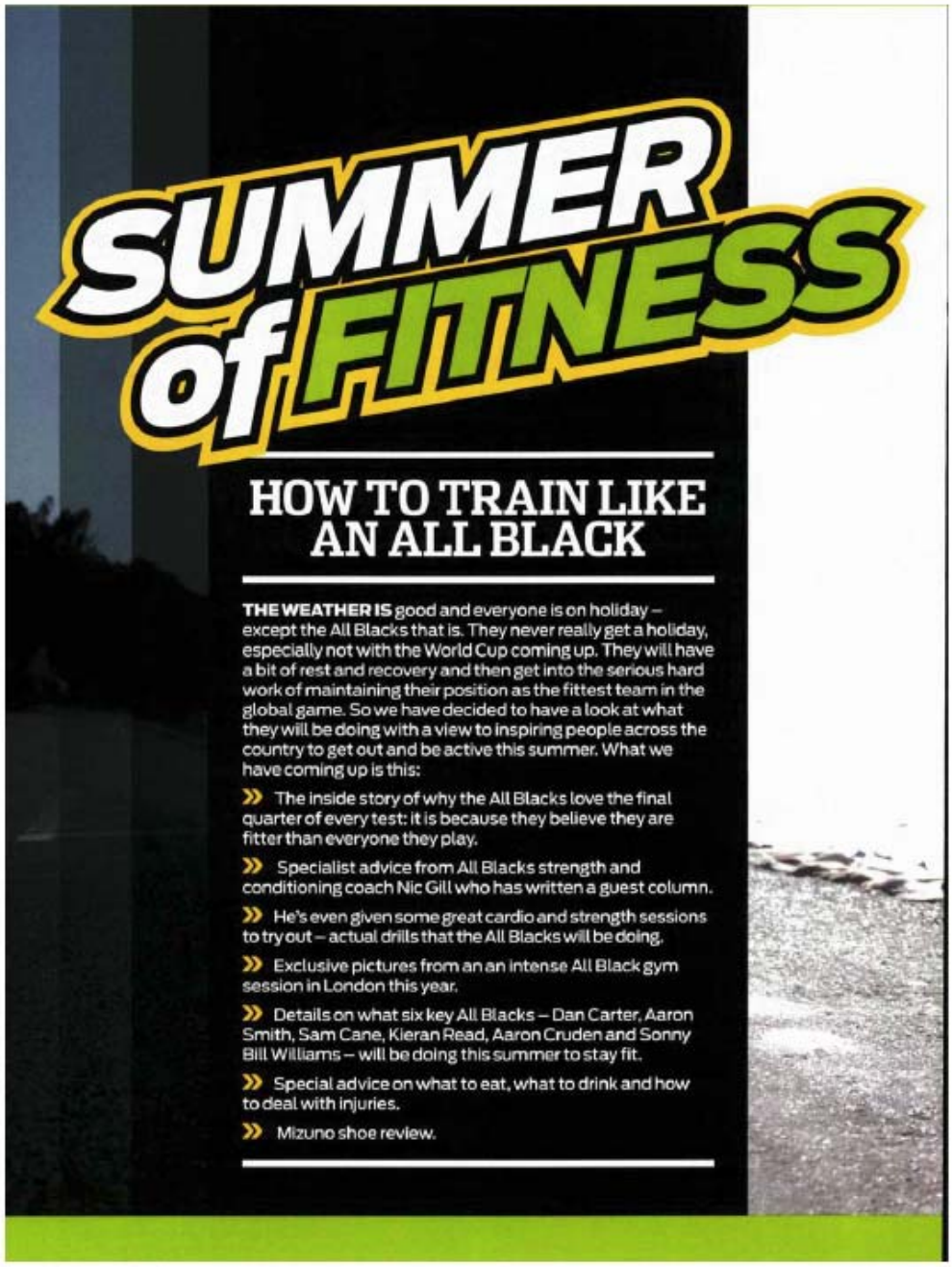
1 January - NZ Rugby World (fitness)

Associate Professor Nic Gill was also highlighted in the New Zealand Rugby World magazine providing advice on how to improve recovery and improving power and strength in rugby union players. A portion of the article is reproduced in this newsletter; see the magazine for the full article.

NZ Rugby World, New Zealand
01 Jan 2015, by Nic Gill

General News, page 50 - 13,224.00 cm²
Magazines Sport - circulation 9,928 (Monthly)

ID 351797953



SUMMER of FITNESS

HOW TO TRAIN LIKE AN ALL BLACK

THE WEATHER IS good and everyone is on holiday – except the All Blacks that is. They never really get a holiday, especially not with the World Cup coming up. They will have a bit of rest and recovery and then get into the serious hard work of maintaining their position as the fittest team in the global game. So we have decided to have a look at what they will be doing with a view to inspiring people across the country to get out and be active this summer. What we have coming up is this:

- The inside story of why the All Blacks love the final quarter of every test: it is because they believe they are fitter than everyone they play.
- Specialist advice from All Blacks strength and conditioning coach Nic Gill who has written a guest column.
- He's even given some great cardio and strength sessions to try out – actual drills that the All Blacks will be doing.
- Exclusive pictures from an an intense All Black gym session in London this year.
- Details on what six key All Blacks – Dan Carter, Aaron Smith, Sam Cane, Kieran Read, Aaron Cruden and Sonny Bill Williams – will be doing this summer to stay fit.
- Special advice on what to eat, what to drink and how to deal with injuries.
- Mizuno shoe review.

TRAIN LIKE AN ALL BLACK

NIC GILL

The preparation that you do when no one else is watching or when you are not being told what to do is what creates the difference between the average and elite performer.

It's the little things you do, the consistency with which you do them and the accumulation of small gains that prepares the best Athlete's for the biggest stage.

To prepare for your best season of rugby union, many of you will be thinking about all the new and trendy things you could do like altitude training, hypoxic intervals, maximum isometrics, gymnastics, eccentrics or the use of the latest supplements.

Be warned it is far simpler than this! If you are constantly searching for the magic potion chances are you are simply overlooking the things that really matter...the big things right in front of you.

The world's most accomplished mountain climbers don't look for shortcuts to the summit, they don't look for the quickest way to the summit: they plan meticulously, and they assess all the risks, then implement the plan with absolute commitment.

This is no different to rugby players trying to get better. The most important thing is to have a plan that has clear direction and regular check points.

The plan should be about becoming a better player; being able to perform your role to a great standard for 80 minutes. To be able to perform to that standard when put under pressure and to be able to do it while fatigued.

The foundation of any good athlete's performances in any given year comes from the off-season and pre-season. Just like the best mountaineers, it's the preparation that goes on at ground level that enables you to reach great heights.

If you do not get this right you will be playing catch up for the whole competition. The requirements for any player to improve will depend on all of the facets of performance and understanding what are the priorities in the physical, technical, tactical and psychological domain. Once the priorities are identified then the plan can be formulated.

If I was still playing rugby union and had my time over I have some key beliefs I would implement in my plan.

Obviously I have had the privilege of working with some of best players in the

THE BASICS

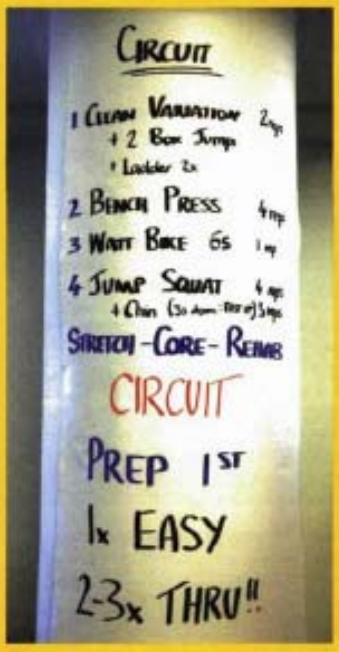
NIC RECOMMENDS RUGBY PLAYERS FOCUS ON FOUR ESSENTIAL EXERCISES TO STRENGTHEN THE BODY FOR RUGBY. THEY ARE:

VICTOR VITO shows the way.

