We acknowledge the support of AUT Millennium and SPRINZ for hosting the publication of this e-Magazine.

RCRG website:
https://sprinz.aut.ac.nz/areas-of-expertise/interdisciplinary-research/rugby-codes
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IMPORTANT NOTE: The text and images from publications in this RCRG e-Magazine are reproduced without express permission, for educational purposes only.
Professor Patria Hume - e-Mag Editor Welcome

Welcome to issue 6 of the Rugby Codes Research Group (RCRG) e-Magazine. The aim for the RCRG e-Magazine is to communicate advances in evidence-based knowledge and its practical application to the wider support network of rugby codes. In this issue we provide updates on work by members including publication details and poster content.

The Rugby Codes Research Group (RCRG) celebrates 10 years of existance in 2019.

We look forward to your continued work to improve performance and reduce risk of injury in the rugby codes.

Dr Farah Palmer – Sport NZ Leadership Award

In New Zealand we celebrate Dr Farah Palmer being awarded the Halberg “Sport New Zealand Leadership Award”.

This is the highest sports leadership award in New Zealand and well deserved for her leadership in rugby including being the first woman appointed to the NZ Rugby board. Farah is an active researcher and is perhaps best known for her role as the former captain of the NZ Black Ferns – the New Zealand Women’s Rugby World Cup Champions.
Australian Rugby Player Eye Health Study

In the weeks leading up to Christmas the Save Sight Institute hosted the second clinic day for our Sydney based study investigating the eye health of Australian Rugby players. The health risks of contact sports have been a hot topic in the media recently, with numerous studies demonstrating concussion related cognitive and neuropathological changes in contact sport players, a condition referred to as Chronic Traumatic Encephalopathy (CTE).

One of the features of CTE is thinning of white matter in the brain, a type of brain tissue which represents connections between neurons. Dr Clare Fraser, a neuro-ophthalmologist, and her team believe that given the connections between the brain and the eye, the changes seen in CTE may also manifest in the eye by way of retinal thinning. This thinning could therefore be detected non-invasively using Optical Coherence Tomography, a modern technique that scans structures inside the eye including the retina. If such a link is found this technology may have uses in both early detection and monitoring of CTE. In addition, the team are also looking at the rates of other eye health problems including retinal detachment, glaucoma and cataract. The clinics to date have been lively and often serve as an opportunity for players to catch up with one another. Our most recent clinic included well known former Professional Rugby League legends Mr Paul Sironen and Mr Steve Roach (‘The Blocker’). The study will be running into the first quarter of 2019, with more clinics planned.

Clare is also now collaborating with Dr Michael Buckland - neuropathologist and Dr Rowena Mobbs – neurologist. For further information contact:

Clare Fraser
MBBS, MMed, FRANZCO
A/Prof of Neuro-Ophthalmology
University of Sydney | SAVE SIGHT INSTITUTE
Faculty of Medicine and Health
South Block | Sydney and Sydney Eye Hospital | 8 Macquarie Street | Sydney NSW 200
T +61 2 9382 730
Consultant Ophthalmologist (VMO) - Sydney Eye Hospital, St Vincent’s Hospital
Mark Hecimovich – Project Update

Mark Hecimovich (USA) and Doug King (NZ) are analysing data for the project “Saccades, fixation and blink counts in Sport Related Concussion: Utilizing King-Devick eye tracking in collegiate rugby”.

Contact Mark for further information:
Mark Hecimovich, PhD, ATC
Associate Professor
Athletic Training
University of Northern Iowa
003C Human Performance Center
Cedar Falls, IA 50614-0244
Phone: 319.273.6477
mark.hecimovich@uni.edu

Dr Sarah Kate Millar – Project Update

Dr Sierra Keung and Dr Sarah Kate Millar (both AUT) are collaborating on the project “Exploring athlete pathways: Players, barriers and facilitators of talent development within Rugby League in New Zealand” with Dr Donna O’Connor, Professor (University of Sydney); Dr Stephen Cobley (University of Sydney), Balin Cupples, PhD candidate (University of Sydney).