1 JUMP SQUAT – Full body exercise that will improve strength through trunk, hips and legs. However it is essential that technique is good to avoid injury. [See safety and technique tips]

EXCLUSIVE COLUMN WITH NIC GILL – ALL BLACKS STRENGTH AND CONDITIONING COACH

NIC GILL became the All Blacks strength and conditioning coach in 2008 and has been a major influence in turning them into the fittest team in the world. In this exclusive column, he offers general and specific training advice that players across the country would be advised to follow. To be an All Black – you have to train like an All Black.



2 BENCH PRESS – An important shoulder girdle exercise. Done properly, this will work the chest, shoulders, biceps, triceps and abdominals. [See safety and technique tips]

The sets, repetitions, rest periods, speed of lift and number of sessions per week will depend on training experience, age and phase of season.

TRAINING SCHEDULE

	O-S	P-S	Co
Sets	3-4	3-8	3-5
Repetitions	4-10	2-8	1-6
Rest periods	120s	60-180s	60-240s
Speed	Controlled	Controlled eccentric Fast intent on concentric	Controlled – Fast intent dependent on session purpose
No. of Sessions	2-3	3-8	3-5

KEY:
O-S – Off Season
P-S – Pre Season
Co – Competition

In the preparatory phase your running ability needs to be developed just like your strength, power and durability. Every position in rugby union has different running demands and different desired body compositions. The key here is to build towards what you need to be able to do. Typically change of direction, acceleration and deceleration is vital and very energy sapping. See over for training schedule.

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3 CHIN UP – The partner of the Bench Press in strengthening the shoulder girdle. Essentially the back will get strong but also the arms will get hit.

4 CLEAN – An explosive lift that can build strength and power throughout your body. Great for improving triple extension (ankle, knee and hip) which are key joints involved in running, jumping and pushing. Therefore your glutes, hamstrings, quads, calves and trunk will improve if this is performed correctly. [See safety and technique tips]

in the world for some time now. Through this I have not only learnt a lot I have also made numerous mistakes: and these mistakes have been important. From these, I have learned even more.

Rugby is a collision sport that requires most players to run five km-10km in a game, collide with one or two opposition players at full speed... and get up to do it again.

The most important thing to include in any off-season programme is a plan to strengthen all of the key muscle groups and joints through a balanced, progressive, resistance training programme.

This programme must include specific attention to areas you have previously injured. Injury is the most common barrier to people progressing. It restricts and inhibits game time and therefore repetitive execution of skills in the game situation.

Whatever you do, don't progress too fast. Don't lift more weight than you can without keeping good form. Generally speaking, poor form comes from poor movement so get your movements right before progressing into maximum strength.

Range of motion should be a key focus in the off-season to maximise the efficiency of your movement and also to prevent injury or asymmetry occurring.

While increasing your strength and improving your movement you need to perfect your nutrition. You cannot out train a bad diet so if your eating is not well planned your gains will not be anywhere near as significant.

In the off-season / pre-season the specific strength and power training required by players in different positions is not as important as the specifics of training age and injury history.

Essentially all rugby players should be improving the ability to push and pull through all planes in the shoulder and to improve all pushing and pulling movements through the hips. My 'must have' exercises are included and are a foundation movement in my programmes.

INTERVAL TRAINING

A great interval to perform in an off-season or pre-season would look something like this.

TIGHT FORWARDS

Hill Repeats of 30s on 30s off. 10 reps. 4 mins rest. 6x 400m @ 3 mins. If the 400m takes you 150s to complete then you get 30s rest before you repeat. The faster you run the more rest you get. The fitter you get the faster you recover between efforts.

LOOSE FORWARDS

Hill Repeats of 25s on 25s off. 12 reps. 4 mins rest. 8x 400m @ 2.45mins.

BACKS

Hill Repeats of 20s on 30s off 15 reps. 4 mins rest. 10x 300m @ 3mins.

ABOUT NIC GILL

Nic Gill has been the All Blacks strength and conditioning coach since 2008. Prior to that he was an assistant with the national team, and has also worked with the Chiefs and Waikato. He is an associate professor at AUT University and is involved in various research projects – some of which are focused on recovery and improving power and strength in rugby union players.

RUGBY CODES PROJECT UPDATES

Dr Doug King

Congratulations to Dr Doug King in submitting his second PhD for examination at AUT University. Doug has also accepted a senior lecturer position at AUT and is 0.2 FTE for the remainder of 2015 while he is still based in Wellington, and will be full time from 2016 when he moves to Auckland.

Sports-related concussions in New Zealand amateur rugby union and league: Identification, assessment and impact forces involved.

What are the costs and frequency of concussions in sports in New Zealand and how can we identify and measure them? The overarching aim of the thesis was to examine sports-related concussions in New Zealand amateur rugby union and rugby league via the identification, assessment and impact forces involved in concussion incidents. Specific aims included the identification of the costs and epidemiology of concussions in New Zealand rugby union and rugby league, the identification of a sideline concussion assessment tool for use by non-medical lay-people, and the identification of the magnitude, frequency and distribution of head impacts in real-time that occur during rugby union games with instrumented mouthguard equipment.

Methodological approaches utilised in this thesis included epidemiological analysis, cross-sectional surveys, prospective cohort analysis using the King-Devick and SCAT3 concussion assessment tools, and impact analyses using instrumented mouthguards.

The identification of the costs and epidemiology of concussions in New Zealand rugby union and rugby league was evaluated using epidemiology analysis of the national Accident Compensation Insurance Corporation database, and then via a survey of 213 amateur rugby league players.

A total of 20,902 claims costing $NZD 16,546,026 were recorded in the period of 1st July 2001 to 30th June 2011 of which 1,330 (6.4%) were MSC claims. The mean yearly number and costs of MSC claims was 133 ±36 and $1,303,942 ±$378,949. Rugby union had the highest number of MSC claims per year (38; 95% CI 36 to 41 per 1,000 MSC claims). New Zealand Māori recorded the highest total ($6,000,759) and mean cost ($21,120) per MSC claim. The average cost per claim for a moderate to severe concussive injury varied by sports code, ethnicity, gender and age over a 10 year period for seven sporting codes in New Zealand. Māori rugby league males aged between 30 and 39 years, female players and rugby union players need to be targeted for injury prevention initiatives.

A reason for high concussion claim numbers in sport may be related to the focus on concussion identification and management education resulting in increased reporting. Rugby league had the third highest number of claims (n=179) for reported concussions over the ten years. However, the overall knowledge level of concussion identification and management was only 42% for rugby league team coaches and trainers in New Zealand which was lower than other studies reporting concussion knowledge of team coaches (62% to 84%). Of 95 rugby league coaches and team managers, 26% reported they would not remove a player with symptoms of concussion, 20% would return a symptomatic player to participation and 39% reported that concussion only occurred when a player lost consciousness. Recently it has been reported that un-witnessed concussive events were identified with the use of a saccadic reading test in rugby league and rugby union. The number of un-witnessed to witnessed concussions occurred at a 3.4 to 1 ratio. As a result of the study findings, it was recommended that a wider understanding of concussion identification for team coaches and first aiders, and removal from play for assessment at all levels of participation, may assist in the identification of concussive injuries.

In reviewing a total of 213 (mean ± *SD*: age, 19.2 ± 4.4) amateur rugby league player concussion questionnaires, there were an average of 4.0 ± 2.6 concussive injuries per player in the preceding two years (2010-2012) and an average of 5.0 ± 4.6 concussive injuries per player in the years that they were involved in the sport preceding this. A total of 7.5% participants saw a medical doctor for their concussion, while only 5.2% completed the required three week return-to-play. Only 2.8% of the players reported that they saw a medical doctor for medical clearance to

return to sport. No under 15 yr. old player reported seeing a medical doctor or having a stand-down period for return to play when they had a concussion. As a result of these findings it was suggested that further educational efforts are warranted targeting both players and team management on the risks associated with, and management of sport-related concussion.

The identification of a sideline concussion assessment tool for use by non-medical lay-people was evaluated using the King-Devick (K-D) saccadic reading test.