Sierra graduated her PhD in December 2018: Link to thesis: [http://hdl.handle.net/10292/11941](http://hdl.handle.net/10292/11941)

The Global Rugby Health Research Programme – Ethics tracking

The SPRINZ Code of Ethics for Members includes the statement:

- “ensure ethical approvals are obtained from the appropriate bodies where necessary”

The list below shows the ethics tracking for the Global Rugby Health Research Programme. Please send details to Patria.Hume@aut.ac.nz

- Hind, K., I Entwistle... Fitzgerald M, Hume P (2016, updated 2018 to include analysis of plasma at Curtin University, Australia). Ethics: Clinical assessments in retired rugby players: the UK Rugby Health project. (part 2 of UK Rugby Health project).

For details on the UK Rugby Health Research Programme please contact karen.hind@durham.ac.uk
New Technology

This is a comment on new technology provided by the eMag editor Prof Patria Hume, after receiving an email from the supplier Brenton Short. This comment is not an endorsement of the product – rather information to the RCRG members. Prof Lindy Fitzgerald in Perth, Australia, is now using this technology for the analysis of Dr Karen Hinds blood samples for the collaborative UK Rugby Health Project.

There is a new technology “that would enable you to potentially diagnose and monitor recovery from TBI/concussion via the use of serum biomarkers, which would allow you to objectively measure biological outcomes of impacts observed via the X-Patch system.

GeneWorks are the Australian/New Zealand distributors for Quanterix, who have developed an ultrasensitive digital ELISA platform called the Single Molecule Array, or Simoa. This platform provides unparalleled sensitivity (sub fg/ml) in a range of biological matrices and has proved extremely popular in both concussion and neurodegenerative disease research, where this sensitivity has allowed the detection of biomarkers of a range of neurological disorders in blood thus obviating the need for CSF sampling. Quanterix offer a range of single and multiplex kits looking at a range of biomarkers (GFAP, Tau, NF-Light, UCH-L1 etc) via analysis of serum samples.

Additionally, the Simoa platform can be used to examine microRNAs at a similar sensitivity to PCR based methods without the need for nucleic acid amplification, which could potentially allow you to increase the specificity and sensitivity of your test by analysing both nucleic acid and protein biomarkers.

Quanterix offer a semi-automated instrument, the SR-X as well as the fully automated HD-1, which would enable routine diagnostic analysis of serum samples in an automated, high throughput manner.” (email to P Hume, 15/02/2019).

For further information contact:

Brenton Short
Scientist (Immunoassay and Cell Biology)

GeneWorks Pty Ltd | Head Office | 28 Dalgleish Street, Thebarton SA 5031, Australia
p +61 8 8159 6217 | fc 1800 882 555 | m 0403 114 836 w http://www.geneworks.com.au

GeneWorks – Molecular & Cell Biology Experts | Innovative Technologies and Services | Instrumentation Services
Enora Le Flao PhD candidate - Project Update


A validation study of the CSx mouthguards is on-going for my PhD in collaboration with my PhD supervisors (Prof Patria Hume, Dr Doug King) and collaborators from Strasbourg University, France (Dr Khyati Verma, Dr Nicolas Bourdet and Prof Remy Willinger) and Lincoln University, NZ (Dr Mike Hamlin, Dr Sohei Takamori). The validity and reliability of the linear and angular components of the sensors will be assessed, as well as the overall validity with respect to a Hybrid III head form. An initial paper on the linear data was submitted to the International Society of Biomechanics conference in Calgary 2019.

Publications have included a Sports Medicine literature review, a ISBS conference 4-page paper, and a one page SMNZ abstract:


Two literature reviews on head impacts research are on-going:

Abstract presented at the Australasian Neuroscience Society annual conference in Brisbane in December 2018. The manuscript describing the work is currently being prepared for publication. The work was also presented at the Australian College of Emergency Medicine Meeting in Perth in November 2018 and the Trauma 2018 meeting in Perth in October 2018.

PREDICTING OUTCOMES FOLLOWING MILD TRAUMATIC BRAIN INJURY

Aleksandra Gozt1,2, Melissa Licari3, Alison Halstrom4, Hannah Milbourn4, Anna Black1,2, Glenn Arendts5,11, Stephen Macdonald5,9,11, Swithin Song10, Ellen Macdonald5,11, Michael Bynevelt6,8, Carmela Pestell7, Daniel Fatovich5,9,11, Melinda Fitzgerald1,2,4

1Curtin Health Innovation Research Institute, Curtin University, 2Perron Institute for Neurological and Translational Science, Ralph and Patricia Sarich Neuroscience Research Institute Building, Verdun St, Nedlands 6009 Western Australia, Australia; 3Telethon Kids Institute, West Perth; 4School of Biological Sciences, 5Emergency Medicine, 6School of Surgery, 7School of Psychological Science, The University of Western Australia; 8Neurological Intervention & Imaging Service of Western Australia; 9Emergency Department, 10Radiology Department, Royal Perth Hospital; 11Centre for Clinical Research in Emergency Medicine, Harry Perkins Institute of Medical Research, Perth, Western Australia, Australia

Post-Concussion Syndrome (PCS) is a complex condition where symptoms of concussion persist beyond the timeframe that they typically resolve. However, there is currently a lack of predictive measures that can be used to direct clinical care. Here, we assessed blood-based biomarkers, MRI and neuropsychological outcomes in a cohort of concussion patients (mTBI) at the time of presentation to Royal Perth Hospital Emergency Department (T0), and related these to outcomes at 28 days (n=36), and/or age matched healthy controls. The Repeatable Battery for the Assessment of Neuropsychological Status total score was significantly lower at T0 in patients that developed PCS, than in patients that recovered normally (t (34) = 2.8215; p = 0.008). Diffusion Tensor Imaging analyses using tract based spatial statistics in a subset of patients indicated that fractional anisotropy measures in the left inferior frontal occipital fasciculus (IFOF) were significantly lower in mTBI patients than controls (t (20.587) = -2.174; p = 0.042). This area of the brain is implicated in visual-spatial processing abilities. There was a statistically significant difference in the plasma concentration of GFAP amongst the three groups (ANOVA: F (2,60) = 12.903, p < 0.001), with a significant increase with mTBI relative to control (p < 0.001). The goal is to establish a predictive model of PCS based on a suite of outcome measures that can be used to identify patients at risk of poor outcome following concussion. The work is being developed as a broader nationwide collaboration to improve lives following traumatic brain injury.

NOTE: The slides are from the talks and are presented without detailed explanation, and without compromising copyright for later publication.

Subset of participants: N=15 mTBI (3 with PCS), N=8 controls. Tract based spatial statistics: mTBI compared to control, no significant differences. Red - areas of the brain in which mTBI patients had lower FA values than healthy, uninjured age and gender-matched controls within the mean FA skeleton (green).
Professor Mike Hamlin - Project Update

Mike has conducted a number of studies with colleagues resulting in journal publications:

T. Raj., C. Elliot., Hamlin, M.J. Impact of 12-weeks of yoga intervention on balance in university level rugby players. 8th World Congress of Biomechanics, Dublin, Ireland July 8-12, 2018; p4272.

The results of this inquiry confirm previous finds indicating that yoga may decrease postural sway and improve balance. If a decrease in postural sway correctly reflects an increase in balance in our subjects, we might expect more efficient movement patterns in our players after such a yoga intervention. Decreased postural sway may also reflect increased proprioception in the foot and ankle after the yoga intervention which may result in fewer injuries.


The standardized typical error (0.37) suggests moderate congruency between the two 1.2 km shuttle tests, but the reliability found in this study on elite young rugby players (coefficient of variation was 2.1%) is typically better than that found in young active recruits completing the same test (coefficient of variation approximately 10%), or under 17 soccer players completing a Yo-Yo Intermittent Recovery Test Level 1 (coefficient of variation approximately 8%).
Impact of 12-weeks of yoga intervention on balance in university level rugby players

Tilak Raj
Dr. Catherine Elliot
Dr. Mike Hamlin
Department of Tourism, Sport and Society,
Faculty of Contenmtnt and Design,
Lincoln university, New Zealand.