In the observational study on the use of the sideline remove from play saccadic reading tool, every player was required to complete a pre-competition questionnaire on concussion history, a baseline Post Concussion Symptoms Scale (PCSS) and two trials of the K-D before they participated in any match activities. After-match assessment of players identified there were 22 concussive incidents recorded over the duration of the competition. Although five of the concussive incidents were witnessed, a further 17 were not witnessed (unrecognised) at the time of the event, but were identified post-game with the K-D, and were later confirmed via a medical assessment by a physician. Witnessed concussions recorded, on average, a longer K-D on the day of injury (5.5 ± 2.4 s) than unrecognised concussions (4.4 ± 0.9 s) when compared with the players' baseline K-D. The K-D was able to identify players that had not shown, or reported, any signs or symptoms of a concussion but who had meaningful head injury. The current rate of concussion reported was a ten-fold increase in previously reported concussion injury rates. As a result of the study findings it was recommended that the K-D is suitable for rapid assessment on the side-line in a limited time (e.g. five-minutes) to assess and review suspected concussed players in rugby.

In a prospective observational cohort study on a club level senior amateur rugby union team (n=36 players in 2012 and 35 players in 2013) and a senior amateur rugby league team (n=33 players in 2014), all 104 players completed two trials, 10 minutes apart, of the K-D at the beginning of their competition season. A total of 52 (8 witnessed, 44 unwitnessed) concussive events were identified over the duration of the study resulting in a concussion injury incidence of 44 per 1,000 match participation hours. There was a six-fold difference between the incidence of witnessed and unwitnessed concussions. There were observable learning effects between the first and second K-D test baseline testing (50 vs. 45 s) for all players. It was identified that for every 1 point reduction in each of the post-injury Standard Assessment of Concussion (SAC) components there was a corresponding increase (worsening) of K-D test times post-match for changes in orientation (2.9 s), immediate memory (1.8 s) concentration (2.8 s), delayed recall (2.0 s) and SAC total score (1.7 s). As a result of the study findings it was recommended that the inclusion of a visual dimension tool such as the K-D test may assist in increasing the capacity for the identification of concussed players and decrease the likelihood of players with a concussive injury not reporting the symptoms and exposing themselves to further concussive events. Using the K-D test as part of a continuum for the assessment and monitoring of players with a concussion can assist healthcare providers to evaluate adequate cognitive rest and informed clinical decisions regarding return-to-play and return-to-academic activities. A composite of rapid brief tests such as the K-D test, the SAC and the BESS are likely to provide a series of effective clinical tools to assess players on the sideline with a suspected concussive injury.

The identification of the magnitude, frequency and distribution of head impacts in real-time that occur during rugby union games was evaluated using X2Biosystems XGuard, an instrumented mouthguard that provided head accelerations in three dimensions.

In conducting the cross-sectional study on the impact magnitude and frequency of head impacts to amateur senior rugby union players, through the use of the moulded instrumented mouthguards, thirty eight premier amateur senior rugby players recorded a total of 20,687 impacts >10*g* (range 10.0-164.9*g*) over the duration of the 2013 domestic club competition season. The mean number of impacts per player over the duration of the season of matches was 563 ±618 resulting in a mean of 95 ±133 impacts to the head per player, per match over the duration of the season of matches. The acceleration magnitudes and number of head impacts in amateur rugby union players over a season of matches were higher than for most sports previously reported. Mean linear acceleration measured over the season of matches was similar to the mean linear accelerations previously reported for American youth footballers, American high school footballers, and American collegiate footballers, but lower than female youth

soccer players. Mean rotational acceleration measured over the season of matches was similar to American youth footballers, American high school footballers, and American collegiate footballers, but less than female soccer youths, concussed American collegiate players and professional American footballers. As a result of the study findings it was recommended that further studies are warranted to explore these impacts that occur from participation at the junior, female and professional levels of participation.

As a result of this study, and trying to compare the results with other published studies, an issue in the way in which authors presented head impact data was discovered. Therefore, a retrospective review was conducted to compare the published data reporting on impact thresholds obtained from accelerometer systems with data recorded at the 10*g* impact threshold obtained from 38 senior rugby players in New Zealand. The comparison was undertaken to identify the percentage, and number, of impacts that were removed with different thresholds. In addition the reporting modalities were also compared to identify the most common format. Of 43 studies identified, 16 (37.2%) reported impacts using >10*g* threshold. Application of the varied impact thresholds used in publications to the New Zealand data resulted in 20,687 impacts >10*g*; 11,459 (44.6% less), impacts >15*g*; and 4,024 (80.5% less) impacts >30g. Studies reported descriptive statistics as mean (±SD), median, 25^{th} to 75^{th} interquartile range, and 95^{th} percentile. The differing descriptive statistics utilised for reporting head impacts in sports limits the use and availability of inter-study comparisons. As a result of this analysis it was recommended that a consensus on methods of data analysis, including the thresholds to be used in sports impact assessment is needed. Based on the data available to date, the 10*g* threshold is the most commonly reported impact threshold. Validation studies are required to determine the best threshold for impact data collection in sport. Until validation is conducted, the 10g threshold should be standardised for all studies reporting impacts to the head in sport.

This PhD research has contributed knowledge regarding costs of concussions in rugby union, rugby league, soccer, touch rugby, hockey and softball/baseball. The percentage of concussions medically managed in a cohort of amateur rugby league players, the benefit of use of a sideline remove-from-play screening tool for concussions in amateur senior rugby union and rugby league players and a description of the magnitude, frequency and duration of impacts to the head in senior amateur rugby unions players. In addition, this PhD research has identified the need for a consensus approach to the reporting of impact biomechanics in future studies. As a result of this research a new cyclical model of concussion management has been developed.

Doug has produced a number of publications during his second PhD including:

King DA, Hume PA, Brughelli M, et al. Instrumented mouthguard acceleration analyses for head impacts in amateur rugby union players over a season of matches. *American Journal of Sports Medicine* 2014.

King D, Brughelli M, Hume PA, et al. Concussions in amateur rugby union identified with the use of a rapid visual screening tool. *Journal of the Neurological Sciences* 2013; 326(1-2):59-63.

King D, Hume PA, Clark T. Nature of tackles that result in injury in professional rugby league. *Research in Sports Medicine* 2012; 20(2):86-104.

King D, Hume PA, Gissane C, et al. Sports-related concussions in rugby league: The magnitude of the problem and evidence for impact assessment. A report for the National Rugby League and New Zealand Rugby League. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology. 2015:54.

King D, Gissane C, Hume PA, et al. 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* 2015; 351(1-2):58–64.

John Paul Alder

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

Supervisory Team: Dr. Lynn Kidman[1, 2], Dr. Tom Patrick[3] and Dr. Lesley Ferkins[1, 2]
[1]Sports Performance Research Institute New Zealand (SPRINZ), Auckland University of Technology, Aotearoa New Zealand; [2] School of Sport & Recreation, Auckland University of Technology, Aotearoa New Zealand; [3] Nation Sports Medicine Program, Aspetar, Qatar.

Despite the espoused importance of culture and change management amongst high performance sport professionals and practitioners, there is limited theoretical or practical clarity surrounding these organisational phenomena and processes. To learn about this relatively emergent aspect of high performance sport management, my research investigated how a National Sports Organisation could effectively promote a performance culture within their high performance unit (HPU; CEO, performance leaders, players, coaches, and support staff of the national team) as their national team prepared for and competed in their pinnacle event, the world cup. Adopting the perspective that organisational culture involves a process of sensemaking and subsequent meaning construction, this research is the product of a qualitative inquiry spanning almost two years investigating how people worked with, interpreted, made sense of and acted during an attempted change process.

Grounded in a constructivist paradigm, I used an ethnographic action research (EAR) methodology to draw upon the experiences of living through change in real time and offer a rich, contextual narrative of a change effort on a national sport team. With an overall intended outcome of improving on and off-field performance by enhancing the understanding and performance of the HPU culture, I engaged key leaders to identify specific issues, design interventions, action steps, and reflect upon outcomes, as the research passed through a series of intervention-action phases focused upon manager-led change. Aligning with ethnographic underpinnings, the research employed varied data collection methods including participant observation, informal and formal interviewing, artefact analysis and reflexive journaling to uncover a rich and detailed picture, sensitive to the local context and the meanings of the participants involved.