Abstract
Impaired balance can result in increased postural sway, particularly in the anterior-posterior and lateral-medial planes which may result in undesired movement patterns possibly affecting player’s performance. Yoga, an exercise regimen that involves various poses, and dynamic stretching positions, breathing techniques, and meditation has been shown to improve balance, yet relatively few balance interventions involve the use of yoga. The purpose of this study was to evaluate the impact of a 12-week structured yoga intervention which included balance training on single and double foot balance measured as postural sway in male rugby union players.

Method
Twenty-three male rugby union players, 19 ± 1.3 years, mean Ht=178 cm, mean Wt=85.6 kg, were assigned randomly to 3 groups: an experimental group (EG, n=12), who participated in yoga for one hour, two times a week for 12 weeks; a control group (CG, n=12), who continued their normal rugby training routine without any yoga intervention; Balance data were collected using the Biodex Balance System (BHS) and the Elbow-Room Force Plate (FRP) using PLP software. Postural sway was measured using the BHS and the FRP. The participants were asked to perform the tests while standing on their right, left, and both legs with eyes open and closed.

Results
There was very little change in postural sway measures. The mean SDI over the 12-week period was 33.4%. The ANOVA analysis showed no differences between the groups for the various dependent variables. The two-tailed t-test showed no significant differences between the control and experimental groups for any measurement of balance.

Conclusion
Results suggest that short-term 12-week yoga practice may help to reduce postural sway and thereby improve balance. However, more research is needed to determine the long-term effects of yoga on balance.

Introduction
Yoga, a field-based contact sport and one of the most commonly played sports in New Zealand requires players to be physically strong and able to engage in frequent bouts of high intensity exercise. Along with other components of fitness, balance plays a major role in a rugby player’s running, tackling, passing, and scrumming performance.

Impaired balance can result in increased postural sway, particularly in the anterior-posterior and lateral-medial planes which may result in undesired movement patterns possibly affecting player’s performance. Yoga, an exercise regimen that involves various poses, and dynamic stretching positions, breathing techniques, and meditation has been shown to improve balance, yet relatively few balance interventions involve the use of yoga. The purpose of this study was to evaluate the impact of a 12-week structured yoga intervention which included balance training on single and double foot balance measured as postural sway in male rugby union players.

Method
Data was collected at the same time of the day at Lincoln University using a force plate (Bertec Corp., Columbus, OH) on 3 occasions (baseline, 6 weeks and 12 weeks). Data from the force plate (exampled at 1000 Hz) included: Anterior-Posterior Force (FPa), Lateral-Medial Force (FPL), Vertical Ground Reaction Force (T), Center of Pressure Anterior-Posterior (cOPa), and Center of Pressure Lateral-Medial Force (cOPl) which was exported to Microsoft Excel. The raw data was then normalised to subjects body mass and the standard deviation of each 30-second signal was used as an indicator of postural sway variability. The data presented is the average of all subjects standard deviation’s for each task within each group.

Results
We found no significant differences in any variables between groups. Changes in balance from baseline to 12 weeks was not significant.

Table 1

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline</th>
<th>6 Weeks</th>
<th>12 Weeks</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>T (N)</td>
<td>0.04 ± 0.03</td>
<td>0.04 ± 0.03</td>
<td>0.03 ± 0.01</td>
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<tr>
<td>FPa (N)</td>
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<tr>
<td>FPL (N)</td>
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<td>cOPa (N)</td>
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<td>cOPl (N)</td>
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Notes for Table 1-4
Balance data are mean ± SD. Significant differences between the baseline and the 12-week post-test: P<0.05 (two-tailed t-test) is considered significant for detection of significant differences between the baseline and the 12-week post-test.

Table 2

<table>
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<tr>
<th>Measure</th>
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<th>12 Weeks</th>
<th>Difference</th>
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<tbody>
<tr>
<td>LEET LEG ONLY - EYES OPEN</td>
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<tr>
<td>Balance</td>
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Table 3

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<th>12 Weeks</th>
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<tr>
<td>BOTH LEGS - EYES CLOSED</td>
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<tr>
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Table 4

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<th>12 Weeks</th>
<th>Difference</th>
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<tbody>
<tr>
<td>BOTH LEGS - EYES OPEN</td>
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Conclusion
The results of this study confirm previous findings indicating yoga may decrease postural sway and improve balance. If a decrease in postural sway correctly reflects an increase in balance in our subjects, we might expect more efficient movement patterns in our players after such a yoga intervention. Decreased sway may also reflect increased proprioception in the foot and ankle after the yoga intervention which may result in fewer injuries.

References

New Zealand’s specialist land-based university
Reliability of the 1.2 km shuttle run test in young elite rugby union players

Abstract

To be useful, fitness tests need to have adequate reliability i.e. reproducible results, so important changes in athlete’s performance can be identified. The aim of this study was to investigate the reliability of the 1.2 km shuttle run test (1.2SRT), a novel field test also known as the Bronco test, on young elite rugby players. On two occasions, separated by 2-3 weeks during the pre-season, 40 male elite rugby players (U19 forwards, age 17 ± 0.5 years, mean ± SD) completed the 1.2SRT on a grass rugby pitch in their usual playing footwear, under similar environmental conditions. To complete the 1.2SRT, players completed maximal shuttle runs and to form a start line to 25, 40 and 60 m marks, 5 times without a break. Players were scored on the time taken to complete the shuttle runs. Prior to the study, all players performed familiarisation with the 1.2SRT and to ensure consistency, players completed a standard warm up before the test. To minimize confounding variables, players were asked to refrain from heavy exercise and consumption of alcohol for 24 hours prior to testing. Overall performance statistics (i.e. time between 25, 40 and 60 m ± 0.2 m/s to 4.00 ± 0.04 m/s, mean ± SD) which corresponded to a higher percent test rates of perceived exertion (17.0-2.8) on the Borg 6-20 scale. For all players combined, the standardised typical error of the average speed between tests was 0.57 (0.39-0.85) mean, 90% CI which corresponds to a coefficient of variation of 2.7% (1.5-4.2%). The typical error was similar for forwards (0.39) and backs (0.50). We conclude that the 1.2SRT demonstrated moderate between-test reliability when conducted under similar environmental conditions and suspect that increased fitness levels in individuals between tests may have contributed to the increased variability and lower reliability than expected.

Introduction

Reliability is important in any fitness testing because good reliability enables practitioners to identify small but practically important changes in an individual subject’s performance. Therefore, allowing researchers to quantify changes in a controlled trial with a reasonable sized subject sample.

Methods

Forty players from the Christchurch region in New Zealand participated in two 1.2SRT’s conducted over 5 weeks in March 2017. Ethical approval for this research was obtained from the local University Human Ethics Committee (Reference 2017-001). The 1.2SRT consists of a continuous, straight line, maximal, and back again shuttle run (see Figure 1), repeated 4 times. Average speed calculated as distance covered during the test divided by the time taken to complete the test was used in the analysis. The standardised typical error (Cohen’s d) was used to determine magnitude of error, which needs to be doubled (4d), and interpreted using 0.2, 0.6, 1.2, and 2.0 to indicate small, moderate, large, very large and extremely large effects respectively (1).

Results

The test-re-test 1.2SRT performances of the rugby players are shown in Figure 2 and Table 1.

Discussion

The standardised typical error suggests moderate congruency between the two tests, but the reliability found in this study on elite young rugby players is typically better than that found in young active recruits completing the same test (CV = 10%-16%), or under 17 soccer players completing a Yo-Yo intermittent recovery test (CV = 8%-11%) (2).

References

Other RCRG member brief updates

Professor John Cronin is starting a wearable resistance study with the University of Pretoria in South Africa and Helen Blayne.

Professor Patrick Neary has successfully completed the collection of physiological data on 60 participants (n=50, mTBI; n=10 controls) using the "Neary Protocol" at the University of Victoria in Victoria BC (Drs Patrick Neary, Steve Martin, Catherine Gaul and Lynneth Stuart-Hill). This was funded by the CASEM, the Canadian Academy of Sport and Exercise Medicine (PI, Dr Steve Martin) ($15,000). Patrick’s graduate students are currently crunching the data for publication.