Outcomes of the research highlighted the highly complex, multifaceted and situational nature of change in high performance sport where changing the deeply embedded meanings on a national sport team was proven to be a highly challenging task. Findings centred on the importance of personal and shared experience, and identity and identification in meaning construction and change. Meaning was shown to be enacted, constructed by doing and experiencing, and was therefore located in the subtle and often overlooked aspects of everyday life, actions and practices of high performance athletes and management staff. The context of the national sport team was revealed as a complex network of loosely connected agents, where prevailing discourses and flows of power framed and frustrated change, whilst meaning formed one of the few remaining anchors for collective action. Subsequently, the research highlighted the importance of change interventions not imposing an ideological order on others or reducing meaning to superficial architecture and artefacts, but engaging stakeholders in constructing a meaningful local construction of organisational reality. Following pathway one, the thesis is undergoing its final internal edit and submission for examination will be made by 29th June 2015.

Richard Swinbourne

Sleep for athletic performance and recovery.

Richard has completed his PhD research and is to submit his thesis in July. Richard says "I owe a debt of gratitude to my supervisors Dr Nic Gill and Dr Jo Vaile, and to Dr Dan Smart and Dr Deb Dulson for their technical expertise. Much of my work has focused on collision sports, namely professional rugby. My studies have been 'ground up' as there is a brevity of research in this area in NZ and indeed globally. Research initially focused on characterising athlete sleep quality with both qualitative and quantitative methodology, unearthing a significant issue with respect to inadequate total sleep time, poor sleep quality and resultant daytime sleepiness. I then applied a controlled behaviour change and sleep education programme to a Super 15 rugby team during a two month trial, with positive impacts on sleep extension, sleep quality, stress hormone secretion and performance. My final study, a placebo controlled nutritional intervention using tart cherry juice, aimed to improve variables of sleep, muscle function and inflammation during an off-season training phase, with favourable results suggesting a role for tart cherries in mitigating markers of secondary inflammation, which may be an important consideration when trying to improve sleep quality in athletes. I am excited to be coming to an end in my PhD journey, and looking forward to applying my new knowledge with a lot of passion to our elite environments in New Zealand."

Kim Simperingham

Enhancing sprint performance in team sport athletes.

Kim says the overarching question for his research is: "Can body-based loading (BBL) strategies 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. My research is first quantifying the kinematic and kinetic changes that occur during sprint-running when additional load is attached to the upper or lower body. Subsequently I am exploring the potential for contrast loading protocols to be used to acutely enhance sprint performance. Early research findings indicate that when an additional load is attached to the lower body rather than the upper body, less load is required to elicit changes in sprint kinematics and kinetics. In a case study with a former international rugby athlete, we observed a short term enhancement in sprint acceleration performance following a 20-minute warm-up wearing an additional load (3% of body mass) on the lower body. Further research projects with rugby players are scheduled over the next six months.

Scott Brown

Does symmetry matter?

Scott has one more year to complete his PhD. He is attending three conferences (ECSS, ISBS and ISB) to present work from his PhD to gain feedback on his thesis chapters. He has manuscripts titled, 'Profiling lower-extremity isokinetic strength in academy rugby union athletes' and 'Profiling sprint mechanics by leg preference and position in rugby union athletes' submitted to IJSPP. However all results at this time for both manuscripts are confidential.

An abstract titled, 'Sprint kinetics and kinematics on a non-motorised treadmill are unique to position in rugby athletes' has been accepted for a mini-oral presentation to ECSS to be held in Malmö, Sweden on 24-27 June, 2015.

Sprint kinetics and kinematics on a non-motorised treadmill are unique to position in rugby athletes

Brown, S.R., Cross, M.R.

INTRODUCTION: Unique positional characteristics are an accepted part of rugby union. Ruling structures indirectly govern athletes to specific actions that result in distinct mechanical stresses specific to position. While variables such as horizontal force (*FH*) have been highlighted as fundamental to sprint performance in rugby (Cross et al., 2014), kinetics and kinematics specific to position have not been investigated. We assessed rugby athletes on a non-motorised treadmill (NMT) to illuminate if position-specific sprint profiles exist.

METHODS: Thirty male academy rugby athletes, separated into forwards and backs (n=15/15), performed maximal 6s sprints on a NMT. Comparison of kinetic and kinematic variables were made between positions during initial acceleration (steps 1-2), acceleration (steps 3-12) and maximal velocity (steps 13-22) phases using effect sizes (ES).

RESULTS: Backs produced higher absolute and relative *FH* at initial acceleration (ES=1.07 and ES=1.6 respectively) but lower absolute *FH* at acceleration (ES=-0.78) and maximal velocity (ES=-1.0) compared to forwards. Backs displayed faster split times at 2m (ES=-1.03), 5m (ES=-0.82), 10m (ES=-0.63) and 15m (ES=-0.50) but achieved a lower peak velocity (ES=-0.54) compared to forwards.

DISCUSSION: During NMT sprinting, backs generated greater levels of *FH* during initial acceleration, resulting in faster short-distance split times, whereas forwards produced greater levels of *FH* during acceleration and maximum velocity. While backs typically reach greater peak velocities during over-ground sprinting (Cross et al., 2014), forwards displayed higher peak velocities on the NMT; seeming contradictory to moderate correlations between NMT and over-ground sprinting (Highton et al., 2012). Given forwards are heavier and possess greater posterior-chain strength (Brown et al., 2014), the superior levels of absolute force and peak velocities exhibited by this position supports the notion that NMT sprinting favours these characteristics. The high intrinsic resistance of the NMT, requiring greater levels of *FH*, reinforces the contention that the lighter and weaker backs were disadvantaged in maintaining faster split times with increasing distance and reaching peak velocity. The relationship between over-ground and NMT sprint performance may be weakened in sporting codes featuring position-subsets with differing mechanical profiles. Practitioners wishing to profile and compare sprint mechanics using NMTs are advised to separate athletes by position.

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Cross MR, Brughelli M, Brown SR, Samozino P, Gill ND, Cronin JB, Morin J-B. (2014). *Int J Sports Physiol Perform*, in press.
Highton JM, Lamb KL, Twist C, Nicholas C. (2012). *J Strength Cond Res*, 26(2), 458-465.

An abstract titled, 'Carrying a ball can influence sidestepping mechanics in rugby' has been accepted for an oral presentation to ISBS to be held in Poitiers, France on 29 June-3 July, 2015.

Carrying a ball can influence sidestepping mechanics in rugby

Scott R Brown, Matt Brughelli and Patria A Hume

Sidestepping mechanics have been implicated as a risk factor for knee injury in rugby. Carrying a ball is proposed to alter movement patterns. Therefore the purpose of the study was to examine the effects of sidestepping with a ball compared to sidestepping without a ball on lower-extremity biomechanics in male rugby athletes. Three-dimensional kinematics of 18 male rugby athletes were recorded during a maximal effort 45° sidestepping task without and with a ball. Sidestepping with a ball resulted in 15% greater knee adduction angle during weight acceptance and 18% greater hip adduction angle during peak push-off than without a ball. Future biomechanical evaluations of athletes require the inclusion of the ball specific to the sport to ensure accurate interpretation of movement patterns.

KEYWORDS: knee injury, anterior cruciate ligament, ACL, planned, cut, manoeuvre.

INTRODUCTION: Rugby union is the most played contact sport in the world with over seven million participants spanning 120 countries ("Year in Review 2014," 2014). Rugby includes an assortment of physically demanding activities including running, sprinting, kicking, passing, colliding, tackling and scoring; all are required during the course of an 80-minute match (Brown, Brughelli, Griffiths, & Cronin, 2014). Rugby athletes are often plagued with lower-extremity musculoskeletal injuries, specifically hamstring and anterior cruciate ligament (ACL) injury (Brown, Brughelli, & Hume, 2014). The majority of ACL injury rehabilitation claims are classified as non-contact and are seen frequently during sidestepping (Brown, Brughelli, & Hume, 2014).

Previous research examining sidestepping has primarily focused on females, footballers or a combination of the two (Brown, Brughelli, & Hume, 2014). With 78% (4.5 million) of all rugby athletes being male ("Year in Review 2014," 2014), there is limited research that has examined male rugby athletes and accurately replicated the tasks seen in match play. While sidestepping has been examined in Australian Rules footballers, the velocities at which the task was performed may potentially be lower than match velocities (Brown, Brughelli, & Hume, 2014), calling into question the applicability of findings. Several authors have examined the influence of ball-handling (Chaudhari, Hearn, & Andriacchi, 2005), passing (Fedie, Carlstedt, Willson, & Kernozek, 2010) and dribbling (Chan, Huang, Chang, & Kernozek, 2009) during sidestepping and have discovered substantial alterations in lower-extremity mechanics. There is no published study that has examined the effects of carrying a ball during sidestepping in rugby; ball retention being a major component of success in rugby ("Year in Review 2014," 2014).

The purpose of this research was to examine the effects of carrying a ball on lower-extremity biomechanics during sidestepping compared to sidestepping without a ball in male rugby athletes. It was proposed that sidestepping with a ball would alter knee kinematics relevant to ACL injury risk such as decreased knee flexion angle at initial contact and increased knee adduction angle during weight acceptance.

METHODS: Eighteen male academy (high performance development) rugby athletes (age 20 ± 3 y, body-height 1.9 ± 0.1m, body-mass 100 ± 14 kg) performed maximal effort 45° sidestepping tasks without and with a rugby ball.

Data collection: The planned sidestepping task (Brown, Wang, Dickin, & Weiss, 2014) consisted of athletes accelerating with maximum effort for 10-m before performing an offensively-initiated evasive manoeuvre, using their preferred kicking leg, at a 45° angle and then reaccelerating out to complete the task. Following a warm-up, static calibration and range of motion trials were captured at 200 Hz with a nine-camera three-dimensional motion capture system (T10S, Vicon Motion System Ltd., Oxford, UK) and a synchronised embedded force platform (Type 9287C, Kistler Instrumente AG, Winterthur, CH) collected at 1000 Hz. Athletes completed a minimum of eight trials without and with a ball given in a random order. A successful trial consisted of athletes reaching a velocity of ≥ 6 m/s, striking the force platform completely with the sidestepping leg and executing the task as quickly as possible to closely simulate the requirements of a match situation.

Data processing: Athlete-specific joint-centre locations were calculated from the range-of-motion trials using a custom-made MATLAB programme (R2014b, The MathWork, Inc., Natick, MA, US). Three-dimensional motion and ground reaction force data were filtered with a fourth-order Butterworth low-pass filter using a cutoff frequency of 16 Hz in Visual 3D (4.91.0, C-Motion, Inc., Germantown, MD, US). Knee power data were normalised by body-mass (W/kg) and time data were normalised to stance phase (%; from initial contact to final contact) to facilitate comparison between all athletes. Knee angle and hip data were examined during initial contact, weight acceptance, peak push-off and final push-off phases while knee power and knee velocity were examined at peak braking and peak propulsive phases using another custom-made MATLAB programme (Brown, Wang, et al., 2014).
Data analysis: To describe the results in detail, two-tailed, paired Student's *t*-tests were established and magnitude-based inferences were used to assess the standardised effects (the difference between the means was divided by the standard deviation of the leg sidestepping without a ball; effect size [ES]) of sidestepping with a ball using previously established methods (Hopkins, Marshall, Batterham, & Hanin, 2009). If the confidence limits were within the levels of the negative, trivial or positive mechanistic scale, the outcome was noted as clear and the likelihood of the true effect observed was described. If the confidence limits spanned all three levels, the outcome was noted as unclear.

Table 1. Mean ± standard deviation of knee and hip joint kinematics during sidestepping without and with a ball and inferences for change of the means.

With–without ball sidestepping					
Joint angles: Sidestepping phase:	Without ball (°)	With ball (°)	*p*-value	Mean change; 90% CL	ES: Qualitative inference
Knee flexion (+) / extension (–)					
Initial contact	27 ± 8	26 ± 7	0.091	-1.4; ±1.3	-0.16: Trivial* -ive
Weight acceptance	39 ± 7	39 ± 6	0.732	0.29; ±1.41	0.041: Trivial**
Peak push-off	52 ± 5	52 ± 6	0.919	-0.086; ±1.457	-0.016: Unclear
Final contact	22 ± 7	22 ± 6	0.877	-0.15; ±1.69	-0.023: Unclear
Knee adduction (+) / abduction (–)					
Initial contact	9 ± 5	10 ± 4	0.199	1.1; ±1.5	0.19: Trivial* +ive
Weight acceptance	13 ± 5	15 ± 4	0.023	2.2; ±1.5	0.38: Small** +ive
Peak push-off	18 ± 7	19 ± 6	0.207	1.3; ±1.7	0.17: Trivial* +ive
Final contact	11 ± 5	11 ± 4	0.821	0.16; ±1.24	0.039: Unclear
Hip adduction (+) / abduction (–)					
Initial contact	5 ± 8	6 ± 6	0.179	1.04; ±1.28	0.13: Trivial**
Weight acceptance	6 ± 8	7 ± 7	0.191	0.94; ±1.20	0.12: Trivial**
Peak push-off	10 ± 8	12 ± 7	0.031	2.2; ±1.6	0.27: Small* +ive
Final contact	11 ± 7	11 ± 5	0.561	0.33; ±0.97	0.055: Trivial***

Values are means ± standard deviation; mean change; ±confidence limits (CL) (90%); ES, effect size; (+) and (–) , positive and negative values associated with the corresponding angle; +ive and -ive, substantial positive and negative change with ball relative to without ball sidestepping; trivial and small inference: 25-74%, possibly (*); 75-94%, likely (**).

RESULTS: Performance variable effects of sidestepping with a ball compared to without a ball were: approach velocity (6.6 ± 0.7 m/s and 6.6 ± 0.4 m/s; ES = 0.13) was unclear, stance time (0.19 ± 0.02 ms and 0.19 ± 0.03 ms; ES = 0.013) was likely trivial, depart velocity (6.1 ± 0.4 m/s and 6.2 ± 0.5 m/s; ES = -0.20) was possibly trivial and the angle

(16 ± 2° and 16 ± 3°; ES = 0.092) was likely trivial. Knee flexion angle showed a possibly trivial decrease (ES = -0.16) at initial contact, knee adduction angle showed a possibly trivial increase at initial contact, a likely small increase at weight acceptance, a possibly trivial increase at peak push-off (ES = 0.19, 0.38 and 0.17 respectively) and hip adduction angle showed a possibly small increase at peak push-off (ES = 0.27) when sidestepping with a ball compared to without a ball; all other variables showed unclear or trivial inferences (Table 1). Sidestepping with a ball showed peak knee power as unclear and peak knee velocity with a possibly trivial decrease (ES = 0.032 and ES = -0.14 respectively) during the braking phase and possibly trivial decreases (ES = -0.20 and -0.16 respectively) during the propulsive phase compared to without a ball.

DISCUSSION: Studies (Chan, et al., 2009; Chaudhari, et al., 2005; Fedie, et al., 2010) including a ball during sidestepping have noted kinematic increases in knee flexion, knee abduction and hip adduction angles; the current study can only partially support these findings. Knee flexion angle for example, while carrying a ball, was slightly smaller at initial contact and then remained consistent throughout the remaining phases of sidestepping. Knee adduction angle was slightly larger while carrying a ball at all phases of sidestepping; with an unclear inference at final push-off. Unlike Chan et al. (Chan, et al., 2009) who found that dribbling a ball increased knee abduction angle at weight acceptance in female basketball athletes, we found an increased knee adduction angle at initial contact, weight acceptance and peak push-off when sidestepping with a ball which is more in line with findings (Fedie, et al., 2010) while attending to a ball in male and female basketball athletes. Hip adduction angle was larger at all phases while carrying a ball in this study and showed a clear and possibly small increase during peak push-off, which is comparable to findings of larger hip adduction angles (Chan, et al., 2009; Fedie, et al., 2010). Our findings of larger knee and hip adduction angles may be the result of substantially faster velocities while entering (~6.6 m/s) and exiting (~6.2 m/s) the manoeuvre. In addition, male rugby athletes may present different (unique) sidestepping mechanics as the requirements of the sport differ considerably from those found in male and female basketball athletes.

An abstract titled, 'Knee and hip strength profiles characterise functional needs in rugby athletes' has been accepted for a poster presentation to ISB to be held in Glasgow, United Kingdom on 12-16 July, 2015.

Knee and hip strength profiles characterise functional needs in rugby athletes

Scott Brown
Sports Performance Research Institute New Zealand, Auckland University of Technology, Auckland, New Zealand

Introduction and Objectives: Rugby union is an intermittent high-intensity contact sport requiring maximum strength and power performances, interspersed with low-intensity efforts [1]. Rugby forwards utilise strength for success in contact situations such as front-on tackling, rucks, mauls and scrums; whereas backs utilise power for success in high-speed side-on tackling and contact evasion [2]. Unique force-producing attributes are developed in specific joints and angles between the two positions for efficiency. Lower-extremity strength assessment techniques should shift their importance to multi-joint assessments in conjunction with the angles of peak torque for a complete representation of an athlete's lower-extremity strength [3]. Bilateral single-joint or unilateral multi-joint strength deficits may increase risk of lower-extremity injury; especially when unique positional attributes can further accelerate strength differences [4]. We assessed rugby athletes through multi-joint and multi-speed isokinetic actions to illuminate any position specific strength profiles.

Methods: Twenty-nine male academy (development-level) rugby athletes (age 22±4y, body-height 1.9±0.1m, body-mass 97±11kg), separated into forwards (n=15) and backs (n=14), performed bilateral isokinetic strength assessments at the knee and hip with concentric (60°·s-1 and 180°·s-1) actions and at the knee with eccentric (60°·s-1) actions. Fourth-order polynomial curve fitting was used to identify peak torque and angle of peak torque. Hamstrings-to-quadriceps (H:Q) ratios and knee flexion-to-hip extension (KF:HE) ratios were calculated.

Results: Backs were smaller in stature (MDiff=-0.032m; ES=-0.45) and lighter in body-mass (MDiff=-13kg; ES=-1.3) compared to forwards. Strength comparisons at the knee showed small decreases in strength of the backs compared

to forwards during concentric knee extension and flexion at 60°·s-1 (MDiff=-19N·m; ES=-0.37 and MDiff=-11N·m; ES=-0.48 respectively) and small to moderate decreases at 180°·s-1 (MDiff=-23N·m; ES=-0.59 and MDiff=-15N·m; ES=-0.85). Eccentric peak extension and flexion torques showed unclear and small decreases in strength of backs compared to forwards (MDiff=1.07N·m; ES=0.018 and MDiff=-10.7N·m; -0.30). Compared to forwards, backs showed moderate decreases in peak concentric flexion angles at 60°·s-1 and 180°·s-1 (MDiff=-10°; ES=-1.004 and MDiff=-3.3°; ES=-0.65) and moderate to small changes in peak eccentric extension and flexion at 60°·s-1 (MDiff=-5.7°; ES=-0.78 and MDiff=4.4°; ES=0.58). At the hip, strength comparisons between forwards and backs showed unclear to small decreases in strength during hip extension and flexion at 60°·s-1 (MDiff=-10N·m; ES=-0.12 and MDiff=-11N·m; ES=-0.33) with differences between the groups unclear at 180°·s-1 (MDiff=4.2N·m; ES=0.046 and MDiff=-5.0N·m; -0.16). Backs showed a small increase in angle of peak torque during 60°·s-1 hip extension (MDiff=1.1°; ES=0.29) and a large decrease during hip flexion (MDiff=-2.7°; ES=-1.2) compared to forwards.

Conclusions: It was not surprising that forwards had greater peak torque values at the knee and hip compared to backs considering the conceptual positional requirements of each group [2]. Strength differences between forwards and backs were similar to those reported for professional rugby athletes [1]; with the exception of an overall decrease in strength, likely a result of the age, competition level and strength training history. Backs possessed more desirable angles of peak torque during extension and flexion actions (i.e. larger extension and smaller flexion angles) and speeds given the types of movement patterns they use in match play. Adequate strength at long muscle lengths are more desirable in sports with sprinting bouts as hamstring injuries are suggested to occur near full knee extension [5]. Forwards and backs showed substantially smaller H:Q ratios (0.54 vs 0.67 forwards; 0.53 vs 0.64 backs) and KF:HE ratios (0.39 vs 0.58 forwards; 0.37 vs 0.61 backs) compared to professional rugby athletes [1]; most likely resulting from overactive quadriceps and/or weak hamstrings. Meaningful strength differences were present in academy rugby forwards and backs at the knee and hip which became more substantial during faster assessment speeds. While rugby forwards had superior lower-extremity strength compared to backs, their associated angle of peak torque occurred at inferior degrees; potentially lending way to lower-extremity injury. Bilateral single-joint and unilateral multi-joint lower-extremity strength assessments can facilitate more informed recommendations on whether athletes would be more advantaged to perform specific movements aimed to improve strength at longer muscle lengths.

References:
[1] Brown et al., *Int J Sports Physiol Perform*, 9: 358-61, 2014.
[2] Gamble, *Strength Cond J*, 26: 10-23, 2004.
[3] Brown et al., *NZ Sports Med Sci*, 42, 2014.
[4] Brown et al., *Phys Ther Sport*, 15: 211-5, 2014.
[5] Mendiguchia et al., *Brit J Sports Med*, 46: 81-5, 2011.

Dr Sarah-Kate Miller

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.

Dr Stephen Kara, Dr Ralph Maddison and Samantha Marsh

Along with Ralph Maddison and the University of Auckland we are involved in the RuFIT Study. This is replicating a trial conducted in Scotland using professional sporting teams as a conduit to deliver 'healthy' messages around nutrition and exercise (Train Like The Blues is the motto) to facilitate weight loss and a reduction in cardiovascular risk. This has the support of NZRU and we are using this pilot to hopefully be the fore runner for a more extensive trial amongst more of the professional rugby organisations. Dr 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.

RuFIT STUDY

Background: In New Zealand, 28% of adults are obese and a further 35% are overweight. Nationally, significant ethnic and sex disparities exist, 62% of Pacific and 44% of Maori adults are obese compared with 26% of NZ European, and men also have higher rates of obesity than women across all age groups from 35 years of age. Sports clubs to enhance wellness among men: There has been growing interest in the role of professional sports clubs to attract and support men to lose weight and engage in healthy lifestyle interventions. In Scotland, the Football Fans in Training (FFIT) programme was developed and piloted with professional soccer clubs. Developed in collaboration with Scottish Premier League Trust (SPLT), the FFIT programme is a gender-sensitised weight management intervention for men based around nutrition, physical activity and alcohol consumption and delivered using theoretical principles of behaviour change and recognised guidelines for weight management. The FFIT pilot randomised trial (n=103) resulted in a 5.2% difference in weight loss at 12 weeks between the men who completed the FFIT programme and those in the control group. The FFIT group also reported significant improvements on self-reported physical activity levels, eating habits, and self-esteem. The programme was well received by participants and 86% attended two thirds of the available sessions. The FFIT programme has subsequently been funded for delivery in all 12 Scottish Premier League Soccer clubs from August 2011. While FFIT has been extremely successful in engaging men through Scottish football, it's generalizability to other sports and in different countries is yet to be determined. In NZ, rugby (Union and League) is the most popular spectator team sport, and has high participation rates. It is therefore believed that, with appropriate amendments to align the FFIT intervention with the NZ environment and culture, the programme (the first of its kind in NZ) will have significant potential to improve male health.

Aims: The aim of this study is to pilot the RuFIT intervention. Findings will be used to inform the design of larger effectiveness and efficacy trials.

Study design: A single-arm, pre-post-test study design will be used. Anthropometric, fitness, and adherence measures will be collected, in addition to participant and trainer feedback on the programme. Participants will attend an initial baseline assessment (1 hour), twice weekly 75-min RuFIT sessions for 12 weeks, and a final assessment at the end of the programme (1 hour). A number of measures will be taken at baseline and follow-up.
Eligibility: Men aged 18-65 years with a BMI of ≥28 kg/m2, with no contraindications to undertaking physical activity and able to provide written informed consent.

RuFIT Intervention: RuFIT intervention will consist of a group-based healthy living and weight loss programme, delivered in twice weekly, 75-minute sessions at the training facility by a qualified trainer. The Auckland Blues Franchise has the facilities to deliver the intervention. The programme will include a step-based pedometer component. Each session will include an education module introducing different topics relating to nutrition, physical activity, and alcohol, followed by an individually-tailored 'pitch-side' physical activity programme. Between each weekly session men will be encouraged to follow a personal pedometer-based walking programme and their alcohol and nutrition behaviour will be guided by individual goals the men set during the group education sessions. Participants will be referred to existing programmes to support lifestyle change (e.g. Green Prescription, Quitline), if they choose.

WORLD RUGBY FUNDED PROJECTS COMPLETED IN 2015

We completed two research programmes for World Rugby (previously International Rugby Board). The IRB/NZR/AUT RugbyHealth project, and the IRB/AUT IRB/AUT/USC/UOA rugby player equipment review.

IRB/NZR/AUT RugbyHealth project

Patria Hume[1], Ken Quarrie[2,1], Gwyn Lewis[3], Alice Theadom[4], Martin Raftery[5], Scott Brown[1], Stephen Marshall[6,1] Denise Taylor[3], Rosamund Hill[7], Ian Murphy[2], Matt Brughelli[1]

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

Aim: There have been concerns raised about the long-term effects of repeated head trauma for rugby union players. The International Rugby Board (IRB) commissioned the AUT-led study which aimed to better understand the long-term physical and psychological effects of rugby.

Methods: The IRB/NZR/AUT RugbyHealth project described differences and similarities for retired NZ elite rugby union players (ER), retired community level rugby union players (CR) and retired non-contact (i.e. cricket, hockey) elite and community players (NC) for: A) general health (485 retired players, 27% ER, 58% CR, 15% NC); B) neuropsychological health (366 retired players, 28% ER, 54% CR, 18% NC); C) balance (75 retired players, 31% ER, 37% CR, 32% NC); and D) brain excitability (75 retired players, 31% ER, 37% CR, 32% NC). Players were recruited via multiple strategies including a media campaign.

Findings: As World Rugby have not yet approved the release of the results, we cannot report them in this newsletter. A participant fact sheet will be distributed as soon as World Rugby give the approval for release.

Project publications have included:

Hume PA, Lewis G, Brown S, et al. IRB/NZR/AUT RugbyHealth project part A: General health assessment of retired rugby and non-contact sport players. Final report. In: Hume PA, editor. *IRB/NZR/AUT RugbyHealth Project: A technical report to the International Rugby Board and New Zealand Rugby*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2014:61.

Hume PA, Theadom A, Lewis G, et al. IRB/NZR/AUT RugbyHealth project part B: Neuropsychological health assessment of retired rugby and non-contact sport players. Final report. In: Hume PA, editor. *IRB/NZR/AUT RugbyHealth Project: A technical report to the International Rugby Board and New Zealand Rugby*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2014:18.

Hume PA, Brown S, Lewis G, et al. IRB/NZR/AUT RugbyHealth project part C: Balance assessment of retired rugby and non-contact sport players. Final report. In: Hume PA, editor. *IRB/NZR/AUT RugbyHealth Project: A technical report to the International Rugby Board and New Zealand Rugby*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2014:14.

Lewis G, Hume PA. IRB/NZR/AUT RugbyHealth project part D: Brain excitability assessment of retired rugby and non-contact sport players. Final report. In: Hume PA, editor. *IRB/NZR/AUT RugbyHealth Project: A technical report to the International Rugby Board and New Zealand Rugby*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2014:12.

IRB/AUT/USC/UOA Rugby Player Equipment Review

Professor Patria Hume[1], Professor Brendan Burkett[2], Dr Grant Searchfield[3], Dr Paul Gamble[1], Dr Scott Brown[1], Dr Anna Lorimer[1]

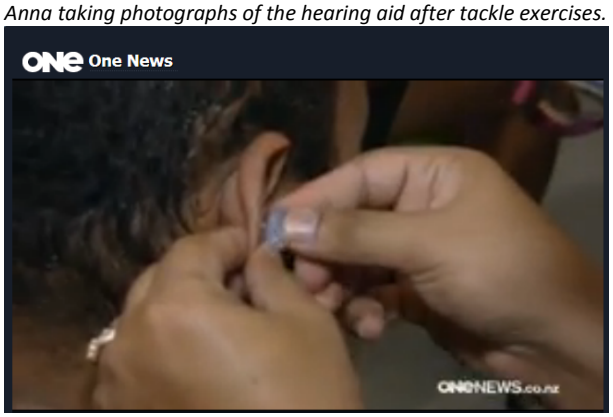
[1]Sports Performance Research Institute New Zealand, Auckland University of Technology
[2]Centre for Healthy Activities, Sport and Exercise (CHASE), University of the Sunshine Coast, Queensland, Australia
[3]Audiology, The University of Auckland, New Zealand;

The IRB/AUT player equipment review aimed to identify products suitable for playing rugby by those who are visually impaired, have hearing disabilities or require prosthetics. The project comprised Part A - Literature review and company product review, Part B – Prostheses in sport conference report, Part C - Pilot research project on hearing aid design.

Players and testing staff on the hearing aid laboratory testing day.

TV NZ news coverage of the hearing aid testing occurred.

Anna taking photographs of the hearing aid after tackle exercises.



A hearing aid being fitted to a players' ear by an audiologist.

There have been considerable developments since the previous amendment to regulation 12 in 1999. New materials and associated development of technology and instrumentation has dramatically reduced the size and increased the ease of use of adaptive devices such as hearing aids, for example. There are limited options for commercially available corrective eyewear and auditory aids that would be suitable for use during competitive rugby matches at present. Equally, this represents an opportunity. Appropriate law amendments might serve as the catalyst to further develop technology with rugby union leading the way. There remains a need to develop and adapt existing commercially available prostheses. There are several developments in prosthetics that have improved the function and control of the device, for example lower limb amputees who compete in the long jump now jump off their prosthetic limb rather than anatomical limb. The IRB should consider development work in these areas. It is envisaged that the local law trials for use of GPS devices inserted into clothing will eventually result in law changes. The positioning of instrumentation devices needs to be considered to ensure minimal risk to players. Other devices such as smart clothing materials requiring small batteries, and instrumented ear patches and mouth guards to measure head acceleration will become more commonly used in rugby. The upcoming results of trials of instrumented mouthguards and ear patches should be assessed. Research projects to develop new prostheses and hearing aids for use in rugby are appropriate given the personnel and institutions identified in the proposals submitted to the IRB via Martin Raftery in 2014.

Publications from the player equipment review studies included:

- Hume PA, Burkett B, Searchfield GD, et al. IRB/AUT Rugby Player Equipment Review Project part A: Literature and company product review. A technical report to World Rugby Board. In: Hume PA, editor. *IRB/AUT Player Equipment Project*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2015:54.
- Hume PA, Burkett B, Searchfield GD. IRB/AUT Rugby Protective Equipment Review Final Report to the World Rugby Board. In: Hume PA, editor. *IRB/AUT Player Equipment Project*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2015:78.
- Searchfield GD, Hume PA, Kobayashi K, et al. IRB Protective Equipment Project: Feasibility testing of the fit and comfort of four hearing aid designs for rugby. In: Hume PA, editor. *IRB Protective Equipment Project*. Auckland: Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand, 2014:14.

PROJECTS WE ARE SEEKING FUNDING FOR

Rugby Codes Research Group (RCRG) governance and technology expansion programme	Purpose	AUT PIs (faculties)	External AIs (organisations)	Novelty
• Rugby governance: Investigating hybrid ownership in Super Rugby	Develop governance solutions for NZ rugby.	A/Prof Lesley Ferkins (HES), A/Prof Coral Ingley (B&L).	Nigel Cass (GM, NZ Rugby), Professor David Shilbury (Deakin University)	New sport governance area for RCRG
• 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 Doug King (HES), Dr Stephen Reay (DCT), Dr Roy Nates (DCT), Dr Anna Lorimer (HES), Prof Patria Hume (HES).	Dr Grant Searchfield (University of Auckland)	New sports technology, joint IP
• X2 concussion: Concussion: Design of new in-the-ear patches for head acceleration measurement in rugby players	Design and develop a rugby in-the-ear X2 device and validate it against 3D motion analyses data and to compare it with the current behind-the-ear X2 ear patch	Dr Doug King (HES), Dr Stephen Reay (DCT), Dr Roy Nates (DCT), Dr Anna Lorimer (HES), Prof Patria Hume (HES).	Dr Grant Searchfield (University of Auckland), Dr Adrian Cohen (Australia NeckSafe company), Ed Mlinek and Jason Thibado (X2 USA company), Dr Yaodong Zhu (China).	New sports technology, joint IP
• Rugby prosthesis: Rugby-specific prosthesis prototype for players that require prosthetics	Design and develop a rugby-specific prosthesis prototype for players that require prosthetics	Dr Matt Brughelli (HES), Dr Stephen Reay (DCT), Dr Roy Nates (DCT), Dr Anna Lorimer (HES), Prof Patria Hume (HES).	Professor Brendan Burkett (Uni of Sunshine Coast), Dr Simone Oehler (German prosthetic company), Professor Wayne Derman (South Africa University)	New sports technology, joint IP
• UK RugbyHealth: Physical, neuropsychological and musculoskeletal health of retired rugby players	Describe the current physical, neuropsychological and musculoskeletal health of retired elite rugby, community rugby and retired non-contact sport players who participated in sport in the 1970's to 2011 in the UK.	Dr Alice Theadom (HES) Associate Professor Gwyn Lewis (HES), Scott Brown (HES), Prof Patria Hume (HES).	Dr Karen Hind (Leeds Met University UK), Prof Richard Aspden (Institute of Medical Sciences, University of Aberdeen, UK), Dr Theocharis Ispoglou, (Carnegie Faculty, Leeds Beckett University, UK), Dr Katalin Pauley-Takacs (Faculty of Health, Leeds Beckett University, UK).	Expansion of NZ RugbyHealth, new bone health
• USA Rugby7s: Epidemiology app created	Analyse the incidence of injury among U.S. Rugby-7s athletes, according to international standards on injury research in the sport of rugby.	Dr Doug King (HES), Mitali Purohit (AUTEL), Prof Patria Hume (HES).	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).	New ehealth app, joint IP

We submitted five expressions of interest for the April 2015 World Rugby Research Round. Unfortunately none of the expressions of interest were invited to proceed to the next round, given the current priority areas of research for World Rugby precluding the development of any new technologies for rugby (four of our projects). We thank our collaborative partners for their commitment to enhancing rugby codes research knowledge with us and we are aiming to proceed with these projects by requesting funding from the AUT Strategic Research Investment Fund (SRIF). Dr Lesley Ferkins will lead the submission on behalf of the RCRG team for the AUT SRIF application for the expansion of the RCRG work. The World Rugby applications will form the basis of the application, with some modifications to projects, and the addition of a new project in rugby governance. The SRIF application will be for $500,000+. Decisions are made in November with successful grants outworked in 2016.

FACE OFF: Players from Lincoln and Waihora pack down for a scrum during a game in 2013. A new study has found players can suffer dozens of impacts to the head per game. **PHOTO:** KAREN CASEY

RUGBY CODES CONCUSSION POLICY UPDATE

Isaac Carlson and Natalie Hardaker from ACC lead the Sports Collaboration Group involving representatives from New Zealand Rugby, New Zealand Football, Netball New Zealand, Netball New 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'.* The guidelines on concussion are to be distributed as widely as possible. The *New Zealand Journal of Sports Medicine* article outlined the development of the guidelines. For full details see: Hume PA, Carlson I, Hardaker N. Concussion guidelines introduction: Safeguarding against concussion harm - launch of the ACC Sport Concussion Guidelines. *New Zealand Journal of Sports Medicine* 2014; 41(2):61-66.

Professor Meeuwisse MD (University of Calgary Sport Injury Prevention Research Centre, and Zürich Concussion in Sport Consensus Group) provided a seminar at AUT Millennium on 5th December that outlined the Zürich consensus and the international medical and science concussion group discussions. He talked with the Sport Collaboration Group members and helped develop the national concussion guidelines. Associate Professor Paul McCrory MD (Melbourne Brain Centre, and Co-Chair, International Concussion in Sport Group) has since provided us with important updates to the guidelines which we are thankful for – so a version 2 will be provided by ACC soon.

Concussion Guidelines Introduction

Safeguarding against concussion harm - launch of the ACC Sport Concussion Guidelines

Patria Hume
Professor, Auckland University of Technology
Isaac Carlson and Natalie Hardaker
Accident Compensation Corporation

The consequences of head injuries and concussion in sport has brought widespread public focus on the importance of having well defined policies and practices to reduce the harm from concussion. Over 7,000 head injuries are recorded by ACC each year as a direct result of sport related activity. In the last four years sports related concussion claims cost ACC $76 million.

ACC has been working with four National Sports Organisations (NSO's) to develop and implement injury prevention initiatives. The Sports Collaboration Group (SCG) - New Zealand Rugby, New Zealand Rugby League, Netball New Zealand and New Zealand Football working closely with Auckland University of Technology's Sports Performance Research Institute New Zealand (SPRINZ) – was formed to work together to provide a leadership platform to address issues related to sport. The first issue identified was concussion in sport.

The ACC Sport Concussion Guidelines were officially launched by Dr Peter Robinson (Chief Clinical Advisor for the Accident Compensation Corporation), at a media briefing on Friday 5th December at AUT Millennium. "The knowledge, experience and expertise this group brought in dealing with issues around concussion has been invaluable," said Dr Robinson. "We all agreed something had to be done and that a national guideline would be a starting point for all NSO's, the recreation, health and education sectors to have a policy around concussion." "It is no longer acceptable to allow sports participants who sustain a knock to the head to continue to play until a proper medical assessment has been made." "The important thing is to get everyone involved to ensure a high standard of care across New Zealand," said Dr Robinson. The aim of the ACC Sport Concussion Guidelines is to translate to the New Zealand context the key information from the 2012 Zurich Consensus, and to build on the work in concussion of the four sports leading the SCG. It is acknowledged that a number of groups such as Sports Medicine New Zealand (SMNZ) have also had useful guidelines for concussion in sport.

The ACC Sport Concussion Guidelines set out what to do, how to recognise the signs and symptoms, what action to take and how sports organisations can develop a concussion policy and implementation plan for their particular activity. ACC has an expert panel available to assist sports organisations to develop and review their policies, plans and education material. Members of SMNZ are encouraged to volunteer to be part of the ACC expert panel. The ACC website (www.concussion.acc.nz) and the SMNZ website have downloadable pdfs of the Concussion Recognition Tool (CRT), the SCAT3 and the ACC Sport Concussion Guidelines.

ACC with the SCG and AUT's SPRINZ are now working on the concussion implementation plan. Consultation with members of SMNZ, Sport New Zealand, and Ministry of Health amongst other key groups will be undertaken to ensure its appropriate implementation, including education, in those groups involved with the identification and treatment of concussion. For example, education for medical doctors could include:

- SCAT3 use
- Clinical assessment and diagnosis as per the Zurich Consensus
- Knowledge of medical clearance for return to school/work/sport

Education for allied health care professionals and public (non-doctor, non-allied health) involved in physical activity rehabilitation during return to play (e.g. coaches, teachers) could include:

- CRT
- SCAT3 symptom only use
- Return to physical activity as per the Zurich Consensus

The media launch of the ACC Sport Concussion Guidelines followed a public seminar by Professor Winne Meeuwissee on the Zurich Concussion Consensus Statement and research updates since the statement was published in 2012. Dr Meeuwisse as a founding member of the Concussion in Sport Group and Co-Chair of the 2012 International Consensus Conference on Concussion in Sport, was able to provide advice to ensure the ACC Sport Concussion Guidelines were up to date with international best practice and current research on concussion.

Members of the SCG who helped develop the guidelines were Isaac Carlson (ACC), Natalie Hardaker (ACC), Patria Hume (AUT SPRINZ sports injury biomechanist and SMNZ member), Alice Theadom (AUT NISAN neuropsychologist), Rosamund Hill (Auckland Hospital Neurologist), Mark Fulcher (Sports Physician, and Medical Director for both NZ Football and Netball New Zealand and SMNZ member), Dean Watkins (National Talent Development Manager for NZ Rugby League), Richard Skelly (Game Development Manager at NZ Rugby), Ian Murphy (NZ Rugby Medical Director and SMNZ member), Cam Mitchell (NZ Football), Jamie Milne (NZ Football), Adrienne Morrin (NZ Netball), Laura Menzies (NZ Netball), Jacob Cameron (NZRL), and Sharon Kearney (NZ Netball Physiotherapist and SMNZ member). Dr Bruce Hamilton (HPSNZ and SMNZ member) and Dr Bryn Jones (Ministry of Health) also contributed to the media interviews during the launch.

Media panel during the launch of the ACC Sport Concussion Guidelines Professor Patria Hume, Dean Watkins, Dr Peter Robinson, Dr Mark Fulcher, Richard Skelly.

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