Do you want to be part of the Global Rugby Health Research Programme? If so contact one of the country PI's. Please remember to fill in the member profile form at: https://sprinz.aut.ac.nz/areas-of-expertise/rugby-codes/member-profiles. The example profile link is at the bottom of the web page.
Professor Melinda Fitzgerald
BSc (Hons), PhD

Research specialisation: Neurotrauma: understanding pathology, testing therapies

Experience: Recently appointed Professor of Neurotrauma, jointly with Curtin University and the Perron Institute, located at the new Sarich Neuroscience Research Institute in Western Australia. Prof Fitzgerald has 14 years’ post-doctoral experience (note parental career disruption 1998-2005) and is an independent researcher leading a team of 12 researchers and post-graduate students. Australian representative for the Asia Pacific Regional Committee for IBRO, serves on the international scientific committees for BIOMATSEN2016 and ICNT2016. Currently Held Grants/Projects total $2 million; she is CIA for all of these; total funding awarded for her career is $6.5 million, $3.9 million as CIA. Currently holds an NHMRC Career Development Fellowship, a CIA Project Grant and has previously held two NHMRC Project grants as CIA. A patent entitled ‘Multifunctional Nanoparticles’ reached international PCT stage and was developed by a biotechnology company. Chairperson and Convener of the annual Symposium of Western Australian Neuroscience (SWAN), and the UWA neuroscience seminar series. Member of the UWA Faculty of Science Planning Task Force addressing Grantsmanship, Mentoring and Expectations, and coordinates dissemination of collated information regarding all seminars in science and health in Perth. Reviews for numerous scientific journals including EJN, IOVS, Neurochem. Int., international funding bodies including fight for Sight UK, MS Australia and the Alzheimer’s Australia Dementia Research Foundation and serves on NHMRC and MS Australia Grant Review Panels. Instituted a UWA Faculty of Science gender equity group and coordinates the UWA Faculty of Science mentoring program for PhD students and early career researchers, which extends across Institutional boundaries. Member of the Perkins Institute EMCR Mentoring Committee and regularly speaks at events regarding gender equity in science.

Research overview: Prof Fitzgerald’s research is focused around understanding and preventing the loss of function that occurs following neurotrauma. She uses innovative analytical techniques to demonstrate changes to key biochemical, cellular and structural components of nerves following injury and is assessing treatment strategies including nanotechnologies and combinatorial pharmacotherapeutics. Her drive to translate her research findings to the clinic is evidenced by her current collaborative clinical trial assessing biomarkers and MRI for prediction of post-concussion syndrome.

Postgraduate supervision: In the past 5 years A/Prof Fitzgerald has supervised 20 Honours students or equivalent, 10 PhD students (5 completions), 6 post-doctoral researchers and gives regular guest lectures.

Research publications: In her 14 post-doctoral years A/Prof Fitzgerald has published 66 papers. Handling Editor for the Journal of Neurochemistry, an Editorial Board Member for Neural Regeneration Research, Frontiers Journals and an Associate editor for PeerJ. Example publications:

Melinda Fitzgerald (PhD)
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M: +61 (0) 467 729 300
E: lindy.fitzgerald@uwa.edu.au
Also: The University of Western Australia, Stirling Hwy, Perth, 6009, WA Australia
Dr James Craig Brown
PhD, Exercise Science. MPH, Health Economics

Research specialisation: Injury prevention, intervention evaluation, injury epidemiology.

Experience: James Brown did his PhD jointly at the University of Cape Town (UCT) and Vrije University Medical Centre, Amsterdam. His PhD evaluated SA Rugby’s nationwide injury prevention programme, BokSmart, which was developed based on RugbySmart. James completed a 2.5 year Postdoctoral position at UCT, evaluating the BokSmart programme and is currently on a 2 year Postdoctoral position at the Institute of Sport and Exercise Medicine and Stellenbosch University, focusing on concussion (https://www.isemsun.com).

Research overview: James’ research (PhD and post-PhD) has mainly focussed on the evaluation of SA Rugby’s nationwide injury prevention programme (BokSmart), which has involved monitoring and evaluation and epidemiology research. In addition, James has done a bit of qualitative research, using focus groups to gather information on coach and referee perceptions of BokSmart.

Postgraduate supervision: James has supervised 8 students to completion – 1 PhD, 1 Masters, 2 MPhil and 4 Honours. He is currently supervising 1 PhD and 2 Masters students.

Research publications and presentations: Example publications: