This collection of research paper summaries outlines some of the applied research work Professor Patria Hume has conducted since she established SportSmart in 1999 - the nationwide sports injury prevention programme for ACC. Patria collaborated with industry partners and academics from varied disciplines, which resulted in SportSmart being developed into numerous sport-specific programmes such as "RugbySmart" and "NetballSmart". For 25 years she has been lead reviewer of SportSmart, most recently reviewing the programme for all New Zealand sporting bodies.

Professor Hume has been a World Championships competitor, international coach and judge in rhythmic gymnasts. She was inaugural Director of the Sports Performance Research Institute of New Zealand (SPRINZ) from 2000 to 2009. With SPRINZ, she established the Rugby Codes Research Group in 2010. She led the Global Rugby Health Research programme in 2015, which contributed to improved concussion injury awareness and management nationally and internationally. Her contributions to sporting codes include analysis of techniques for rowing, netball shooting, grinding biomechanics for sailors, shin and mouthguard impact testing, and development of a gymnastics vaulting feedback system. Professor Hume has served on boards for Drug Free Sport New Zealand, Sports Medicine New Zealand, GymSports New Zealand, Sport and Exercise Science New Zealand, among contributions to numerous other national and international organisations. She has received awards including: Royal Society Te Apārangi Fellowship (2021), Geoffrey Dyson Award, International Society of Biomechanics in Sports (2016) and AUT Research Medal (2016).

PROFILING

Profile I Gymnastics

Williams, S. D., Gleave, J., Hume, P. A., Bradshaw, E., Batchelor, E., Lyn, G., Whatman, C., & Sheerin, K. (2011). Effects of gymnastics training on physical function in children: Technical Report for North Harbour Gymnastics. Auckland, Sport Performance Research Institute New Zealand: 12.

Aim: To assess the impact of nine weeks of gymnastics training on various physical functions in children and to establish normative ranges for fitness tests in this demographic.

Key findings: The research found substantial improvements in abdominal strength, flexibility, coordination, and lower body strength following the gymnastics training. Normative data sets were created to categorize children's performance levels across different fitness tests.

Practical implications: Gymnastics training could be an effective method for enhancing certain aspects of physical function in children over a short period. The established normative ranges aided practitioners in fitness testing for talent identification and early detection of children needing improvement. This led to better sports participation and lifelong health benefits. There is a need for further research with control groups to confirm the specific benefits of gymnastics training and to determine if these benefits persist after the training ends.

Profile I Netball

Hume, P. A. (2007). Anthropometry technical report for Netball New Zealand Squad January 2007, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 21.

Aim: To assess body composition of the New Zealand Netball Squad and provide recommendations for coaches, nutritionists, and physical conditioning staff to optimize players' performance.

Key findings: Players were categorized based on their body composition into ratings from A (excellent) to D (needs work). Players had detailed assessments showing changes in body mass, skinfolds, and muscle mass over time. Recommendations included increasing muscle mass for some players and reducing fat mass for others.

Practical implications: Tailored conditioning programmes to increase muscle mass and reduce fat mass. Specific dietary advice to help players achieve optimal body composition. Regular monitoring of body composition to track progress and make necessary adjustments.

Profile I Basketball

Sansone, P., Makivic, B., Csapo, R., Hume, P. A., Martínez-Rodríguez, A., & Bauer, P. (2022). "Body composition of basketball players: A systematic review and meta-analysis." Sports Med – Open 8(1): 21. https://doi.org/10.1186/s40798-022-00418-x

Aim: To establish reference body fat (BF) values for basketball players, accounting for differences based on sex, BF measurement techniques, and levels of competition.

Key findings: Male players had a pooled mean BF of 13.1%, while female players had 20.7%. BF values varied significantly with methods used, with dual-energy X-ray absorptiometry (DXA) showing higher BF percentages than bioelectrical impedance analysis (BIA) or skinfold measurements. International-level players had lower BF percentages compared to national and regional-level players.

Practical implications: Coaches and practitioners should consider higher BF in female players due to physiological differences. Accurate BF assessment requires consistent use of measurement methods and consideration of their inherent differences. Lower BF in international players suggests that managing BF could be crucial for achieving higher performance levels in basketball. There is a need for standardized BF measurement practices and acknowledgment of the influence of sex and competitive level on BF percentages.

Profile I Rugby league

King, D., Hume, P., Milburn, P., & Guttenbeil, D. (2009). "A review of the physiological and anthropometrical characteristics of rugby league players." South African Journal for Research in Sport, Physical Education and Recreation 31(2): 49-67. https://www.ajol.info/index.php/sajrs/article/view/46328

Aim: To determine the anthropometric and physiological characteristics of rugby league players by reviewing literature published from 1948 to May 2008.

Key findings: Excess body fat negatively affected players' performance, with forwards generally having higher body mass and fat percentage than backs. Professional players had lower body fat and higher aerobic capacities compared to amateur players. The demands of rugby league increased with the level of participation. However, physiological capacities may deteriorate over a season, indicated by increased skinfold thickness and decreased maximal aerobic power and muscular power. Different positions had varying physical and physiological demands. Forwards were involved in more physical collisions and tackles, requiring higher body mass and fat percentage for impact absorption and force generation.

Practical implications: Training programmes should be tailored to specific needs of different playing positions and levels of participation. Monitoring changes in players' physiological capacities throughout the season helped in maintaining performance and reducing injury risks. The study provided insights into the physical and physiological profiles of rugby league players, which could inform talent identification and development processes.

Profile I Rugby league

King, D. A., Hume, P. A., & Clark, T. (2010). Changes in anthropometric and speed characteristics and the incidence of injury in professional rugby league. Auckland, Sport Performance Research Institute New Zealand, AUT University: 11.

Aim: To investigate the relationship between anthropometric changes, speed characteristics, and injury rates in professional rugby league players over two seasons.

Key findings: There was no significant increase in body mass over the study period, but a significant decrease in the sum of eight skinfolds was noted. No significant change in 10-m sprint times was found. Players with an increased injury rate (106 to 238 per 1,000 playing hours) had a faster 10-m sprint time, decreased skinfolds, and increased body mass, indicating that these factors might have contributed to higher injury rates. Conversely, players with a decreased injury rate (301 to 142 per 1,000 player hours) had slower sprint times and less increase in body mass.

Practical implications: changes in body composition and speed did not significantly correlate with the total number of injuries. The study emphasized the complexity of injury prevention in sports and suggests that multiple factors, including fitness level, training duration, and match exposure, may contribute to injury rates. There is need for further research to determine the optimal physical fitness state to minimize injury risk in professional rugby league players. It called for more comprehensive longitudinal studies to better understand the correlations between physical changes and injury risks.

Profile I Rugby union

Brown, S. R., Brughelli, M., Hume, P. A., King, D., Gill, N., Craighead, H., & Kara, S. (2013). Multi-disciplinary perspectives on the use of lower-extremity injury assessments for a rugby player's return-to-play. Sports Medicine New Zealand Conference, Wellington, Sports Medicine New Zealand. Pg 96.

Aim: To provide multi-disciplinary perspectives on the usefulness of assessing lower-extremity strength symmetry in rugby players pre- and post-rehabilitation as a determinant for return-to-play.

Key findings: A professional male rugby league player was assessed pre- and post-rehabilitation for a patellar tendon rupture. The results showed significant improvements in peak torque, reduced leg asymmetry, and increased sprinting horizontal force, indicating recovery and readiness to return to play.

Practical implications: Experts from various disciplines highlighted the importance of objective data in assessing rehabilitation quality and progress. Baseline values and normative databases were essential for determining return-to-play levels. Regular assessments helped ensure players could maintain or improve these values throughout the season. Lower-extremity assessments are valuable for an athlete's career and a team's investment, and coaching staff should support baseline and post-injury assessments for enhanced performance and informed return-to-play decisions.

Profile I Rugby union

Hume, P. A., Lewis, G. N., Brown, S. R., Rashid, U., Theadom, A., & Taylor, D. (2023). NZ–RugbyHealth study: Current postural control ability of former rugby union and non-contact sport players. Sports Medicine, 53, 2257–2266. https://doi.org/10.1007/s40279-023-01864-7

Aim: To assess postural control in retired rugby players compared to retired non-contact sport players and evaluate any association with self-reported sport-related concussion history.

Key findings: No significant differences in balance ability were found between retired rugby players and non-contact sport athletes. A relationship was observed between the number of sport-related concussions and postural stability, with increased path length indicating decreased stability in challenging balance conditions.

Practical implications: While retired rugby players do not exhibit impaired balance compared to non-contact sport athletes, a history of sport-related concussions may be associated with subtle changes in postural control. This highlighted the importance of monitoring and managing concussions in contact sports to mitigate potential long-term effects on postural stability.

Profile I Rugby union

Lewis, G. N., Hume, P. A., Stavric, V., Brown, S. R., & Taylor, D. (2017). NZ Rugby Health study: Motor cortex excitability in retired elite and community level rugby players. New Zealand Medical Journal, 130(1448), 34–44.

Aim: To investigate corticomotor excitability and inhibition in retired elite and community level rugby players compared to non-contact sport athletes. The design was a cross-sectional study with three groups of retired athletes: elite rugby (n=23), community level rugby (n=28) and non-contact sport control (n=22). Assessments of corticomotor excitability were made using transcranial magnetic stimulation.

Key findings: Elite rugby players showed higher resting motor thresholds and greater long-interval intracortical inhibition, indicating altered corticomotor function. Community level rugby players did not show these changes despite similar concussion history. The association between these findings and previous brain injuries was not clear due to absence of similar findings in the community rugby group. Participants in the two rugby groups had sustained significantly more concussions than the control group.

Practical implications: The study suggested potential long-term changes in motor cortex function in retired elite rugby players. These findings highlight the need for further research on the long-term effects of concussions in contact sports. Understanding these changes could inform guidelines for managing the health of athletes with a history of concussions. The study emphasized the importance of considering the level of play and the athlete's size when assessing the long-term impacts of contact sports on brain function.

Profile I Volleyball

Matłosz, P., Makivic, B., Csapo, R., Hume, P. A., Mitter, B., Martínez-Rodríguez, A., & Bauer, P. (2023). Body fat of competitive volleyball players: A systematic review with meta-analysis. Journal of the International Society of Sports Nutrition, 20(1), 708-722. https://doi.org/10.1080/15502783.2023.2246414

Aim: To establish reference values for body fat percentages in competitive volleyball players, considering differences across sex, measurement methods, and competitive levels.

Key findings: Male players had significantly lower body fat (12.8%) compared to female players (22.8%). Body fat percentages varied by measurement method, with dual-energy x-ray absorptiometry (DXA) yielding higher values than skinfolds and bioelectrical impedance analysis (BIA). No robust differences in body fat percentages were found between different competitive levels (regional, national, international).

Practical implications: Due to significant differences in body fat percentages between sexes, sex-specific reference values were recommended for accurate assessment. Professionals should use consistent measurement methods and devices to ensure reliable comparisons within the same group of athletes. Body fat percentage is not a highly indicative performance measure across different competitive levels in volleyball.

Profile I General

Hamilton, B., Stewart, T., Hume, P. A., & Jellyman, C. (2019). Athlete wins survey – WHISPA data analyses: Technical report to High Performance Sport New Zealand. Auckland, SPRINZ, AUT: 55.

Aim: To investigate the incidence and nature of illnesses and injuries among High Performance Sport New Zealand female members, hypothesizing a high incidence of chronic injuries and a correlation between gynaecological conditions and sport-related pressure.

Key findings: Approximately half of the athletes had suffered at least one injury or illness, with stress fractures and concussions being the most common. Supplement use was prevalent, especially protein, vitamins, and iron, with a significant number of athletes diagnosed with low iron levels or anaemia. A third of athletes used contraception to manage periods, with most reporting normal menstrual cycles. However, menstrual issues were linked to period pains, fatigue, and performance impacts, although missing training or competition due to menstrual symptoms was rare. Athletes acknowledged unrealistic pressures to be both strong and toned as well as pretty and feminine, sometimes leading to disordered eating and anxiety.

Practical implications: The survey data was intended to inform HPSNZ's strategic support for elite athletes by understanding the health issues affecting female athletes. The findings suggested the need for improving dialogue between athletes and support staff regarding menstrual health and barriers, addressing the high incidence of injuries and the prevalence of iron deficiency among athletes, recognizing and mitigating the socio-cultural pressures that may negatively impact athletes' health and performance.

CONDITIONING

Conditioning I General

Reid, D., Ikeda, E., & Hume, P. A. (2017). AUT ACC SportSmart-9 Review Project Appendix D: Effects of mobility on injuries in recreational and elite athletes in various study designs: A systematic review. A technical report to ACC. ACC SportSmart-9 Review. P. A. Hume. Auckland, SPRINZ, Auckland University of Technology: 20.

Aim: To evaluate impact of mobility exercises during warm-ups on injury prevention in athletes, hypothesizing that such interventions would significantly reduce injury rates.

Key findings: The review analysed 17 studies involving 11,037 participants, revealing strong evidence that mobility-based warm-ups effectively reduce sports injuries. The FIFA 11+ programme, which included mobility exercises, was highlighted for its positive impact on injury reduction, especially in team sports like soccer and basketball.

Practical implications: Incorporating the FIFA 11+ or similar neuromuscular training elements into warm-up routines should become standard practice in team sports to minimize injury risks. The study emphasized the importance of compliance and coach education in implementing these injury prevention strategies effectively.

Conditioning I General

Weerapong, P., Hume, P. A., & Kolt, G. S. (2004). Stretching: Mechanisms and benefits for sport performance and injury prevention. Physical Therapy Reviews, 9(4), 189–206. https://doi.org/10.1179/108331904225007078

Aim: To evaluate mechanisms and benefits of various stretching techniques, including static, ballistic, and proprioceptive neuromuscular facilitation (PNF), and their impact on sport performance and injury prevention.

Key findings: Most stretching techniques effectively increased static flexibility as measured by joint range of motion. The results for dynamic flexibility, as measured by active and passive stiffness, were inconclusive. Stretching can have detrimental effects on performance parameters such as muscle strength and jumping performance. The minimal effects of stretching on injury prevention were discussed, with no clear evidence that stretching could reduce the rate of injury.

Practical implications: Different stretching techniques increase flexibility through various mechanisms, but their effectiveness may vary based on factors like duration and technique. The use of stretching as a strategy to enhance performance and reduce injury risk was not strongly supported by current scientific research. Additional studies were recommended to explore the mechanisms and effects of stretching techniques on dynamic flexibility, muscle soreness, sport performance, and injury rate.

Conditioning I General

Weerapong, P., Hume, P. A., & Kolt, G. S. (2005). The mechanisms of massage and effects on performance, muscle recovery and injury prevention. Sports Medicine, 35(3), 235–256. https://doi.org/10.2165/00007256-200535030-00004

Aim: To explore how massage may benefit athletes by enhancing performance, aiding in recovery, and preventing injuries. It reviewed the possible biomechanical, physiological, neurological, and psychophysiological mechanisms of massage.

Key findings: Massage can lead to increased muscle compliance, decreased passive and active stiffness, and improved joint range of motion. It indicates that massage may enhance blood flow, reduce muscle tension, and promote relaxation through various mechanisms, although empirical data supporting these claims are limited.

Practical implications: Despite widespread belief in the benefits of massage among coaches and athletes, scientific evidence is not conclusive. There is need for more rigorous research to substantiate the effects of massage on athletic performance and recovery. While massage may offer psychological benefits and contribute to a sense of well-being, its role in performance enhancement and injury prevention remains unclear. Future research should focus on efficacy of different massage techniques and their timing in relation to exercise. Scientific data is needed to support the therapeutic use of massage in sports.

PSYCHOLOGY

Psychology I Rugby league

King, D. A., Clark, T., Kellmann, M., & Hume, P. A.. (2017). "Stress and recovery changes of injured and non-injured amateur representative rugby league players over a competition season." New Zealand Journal of Sports Medicine 43(2): 57-63.

Aim: To monitor stress and recovery in amateur representative rugby league players using two tools: the Recovery-Stress Questionnaire for Athletes (RESTQ-Sport) and the Recovery-Cue. The goal was to identify which tool could better differentiate players at higher risk of injury during match and training activities.

Key findings: Over a 9-week period, 13 training injuries and 39 match injuries were recorded among 30 players. Players who were subsequently injured had significantly higher general and sport-specific stress scores and lower recovery scores on the RESTQ-Sport than non-injured players.

Practical implications: A shortened version of the RESTQ-Sport, focusing on scales like Social Stress, Success, Personal Accomplishment, Fatigue, Emotional Exhaustion, Injury, and Self-Efficacy, could be beneficial for identifying players at risk of injury. This would be quicker to complete, minimizing disruption to the training environment. The results supported use of the RESTQ-Sport by sports medicine practitioners to systematically monitor players' stress and recovery. The Recovery-Cue, a quicker tool taking only 30 seconds to complete, could provide timely feedback to players and coaches, although it was not as detailed as the RESTQ-Sport. Overall, the study highlighted the importance of monitoring stress and recovery to prevent injuries in athletes. It emphasized the need for tools that are effective and efficient, to ensure they can be easily integrated into the training and competition schedules.

Psychology I Rugby union

King, D. A., Hume, P. A., Clark, T. N., & Hind, K. (2021). Use of the Recovery-Stress Questionnaire - Sport (RESTQ-Sport) and King-Devick test to monitor changes during recovery of concussion in an amateur women's rugby union team. JSM Physical Medicine and Rehabilitation, 5(1), 1014. https://doi.org/10.47739/2578-3572/1014

Aim: To monitor stress and recovery of players with a concussion in an amateur women's rugby union team using the Recovery-Stress Questionnaire - Sport (RESTQ-Sport), King-Devick (K-D) test, and Post-Concussion Symptom Scale (PCSS). A prospective observational study was undertaken following an amateur women's domestic rugby union club-based team over two years.

Key findings: One training-related and nine match-related concussions were recorded, with a concussion injury rate of 0.3 per 1,000 training hours and 16.1 per 1,000 match hours. Post-injury K-D test scores were significantly slower than baseline scores, indicating cognitive impairments. There was a significant increase in the mean score of the Fatigue scale on day-7 post-injury compared to baseline. The RESTQ-Sport and K-D tests were effective in monitoring individual players' stress and recovery following a concussion.

Practical implications: The RESTQ-Sport and K-D tests can be valuable tools for tracking stress and recovery in athletes with concussions. These tools can help in developing individualized recovery programmes for athletes, ensuring better management of concussion recovery. Increased awareness of concussion rates and recovery timelines can help in better managing and preventing concussions in amateur sports.

Psychology I Rugby union

Hume, P. A. and P. Griffiths (2013). IRB/NZR/AUT RugbyHealth Project: Progress report #1 to the International Rugby Board. IRB RugbyHealth Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 23.

Aim: The IRB RugbyHealth Project, funded by the International Rugby Board (IRB) and other organizations, aimed to compare neuropsychological and general health between retired international/national level rugby players, community level rugby players, and non-contact sport athletes in New Zealand.

Key findings: The study utilized online and clinic-based assessments to evaluate cognitive functions, general health, balance, and brain corticomotor excitability. Despite extensive recruitment efforts, participation numbers were lower than expected, prompting a revision of the project timeline and recruitment strategies.

Practical implications: The findings informed the understanding of health outcomes related to rugby, with potential implications for player welfare, safety protocols, and long-term health strategies. The project's challenges highlighted the need for effective engagement and communication within sports communities for research participation.

Psychology I Rugby union

Hume, P. A., et al. (2014). IRB/NZR/AUT RugbyHealth Study: Progress report #2 to the International Rugby Board and New Zealand Rugby. IRB RugbyHealth Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 35.

Aim: To assess neuropsychological and general health of retired rugby players compared to non-contact sports athletes, and to evaluate balance and brain corticomotor excitability.

Key findings: Out of 600 targeted participants for online tests, 269 completed the general health questionnaire and 245 completed the CNS test. For clinic tests, 75 completed the balance test and 73 completed the TMS test. Recruitment challenges were noted, with some athletes hesitant to participate due to concerns about the results and the game's future.

Practical implications: The study's findings will inform player welfare programmes and may lead to strategies for improving long-term health outcomes for athletes. The IRB is particularly interested in understanding potential improvements for player welfare. It highlighted the importance of understanding the long-term health implications of contact sports and the need for comprehensive player welfare programmes.

Psychology I Rugby union

Hind, K., Konerth, N., Entwistle, I., Theadom, A., Lewis, G., King, D., Chazot, P., & Hume, P. (2020). Cumulative sport-related injuries and longer term impact in retired male elite- and amateur-level rugby code athletes and non-contact athletes: A retrospective study. Sports Medicine, 50(11), 2051–2061. https://doi.org/10.1007/s40279-020-01310-y

Aim: To examine cumulative injuries and their long-term impact on retired male elite and amateur rugby code athletes compared to non-contact athletes. One hundred and eighty-nine former rugby code athletes (rugby union n = 145; rugby league n = 44) and 65 former non-contact athletes were recruited to the UK Rugby Health Project between September 2016 and December 2018. Details on sports participation, sports injuries and concussion history, sports injury-related surgeries, and previous and current health were obtained from a validated, online self-report questionnaire.

Key findings: Elite rugby athletes reported a median of 39 total injuries per player, significantly higher than amateur rugby athletes (median 23) and non-contact athletes (median 7.5). Concussion was the most common injury, with high recurrence in rugby athletes. The prevalence of osteoarthritis was over twofold greater in elite rugby athletes compared to non-contact athletes (51% vs. 22%). A high prevalence of back pain and severe joint pain was reported across all groups, especially among elite rugby athletes.

Practical implications: Given the high number of reported concussions (and their recurrence) and associations between previous injuries during a player's career and current musculoskeletal conditions, efforts should be prioritized to reduce the occurrence and recurrence of injuries in rugby codes at all levels of the sport. Strategies should be developed for supporting the specific physical health needs of rugby code athletes post-retirement.

Psychology I Rugby union

Hind, K., Konerth, N., Entwistle, I., Hume, P. A., Theadom, A., Lewis, G., King, D., Goodbourn, T., Bottiglieri, M., Ferraces-Riegas, P., Ellison, A., & Chazot, P. (2022). Mental health and wellbeing of retired elite and amateur rugby players and non-contact athletes and associations with sports-related concussion: The UK Rugby Health Project. Sports Medicine, 52, 1419–1431. https://doi.org/10.1007/s40279-021-01594-8.

Aim: To examine differences in mental health, sleep, and alcohol use between retired elite and amateur rugby players compared to non-contact athletes, and to explore associations with sports-related concussion. One hundred and eighty-nine retired elite (ER, n=83) and amateur (AR, n=106) rugby code players (rugby union n=145; rugby league n=44) and 65 former non-contact athletes (NC) were recruited to the UK Rugby Health Project between 2016 and 2018.

Key findings: Retired elite rugby players reported more concussions and had higher negative mental health scores than amateur players and non-contact athletes. Sleep disruption was more prevalent among elite players, especially those with a history of three or more concussions. Anger and irritability were higher in athletes with five or more concussions. One in five elite players would not seek help if they had a problem or felt upset.

Practical implications: There is a need for strategies to address mental health and sleep disturbances in retired elite rugby player. There is a necessity for further research to understand the neurobiological link between concussion and long-term psychological health. The study highlighted the importance of support systems for elite athletes post-retirement, particularly for those reluctant to seek help.

Psychology I Rugby union

Hume, P. A., Quarrie, K. L., Lewis, G. N., & Theadom, A. (2022). New Zealand RugbyHealth study: Self-reported injury experience and current health of former rugby union and non-contact sport players. Sports Medicine, 52, 1701–1713. https://doi.org/10.1007/s40279-021-01630-7

Aim: To investigate differences in self-reported sport injury history and current health between former New Zealand rugby players and non-contact sport players, and to identify issues for further epidemiological research. Using a cross-sectional design, the NZ-RugbyHealth study surveyed 470 former rugby and non-contact sport players (43.8 ±8.1 yr; 127 elite rugby, 271 community rugby, 72 non-contact sport) recruited from October 2012 to April 2014.

Key findings: Former rugby players reported a significantly higher number of concussions and injuries requiring hospital treatment. Higher percentages of the elite rugby player group had sustained injuries of a given body site-type (e.g. neck sprain/strain, thigh bruising, hamstring strain) combination than the non-contact sports players. Rugby players had a higher prevalence of

osteoarthritis and engaged in more hazardous alcohol consumption post-retirement compared to non-contact sport players. No substantial differences were found between the groups in terms of mood, substance use, or current physical and psychological health ratings.

Practical implications: Former rugby player groups were at higher risk than the non-contact player group for most injuries during their playing careers, and in retirement had greater prevalence of osteoarthritis and hazardous alcohol consumption. The relative youth of the groups (44 years on average) means that health issues that typically do not emerge until later life may not have yet manifested. These findings highlighted the need for further research to understand the long-term health implications of playing rugby and to inform players about potential health risks associated with the sport. The study emphasized the importance of longitudinal research to monitor health changes over time and to address non-response bias. It called for an interdisciplinary approach to support former athletes' physical and mental health post-retirement. Research to explore factors contributing to hazardous alcohol consumption among rugby players was needed to enable advice to players on injury risks and long-term health issues.

Psychology I Rugby union

Hume, P. A., Theadom, A., Lewis, G. N., Quarrie, K. L., Brown, S. R., Hill, R., & Marshall, S. W. (2017). A comparison of cognitive function in former rugby union players compared to former non-contact sport players and the impact of concussion history. Sports Medicine, 47(6), 1209–1220. https://doi.org/10.1007/s40279-016-0608-8

Aim: To compare cognitive function between former rugby players and non-contact-sport players, and to assess the impact of concussion history on cognitive function. 366 former players (mean ±SD age 43.3 ±8.2 years) were recruited from October 2012 to April 2014.

Key findings: Former elite rugby players showed deficits in complex attention, processing speed, executive functioning, and cognitive flexibility compared to non-contact-sport players.

Community rugby players exhibited worse executive functioning and cognitive flexibility than non-contact-sport players. Both rugby groups reported more concussions and displayed greater individual differences in several cognitive domains compared to US norms.

Practical implications: Past participation in rugby and a history of concussion were associated with small to moderate neurocognitive deficits post-retirement. This highlighted the need for increased awareness and better management of concussions in contact sports to mitigate long-term cognitive risks.

TECHNIQUE

Technique I Netball

Hewit, J. K., Cronin, J. B., Hume, P. A., & Button, C. (2008). Preliminary change of direction assessment and initial findings: A technical report for Netball New Zealand. Auckland, AUT University: 11.

Aim: To understand three fundamental COD movements in netball—Up and Back (U&B), Backward Facing 180˚COD (COD-180), and Laterally Facing 90˚COD (COD-90)—to develop a comprehensive agility assessment battery.

Key findings: No single technique factor explained differences in COD ability. Mass and time taken to complete the COD task were significant variables. The small amplitude bouncing technique used before COD tasks improved speed for the 90˚turn.

Practical implications: Overcoming inertia associated with one's mass is crucial for COD tasks. A variety of movement strategies were observed, but no superior technique was identified. The small amplitude bounces commonly used by netball players contributed to faster overall movement times, indicating a potential performance enhancement when incorporated. The report emphasized the need for agility training that addresses technical, physical, and perceptual components to excel in netball. It highlighted the importance of player selection and conditioning to ensure players are as lean as functionally possible for optimal agility performance. The results inform development of appropriate training programmes to potentially improve player performance.

Technique I Netball

Hewit, J. K., et al. (2009). Agility assessment battery testing protocol and initial results: A technical report for Netball New Zealand. Auckland, AUT University: 15.

Aim: To develop a valid and reliable agility assessment tool that differentiates between the technical, physical, and perceptual components of netball agility.

Key findings: The study found low shared variance between horizontal and lateral jump distances, indicating these tests are relatively independent. Asymmetries between legs were generally less than 10%, with the right leg average being slightly greater than the left. Sprint times showed a strong relationship between 2.5 m and 5 m distances, suggesting only one distance is needed for testing. There was a weak correlation between straight sprinting speed and change of direction speed, highlighting different agility components.

Practical implications: The results provided insights into multidirectional strengths and weaknesses in players' leg power. Differences in sprinting speed and change of direction measures indicated technically based strengths and weaknesses. The findings helped trainers individualize programmes to focus on players' strengths and address their weaknesses. The study emphasized the multidimensional nature of agility and the need for specific training and testing protocols to enhance performance in netball players.

Technique I Netball

Hewit, J. K., et al. (2009). Assessing and developing agility in netball players: 180 degrees aerial change of direction. A technical report for Netball New Zealand. Auckland, AUT University: 18.

Aim: To create an aerial change of direction (aCOD) assessment reflecting common aerial manoeuvers in netball games.

Key findings: Initial findings suggested critical features for superior aCOD performance, such as aggressive lower body rotation while airborne, which is indicative of core strength. Only one player achieved a full 180° turn before landing, highlighting the importance of lower body rotation for completing the manoeuvre and reducing injury risk.

Practical implications: Coaches should focus on dynamic core strengthening and rapid upper and lower body rotation at take-off to improve players' aerial performance. The study's preliminary analysis suggested that these factors are crucial for successful aCOD execution.

Technique I Netball

Hewit, J. K., et al. (2009). A compilation of NZ-U21 squad initial testing feedback. A technical report for Netball New Zealand. Auckland, AUT University: 9.

Aim: To understand the technical and physical strengths and weaknesses of individual players in movement tasks crucial to netball.

Key findings: Players with more than 10% difference in leg power during single-leg countermovement jumps are at a higher risk of injury. Leg power is directionally specific, not necessarily translating across different directions. Straight sprinting performance does not predict sprinting performance after a rapid COD; various characteristics are associated with superior COD performances.

Practical implications: Players with significant leg imbalances should incorporate jump-specific training in their weaker direction. Players with below-average ground-based COD technique may benefit from additional COD technique training. Players with slower straight sprint times may improve with first step quickness training, especially following a rapid COD. The study emphasized the importance of a tailored approach to training, focusing on individual player needs to enhance overall agility performance in netball.

Technique I Netball

Hewit, J. K., et al. (2010). Assessing and developing agility in netball players: Reactive decision-making. A technical report for Netball New Zealand. Auckland, AUT University: 15.

Aim: To create an assessment for reactive decision-making (RDM) that mirrors the real-time demands of netball, focusing on decision time (DT), movement time (MT), and the appropriateness of the player's pass (APP).

Key findings: DT is the most significant factor in RDM, accounting for about 60% of the total time (TT) taken to complete a pass. The average TT was 0.395 seconds, with an average of 1.1 incorrect passes and 2.3 intercepted passes out of 12 trials. Only two players completed all passes correctly without interception.

Practical implications: Training should target enhancing players' perception and initiation of movement in response to decisions. Drills should mimic actual player movements in competition. Players with faster MT did not necessarily have superior TT, indicating the need for specific training focused on perceptual skills or quicker passing, depending on individual performance profiles.

Technique I Netball

Hewit, J. K., et al. (2010). A compilation of regional netball testing feedback for the new netball-specific agility assessment battery: A technical report for Netball New Zealand. Auckland, AUT University: 20.

Aim: To understand individual player abilities in netball-related movement tasks, focusing on technical, physical, and perceptual aspects of agility.

Key findings: The N-SAAB effectively differentiated players' strengths and weaknesses across agility components. Players exhibited various characteristics influencing ground-based and aerial change of direction performances. Significant leg asymmetries (greater than 10%) may indicate a higher injury risk. Players scoring below average in dynamic passing tasks could benefit from reactive decision-making training.

Practical implications: Players with below-average ground-based or aerial change of direction techniques may improve with targeted training. Addressing leg imbalances through jump-specific training could reduce injury risks. Reactive decision-making training could enhance players' performance in dynamic passing tasks. The study emphasized the importance of a tailored training approach to address specific agility components, potentially providing a competitive edge for netball teams.

Technique I Netball

Hewit, J. K., Cronin, J. B., & Hume, P. A. (2013). Kinematic factors affecting fast and slow straight and change-of-direction acceleration times. Journal of Strength and Conditioning Research, 27(1), 69–75. https://doi.org/10.1519/JSC.0b013e31824f202d

Aim: To investigate the kinematic factors that influence fast and slow straight acceleration (SA) and change-of-direction acceleration (CODA) times in under-21 national netball players.

Key findings: Faster SA times were linked to smaller average step lengths, greater torso angles (forward lean), and smaller hip angles (less knee lift) in the first step. Faster CODA times correlated with higher average step frequency. SA involved longer average step lengths and greater torso and hip angles compared to CODA, indicating different kinematic requirements for SA and CODA tasks.

Practical implications: Training should emphasize decreased step length, increased forward lean, and knee lift for SA, and increased step frequency for CODA to improve performance. Coaches could use these kinematic differences to tailor training and cueing for athletes, potentially enhancing sport-specific acceleration and performance in court-based sports.

Technique I Netball

Hewit, J. K., et al. (2008). Assessing and developing agility in netball players: A technical report for Netball New Zealand. Auckland, Institute of Sport and Recreation Research New Zealand, AUT University: 15.

Aim: The research aimed to create a valid and reliable agility assessment tool that differentiates between technical, physical, and perceptual components of agility in netball.

Key findings: Wing attack and goal defence were key positions for agility. No single technique factor predicted COD ability; player mass and COD movement time were significant across tasks. High variability in techniques used for COD; no superior technique identified. Small amplitude bounces prior to COD improved performance for the 90° task.

Practical implications: Agility assessment targeted these players at all levels. Incorporate rapid changes of direction and situational awareness into the final agility assessment battery. Consider player mass and lean body mass for agility; employ small amplitude bounces for performance enhancement.

Technique I Netball

Hewit, J. K., et al. (2008). Assessing and developing agility in netball players: A technical report for Netball New Zealand. Auckland, Institute of Sport and Recreation Research New Zealand, AUT University: 15.

Aim: The goal was to develop a valid and reliable agility assessment tool for netball, focusing on differentiating the technical, physical, and perceptual components of agility in a netball-specific context.

Key findings: Wing attack and goal defence positions were most crucial for agility research. No single technique factor explained differences in COD ability; player mass and COD completion time were significant across tasks. Various techniques were used for COD, with small amplitude bounces prior to COD enhancing performance.

Practical implications: The battery will target wing attack and goal defence players, incorporating rapid COD movements and situational awareness. Importance of player mass and lean physique for COD performance; training should have included techniques that utilize the stretch-shortening cycle for explosiveness.

Technique I Netball

King, D., et al. (2020). "Physical demands of amateur domestic and representative netball in one season in New Zealand assessed using heart rate and movement analysis." Journal of Strength and Conditioning Research 34(7): 2062–2070.

Aim: To describe the physical demands of netball for different positions and playing levels using microtechnology.

Key findings: Recorded higher mean distance and PlayerLoad (PL) than domestic players. Achieved higher maximal velocity and average maximal heart rate than O19 and U19 players. Centers © were most active, covering greater distances, while goalkeepers (GK) and goal shooters (GS) were least active.

Practical implications: Need for individual player- and position-specific training to meet the demands of competition and reduce injury risk. Highlighted the importance of using microtechnology for routine monitoring in intermittent court-based sports like netball. The study emphasized the varied physical and physiological demands across different netball positions and competition levels, suggesting tailored training and monitoring for optimal performance and safety.

Technique I Netball

Willcox, B. (2011). Classification of player performance in netball using cluster analysis [PhD, The University of Auckland]. Auckland.

Aim: To develop a system for measuring and evaluating netball player performance using cluster analysis to profile different playing positions and classify players within each position based on their strengths, weaknesses, and tactical preferences.

Key findings: Model-based clustering was the most accurate method for partitioning players into playing positions with an 85% accuracy rate. The study identified 3-4 player types within each position, revealing insights into how different players approach the game and their varying strengths when planning game strategy.

Practical implications: The findings offered a novel perspective on team structure and can aid in making informed selection and strategy decisions. The identification of player types within positions helped coaches and selectors understand the advantages and disadvantages of various player combinations, potentially influencing team selection and on-court strategies. The research provided another tool for maximizing performance in elite netball

Technique I Rugby league

King, D., et al. (2010). "Video analysis of tackles in professional rugby league by player position, tackle height and tackle location." International Journal of Performance Analysis in Sport 10(3): 241-254.

Aim: To identify and describe the nature, height, site, field location, and direction of tackles in professional rugby league matches through video analysis.

Key findings: A total of 50,019 tackles were recorded across 80 matches, averaging 701 tackles per match Nearly 50% of tackles came from behind the ball carrier's visual field, indicating a higher risk of injury. Most tackles involved two or three tacklers and targeted the mid-torso and hip-thigh region of the ball carrier. Forwards were more involved in tackles than backs, with adjustables participating in more tackle events than outside backs and hit-up forwards. More tackles occurred in the first half of matches and on the defence side of the field.

Practical implications: Coaches should have emphasized correct tackling techniques, especially for multiple-player tackles and those occurring in the ball carrier's blind vision area. Understanding tackle dynamics could have informed the development of injury prevention programmes . The study utilized video analysis of 80 rugby league matches from 2008, documenting 50,019 tackles. It highlighted the importance of tackle technique and player positioning in both performance and safety.

Technique I Rugby league

King, D. A., et al. (2018). "Head impact exposure from match participation in women's rugby league over one season of domestic competition." Journal of Science and Medicine in Sport 21(2): 139-146.

Aim: To quantify the magnitude, frequency, duration, and distribution of head impacts experienced by female rugby league players during a season of domestic competition.

Key findings: A total of 1659 head impacts greater than 10g were recorded across nine matches. On average, there were 184 impacts per match, translating to about 14 impacts per player per match. Forwards experienced more frequent and higher magnitude impacts compared to backs. The majority of impacts occurred on the side of the head and were more common in the second half of the game.

Practical implications: Clinicians, coaches, and players should be aware of the rates and magnitude of head impacts in female rugby league athletes. Training, fitness, and technique should be optimized to limit the burden of repetitive head injuries. Recognition and optimal management of athletes was crucial to reduce potential harm from concussive injuries. This study was significant as it provided insights into the head impact biomechanics experienced by female rugby league players, which could inform strategies to improve player safety and well-being.

Technique I Rugby league

King, D., et al. (2019). "Head impact exposure comparison between male and female amateur rugby league participants measured with an instrumented patch." Journal of Sports Medicine and Therapy 4: 024-037.

Aim: To quantify the magnitude, frequency, duration, and distribution of head and body impacts in rugby league match activities, comparing female versus male players.

Key findings: Male players experienced more head impacts per match than females. Males had higher median Peak Linear Acceleration (PLA) but lower median Peak Rotational Acceleration (PRA) compared to females. Females recorded more impacts to the side of the head and had a higher 95th percentile resultant PRA to the top of the head.

Practical implications: while females may experience fewer impacts, the impacts they do receive could be more severe, particularly to the side and top of the head. This information could inform training and protective equipment design to better prevent concussions and head injuries in rugby league players of both genders. The study provided valuable insights into the biomechanics of head impacts in amateur rugby league players, highlighting the need for gender-specific considerations in sports safety research and interventions.

Technique I Rugby union

Brown, S. R., Brughelli, M., & Hume, P. A. (2015). Carrying a ball can influence sidestepping mechanics in rugby 33rd International Society of Biomechanics in Sports, Poitier, France.

Aim: To investigate how carrying a ball affects sidestepping mechanics in male rugby athletes and its implications for knee injury risk, particularly ACL injuries.

Key findings: The research found that sidestepping with a ball resulted in a 15% greater knee adduction angle during weight acceptance and an 18% greater hip adduction angle during peak push-off compared to sidestepping without a ball.

Practical implications: Including a ball in biomechanical evaluations of rugby athletes is crucial for accurate interpretation of movement patterns and injury risk4. This could lead to better injury prevention strategies by understanding the altered mechanics when carrying a ball. The study emphasized the importance of sport-specific assessments to ensure the relevance of findings to actual match play conditions. It highlights the potential need for tailored training and rehabilitation programmes that consider the unique demands of ball-carrying in rugby.

Technique I Rugby union

Brown, S. R., Hume, P. A., Lorimer, A. V., Brughelli, M., & Besier, T. F. (2020). An individualised approach to assess the sidestep manoeuvre in rugby union athletes. Journal of Science and Medicine in Sport, 23(11), 1086–1092. https://doi.org/10.1016/j.jsams.2020.03.015

Aim: To assess external knee abduction moments and anterior cruciate ligament (ACL) injury risk during the sidestep manoeuvre in male rugby union athletes.

Key findings: Athletes produced 25% greater knee abduction moments when sidestepping on the non-preferred leg. Individual asymmetries ranged between 2.2 and 47%, with only 9 out of 16 athletes showing higher abduction moments in their non-preferred leg. The non-preferred leg showed modified postural adjustments associated with injury risk, such as an extended knee, more trunk lateral flexion, and greater distance between the center-of-mass and ankle-joint-center.

Practical implications: Group mean data may conceal individuals who could benefit most from targeted intervention. Injury risk assessments should consider both individual and group data to identify athletes with significant asymmetries or who are outside normal group limits. Using group mean data for assessment might allow nearly half of the athletes to “slip under the radar,” highlighting the importance of individualized data analysis for ACL injury risk factors.

Technique I Rugby union

King, D. A., et al. (2015). "Instrumented mouthguard acceleration analyses for head impacts in amateur rugby union players over a season of matches." American Journal of Sports Medicine 43(3): 614-624.

Aim: To quantify head impacts in amateur rugby union players over a season of matches using instrumented mouthguard acceleration analyses.

Key findings: A total of 20,687 impacts greater than 10g were recorded. The mean number of impacts per player was 564, with an average of 95 impacts per match. Mean linear acceleration was 22.2g, and mean rotational acceleration was 3902.9 rad/s²4. Impacts were skewed towards lower values, indicating a higher frequency of less severe impacts.

Practical implications: The frequency and magnitude of head impacts were higher than most sports previously reported. The data suggested a need for monitoring head impacts in rugby to potentially reduce concussion incidence and understand the role of sub-concussive events in long-term health. This study provided valuable insights into the biomechanics of head impacts in non-helmeted collision sports and underscored the importance of continued research and monitoring to enhance player safety.

Technique I Rugby union

King, D. A., et al. (2016). "Similar head impact acceleration measured using instrumented ear patches in a junior rugby union team during matches in comparison with other sports." Journal of Neurosurgery: Pediatrics 18(1): 65–72.

Aim: The study aimed to quantify head impact acceleration characteristics in junior rugby union players, focusing on impact magnitude, frequency, and location using wireless head impact sensors.

Key findings: A total of 721 impacts greater than 10g were recorded across four matches. The median impact magnitudes were 15g for linear acceleration and 2296 rad/sec² for rotational acceleration. There were 121 impacts (16.8%) above the rotational injury risk limit and 1 (0.1%) impact above the linear injury risk limit. The median linear acceleration for under-9-year-old rugby players was similar to 7- to 8-year-old American football players but lower than 9- to 12-year-old youth American football players. The median rotational accelerations measured were higher than the median and 95th percentiles in youth, high school, and collegiate American football players.

Practical implications: junior rugby union players experience a higher number of high-magnitude impacts compared to similar age-group sports participants. The study highlighted the need for standardized reporting of head impact biomechanics to enable accurate comparisons across studies. It emphasized the importance of protective measures and monitoring to prevent head-related injuries in youth sports. This study provided valuable insights into the risks associated with head impacts in youth rugby and underscores the necessity for further research and improved safety protocols.

Technique I Rugby union

King, D., et al. (2020). "Does playing away from home influence the number and severity of impacts in amateur rugby union players: Analyses by home/away, won/lost and first/second season halves." Annal Sports Med Res 7(3): 7.

Aim: To analyse head impact characteristics in amateur rugby union players, focusing on differences in impacts during home/away games, won/lost matches, and first/second halves of the season.

Key findings: More impacts were recorded in away games, won matches, and the first half of the season. Front-row forwards experienced more impacts in away games. The front of the head had longer impact durations and higher accelerations in games won compared to games lost.

Practical implications: the nature of matches influences head impacts, with more frequent and severe impacts occurring in away games and matches won. The disparity in impacts between the first and second halves of the season could have been related to players' fitness levels. Understanding these patterns could have helped in developing strategies to reduce head impacts and improve player safety.

Technique I Rugby union

King, D. A., et al. (2022). "Match participation and movement demands in amateur domestic women's rugby union in New Zealand." New Zealand Journal of Sports Medicine 48(2): 58-65.

Aim: To quantify the movement demands and physiological responses of amateur domestic women's rugby union players in New Zealand during match participation. Data were collected from 69 amateur female rugby union players over two consecutive seasons, using heart rate and microtechnology devices. Total distance, maximum velocity, Player Load ([PL] accumulated accelerometer-derived lad), and individual PL vectors (PL forward [PLF], PL sideward [PLS] and PL vertical (PLV]) and speed zones were examined. Analysis by player position, player group, matches won and lost, and years of competition were conducted.

Key findings: Inside Backs covered significantly more distance per match compared to Front-Row Forwards and Outside Backs. A higher maximum heart rate was recorded in 2018 compared to 2019. Positional groups showed similar physical and physiological profiles, suggesting generalized training regimes.

Practical implications: There is a need for position-specific training to better prepare players for higher levels of competition. Forward positions may have benefited from training focused on collision and contact abilities, while backs could improve high-intensity running capacity.

Alternative monitoring methods like heart rate measurement and perceived exertion scales could be useful for teams without access to microtechnology. The study emphasized the importance of integrating various external load metrics into routine monitoring for collision-based sports like rugby union.

Technique I Rugby union

King, D., et al. (2018). "Physical demands of amateur senior domestic rugby union players over one round of competition matches in New Zealand assessed using heart rate and movement analysis." International Journal of Sports Science & Medicine 2(3): 66-71.

Aim: To quantify movement demands and physiological responses of senior amateur rugby union players in New Zealand using heart rate and microtechnology data over one round of 13 competition matches.

Key findings: Outside backs covered the highest mean distance (5,880 ± 1,979 m) per match, while front-row forwards covered the least. Forwards had higher low-speed activity loads but lower forward, sideward, and vertical loads compared to backs. Forwards recorded higher mean heart rates than backs. Matches lost had higher mean heart rates compared to matches won.

Practical implications: Players at this level may benefit from more positional-specific training to better prepare for higher levels of competition. Incorporating a variety of external load metrics into routine monitoring helped better quantify the workload across different playing positions in rugby union. There is need for tailored training programmes to improve the fitness levels of amateur players, considering their dual commitments to work, studies, and family.

Technique I Rugby league

King, D., et al. (2012). "Nature of tackles that result in injury in professional rugby league." Research in Sports Medicine 20(2): 86-104.

Aim: To analyse the nature of rugby league tackles that result in injuries, focusing on the tackle height, direction, and the number of tacklers involved.

Key findings: Injuries were most frequent when two tacklers tackled the ball carrier from the side at shoulder or mid-torso levels. Ball carriers had a higher injury rate when tackled from behind their visual field at shoulder height, especially in the fourth quarter of matches. Tacklers were at higher risk of injury when tackling from the side as the first tackler, particularly in the third quarter of matches.

Practical implications: Coaches should have trained players in correct tackling techniques with emphasis on tackling with two or more tacklers and when tackling in the ball carrier's blind vision area to reduce the risk of injury. The study's results highlighted the importance of proper tackling techniques and the potential for tailored injury prevention programmes in professional rugby league.

Technique I Rugby union

King, D., et al. (2018). "Head impact biomechanics: Comparison between sports and genders." Journal of Science & Medicine in Sport 36: S3-4.

Aim: To discuss head impacts in various contact and collision sports, focusing on amateur rugby and Australian football. It aimed to analyse the frequency, magnitude, and location of head impacts using instrumented mouthguards and ear patches. The research highlighted head impact telemetry findings using a sensor device applied onto the side of the head (XPatch) of youth rugby league and rugby union, senior and junior Australian football, and male and female rugby league players. The differences in head impact locations, and resultant forces applied to the head, and how this information can be utilised to assist with possible reduction techniques, were reported.

Key findings: The keynote presentation highlighted significant differences in the number of head impacts across different sports and levels of play. Linear and rotational accelerations varied, with higher values observed in senior amateur rugby league compared to other sports. The majority of impacts were recorded on the front and side of the head, with differences between male and female players.

Practical implications: There is need for improved protective equipment and training protocols to reduce head impact exposure. The data informed sports governing bodies to develop policies aimed at minimizing head injuries. There is need for ongoing research to better understand the long-term effects of head impacts in sports.

Technique I Rowing

Coker, J., et al. (2008). Validity of force and angle data from the PowerLine Boat Instrumentation System, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 11.

Aim: To assess the reliability and validity of force and angle data from the PowerLine system's instrumented oarlocks, which are crucial for analysing rowing technique and boat speed in elite rowing programmes .

Key findings: Laboratory tests confirmed the system's validity for force and angle measurements within the tested range (0 to 60 kg for force, and -80° to +60° for angle). The standard error of the estimate was less than 0.90 kg for force and less than 0.5° for angle, with an R^2 value of 1.00, indicating high accuracy.

Practical implications: The study recommended the PowerLine system for on-water biomechanical analysis in elite rowing, as it provided relevant data without altering the athlete's setup. However, it highlighted the need for regular validity testing and further on-water reliability testing to fully evaluate its application in technique and boat setup adjustments.

Technique I Rowing

Coker, J., et al. (2010). Quantifying catch technique in elite scullers: An experimental evaluation of different methodologies. A technical report for Rowing New Zealand. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology: 18.

Aim: To determine the best method for quantifying catch slip technique in elite scullers and establish the strength of relationships between catch slip values and boat velocity.

Key findings: Sculler Am showed trivial or unclear relationships between all slips and boat velocity.

Sculler B displayed significant negative relationships between boat velocity and PowerLine-Angle and PowerLine-Time. All relationships between angle and time versions of each slip method were significant. Elite scullers should be analysed individually due to variations in technique and performance predictors.

Practical implications: PowerLine™ slip values related to boat velocity but were inconsistent across different elite scullers. The velocity at which the blade is buried is a key performance predictor and varied in its impact on boat velocity. Coaches should focus on individual analysis rather than a one-size-fits-all approach, considering the unique technical characteristics of each sculler.

Technique I Rowing

Coker, J., et al. (2009). Quantifying catch technique in elite scullers – an evaluation of different methodologies. A technical report for Rowing New Zealand. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 25.

Aim: To identify the best method for quantifying catch slip technique in elite scullers and to understand the relationship between catch slip values and boat velocity, which is crucial for enhancing rowing performance.

Key findings: The research found that the PowerLine™ slip values can relate to boat velocity but vary for different elite scullers. For one sculler, no significant relationship was found between catch slips and boat velocity, while for the other, significant negative relationships were observed with certain slip values. The study highlighted the importance of the blade's velocity at the point of being buried as a key performance predictor.

Practical implications: elite scullers should be analysed individually due to the variation in how catch technique affects performance. Coaches are advised to focus on quick and precise blade entry without decelerating the boat and to consider other biomechanical stroke variables for performance prediction. The study emphasized the need for further research with more data to confirm the findings.

Technique I Rowing

Coker, J., et al. (2008). Evaluating rowing force profiles: Implications from literature, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 19.

Aim: The report sought to consolidate existing literature on rowing force profiles to understand their impact on rowing performance.

Key findings: Effective force profiles had a large area under the curve during the drive phase, maximizing impulse and work. A more rectangular force profile shape, with a high rate of force development, was more efficient than a triangular one. Smooth force curves, indicating consistent force application, correlate with higher rowing efficiency. Peak force should occur before the oar is perpendicular to the boat to maximize lift forces and utilize the oar shaft's elastic energy recoil. Crew coordination was crucial, but the optimal pattern of synchronization varies across different boat types.

Practical implications: rowing force profiles can be improved through training focused on achieving a more rectangular shape and smoother curves. It highlighted the need for further research to match force profile characteristics with specific boat types for effective performance. The limitations of the PowerLine system in measuring pin force instead of blade force are noted, suggesting the need for more accurate measurement tools.

Technique I Running

Sheerin, K. R., et al. (2010). Relationship of hip strength to running mechanics in children aged 9 to 14 years, Sports Performance Research Institute New Zealand, Auckland University of Technology: 37.

Aim: To explore the connection between hip strength and running mechanics in young athletes and assess the impact of an eight-week strengthening programme on their strength, flexibility, and gait.

Key findings: The study found a weak relationship between hip strength and running mechanics. The eight-week intervention showed small improvements in strength, flexibility, and gait measures. Notably, the reliability of strength and flexibility measurements was established for young athletes.

Practical implications: The research suggested that while the strengthening programme had minimal impact, it did lead to some changes in gait mechanics. This indicated that coaching interventions, such as the provided hip strengthening fact sheet, may help reduce lower limb malalignment and injury risk. Future research should have focused on more reliable strength and flexibility measures, include a larger participant pool, and monitor the effects of coach education on these measures. The study's findings informed SPARC's strategies for reducing injuries and enhancing athletic performance in youth.

Technique I Running

Sheerin, K., et al. (2010). New Zealand running survey: A technical report for adidas New Zealand. Auckland, Clinic for Running Mechanics, Sport Performance Research Institute New Zealand: 32.

Aim: To describe the physical, training, and injury characteristics of runners due to their participation in running activities.

Key findings: The survey included 812 runners (437 females, 375 males) with an average age of 38.8 years. Most runners trained 3-4 times weekly, with 56% running on roads. 86% participated in events, predominantly road running (43%) and trail running (24%). 72% bought 1-2 pairs of running shoes annually, with 8% not purchasing any. There were 887 injuries reported, with the calf/shin (27%), knee (20%), and ankle (15%) being the most injured sites. 62% of injuries had a gradual onset, with muscle strains (28%), tendinitis (15%), and ligament sprains (12%) being common.

Practical implications: runners are diverse in their characteristics, necessitating a variety of shoes in the market. The high injury prevalence and re-injury rate (43%) indicated an opportunity for adidas to market shoes emphasizing injury reduction. adidas could lead in running-specific injury prevention education and conduct gait studies to demonstrate how different shoes could reduce lower limb injuries. This information could have helped adidas tailor their products and educational efforts to better serve the running community in New Zealand.

Technique I Running

Sheerin, K., et al. (2012). The effects of a running-based training programme on physical function in children. A technical report for Run4it Limited. Auckland, Sports Performance Research Institute New Zealand, AUT University: 13.

Aim: To assess the impact of a 7-week running-based training programme on the physical function of children.

Key findings: The programme led to significant improvements in children's running acceleration (6%), isometric hip (13%) and knee strength (16%), aerobic endurance (2%), and dynamic balance in anterior (3%) and postero-medial (4%) directions.

Practical implications: Running-based training could be an effective way to enhance certain aspects of physical function in children, which may contribute to better health outcomes and sporting success. The study highlighted the potential for such programmes to be used for talent identification and early intervention for children needing physical development. The study discussed the importance of fitness testing in children, the relationship between motor skills, physical activity, and fitness, and the long-term health benefits of physical fitness established during childhood. It acknowledged the need for larger-scale studies to generalize the results and the limitations due to the lack of a control group. The research provided a foundation for developing targeted training programmes to support children's physical and health education.

Technique I Snow sports

Costa-Scorse, B. and P. A. Hume (2010). NZ snow safety ski binding standards, education and testing project: Functional and release test requirements for alpine ski-binding-boot systems: A fact sheet for ski industry staff., Sport Performance Research Institute New Zealand, Auckland University of Technology: 3.

Aim: The fact sheet aimed to inform ski industry staff about the functional and release test requirements for alpine ski-binding-boot systems, based on a study of release torque testing of ski rental stock.

Key findings: The study revealed that 67% of tested ski-bindings failed to meet the international standard for release torque. Notably, skis one year old had a 91% pass rate, while older skis (two to four years) were 55-88% more likely to fail.

Practical implications: the current three-to-four-year stock replacement cycle was inadequate. The article recommended adherence to international standards ISO 13993:2001 and ISO 11088 – 2006 (E) for ski shop practices, including pre-season checks, boot inspections, and routine visual inspections with calibration equipment to ensure safety and proper functioning of ski-binding-boot systems.

Technique I Snow sports

Costa-Scorse, B., et al. (2008). A critical review of ski binding standards and related research: Part A – Review of literature and analysis of New Zealand snowsport injury epidemiology, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 34.

Aim: The paper aimed to critically review literature on ski equipment standards and their impact on knee injury prevention, alongside a descriptive epidemiology of snow sports injuries in New Zealand, emphasizing knee injuries.

Key findings: The review identified risk factors for knee injuries, such as gender, age, and previous injuries, with women and older beginners being more susceptible. It highlighted the need for proper ski binding settings to prevent injuries and suggests that current standards may be too high for certain groups.

Practical implications: Recommendations included adjusting ski binding retention settings for women and lightweight males over 24, professional testing of ski equipment, physical conditioning, and skier education to reduce injury risks. The study emphasized the importance of ongoing research and intervention development to improve snow sports safety.

Technique I Snow sports

Costa-Scorse, B., et al. (2008). A critical review of ski binding standards and related research: Part B – Critique of international ski binding standards and research related to standards, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 18.

Aim: The article aimed to critique international ski binding standards and research related to those standards, with a focus on reducing knee injuries in alpine skiing and informing potential changes in industry practice.

Key findings: The review identified twenty-two international and regional alpine skiing standards, noting significant overlap among them. It highlighted the AFNOR standard's unique approach, which includes more detailed skier categories and recommends lower binding adjustment values for certain groups to reduce injury risk.

Practical implications: Recommendations included adopting ISO 13993 - 2001 as an industry guideline for rental ski shop practices, considering the adoption of the AFNOR ski binding adjustment table in New Zealand, and establishing formal relationships with international standard bodies to contribute to snow sports safety initiatives. There was a need for standardized practices and the potential for adjusting current standards to improve safety and reduce knee injuries in skiing.

Technique I Snow sports

Costa-Scorse, B., et al. (2008). A critical review of ski binding standards and related research: Part C – Survey of current ski binding practices in New Zealand ski rental and retail facilities, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 27.

Aim: To survey current ski binding practices in New Zealand's ski rental and retail facilities, assessing adherence to international standards and identifying areas for improvement1.

Key findings: A significant portion of employees lacked formal training in ski binding adjustment, with many not using mechanical testing devices. Discrepancies were found in the application of ski binding release value tables, and there was a lack of consistency in adjusting practices during rush hours. Discussions revealed a need for better education on injury prevention and ski binding mechanics, as well as a more standardized approach to ski binding adjustments across the industry.

Practical implications: Adoption of international standards for ski binding adjustments, development of national education programmes for industry employees, and public injury prevention campaigns were suggested to improve safety and standardization in ski binding practices.

Technique I Snow sports

Costa-Scorse, B., et al. (2008). A critical review of ski binding standards and related research: Part D – A critical review of ski binding standards and related research: Stakeholders Information Sheet, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 6.

Aim: To assess the extent of knee injuries in alpine skiing in New Zealand, evaluate international best practices for ski binding adjustments, and identify current practices in New Zealand. The goal was to inform changes in industry practice and future injury prevention initiatives.

Key findings: The review found that international standards for ski binding adjustments are not consistently followed in New Zealand. There was a lack of uniformity in the use of release value tables and mechanical testing devices for adjusting ski bindings. Additionally, there was a discrepancy in training for ski rental employees and an inaccurate understanding of injury rates among them. The article suggested adopting ISO 13993 – 2001 as an industry guideline for rental ski shop practices and the AFNOR FD S 52–748 standard for ski binding adjustments. It recommended developing a national education intervention for standardized practices and a public injury prevention campaign on ski binding adjustments.

Practical implications: Implementing these recommendations could standardize ski binding adjustment practices across New Zealand, potentially reducing the risk of knee injuries in alpine skiing. Education and awareness campaigns may have further enhanced injury prevention efforts.

Technique I Snow sports

Hume, P. A., Hemingway, J., & Malpas, K. (2017). ACC/AUT/Coronet Peak ski-binding-boot torque and knee injury project 2016: A technical report to ACC and Coronet Peak NZSki Ltd. Auckland, Sport Performance Research Institute New Zealand: 12.

Aim: To describe knee injury characteristics and their association with ski-boot-binding characteristics at Coronet Peak. It focused on ski-binding-boot torque calibration as a potential risk factor for knee injuries due to inaccurate release values.

Key findings: For the 37 “black” and 42 “yellow” category ski bindings tested, a small percentage failed in specific tests. Black category skis had a 2.7% failure rate in forward lean for the right ski, while yellow category skis had a 2.4% failure rate in twist for both left and right skis. Knee injuries were the most frequently reported injuries among skiers. However, there was insufficient data to establish a definitive relationship between ski-binding-boot torque and knee injuries.

Practical implications: The New Zealand ski industry should develop best practice guidelines for the replacement and refitting of ski-boot-bindings based on international standards and local degradation data. More extensive data collection over several seasons was needed to better understand the effects of ski-boot-binding characteristics on injuries. This will help in developing effective injury prevention strategies.

Technique I Surf life saving

Diewald, S., et al. (2019). Boat instrumentation feasibility study to assess biomechanics of competitive surf lifesavers during inflatable rescue boat activities: Technical Report #5 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 35.

Aim: To pilot a data collection system for capturing acceleration and video footage of the IRB and crew on water, which could be used in future studies of IRB-related activities.

Key findings: The researchers successfully established a method to measure crew and boat accelerations and movement patterns. They found that inertial sensors attached to surf lifesavers could help quantify loads and frequencies associated with common injuries like lower back pain and soft-tissue ankle injuries.

Practical implications: The study recommended that future research should be conducted under various conditions to assess the biomechanical loading endured by the crew member. It suggested standardizing water-based manoeuvres to compare across populations and conditions and investigating different biomechanical positioning of crew members in a lab environment to assess potential injury mechanisms.

Technique I Surf life saving

Wyatt, H. E., et al. (2020). Biomechanics and user testing of the impact of IRB modifications on tibial loading: Technical Report #8 to Surf Life Saving New Zealand (SLSNZ). Surf Life Saving New Zealand (SLSNZ) Research Reports. P. A. Hume. Auckland, Auckland University of Technology: 29.

Aim: To evaluate how changes to IRB foot straps, bow ropes, and boat hull designs affect lower limb kinematics and tibial loading, both in-lab and on-water.

Key findings: Lower limb loading was significantly higher during on-water testing compared to in-lab simulations. The use of a modified left foot strap alone reduced left tibia loading. The prototype air hull IRB, which incorporated a cushioned floor, resulted in the lowest limb loading, especially when combined with the modified foot strap and alternative bow rope.

Practical implications: The study supported the use of modified foot straps and cushioned hull designs to reduce lower limb loading and potential injury risk. Further research was recommended to explore the combination of modified foot straps with other IRB features, such as air cushioning in the hull, to enhance injury prevention. Adjustments to bow rope and handle designs were needed to allow for individualized lengths and improved stability. The research helped in enhancing the safety of surf lifesavers.

Technique I General

Hume, P. A., Alderson, J., & Hardaker, N. (2020). AUT ACC SportSmart-9 Review Project Appendix A: Effects of technique on injuries in athletes: A scoping literature review. A technical report to ACC. ACC SportSmart-9 Review. P. A. Hume. Auckland, SPRINZ, Auckland University of Technology: 12.

Aim: To scope literature on the effects of technique interventions on injury reduction in athletes.

Key findings: Of 42 articles finally quality scored, various studies showed significant injury reductions in athletes through technique-based interventions, such as intellectualization of training, proprioceptive exercise programmes , and balance training. Technique screening studies aimed to identify injury risk factors and develop preventive strategies, although no clear evidence linked screening results to reduced injury risk.

Practical implications: specific interventions, including mental-intellectual teaching and proprioceptive exercises, can significantly lower injury rates, particularly in lower limbs and joints. There is a need for easy-to-adopt screening tools leveraging artificial intelligence to improve predictive ability and refine intervention strategies. The article underscored the potential of technique interventions in sports injury prevention and highlights the importance of ongoing research to develop effective screening tools.

NUTRITION

Nutrition I Other

Hume, P. A. (2023). Changing body composition and anthropometry. In R. Belski, A. Forsyth, & E. Mantzioris (Eds.), Nutrition for Sport, Exercise and Performance (Vol. 2, pp. 12). Routledge.

Aim: The chapter from “Nutrition for Sport, Exercise and Performance” provided an in-depth look at body composition and anthropometry, the methods to assess it, and how it can be altered through diet and exercise.
Key results: It explained that body composition is made up of fat, protein, water, and minerals, with techniques like air displacement plethysmography and bioelectrical impedance analysis used for measurement. The chapter emphasized the importance of accurate assessment techniques, as factors like hydration can impact results.
Practical implications: The text highlighted that body composition can be modified through diet and exercise, with specific strategies for weight gain or loss. It also discussed the ethical considerations and training required for those conducting physique assessments.

WEAR

Wear I Rugby union

Hume, P. A., et al. (2015). IRB/AUT Rugby Player Equipment Review Project part A: Literature and company product review. A technical report to World Rugby Board. IRB/AUT Player Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 54.

Aim: To assess whether Regulation 12 and Law 4 needed updates based on new technologies for players with disabilities.

Key findings: There was a lack of suitable commercial eyewear and auditory aids for rugby. Advancements in prosthetics suggested potential for development in rugby. A pilot study indicated a need for custom-made, durable, and safe hearing aids for rugby.

Practical implications: Updating Regulation 12 to accommodate new technologies and designing protective gear that considers injury mechanisms and ergonomic performance were recommended. The report advocated for research to develop new prostheses and hearing aids for rugby. The report underscored the necessity for World Rugby to lead in technological development, ensuring safety and inclusivity for all players.

Wear I Rugby union

Hume, P. A., et al. (2014). IRB/AUT Rugby Protective Equipment Review Progress report #1 to the International Rugby Board. IRB/AUT Player Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 28.

Aim: To review and potentially update Regulation 12 and Law 4, ensuring technical specifications and testing methodologies accommodate players who are visually impaired, have hearing disabilities, or require prosthetics.

Key findings: Identified technical specifications for prostheses, hearing aids, and goggles. Suggested improvements for prosthetic devices to enhance safety and performance in rugby. Presented research on technology and equipment in sports, emphasizing the need for prosthetic advancements in rugby. Evaluated new hearing aid designs for retention, comfort, and safety during rugby play. Recommended custom hearing aids and further development of rugby-specific aids.

Practical implications: Proposed updates to regulations to allow the use of improved protective equipment for disabled players. Encouraged research to develop new prosthetic equipment tailored to rugby's demands. Highlighted the importance of safe and inclusive equipment that does not compromise the safety of the wearer or other players. The report underscored the necessity of technological advancements in protective equipment to ensure the safety and inclusion of disabled players in rugby.

Wear I General

Hume, P., et al. (2006). Impact testing of 18 adult mouthguards available in New Zealand. Technical report for Consumer's Institute. Auckland, Institute of Sport and Recreation Research New Zealand, AUT University: 22.

Aim: To compare the biomechanical impact performance data of 18 adult mouthguards.

Key findings: The best performing mouthguards based on impact scores were Avaro International, Shock Doctor Power Hilo v4.5, and Signature Proplus Gel Type 35. The worst performers were Signature Pro Type 2 and Professional moulded 1 senior custom laminated. Custom-fitted mouthguards did not show more favorable impact results compared to boil-and-bite types, which contradicts most literature.

Practical implications: When selecting a mouthguard, consider impact absorption characteristics, comfort, retentive fit, coverage, durability, and material quality. Custom mouthguards generally fit better and stay in place during impact testing. mouthguards should be chosen based on specific sport requirements, with different stiffness levels for contact sports versus hard-object collisions. The study highlighted the importance of proper fitting and the potential for mouthguards to reduce dental injuries and concussions in sports. It emphasized the need for further research on mouthguard design and materials to enhance protective qualities.

Wear I General

Hume, P. A., et al. (2006). Foot orthotic meta-analysis project: Final report. Technical report for Accident Compensation Corporation. Auckland, New Zealand, Institute of Sport and Recreation Research New Zealand: 35.

Aim: To assess the effectiveness of foot orthoses for treating and preventing lower limb injuries such as plantar fasciitis, stress fractures, patellofemoral pain syndrome, and hallux valgus.

Key findings: The results indicated that foot orthoses had mostly trivial effects on pain or injury prevention. They were not effective for patellofemoral pain syndrome and hallux valgus. However, semi-flexible and semi-rigid orthoses showed moderate to large beneficial effects in reducing pain for metatarsalgia arthritis and juvenile idiopathic arthritis. Rigid orthoses had moderate beneficial effects for plantar fasciitis. For injury prevention, custom-made rigid orthoses reduced the incidence of shin splints, and soft orthoses reduced stress fractures among army recruits.

Practical implications: Semi-rigid foot orthoses are recommended for moderate to large beneficial effects in treating and preventing plantar fasciitis and stress fractures. podiatrists should prescribe orthoses with specific functional goals in mind, such as reducing knee joint moments or tibial rotation. It emphasized the need for biomechanists and podiatrists to collaborate to ensure the functional goals of the orthosis intervention are achieved, considering individual responses to orthosis intervention. The study concluded that further research with randomized controlled trials is necessary to establish the clinical utility of various orthoses for different lower limb injuries. It highlights the limited number of high-quality studies available for certain injuries and the need for more focused research on patellofemoral pain syndrome and hallux valgus.

Wear I General

Hume, P. A. and D. F. Gerrard (1998). Effectiveness of external ankle support: bracing and taping in rugby union. Sports Medicine 25(5): 285-312.

Aim: To review the effectiveness of external ankle support, such as bracing and taping, in preventing ankle injuries in rugby, focusing on how it affects performance and injury prevention mechanisms.

Key findings: Studies indicated that external ankle support can reduce the incidence of ankle injuries. The effectiveness varies based on the material properties, application method, and the athlete's history of ankle stability or previous injuries. While some supports offered no performance enhancement, others may adversely affect performance.

Practical implications: While external supports can decrease ankle injury rates, their mechanical support is limited. The International Rugby Board should consider allowing ankle braces with stiff lateral components to reduce the risk of ankle inversion sprain injuries. There is need for future research on the dynamic effects of external ankle support and brace manufacturers should use this information to improve design and reduce injury risks.

Wear I General

Williams, S., et al. (2012). "Kinesio taping in treatment and prevention of sports injuries: A meta-analysis of the evidence for its effectiveness." Sports Medicine 42(2): 153-164.

Aim: To assess effectiveness of kinesio taping (KT) using meta-analysis.

Key findings: Pain relief was insignificant and not clinically important. Range of motion showed mixed results; some small benefits in certain studies. Strength testing showed likely beneficial effects on strength in some cases. There was beneficial effect on grip force sense error, but not on ankle proprioception. Muscle activity had substantial effects, but unclear if they were beneficial or harmful.

Practical implications: Limited evidence to supported use of KT over other elastic tapes for sports injuries. KT may have offered minor benefits in strength, range of motion, and proprioception in some injured cohorts. More research was needed, particularly on sporting injuries, to provide clear guidance for practitioners. The study highlighted the need for well-designed experimental research to substantiate the anecdotal support for KT.

PLAYER ENVIRONMENT

Environment I Football

Williams, S., et al. (2011). "A review of football injuries on third and fourth generation artificial turfs compared with natural turf." Sports Medicine 41(11): 903-923.

Aim: To compare the incidence, nature, and mechanisms of injuries sustained on newer generation artificial turfs and natural turfs across football codes.

Key findings: Overall injury rates were comparable between new generation artificial turfs and natural turfs. Ankle injuries were an increased risk on artificial turf with incidence rate ratios ranging from 0.7 to 5.24. Knee injuries showed inconsistent evidence with incidence rate ratios from 0.4 to 2.85. Muscle injuries showed mixed results; some cohorts showed beneficial effects on artificial turf.

Practical implications: While new generation artificial turfs had similar overall injury rates to natural turfs, specific injury prevention strategies, especially for ankle injuries, should have been prioritized for athletes regularly playing on artificial turf. Further research was needed to clarify the effects of artificial surfaces on muscle and knee injuries.

INJURY

Injury I Cycling

Hume, P. A., Le Flao, E., Barry, M., & Malpas, K. (2017). ACC/AUT Mountain Biking Injury Prevention Literature Scoping Project: A technical report to ACC. Sport Performance Research Institute New Zealand, Auckland University of Technology: 42.

Aim: To provide evidence-based insights into risk factors and the effectiveness of injury prevention measures for mountain biking, informing potential initiatives for New Zealand's mountain bike parks.

Key findings: Increased injury risk associated with higher speeds, new bicycles, jumping, downhill riding, and wearing more protection (indicating more experienced riders). Falling forward over the handlebars was the most frequent cause of injury. It emphasized the importance of physiological factors (strength and endurance), biker skill, psychological factors (judgment and attentiveness), safety gear (body armour), bicycle maintenance, and trail conditions.

Practical implications: Educational initiatives on risk factors, equipment maintenance, and mountain biking techniques are recommended. Suggested improvements include trail conditions, signage, and consistent trail standards. Provision of protective gear and maintenance of rental and visitors' bikes is advocated. Enforcement of national trail standards to match biker abilities with terrain challenges is needed.

Injuries I Netball

Hume, P. A., et al. (2007). National Bank Cup Netball Injury Surveillance Reporting 2007. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 26.

Aim: To provide an overview of injury surveillance for the 2007 National Bank Cup netball season, focusing on the types, causes, and circumstances of injuries among players from five franchises: Auckland Diamonds, Waikato Magic, Wellington Shakers, Canterbury Flames, and Otago Rebels.

Key findings: The most common injuries were ligament sprains (25%), muscle strains (17%), and joint strains (15%). Ankle injuries were the most frequent, accounting for 15% of all injuries. Injuries were equally likely to occur during training and competition, with most injuries happening in the second and third quarters of games. Goal defence and goal keeper positions had the highest injury rates during competition, while centre court positions were more frequently injured during training. The primary causes were overuse, collisions with players, and landing from jumps.

Practical implications: Emphasizing jump training and lower limb stability training could help reduce the incidence of injuries related to jumping and landing. Ensuring proper warm-up routines and managing player fatigue, especially for those entering games mid-way, potentially reduced injury rates in the second and third quarters. Increasing the use of protective equipment, particularly ankle braces, mitigated the risk of injuries.

Injuries I Rugby union

Kara, S. (2013). Injuries in professional rugby union: A study of five years of injury data with training loads and travel as co-variates. SPRINZ. Auckland, Auckland University of Technology. MHSci: 89.

Aim: To analyse the effect of changing match demands and competition expansion on injury incidence in professional rugby union. It focused on in-season training and injury data from 2006-2010 for a Super 14 Rugby team.

Key findings: The overall injury incidence was 113.6 match-related injuries and 6.3 training-related injuries per 1000 player hours over five seasons. 74% of injuries occurred in matches, with 58% being contact-related. The lower limb accounted for 66% of all injuries. Higher actual training loads were associated with higher injury risk. However, higher prior cumulative training load over a 10-day period had a protective effect on training-related non-contact soft tissue injuries.

Practical implications: gradual increases in training load within a defined period can promote adaptation and reduce injury risk. Higher prior cumulative training load increased match-related contact injury risk, highlighting the importance of tapering into a match. The study observed a trend towards increased match-related non-contact soft tissue injuries post long-haul travel, suggesting the need for strategies to mitigate travel-related injury risks.

Injuries I Cricket

Walter, S. B. N., et al. (2022). "New Zealand cricket injury analysis based on 12 years of Accident Compensation Corporation data." BMJ Open Sport & Exercise Medicine 8(3): Article number e001340 002022.

Aim: To provide epidemiological data on cricket injuries in New Zealand, analysing 12 years of data from the Accident Compensation Corporation (ACC).

Key findings: The study found 86,562 injuries with a higher incidence in males (64.1) than females (36.1)1. Injury claims increased by 42.6%, but the incidence rate decreased from 59.0 in 2006 to 42.8 in 2016. The most affected body regions were hands/fingers and lumbar, primarily due to contact activities. Young players aged 10–20 years were more prone to injuries.

Practical implications: Injury prevention programmes should focus on reducing contact injuries to hands/fingers and head by promoting the use of protective gear and correct technique, especially among young players. Practical steps can be taken to mitigate injury risks in cricket.

Injury I Football

King, D., et al. (2024). "Soccer (Football) Injuries in New Zealand: A Review of Ten Years (2010-2020) of Accident Compensation Corporation Entitlement Claims and Costs." Physical Medicine and Rehabilitation – International 11(1).

Aim: To provide epidemiological data and related costs for moderate-to-serious soccer injuries in New Zealand over a ten-year period (2010-2020), analysing data from the Accident Compensation Corporation (ACC).

Key findings: A total of 429,681 injury entitlement claims were recorded, costing $420,593,76434. Lower limb injuries were most frequent, accounting for 64.3% of claims. Players over 35 years old accounted for 23.1% of total claims and 35.2% of total costs. Despite prevention efforts, soccer injuries remained frequent and costly, with lower limb injuries, fracture dislocations, and concussions being particularly significant.

Practical implications: Injury prevention interventions should be targeted at specific age groups and injury causes, especially since players over 35 years old sustain more severe injuries. The increase in costs over the study period was greater than the rate of inflation, indicating a need for further research and potential rule modifications to reduce injuries. Concussion-related claims and costs warranted further investigation to understand gender differences in soccer injuries.

Injury I Football

King, D. A., et al. (2022). "Match and training injuries in women's football: A systematic review and pooled analysis of published studies." Annals of Sports Medicine and Research 9(2): 1193.

Aim: To review and calculate pooled data estimates for injury epidemiology in women's football across different participation levels during matches and training sessions.

Key findings: 48% to 70% of female football players sustained at least one injury per season, with acute injuries being the most common (69% to 85%). These were the most frequent, with a significantly higher pooled injury incidence rate (IIR) compared to other body regions. Contusions were more common than sprains, strains, and concussions. Female junior football players reported more training injuries compared to adolescent, amateur, and elite levels. The estimated cost of injuries in female football in New Zealand was NZD$257,667,307, with match injuries accounting for 63.6% of this total.

Practical implications: Interventions should have targeted female junior football players to reduce lower limb injuries and contusions. The study highlighted the need for further research in the southern hemisphere to enhance the generalizability of findings. The article emphasized the importance of injury prevention programmes and suggests that future research should focus on increasing awareness and management of concussions among team members. It called for more studies from the southern hemisphere to provide a more comprehensive understanding of injury patterns in women's football globally. The findings had significant implications for coaches, trainers, and healthcare professionals involved in women's football, underlining the need for targeted injury prevention strategies.

Injury I Football

King, D., et al. (2024). "Use of the concussion check protocol for concussion assessment in a female soccer team over two consecutive seasons in New Zealand." Journal of the Neurological Sciences 460(123011): 9.

Aim: To address the lack of medical care on sports sidelines by employing the concussion check protocol (CCP), which can be used by non-medically trained individuals, to identify players at risk of concussion.

Key findings: The CCP showed a 100% sensitivity and specificity in identifying concussions. The study found an overall incidence of 20.8 concussions per 1000 match-hours, with an average missed-match duration of 31 days. The King-Devick (K–D) test, part of the CCP, was effective in detecting oculomotor dysfunction indicative of concussion.

Practical implications: The successful sideline use of CCP by non-medical personnel suggested that it can serve as a reliable tool for early concussion identification, which is crucial for the timely removal of affected players from play and preventing long-term consequences. The study highlighted the need for accessible concussion assessment tools in amateur sports settings. The findings underscored the importance of implementing protocols like CCP to enhance player safety and support non-professional staff in managing potential concussions effectively.

Injury I Hockey

Hume, P. A. (2001). National sports injury prevention programme injury surveillance reporting 2001: New Zealand Hockey. Auckland, School of Community Health and Sports Studies, Auckland University of Technology: 18.

Aim: To monitor and analyse injury rates in hockey using data from the 2000 season, enabling the identification of trends and the evaluation of Injury Prevention (IP) programmes.

Key findings: A total of 1,137 injury report cards were collected, showing a 17% increase from the previous season. The overall injury rate decreased by 16%, with bruises and cuts being the most common injuries. Injuries were most likely to occur during the second quarter of games and were not associated with the playing surface.

Practical implications: Tackling and being hit by the ball were the leading causes of injuries, suggesting a need for improved safety measures and rule enforcement in these areas. The significant increase in mouthguard usage indicated a positive trend towards adopting protective equipment. Recommendations included continuing the IP programme, refining data collection methods, and maintaining consistent reporting periods for accurate seasonal comparisons.

Injury I Rowing

McDonnell, L. K., et al. (2009). Occurrence rates of rib stress fractures among New Zealand's rowing squads. A technical report for Rowing New Zealand Auckland, Institute of Sport and Recreation Research New Zealand: 7.

Aim: To determine the occurrence rate of rib stress fractures among New Zealand's elite rowing squads by analysing injury data from 2002 to 2008.

Key findings: Rib stress fractures were found in 11.7% of the athletes, with 24 instances among 21 athletes. The year preceding the Olympics saw the highest number of fractures, suggesting a trend of increased injuries during intense training periods.

Practical implications: The study recommended that coaches and sports scientists implement injury prevention strategies, particularly in the year leading up to the Olympics, to mitigate the risk of rib stress fractures. Early recognition and proper rest were advised for a quicker recovery..

Injury I Rugby league

King, D., Hume, P. A., Gissane, C., & Clark, T. (2017). Semi-professional rugby league players have higher concussion risk than professional or amateur participants: A pooled analysis. Sports Medicine, 47(2), 197–205. https://doi.org/10.1007/s40279-016-0576-z

Aim: To review published studies on rugby league injuries, focusing on concussions during matches and training, and to present pooled data estimates for concussion injury epidemiology.

Key findings: Amateur players had the highest concussion rates during matches (19.1 per 1000 match hours). Semi-professional players had highest concussion rates during training (3.1 per 1000 training hours) and nearly three times greater risk of concussion during matches compared to amateurs. Professional players had significantly lower concussion rates during training compared to semi-professionals.

Practical implications: There is need for targeted injury prevention programmes , especially for semi-professional players who face a higher risk during training. Adjustments in training practices could have mitigated the high concussion rates observed in semi-professionals. More detailed analysis of concussion incidents was needed to develop effective prevention strategies, considering factors like time, activity, and player position. The article emphasized the importance of understanding concussion risks at various participation levels to improve player safety and inform training protocols.

Injury I Rugby league

King, D. A., Hume, P. A., Milburn, P. D., & Gianotti, S. M. (2011). Neck, back and spine injuries in amateur rugby league: A review of nine years of Accident Compensation Corporation injury entitlement claims and costs. Journal of Science and Medicine in Sport, 14(2), 126–129. https://doi.org/10.1016/j.jsams.2010.07.004

Aim: To provide an epidemiological overview of neck, back, and spine injuries in amateur rugby league in New Zealand over nine years, analysing the number, type, and cost of injuries.

Key findings: There were 206 moderate to serious injury claims, constituting 3% of total rugby league claims and costing NZD$1,585,9273. The injury rate was 26 per 1,000 claims, with a significant increase in both the number of claims and the cost per claim over the study period.

Practical implications: coaches should ensure proper tackling technique to reduce injury risk. Team medical personnel should be trained to handle neck and spine injuries, and emergency procedures should be practiced at clubs. Further research was needed to understand the mechanisms of injury and develop prevention strategies.

Injury I Rugby league

King, D. A., et al. (2011). "Neck, back and spine injuries in amateur rugby league: A review of nine years of Accident Compensation Corporation injury entitlement claims and costs." Journal of Science and Medicine in Sport 14: 126-129.

Aim: To provide an epidemiological overview of rugby league neck, back, and spine injuries, along with the associated costs in New Zealand over a nine-year period.

Key findings: There were 206 moderate to serious injury entitlement claims (MSC) for neck, back, and spine injuries, which was 3% of total rugby league claims. These injuries amounted to NZD$1,585,927, which was 4% of the total injury entitlement costs for rugby league. The rate of MSC neck, back, and spine rugby league injuries was 26 per 1000 total rugby league claims. There was a significant increase in both the number of neck, back, and spine MSC claims and the cost per MSC injury claim over the study period.

Practical implications: Coaches were advised to teach correct tackling technique to reduce the risk of such injuries. Team medical personnel should have been trained to handle neck, spine, and head injuries, and emergency procedures for suspected neck or back injuries should be practiced at clubs. A prospective injury epidemiology study was suggested to collect information on the mechanisms of injury and potential risk factors, such as tackling technique.

Injury I Rugby league

King, D., et al. (2010). "Match and training injuries in rugby league: A review of published studies." Sports Medicine 40(2): 1-16.

Aim: To update the descriptive data on rugby league injury epidemiology and add information for various levels of participation in both match and training environments.

Key findings: Most injuries occurred during matches, with professional players having lower injury rates compared to semi-professional participants. Earlier research highlighted ligament and joint injuries, especially to the knee, as common. Recent studies showed a shift in injury sites, with the shoulder now being the most frequent injury site. There was inconsistency in injury definitions across studies, affecting the comparability of studies. A standard definition based on international consensus is suggested.

Practical implications: The change in injury sites and types could prompt further research and development of injury reduction programmes. Further research was needed at all participation levels to confirm the strongest risk factors for injury in both match and training environments. There was a need for standardized injury definitions and reporting methods to better understand and prevent injuries in rugby league.

Injury I Rugby league

King, D., et al. (2009). "Rugby league injuries in New Zealand: A review of eight years of Accident Compensation injury entitlement claims and costs." British Journal of Sports Medicine 43: 595–602.

Aim: To provide an epidemiological overview of rugby league injuries and associated costs in New Zealand, focusing on medical treatment requirements1.

Key findings: A total of 5941 injury entitlement claims were recorded from 1999 to 2007, with a significant decrease in injury rates between 1999–2000 and 2002–20032. The total cost of injuries was $42,822,048 NZD. The knee was the most common injury site, and soft tissue injuries were the most frequent injury type. Concussion/brain injuries, though only 1.8% of total claims, accounted for 6.3% of costs, indicating high severity. The 25–29 age group had the highest percentage of claims and costs.

Practical implications: Injury prevention programmes should have targeted concussion/brain injury and knee and soft tissue injuries. Programmes should focus on the 20–30 years old age range. More detailed studies on injury mechanisms and participation data were needed to further understand and prevent rugby league injuries in New Zealand.

Injury I Rugby league

"A retrospective review over 1999 to 2007 of head, shoulder and knee soft tissue and fracture-dislocation injuries and associated costs for rugby league in New Zealand." International Journal of Sports Medicine 32: 287-291. g, 2011 #270}

Aim: To analyse moderate to serious claims (MSC) for medical treatment due to rugby league injuries, particularly in the knee, shoulder, and head and neck regions, and to understand the nature of these injuries for better sideline management and preparation by team medical personnel.

Key findings: A total of 5,941 MSCs were reported, with the knee (23% of total claims), shoulder (17%), and head and neck (10%) being the most frequent and costly injury sites. Soft tissue injuries (47% of total claims) and fracture-dislocation injuries (44.1%) were the most common and expensive injury types. The study observed significant increases in claims and costs for head and neck soft tissue injuries, shoulder soft tissue injuries, and knee fracture-dislocation injuries over the study period. Conversely, knee soft tissue injury claims decreased significantly from 1999 to 2007.

Practical implications: Sports medical personnel should have focused on reducing musculoskeletal injuries to the head and shoulder. Emphasis should have been placed on increasing awareness of correct tackling technique, head injury awareness, and management of suspected cervical spine injuries. changes in defensive techniques in rugby league may influence the nature of injuries, highlighting the need for injury prevention strategies and possibly rule modifications to reduce injuries.

Injury I Rugby league

King, D. A., Hume, P. A., Milburn, P. D., & Gianotti, S. M. (2011). Neck, back and spine injuries in amateur rugby league: A review of nine years of Accident Compensation Corporation injury entitlement claims and costs. Journal of Science and Medicine in Sport, 14(2), 126–129. https://doi.org/10.1016/j.jsams.2010.07.004.

Aim: To provide an epidemiological overview of neck, back, and spine injuries in amateur rugby league in New Zealand over a nine-year period, along with the associated costs.

Key findings: There were 206 moderate to serious claims (3% of total rugby league claims) with a total cost of NZD$1,585,927 (4% of total injury entitlement costs). The injury rate was 26 per 1000 total rugby league claims, with a significant increase in both the number of claims and the cost per claim over the study period. The most common cause of these injuries was the tackle, especially with multiple tacklers involved.

Practical implications: It was suggested that coaches ensure proper tackling technique to reduce injury risk. Team medical personnel should be trained to handle neck, back, and spine injuries, and emergency procedures should be practiced at clubs. A prospective injury epidemiology study was recommended to collect data on injury mechanisms and risk factors.

Injury I Rugby league

King, D., et al. (2010). "Player perspectives on return to play after match or training injury in amateur rugby league." New Zealand Journal of Sports Medicine 37(2): 48-55.

Aim: To explore and document the reasons players return to rugby league after missing matches or training due to injuries.

Key findings: A total of 63 players were enrolled, reporting 20 training injuries and 73 match injuries. Most returning players were employed (73%), with only 79.6% consulting a health professional during rehabilitation. The team coach influenced the decision to return in 28-29% of cases. Players often felt the recommended recovery time was too long, with many returning earlier than advised.

Practical implications: The study highlighted the need for accurate early assessment and qualified advice to manage injuries effectively. It raised concerns about players underestimating their injuries and the influence of coaches on return-to-play decisions. There is a need for better communication between health professionals, coaches, and players to ensure safe return-to-play protocols.

Injury I Rugby league

Injuries in Rugby league: Incidence, dominance, influences and return to play decisions. Sport Performance Research Institute New Zealand. Auckland, AUT University. PhD.

Aim: The thesis investigated the incidence, influences, and types of injuries in rugby league, focusing on tackles and return-to-play decisions. It aims to understand the epidemiology of rugby league injuries in New Zealand and identify risk factors.

Key findings: From 1999 to 2007, there were 42,754 rugby league injury claims costing $48,704,704. Moderate to severe injuries represented 14% of claims but 88% of costs. Soft tissue injuries were common, especially for females. Concussions accounted for 70% of head injuries, while the knee was the most common injury site. 50% of tackles involved tacklers from behind the ball carrier's visual field. Tackle-related injuries were more frequent when the ball carrier was tackled at shoulder or mid-torso height, in their blind vision, with two or more tacklers, and in the fourth quarter of matches. 80% of injured players saw a health professional for rehabilitation. Coaches often asked players to return to play prematurely.

Practical implications: Understanding the common injury types and their causes helped develop targeted injury prevention strategies. Coaches can modify training to reduce high-risk tackles and improve player safety. The findings informed policy changes in rugby league to enhance player welfare and reduce injury costs. Improving the first aid and concussion knowledge of rugby league personnel was crucial for better injury management and prevention.

Injury I Rugby league

King, D., et al. (2011). "A retrospective review over 1999 to 2007 of head, shoulder and knee soft tissue and fracture-dislocation injuries and associated costs for rugby league in New Zealand." International Journal of Sports Medicine 32: 287-291.

Aim: To analyse knee, shoulder, and head and neck injuries by soft tissue and fracture-dislocation types, providing a deeper understanding of the injuries likely encountered by sports medical personnel in rugby league.

Key findings: There was a significant increase in claims and costs for head and neck soft tissue injuries, shoulder injuries, and knee fracture-dislocation injuries and a decrease in knee soft tissue injury claims. Changes in injury nature may have been related to changes in defensive techniques in rugby league.

Practical implications: Sports medical personnel should focus on reducing musculoskeletal injuries to the head and shoulder. There was emphasis on correct tackling technique, head injury awareness, and management of suspected cervical spine injuries to prevent injuries. The study provided valuable insights for injury prevention strategies and highlights the need for increased awareness and training among medical staff and players.

Injury I Rugby league

King, D., P. A. Hume, P. Milburn and S. Gianotti (2009). "Rugby league injuries in New Zealand: A review of eight years of Accident Compensation injury entitlement claims and costs." British Journal of Sports Medicine 43: 595–602.

Aim: To provide an epidemiological overview of rugby league injuries and associated costs in New Zealand, focusing on medical treatment required from 1999 to 20071.

Key findings: A total of 5,941 injury entitlement claims were recorded, with a significant decrease in injury rates between 1999–2000 and 2002–2003. The total cost of injuries was $42,822,048 NZD, with the knee being the most common injury site and soft tissue injuries the most common type. Concussion/brain injuries, though only 1.8% of total claims, accounted for 6.3% of costs, indicating their severity. The 25-29 age group had the highest number of injury claims and costs.

Practical implications: Injury prevention programmes should target reducing risks of concussion/brain injury, knee, and soft tissue injuries, particularly in the 20–30 years age range. There is need for more detailed longitudinal studies to understand injury mechanisms and participation data in rugby league activities. The research emphasized the importance of evidence-based practice in the management of rugby league injuries and suggests further research into injury mechanisms and the impact of tackle techniques on injury incidence. This had practical implications for clinicians, players, and policymakers in managing these conditions and formulating effective injury prevention strategies.

Injury I Rugby league

*King, D., et al. (2009). "Rugby league injuries in New Zealand: Variations in injury claims and costs by ethnicity, gender, age, district, body site, injury type and occupation." New Zealand Journal of Sports Medicine **36**(2): 48-55.*

Aim: To analyse the epidemiology of rugby league injuries requiring medical treatment in New Zealand from 1999 to 2007, with a focus on differences among ethnic groups.

Key findings: New Zealand Māori accounted for a significant portion of total injury claims (39.8%) and costs (43.5%), despite being only 13.2% of the population. Soft tissue injuries were the most common across all ethnic groups, with the knee being the most frequently injured body part for Māori. Different ethnic groups had varying occupational injury claims, with Europeans more in trade, Māori in plant/machinery, and Pacific peoples in elementary occupations. Māori recorded more injury claims for both males and females compared to other ethnic groups.

Practical implications: The findings suggested the need for generalizable injury prevention programmes that cater to the common injuries across all ethnic groups. The study highlighted the necessity for further research to explore the reasons behind the differences in injury rates and to assess the impact of prevention programmes . The high cost of concussions, especially among Māori, called for additional investigation into the risk factors and potential ethnic-specific treatment strategies. This study shed light on the disparities in rugby league injuries among different ethnic groups in New Zealand, providing a foundation for targeted injury prevention and further research into the underlying causes of these variations.

Injury I Rugby league

*King, D., et al. (2010). "Women's rugby league injury claims and costs in New Zealand." British Journal of Sports Medicine **44**: 1016-1023.*

Aim: To provide an overview of the epidemiology of women's rugby league injuries requiring medical treatment and associated costs in New Zealand.

Key findings: There were 320 moderate to serious injury claims over the study period, with a mean of 37.9 claims per year. The mean annual cost was $196,514, with half of the injury claims occurring in New Zealand Māori. Concussion/brain injuries, while only 3.8% of total claims, accounted for 5.4% of costs, with the highest mean cost per claim. Lower limb injuries were most frequent, accounting for 65% of claims and 58.7% of costs. The 25-29 age group recorded the highest percentage of injury claims and costs.

Practical implications: Injury prevention programmes should focus on the 25-29 age group and aim to prevent concussion and lower limb injuries. The study highlighted the need for more detailed research into women's rugby league injuries to inform tailored injury prevention strategies.

Injury I Rugby league

King, D. A., et al. (2022). "The incidence, cost, and burden of concussion in women's rugby league and rugby union: A systematic review and pooled analysis." Sports Medicine.

Aim: To review published studies reporting concussion injuries from match and training participation in rugby codes and report pooled data estimates for rugby league and union concussion injury epidemiology.

Key findings: Women's rugby league had a higher match injury incidence (10.3 per 1000 match hours) compared to rugby 15s (2.8 per 1000 match hours) and rugby 7s (8.9 per 1000 match hours). A fourfold difference in concussion incidence was found in women's rugby league compared to rugby 15s. The risk of concussion during matches was ninefold higher than during training for women's rugby 15s. The total estimated costs for reported concussions were NZ$1,235,101, with a pooled concussive injury burden of 33.2 days.

Practical implications: There is need for updated guidelines to include sex-specific differences, as the mean days lost due to concussions (33 days) exceeded the expected 7- to 10-day recovery timeframe outlined in the Concussion in Sport Consensus statement. managing concussion risk may require sex-based considerations to prevent further widening of the gap in concussion incidence between male and female sports participants.

Injury I Rugby league

King, D., Hume, P. A., Gissane, C., & Clark, T. (2017). Semi-professional rugby league players have higher concussion risk than professional or amateur participants: A pooled analysis. Sports Medicine, 47(2), 197–205. https://doi.org/10.1007/s40279-016-0576-z

Aim: To analyse published studies on rugby league injuries and provide pooled data estimates for concussion injury epidemiology across different levels of play.

Key findings: Semi-professional rugby league players have a higher risk of concussions compared to professional and amateur players during both match and training activities. Specifically, amateur players had the highest incidence of concussive injuries during matches, while semi-professional players had the highest incidence during training.

Practical implications: Semi-professional players, due to their unique position between amateur and professional levels, may require targeted injury prevention strategies. The higher risk of concussion during matches and training indicated a need for improved safety protocols and awareness programmes at the semi-professional level. The study highlighted the lack of data on training injuries for women and junior participants, pointing to areas for future research.

Injury I Rugby league

King, D. A., et al. (2018). "Concussion incidence for two levels of senior amateur rugby league in New Zealand, 2008-2011." Sports Medicine Rehabilitation Journal 3(1): Article 1026.

Aim: To investigate the incidence, mechanisms, and assessment of concussion in senior amateur rugby league players in New Zealand from 2008 to 201123.

Key findings: 40 match-related and 7 training-related concussions were recorded over the study period4. Concussion incidence was higher for amateur representative players (37.2 per 1,000 match-hr) compared to amateur premier domestic players (16.1 per 1,000 match-hr). The tackle to the ball-carrier was the most common injury mechanism, with the ball carrier experiencing three times more concussions than the tackler. The fourth quarter of matches saw the highest incidence of concussions.

Practical implications: The study suggested a need for longitudinal research to understand recovery times and differences in recovery for players with recurrent concussions. It highlighted the importance of including symptom indices to better identify the distress experienced by concussed players. The findings indicated that concussion incidence is higher at the amateur level compared to professional rugby league, emphasizing the need for enhanced safety protocols and concussion management strategies at the amateur level.

Injury I Rugby league

King, D. A., et al. (2022). "Match and training injury incidence in rugby league: A systematic review, pooled analysis, and update on published studies." Journal of Sport and Health Science 4(2): 75-84.

Aim: To review and update pooled data estimates for rugby league injury epidemiology, adding information for different participation levels in match and training contexts.

Key findings: The study found a five-fold difference in injuries at the semi-professional level compared to professional and elite levels. Hookers recorded the highest injury incidence during matches. There was a notable increase in head-neck region injuries since the last analysis in 20146.

Injury incidence decreased in both halves of matches, with a three-fold decrease in the first half and a two-fold decrease in the second half.

Practical implications: Despite a decrease in overall injury incidence since 2014, the rise in head injuries and higher injury rates at the semi-professional level indicate a need for further injury prevention interventions. more accurate injury data can assist in developing targeted injury prevention programmes , especially for positions and participation levels with higher risks. The article emphasized the importance of continuous monitoring and updating of injury data to improve player safety and inform effective prevention strategies.

Injury I Rugby union

King, D. A., et al. (2018). "Injuries in a senior amateur rugby union team over two competition seasons resulted in a ratio of 1:5 witnessed to unwitnessed for concussions." New Zealand Journal of Sports Medicine 45(1): 22-33.

Aim: To identify the type, site, and rate of injuries in men's senior amateur rugby union matches, with a particular focus on concussion. A prospective observational cohort study was conducted on a men's senior amateur rugby union team (n=36 players in 2012 and 35 players in 2013) in New Zealand.

Key findings: An injury occurred every 17 minutes of match play, with a total of 203 injuries recorded over two seasons. Concussions were frequent, averaging one per match, most of which were unwitnessed. The ratio of witnessed to unwitnessed concussions was approximately 1:53. Most Injured Regions: The head/neck area was the most commonly injured, followed by the upper limb, lower limb, and chest/back/abdomen.

Practical implications: The high rate of unwitnessed concussions suggested that many occur without immediate signs, highlighting the need for post-match cognitive function testing. The findings underscored the importance of pre-season baseline testing and post-game assessments to better identify and manage concussions in amateur rugby.

Injury I Rugby league

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

Aim: To assess the magnitude of sports-related concussions in rugby league and evaluate the evidence for impact assessment tools.

Key findings: Rugby league had the highest percentage of sport code total costs and mean costs per ACC claim for concussion. Semi-professional players had nearly a two-fold greater concussion injury rate than professional players and a three-fold greater rate than amateur players. Instrumented patches recorded 1,977 impacts on 19 junior players and 13,895 impacts on 38 senior players, indicating high-magnitude impacts without witnessed concussive events.

Practical implications: Education on prevention, identification, and assessment of concussion was crucial for player and team management. Baseline and post-match assessment using the King-Devick test was recommended. Further studies were needed to determine cumulative impact loads and validate the use of accelerometer patches for concussion outcomes.

Injury I Rugby union

King, D. A., et al. (2020). "Concussion reporting and return to play over two years for an amateur women's rugby union team in New Zealand " Advances in Orthopedics and Sports Medicine 2020(4).

Aim: To assess concussion reporting and return to play practices over two years for an amateur women's rugby union team in New Zealand.

Key findings: Approximately 50.6% of players reported previous concussions, averaging 2.1 concussions per person. 84.3% of reported concussions were medically diagnosed, but only 68.7% were reported to team management. 26.5% of players experienced prolonged symptoms lasting more than 10 days, and 7.2% returned to the same game after a concussive event. A significant number of concussions were not medically assessed, and many players did not report their concussions to the coach.

Practical implications: There is need for improved education on concussion recognition and reporting among players and coaches. There was a necessity for more female-specific research to understand the true incidence of concussion and mechanisms for prolonged recovery. The study emphasized the importance of proper concussion management protocols to ensure player safety and long-term well-being. The study underscored the critical role of the player-coach relationship in encouraging safe behaviours and proper injury reporting. It suggested that current practices may underestimate the true incidence of concussions due to various factors such as lack of awareness, desire to continue playing, and external pressures. The study called for enhanced efforts to educate and support amateur women's rugby teams in New Zealand to improve concussion management and player safety.

Injury I Rugby union

King, D. A., et al. (2020). "Use of the King-Devick test for the identification of concussion in an amateur domestic women's rugby union team over two competition seasons in New Zealand." Journal of Neurological Sciences 418.

Aim: To evaluate the effectiveness of the K-D test for sideline concussion assessments in an amateur women's rugby team over two seasons.

Key findings: Post-injury K-D test scores were significantly slower than baseline scores, indicating concussions. The K-D test showed good-to-excellent reliability for baseline, post-injury, and post-season assessments.

Practical implications: The research suggested that any player with a slowed K-D test time post-injury should be withheld from further participation until evaluated by a medical professional. The study supported the K-D test as a reliable sideline assessment tool for concussion in women's rugby.

Injury I Rugby union

King, D., et al. (2019). "Match and training injuries in women's rugby union: A systematic review of published studies." Sports Medicine.

Aim: The systematic review aimed to describe the injury epidemiology for women's rugby-15s and rugby-7s in both match and training environments.

Key findings: The pooled incidence of injuries in women's rugby-15s was 19.6 per 1000 match-hours. Women's rugby-7s had a higher injury incidence, with a pooled rate of 62.5 per 1000 player-hours. The tackle was the most common cause of injury, with the ball carrier often being more susceptible. Concussions and sprains/strains were frequently reported, especially at the collegiate level.

Practical implications: women's rugby-7s results in a higher injury incidence compared to rugby-15s. The head/face was the most commonly reported injury site, indicating a need for improved safety measures. Future studies were recommended to further investigate injuries in women's rugby to enhance player safety and inform training practices.

Injury I Rugby union

King, D. A., et al. (2021). "Training injury incidence in amateur women's rugby union in New Zealand over two consecutive seasons." Journal of Science and Medicine in Sport 24: 544–548.

Aim: To describe the training injury incidence in amateur women's rugby union over two consecutive seasons. A total of 69 amateur women's rugby 15s team players were observed. Training exposure and training injury incidence were calculated.

Key findings: The study observed 69 players and recorded 38 training injuries, resulting in an injury incidence of 11.4 per 1,000 training hours. Time-loss injuries were reported at 3.6 per 1,000 training hours. Forwards experienced more injuries than backs, with the tackle being the most common cause of injury. Lower limb injuries were most frequent, particularly in the latter part of training sessions, and were mostly minor, causing minimal time away from training.

Practical implications: The injury incidence in amateur women's rugby union was higher than that reported for national and international competitions. There is a need for improved training protocols to prevent injuries, especially during the latter stages of training sessions and for players with less experience. The study highlighted the importance of warm-ups and skill development to reduce injury risks, particularly for new players and those transitioning from other sports or countries. This study provided valuable insights into the patterns and causes of injuries in amateur women's rugby, which can inform injury prevention strategies and training practices.

Injury I Rugby union

Quarrie, K., et al. (2017). "Facts and values: On the acceptability of risks in children's sport, using the example of rugby." British Journal of Sports Medicine 51: 1136–1141.

Aim: To explore the clash of values regarding injury risks in children's sports, using rugby as an example.

Key findings: The risks of rugby for children were not significantly higher compared to other sports. Factors influencing risk perception included familiarity, dread, and voluntary participation. Pre-existing values affected perspectives on what constitutes acceptable risk.

Practical implications: Better comparative data on injury risks across youth sports was needed. Stakeholders should balance advocacy with scientific objectivity when assessing risks. The debate on acceptable risk in rugby reflected broader values in sports injury prevention. The article emphasized the importance of evidence-based approaches to risk assessment and the influence of societal values on perceptions of risk in sports. It called for more research to inform debates on acceptable risks in children's sports.

Injury I Rugby union

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

Aim: To employ the KD test and SCAT2 for detecting both witnessed and unrecognized concussions in players resulting from match participation.

Key findings: The study found an average of 4.0±2.8 concussions per player over three years. A total of 22 concussive incidents were recorded during the competition, with 5 witnessed (11 per 1000 match hours) and 17 unrecognized (37 per 1000 match hours). The KD test was able to identify players with meaningful head injuries who did not show or report any signs or symptoms of concussion. The rate of reported concussions was significantly higher than previously reported rates, suggesting that many concussions in rugby union may go unrecognized.

Practical implications: The KD test proved to be a rapid and effective tool for sideline concussion assessment, suitable for use within the limited time frame available during matches. It could identify players with suspected concussions, including those that were not reported or witnessed, thus enhancing player safety. the KD test could be used by team management and medical personnel to quickly assess players for concussions, potentially reducing the risk of long-term brain injury from unaddressed concussive events. The study highlighted the importance of rapid concussion screening tools like the KD test in contact sports and calls for further research to explore the impacts of participation in rugby union. It emphasized the need for awareness and proper management of concussions to protect player health.

Injury I Rugby union

King, D. A., Gissane, C., Hume, P. A., & Flaws, M. (2015). The King–Devick test was useful in management of concussion in amateur rugby union and rugby league in New Zealand. Journal of the Neurological Sciences, 351(1–2), 58–64. https://doi.org/10.1016/j.jns.2015.02.035

Aim: To evaluate the effectiveness of the King–Devick (K–D) test in detecting concussions in amateur rugby union and rugby league players in New Zealand over a three-year period.

Key findings: There were 52 concussions recorded, with a higher rate of undetected (44 unwitnessed) compared to detected (8 witnessed) concussions. Players showed improvement in K–D test times between initial and subsequent tests, indicating a learning effect. Worsening K–D test times post-match were associated with reductions in the Standardised Assessment of Concussion (SAC) components.

Practical implications: The K–D test helped identify a significant number of concussions that were not clinically observable. The test provided rapid, objective results and was effective in monitoring cognitive impairment, suggesting its usefulness as part of a sideline concussion assessment toolkit. The findings supported the use of the K–D test alongside other tools like the SCAT3 for a comprehensive assessment of suspected concussions in contact sports.

Injury I Rugby union

King, D., et al. (2015). "Use of the King-Devick test for sideline concussion screening in junior rugby league." Journal of the Neurological Sciences 357(1-2): 75-79.

Aim: To evaluate the effectiveness of the King–Devick (K–D) test as a sideline concussion screening tool in junior rugby league players over a season.

Key findings: The K–D test showed high test-retest reliability and was able to identify seven medically confirmed concussions in players who exhibited more than a 3-second delay in their post-match K–D test times. Post-season testing indicated improvement in K–D times, suggesting a learning effect from repeated use of the test.

Practical implications: The K–D test proved to be a quick, easily administered tool that can be used on the sidelines to help identify players at risk of concussion. This facilitated timely medical assessment and contributed to safer sports participation for junior players. The study highlighted the importance of educating coaches, parents, and players about concussion signs and management.

Injury I Rugby union

King, D. A. (2015). Sports-related concussions in New Zealand amateur rugby union and league: Identification, assessment and impact forces involved [Doctoral dissertation, Auckland University of Technology]. AUT Open Repository. https://openrepositorystage.aut.ac.nz/items/a243b78e-6f60-487b-8b8f-b8c3c0d56fb9

Aim: The thesis aimed to examine sports-related concussions in New Zealand amateur rugby union and league by identifying, assessing, and analysing the impact forces involved in concussion incidents.

Key findings: Over ten years, 20,902 concussion claims were recorded, costing NZD 16,546,026. Rugby union had the most claims, while rugby league had the highest mean cost per claim.

In a survey of 213 amateur rugby league players, an average of 4 concussions per player was reported over two years, with only 8% medically assessed. The King-Devick (K-D) test identified 22 concussive incidents in a rugby union season, with 17 unrecognized during the game but confirmed post-match. Instrumented mouthguards recorded 20,687 impacts >10g in rugby union matches, averaging 95 impacts per player per match.

Practical implications: Highlighting the economic burden of concussions drove policy changes and funding for better management and prevention strategies. The need for consistent reporting thresholds for head impacts to enable better comparison across studies. The K-D test's effectiveness suggested it could be a valuable tool for non-medical personnel to identify concussions and remove players from play. Emphasizing the importance of medical assessment and proper return-to-play protocols to players and coaches to reduce the risk of long-term consequences.

Injury I Rugby union

Quarrie, K. L., et al. (2007). "Effect of nationwide injury prevention programme on serious spinal injuries in New Zealand rugby union." British Medical Journal 334: 1150-1153.

Aim: To evaluate the effectiveness of RugbySmart in decreasing the frequency of spinal cord injuries among rugby union players. From 2001, all New Zealand rugby coaches and referees have been required to complete RugbySmart, which focuses on educating rugby participants about physical conditioning, injury management, and safe techniques in the contact phases of rugby.

Key findings: The study observed a significant reduction in spinal injuries post-RugbySmart implementation, particularly those related to scrums. Only one scrum-related spinal injury was reported between 2001-2005, compared to the predicted nine, indicating a relative rate of 0.11. However, the rate of spinal injuries from other play phases (tackle, ruck, maul) did not show a clear decrease.

Practical implications: The introduction of the RugbySmart programme coincided with a reduction in the rate of disabling spinal injuries arising from scrums in rugby union. This study exemplifies the benefit of educational initiatives in injury prevention and the need for comprehensive injury surveillance systems for evaluating injury prevention initiatives in sport.

Injury I Rugby union

King, D., Hume, P. A., Hardaker, N., Cummins, C., Clark, T., Pearce, A. J., & Gissane, C. (2019). Female rugby union and rugby league injuries in New Zealand: A review of five years of Accident Compensation Corporation moderate to severe claims and costs. Journal of Science and Medicine in Sport, 22(5), 532–537. https://doi.org/10.1016/j.jsams.2018.10.015

Aim: To provide epidemiological data and related costs for moderate-to-serious injuries among women's rugby union players in New Zealand from 2013 to 20171.

Key findings: Over five years, there were 26,070 total claims, costing approximately $18.44 million. The 15–19-year age group had the highest number of claims and costs, with the knee being the most common injury site. 40% of the claims and 41% of the costs were attributed to this age group, with an average yearly cost of around $1.25 million for knee injuries alone.

Practical implications: The costs and claims for injuries have increased over the five-year period, exceeding the rate of inflation. It highlighted the need for modified versions of rugby for players over 35 to reduce injuries and suggests further research to develop sex-specific injury prevention strategies. The study emphasized the importance of medical care at all levels of participation to provide timely and appropriate first aid.

Injury I Surf lifesaving

Diewald, S., et al. (2019). Surf Lifesaving Injuries in New Zealand between 2009 to 2018 derived from the Surf Life Saving New Zealand Injury Reporting Database: Technical Report #2 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 20.

Aim: To identify injury sites, types, and mechanisms of IRB-related injuries occurring to surf lifesavers and reported to SLSNZ.

Key findings: An average of 28 IRB-related incidents were reported each season. Lower extremity injuries were most frequent, accounting for 51.8% of injuries. The most common injury types were unclear (34%) and lacerations (25.7%). The most reported injury mechanism was "landing" inside the IRB after going airborne while in the water.

Practical implications: Injury prevention initiatives should focus on high-frequency areas such as landings after becoming airborne. The mechanisms for lower extremity injuries need to be clearly identified. First aid kits should be adequately supplied to handle frequent lacerations. Staff first aid training should emphasize lower limb fracture, ankle sprain, and laceration treatment. SLSNZ should investigate reporting rates and member mindset surrounding incident reporting, as underreporting of injuries is suggested by the study's feedback. The study concluded that the SLSNZ injury database likely underestimates the number of injuries resulting from the use of IRBs during patrol and competition. It recommends providing fact sheets with key information on injury numbers and risk factors to inform decisions on injury prevention strategies.

Injury I Surf lifesaving

Diewald, S., et al. (2019). Recreational and competitive surf lifesaving injuries associated with inflatable rescue boats derived from an online survey of members: Technical report #3 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 29.

Aim: The research aimed to quantify the risk factors, aetiologies, and mechanisms of IRB-related injuries in surf lifesaving to prescribe injury prevention strategies.

Key findings: Younger females experienced more patrol injuries than older males. The lower back and ankle were the most frequently injured body sites, with sprains and strains being the most reported injury types. Landing in the IRB after being airborne was a significant cause of injuries. 15% of respondents reported chronic injuries as a long-term health effect of surf lifesaving participation.

Practical implications: The study suggested implementing age- and gender-specific strength training, warm-up protocols, and equipment changes to reduce acute and chronic soft tissue injuries. Current IRB crew member guidelines and strength requirements should be reassessed to ensure crew members can withstand the loads experienced during operation. A surf lifesaver task-relevant fitness battery should have been developed to assess the physical fitness level of surf lifesavers in New Zealand.

Injury I Surf lifesaving

Diewald, S., et al. (2019). Surf Life Saving Injuries in New Zealand between 2013 to 2017 derived from Accident Compensation Corporation Claims: Technical Report #4 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 37.

Aim: Technical Report #4 to Surf Life Saving New Zealand (SLSNZ)" aimed to quantify the nature and extent of injuries related to inflatable rescue boats (IRBs) as reported to the Accident Compensation Corporation (ACC) in order to develop injury prevention strategies.

Key findings: IRBs accounted for 63.3% of moderate-to-serious claims for surf lifesaving, costing ACC $875,585. The injury incidence from 2013 to 2017 was 103 per 1,000 surf lifesavers, averaging 0.41 IRB-related claims per day. Most frequently injured body sites were the lower back (20/1000) and ankle (14/1000). Landing in the IRB was reported as the most common cause of injuries.

Practical implications: The study suggested targeted injury prevention strategies should focus on minimizing the number and effects of landings in IRBs. Age and gender-specific injury prevention strategies are recommended due to the higher incidence of injury among younger females and older males. Future research should evaluate current techniques and consider strength intervention strategies to prevent IRB-related injuries. The study concluded that the incidence of surf lifesaving IRB-related injuries is high and emphasized the need for research and strategies to reduce the number and impact of landings, which are a significant cause of injuries. The findings highlight the importance of considering age and gender when developing injury prevention strategies and suggest that technique modifications and strength interventions may be effective in reducing injuries.

Injury I Surf lifesaving

Diewald, S., et al. (2019). An overview of the issues for recreational and competitive surf lifesaving injuries associated with inflatable rescue boats: Technical report #6 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 13.

Aim: The research aimed to identify the key injury issues for New Zealand surf lifesavers related to IRB use, based on a literature review, injury data analysis, and surveys.

Key findings: There was high incidence of lower extremity injuries, particularly to the right limb of crew members, suggesting an issue with foot strap design. Landing after aerial movements in IRBs was a frequent cause of injury. Chronic injuries were reported by 15% of survey respondents as a long-term health effect of surf lifesaving participation.

Practical implications: Recommendations included developing a communication plan to disseminate key messages from the findings to SLSNZ members. Suggested improvements to injury and participation reporting systems. Proposed interventions co-designed with user groups to address the identified issues, such as equipment design changes and occupational fitness standards.

Injuries I Surf lifesaving

Diewald, S., et al. (2019). Recreational and competitive surf lifesaving injuries associated with inflatable rescue boats derived from a systematic literature review: Technical report #1 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 26.

Aim: To investigate the factors influencing injuries related to IRB operations in surf lifesaving and establish priorities for countermeasure interventions.

Key findings: There was High incidence of lower limb injuries, particularly to the right limb of crew members, suggesting issues with foot strap design. Injuries often occurred during navigation in surf and landing after aerial movements. Variability in injury susceptibility between patrol duties and competition use of IRBs, as well as between crew members and drivers.

Practical implications: Future injury recordings should focus on acute and chronic lower back injuries, promoting prevention strategies and training programmes to strengthen lower limbs, trunk, and hip musculature. Further research is needed to quantify injury incidence rates in surf lifesaving and understand injury mechanisms. Recommendations included making foot strap locations adjustable for different body dimensions and standardizing comfortable straps across New Zealand. Increasing the frequency of weather reports and educational programmes for beginners

on interpreting weather and wave conditions to adjust accordingly. Implementing injury prevention strategies such as strength training, technique modifications, and equipment design changes could benefit Surf Life Saving New Zealand (SLSNZ).

Injury I General

Hopkins, W. G., Marshall, S. W., Quarrie, K. L., & Hume, P. A. (2007, 05). Risk factors and risk statistics for sports injuries. Clinical Journal of Sport Medicine, 17(3), 208-210. http://articles.sirc.ca/search.cfm?id=S-1052552

Aim: To introduce clinicians to various risk statistics used in evaluating sports injuries, explaining their practical application and meaning.

Key findings: The various measures of injury incidence are injury risk (proportion of athletes injured in a given period of training, playing, or other exposure time), injury rate (number of injuries per unit of exposure time), odds of injury (probability injury will happen divided by probability injury will not happen), injury hazard (instantaneous proportion injured per unit of time or mean injury count per unit of time), and mean time or mean number of playing exposures to injury. Effects of risk factors are estimated as values of effect statistics representing differences or ratios of one or more of these measures between groups defined by the risk factor. Values of some ratios and their sampling uncertainty (confidence limits) are estimated with specialized procedures: odds ratios with logistic regression, rate ratios with Poisson regression, and hazard ratios with proportional hazards (Cox) regression. Injury risks and mean time to injury in each group can be estimated and can give a better sense of the effect of a risk factor. Risk factors identified in nonexperimental cohort and case-control studies are not always causes of injury; data from randomized controlled trials provide stronger evidence of causality

Practical implications: Understanding these risk statistics helped clinicians make better use of sports injury studies. The paper emphasized the importance of expressing risk statistics in meaningful numbers and considering the uncertainty in estimates before determining the significance of risk factors. The article cautioned against assuming that identified risk factors were direct causes of injury without evidence from controlled trials. It concluded by stressing the need for clear communication of risk magnitudes and uncertainties to aid in injury prevention programmes.

Injury I General

King, D. A., Hume, P. A., & Tommerdahl, M. (2018). Use of the Brain-Gauge somatosensory assessment for monitoring recovery from concussion: A case study. Journal of Physiotherapy Research, 2(1), 13. https://www.imedpub.com/articles/use-of-the-braingauge-somatosensory-assessment-for-monitoring-recovery-from-concussion-a-case-study.php?aid=21757

Aim: To evaluate the effectiveness of the Brain-Gauge Somatosensory Assessment in monitoring an individual's recovery from a concussion.

Key findings: Ms. 'K' exhibited symptoms and somatosensory deficits post-concussion, which were assessed using the Brain-Gauge system. The assessments showed improvements in reaction time, fatigue, amplitude discrimination sequential score, temporal order judgment, and duration discrimination over time. The Brain-Gauge metrics provided a visual representation of Ms. 'K's recovery progress, indicating a return to normal somatosensory function.

Practical implications: The Brain-Gauge Somatosensory Assessment proved sensitive to the degree of recovery and the diversity of symptoms from a concussive injury. It served as a useful tool for monitoring physiological recovery, offering rapid visual identification of recovery status. The study suggested the potential for the Brain Gauge to be utilized for individual assessments of concussion recovery, warranting further research.

Injury I General

King, D., et al. (2019). "Traumatic brain injuries in New Zealand: National Insurance (Accident Compensation Corporation) claims from 2012 to 2016." Journal Neurological Science 399: 61–68.

Aim: To provide epidemiological data and related costs to New Zealand's national health insurance scheme for TBIs.

Key findings: There were 97,955 TBI claims costing $1,450,643,6673. Falls accounted for nearly half of the moderate claims. Motor vehicle accidents (MVAs) had the highest costs for moderate-to-serious (MSC) and severe TBI claims. The incidence of total TBI was 432 per 100,000 population, and 155 per 100,000 for MSC TBI claims.

Practical implications: The study highlighted the need for further research into the assessment and management of TBIs, especially in cases of falls, assaults, and MVAs. It suggested a paucity of studies on the longitudinal effects of TBIs outside of sports-related incidents. The findings indicated a significant financial burden on the national health insurance system due to TBIs. The article emphasized the importance of addressing TBIs in public health policies and called for more comprehensive research into their long-term effects.

Injury I General

King, D., et al. (2019). "Effect of selective head-neck cooling on signs and symptoms of sport originated brain injury in amateur sports: A pilot study." Biomed J Sci & Tech Res 21(4): 16062-16070.

Aim: To investigate the impact of a portable head-neck cooling cap on individuals with SOBI and to observe changes in signs and symptoms post-cooling compared to a control group without cooling. Thirty-five players with an identified SOBI were offered use of a head-neck cooling cap. Following assessment with the Concussion Symptom Scale (CSS) 13 players selected to rest and 22 players selected to wear the cooling cap for up to 30 minutes following the SOBI. Post CSS assessments were made following the rest or cooling cap period.

Key findings: Participants who used the cooling cap showed a significant reduction in the total symptom score and severity of the Concussion Symptom Scale (CSS) compared to those who rested without cooling. This suggested that the cooling cap may help in managing SOBI symptoms.

Practical implications: The findings indicated that short-term, selective head-neck cooling could be an effective strategy for the acute management of SOBI symptoms. However, further research is needed to explore the underlying mechanisms, optimal duration, and long-term effects of this cooling method. The study highlighted the potential of using cooling as part of the management for brain injuries sustained during sports activities, offering a non-invasive and immediate way to alleviate symptoms.

Injury I General

Reid, D., Hume, P. A., Theadom, A., Whatman, C., & Walters, S.. (2017). Knowledge and attitudes (KA) surveys on concussion in sport. Report to Accident Compensation Corporation. SPRINZ. Auckland, Auckland University of Technology: 12.4

Aim: The research aimed to assess the current state of knowledge and attitudes towards concussion management among rugby referees following the implementation of the ACC Sports Concussion Guidelines.

Key findings: the referees were generally knowledgeable about concussions and exhibited positive attitudes towards proper management. However, gaps in understanding specific symptoms like amnesia and the impact of cognitive activities post-concussion were noted. Additionally, confusion regarding the appropriate timeframe for returning to sport after a concussion was observed.

Practical implications: There is a need for further education on less obvious concussion symptoms, the effects of cognitive exertion on recovery, and clear guidelines for return-to-play protocols. The study recommended ongoing education programmes to maintain high levels of knowledge among referees and to measure the impact of the ACC Concussion Guidelines and the Blue Card initiative.

Injury I General

Reid, D., Hume, P. A., Theadom, A., Whatman, C., & Walters, S. (2018). Knowledge and attitudes (KA) surveys on concussion in sport: Parents September 2017 Survey. Third report to Accident Compensation Corporation. SPRINZ. Auckland, Auckland University of Technology: 11.

Aim: To assess the current knowledge and attitudes (KA) of parents regarding sports-related concussion, following the release of the 'Sports Concussion in New Zealand ACC National Guideline' in 2014. It focused on parents of secondary school students involved in key team sports.

Key findings: The survey revealed that parents had some knowledge of concussion and positive attitudes towards its management. However, gaps were identified in their ability to recognize key symptoms and safe return-to-play timeframes. Most parents received information from medical professionals and schools, with only a small percentage recognizing ACC as a source of information.

Practical implications: There is a need for further education of parents to improve understanding of concussion symptoms, onset times, management, and the impacts of multiple concussions. Recommendations included simplifying medical terms, educating on delayed symptom onset, and emphasizing the importance of cognitive rest post-concussion. The study concluded that while parents show moderate levels of knowledge and positive attitudes, there was a clear need for ongoing education programmes to address knowledge gaps and improve concussion management awareness.

Injury I General

Reid, D., Stuart, C., Fulcher, M., Hume, P. A., Theadom, A., Whatman, C., & Walters, S. (2018). Knowledge and attitudes (KA) surveys on concussion in sport: Doctor September 2017 Survey. Report #4 to Accident Compensation Corporation (ACC). SPRINZ. Auckland, Auckland University of Technology: 15.

Aim: To assess current knowledge and attitudes of GPs towards concussion in sports and identify if further educational interventions are needed.

Key findings: Most GPs had good knowledge of sports-related concussion but lacked confidence in management, especially regarding return-to-sport timeframes. There was limited use of the SCAT-3 or SCAT-5 tool and low awareness of the Consensus Statement on Concussion in Sport were noted. The study highlighted the need for greater education on management, return-to-sport decision-making, and the use of the SCAT tool.

Practical implications: Recommended increased education for doctors on the use of the SCAT tool and overall management of sports-related concussion. Suggested dissemination of knowledge through GP CME Conferences and Best Practice publications. Proposed consideration of funding the SCAT assessment to ensure thorough and fair remuneration for practices. The study concluded that while there is a good understanding of medical management among GPs, there was a need to boost confidence and knowledge in certain areas to improve sports-related concussion outcomes.

Injury I General

Reid, D., Hume, P. A., Theadom, A., Whatman, C., Walters, S., & Fulcher, M. (2019). Knowledge attitudes and behaviours (KAB) surveys on concussion in sport: Physiotherapists December 2018 Survey. Report # 6 to Accident Compensation Corporation, Auckland University of Technology: 16.

Aim: To assess the KAB of New Zealand physiotherapists towards SRC after the release of the 'Sports Concussion in New Zealand ACC National Guideline' in 2014. It was the first survey of its kind targeting the NZ physiotherapy profession.

Key findings: The survey revealed that physiotherapists possess strong knowledge about concussion, recognize key signs and symptoms accurately, and show positive attitudes towards proper management of SRC. They expressed a desire to be more involved in sideline management and testing, and advocate for a multidisciplinary approach to return-to-play decisions.

Practical implications: Physiotherapists could play a greater role in educating players about symptom recognition and management of SRC. It recommended fostering a multidisciplinary environment for managing return-to-play strategies and reevaluating the scope of physiotherapy practice in decision-making around SRC management and return-to-play protocols. Additionally, it proposed conducting a KAB survey of strength and conditioning practitioners, who are often involved in return-to-play decisions. The study emphasized the need for improved education on concussion among players and suggests that

physiotherapists, with their expertise, could significantly contribute to this area. It highlighted the potential benefits of involving physiotherapists and other practitioners in a collaborative approach to managing SRC, which could lead to better outcomes for athletes.

Injury I General

Reid, D., Hume, P. A., Theadom, A., Whatman, C., & Walters, S. R. (2019). ACC/AUT KAB Sports Concussion Study: Year 2 report to ACC. Auckland, Sport Performance Research Institute New Zealand: 7.

Aim: To survey secondary school students, coaches, parents, referees, medical practitioners' and equestrian riders to understand their current knowledge and attitudes towards the concussion management before and after the introduction of the ACC guidelines and social media campaign.

Key findings: A total of 3,043 participants completed the surveys. The study found varying levels of knowledge and attitudes across different groups. Recommendations were made for each group to improve education on concussion symptoms, management, and prevention.

Practical implications: Education programmes need to be continued and targeted to address gaps in knowledge, particularly regarding symptoms, the use of headgear, and cognitive rest post-concussion. Sports clubs and schools should play an active role in concussion education. The effectiveness of ACC's concussion strategies should be measured over time to assess impact. It is important to have ongoing education and awareness to enhance the safety and well-being of athletes across all levels of sport. There is a need for clear and accessible information on concussion management protocols to ensure proper care and prevention of long-term effects.

Injury I General

Costa-Scorse, B. and P. A. Hume (2007). Outdoor First Aid Rebuild Stage I: Combined analysis of instructor surveys and participants surveys. A technical report for the New Zealand Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 31.

Aim: The New Zealand Mountain Safety Council (MSC) aimed to analyse external threats and opportunities for the Outdoor First Aid (OFA) programme, and develop a resource platform to inform MSC's decisions for future growth.

Key findings: The OFA programme was not attracting enough participants to meet its goals. There were serious quality assurance issues identified in the OFA programme. The curriculum was overloaded with theory, leaving insufficient time for practical skills. There was a lack of consistency in teaching methods and instructor qualifications.

Practical implications: Rebuild the OFA programme into a two-tier model with fundamentals and wilderness courses. Emphasize outdoor, scenario-based learning over indoor theory. Develop standardized, professional resources for both participants and instructors. Establish a competency matrix and train-the-trainer programme to ensure quality teaching. Aim to increase OFA training participation from 1,108 in 2007 to 5,000 by 2009. These changes aimed to enhance the effectiveness, consistency, and reach of the OFA programme, ensuring it meets the needs of outdoor enthusiasts and aligns with MSC's mission of promoting safe outdoor recreation.

Injury I General

Costa-Scorse, B. and P. A. Hume (2008). Outdoor First Aid Rebuild Phase II Technical Report for the New Zealand Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, AUT University: 12.

Aim: The project aimed to rebuild the Outdoor First Aid (OFA) programme to ensure it meets current best practices in emergency medicine and adult education principles. The goal was to create a competent OFA graduate and ensure the program's sustainability and growth.

Key findings: A trial of the OFA Essentials course at AUT University proved effective, with positive feedback from students and instructors. The trial highlighted the importance of scenario-based learning. The project developed various resources, including a course guidebook, student workbook, and scenario cards. The focus was on creating practical, scenario-based learning materials. Student feedback indicated high satisfaction with skill sessions and scenarios, though more time for practice was suggested. The evaluation identified areas for improvement in teaching materials and methods.

Practical implications: The scenario-based pedagogy and practical skill sessions were effective in preparing students for real-life emergencies. The creation of comprehensive teaching and student resources ensureD consistency and quality in OFA education. The focus on developing a sustainable staffing model and business sense ensured the long-term viability of the OFA programme.

Injury I General

Costa-Scorse, B., et al. (2009). Outdoor First Aid Essentials - Course guidebook for instructors. A Technical Report for NZ Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 110.

Aim: The guidebook aimed to educate outdoor first aiders to respond effectively to common emergencies, with skills applicable outdoors, at home, and in the workplace.

Key findings: Graduates would be able to assess risks, provide pre-hospital treatment, and communicate effectively in emergency situations. The course included patient assessment, skill stations for practical skills like CPR, and various scenarios for hands-on experience. Participants must perform CPR, manage trauma scenarios, and pass a multi-choice test to complete the course.

Practical implications: Regular refresher courses were necessary to maintain first aid skills, especially for workplace first aiders and healthcare professionals. OFA Wilderness was an advanced course that builds on OFA Essentials, covering complex outdoor first aid situations and leadership skills.

Injury I General

Costa-Scorse, B. and P. A. Hume (2007). Outdoor First Aid Rebuild Stage I: Combined analysis of instructor surveys and participants surveys. A technical report for the New Zealand Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 31.

Aim: The New Zealand Mountain Safety Council (MSC) aimed to: analyse external threats to the continuance and opportunities for growth of the Outdoor First Aid (OFA) programme. Develop a resource platform to inform MSC's decisions on the best way forward.

Key findings: The OFA programme was not attracting enough participants to meet its goals. There were serious quality assurance issues identified in the OFA programme. The course was overloaded with theory, leading to a lack of balance and insufficient practical training. There was a lack of consistency in teaching methods and instructor qualifications.

Practical implications: to have developed a two-tier model with OFA fundamentals and OFA wilderness courses. To have ensured the curriculum is based on MSC's philosophy of safe outdoor recreation and current adult teaching principles. To offer courses close to population centres and in remote settings to increase participation. Developed standardized professional resources for participants and instructors. Established a competency matrix and a train-the-trainer programme to ensure quality teaching. Enhanced the professional image of MSC with appropriate branding and uniforms for instructors.

Injury I General

Costa-Scorse, B., et al. (2009). Outdoor First Aid Essentials - Participant workbook. A Technical Report for NZ Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 65.

Aim: The "Outdoor First Aid Essentials" course aimed to educate first aiders to respond correctly to common outdoor first aid problems and emergencies. It provided a basic qualification for first aid in outdoor settings, with skills transferable to home and workplace environments.

Key findings: Participants learnt to identify hazards and reduce risks to prevent further harm. The course covered primary and secondary surveys, vital signs, and history gathering using the SAMPLE method. Practical exercises included wound management, burns, bandaging, splinting, CPR, and positioning. Real-life scenarios helped participants practice and integrate their skills.

Practical implications: The first aid skills gained were applicable in various settings, including home, sports fields, roadsides, and workplaces. Successful completion awarded participants with a New Zealand Mountain Safety Council Outdoor First Aid Essentials certificate and NZQA first aid unit standards. The course prepared individuals to handle emergencies effectively, ensuring better outcomes for patients in outdoor environments.

Injury I General

Costa-Scorse, B. and P. A. Hume (2010). NZ snow safety ski binding standards, education and testing project: Critique of the National Incident Database data parameters (Ski patrol), Sport Performance Research Institute New Zealand, Auckland University of Technology: 11.

Aim: To analyse and critique the 2009 National Incident Database ski patrol (NID-ski) data parameters, form layout, and guidelines. It sought to identify additional data collection requirements for the NZ snow safety ski binding standards, education, and testing project.

Key findings: The review recommended several changes to improve the NID-ski data collection and reporting process. These included aligning severity codes with standard emergency services coding, reordering injury codes anatomically, defining ambiguous terms, and providing more detailed information on incidents, such as lift accidents and injury mechanics.

Practical implications: Implementing the suggested changes could have enhanced the quality and utility of the NID-ski data. This would better inform the NZ Snow Safety Group's injury prevention initiatives and provide more specific injury trends. The report emphasized the need for comprehensive annual analysis and participation of all ski-fields in data entry to maximize the benefits of a national database for injury prevention. Additionally, it highlighted the importance of including ski equipment and binding release characteristics in data collection to target national campaigns and identify causative factors for injuries.

Injury I General

Costa-Scorse, B., et al. (2009). Outdoor First Aid Essentials - Course guidebook for instructors. A Technical Report for NZ Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 110.

Aim: The course aimed to educate first aiders to respond correctly to common outdoor first aid problems and emergencies, with skills transferable to home and workplace settings.

Key Content: It covered a wide range of topics, including patient assessment, wound management, CPR, and handling medical emergencies like allergic reactions, asthma, seizures, strokes, heart attacks, diabetes, hypothermia, and poisoning.

Practical implications: Instructors are equipped with the knowledge to teach structured lectures, supervise activities for skill application, and assess participants' abilities to manage outdoor first aid problems effectively. The guide emphasized experiential learning through scenarios, ensuring participants can problem-solve, adapt, and communicate effectively in emergency situations.

Injury I General

Costa-Scorse, B., et al. (2009). Outdoor First Aid Essentials - Participant workbook. A Technical Report for NZ Mountain Safety Council. Auckland, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 65.

Aim: The course aimed to educate individuals to respond correctly to common outdoor first aid problems and emergencies. It was designed as a basic outdoor first aid qualification, enhancing skills that are applicable in everyday environments.

Key Components: The workbook covered a range of topics, including hazard identification, primary and secondary surveys, vital signs, patient assessment, and various skill stations for practical first aid applications like wound management, burns, bandaging, splinting, and CPR.

Practical implications: Graduates of the course will be able to identify hazards, assess patients systematically, support vital functions, adapt to various first aid situations, provide pre-hospital treatment, and effectively communicate with patients and emergency services. The workbook is structured to facilitate experiential learning through discussions, skill stations, and role-playing scenarios, ensuring participants can apply first aid knowledge in real-life situations. It prepares them for assessment and certification in first aid unit standards recognized by the New Zealand Qualifications Authority (NZQA).

Injuries I General

Hume, P. A., et al. (2006). "Epicondylar injury in sport: Epidemiology, type, mechanisms, assessment, management and prevention." Sports Medicine 36(2): 151-170.

Aim: The paper aimed to provide a comprehensive review of epicondylar injuries, particularly those related to sports activities. It discussed the types of injuries, their causes, diagnostic methods, treatment options, and preventive measures.

Key findings: Epicondylar injuries were frequent in sports with repetitive arm actions, with lateral injuries being more common than medial ones. A variety of tools and tests were used to diagnose these injuries accurately, including MRI and CT arthrograms. Management strategies included conservative treatments like NSAIDs and R.I.C.E. (Rest, Ice, Compression, Elevation), as well as surgical options for severe cases.

Practical implications: Proper technique, equipment, and strength training are important to prevent epicondylar injuries. It highlighted the need for a tailored rehabilitation programme that progresses based on the reduction of inflammation and improvement in range of motion and strength. The article is a resource for medical practitioners, coaches, and athletes to understand, treat, and prevent elbow injuries in sport.

Injuries I General

Cuthbertson-Moon, M., et al. (2024). "Gym and fitness injuries amongst those aged 16–64 in New Zealand: Analysis of ten years of Accident Compensation Corporation injury claim data." Sports Med - Open.

Aim: To offer epidemiological data on minor and moderate-to-serious injury claims related to gym and fitness activities among individuals aged 16–64 in New Zealand. This data is intended to guide the creation of an injury prevention programme.

Key findings: Over a ten-year period, there were 345,254 injury claims, costing NZ$241,298,275 in treatment charges. Soft tissue injuries were the most common, accounting for 96% of all claims and 88% of the total charges. The primary causes of injury were strenuous movement with lifting (47%), without lifting (25%), impact/contact with an object (12%), and impact/contact with the ground (8%). The most frequently injured body sites were the lower back/spine, shoulder, knee, and neck/back of head, which accounted for 63-65% of injuries in both males and females. The age group most at risk were those between 21 to 30 years old.

Practical implications: The most common cause of injury from gym and fitness activities was lifting/carrying/strain, resulting in lower back/spine and shoulder soft tissue injuries. By focusing on these common injuries and the at-risk age group, an injury prevention programme could potentially reduce the burden of gym and fitness-related injuries. There is need for collaboration between gyms and the Accident Compensation Corporation (ACC) to establish gym participation data, which would aid in calculating injury risk and informing future prevention strategies.

Injuries I Other

Chalmers, D. J., et al. (1994). "Trampolines in New Zealand: A decade of injuries." British Journal of Sports Medicine 28(4): 234-238.

Aim: To provide a comprehensive analysis of trampoline-related injuries that resulted in hospitalization in New Zealand, aiming to inform safety standards and preventive measures.

Key findings: A significant increase in hospitalizations due to trampoline injuries was observed, from 3.1 per 100,000 population in 1979 to 9.3 in 1988.The majority of injuries occurred at home (71%) and were due to falls from the trampoline (80%). Fractures were the most common injury (68%), predominantly affecting the upper limb (53%). There was no evidence of a high incidence of severe head and neck injuries.

Practical implications: while trampolines should not be banned, they should not be treated as casual play equipment due to the potential risks. Recommendations included the use of trampolines under expert instruction or supervision, especially for disabled children, and the implementation of safety measures to prevent falls and reduce injury impact. The findings support the modification of safety standards to address the risks identified, emphasizing the need for impact-absorbing surfaces around trampolines and proper supervision. The study underscored the importance of safety and supervision to prevent injuries and ensure the safe enjoyment of trampolines as a recreational activity.

REHABILITATION

Rehabilitation I General

Hing, W., et al. (2005). Management of acute ankle sprain. Progress report # 1 to ACC. Auckland, Faculty of Health and Environmental Sciences, AUT University: 25.

Aim: To determine whether physiotherapy treatment is more effective than standard general advice (Rest, Ice, Compression, and Elevation - R.I.C.E.) in improving recovery time for acute ankle sprains. The goal was to facilitate a faster return to normal activities and reduce costs for public and private insurers.

Key findings: 14 participants had been randomly allocated to either the control group (RICE) or the physiotherapy group. The study aimed for 60 participants in total. The physiotherapy group received 30 minutes of standard treatment over two weeks, plus RICE advice, while the control group receives only RICE advice. Physical examination, ankle volume measurement, range of motion, clinical measures, pain scale, and compliance questionnaire were used for assessment. Technical report on the reliability of water displacement tank volumetric measurement of ankle volume had been completed. Two literature reviews on physiotherapy management and RICE principles were underway.

Practical implications: Effective physiotherapy treatment potentially reduced recovery time, allowing individuals to return to work and sports activities sooner. Faster recovery lea to reduced costs for insurers by minimizing the duration and extent of medical care required. The study provided evidence to support the use of physiotherapy in managing acute ankle sprains, which informed clinical practices and treatment protocols.

Rehabilitation I General

Hing, W., et al. (2006). Physiotherapy management of acute ankle sprain. Progress report # 2 to ACC. Auckland, Faculty of Health and Environmental Sciences, AUT University: 42.

Aim: To determine if physiotherapy combined with standard first aid (RICE: Rest, Ice, Compression, Elevation) reduces pain, swelling, and functional problems in acute ankle injuries more effectively than RICE alone. The goal was to facilitate a faster return to normal activities and reduce costs for insurers.

Key findings: Recruitment was slower than anticipated, with 24 out of the required 30 participants completed by May 2006. There was a significant reduction in pain for the physiotherapy group compared to the RICE group from Day 1 to Day 24. There was no significant difference in swelling reduction between the two groups. Compliance with the RICE protocol was generally good, with no significant difference between the groups.

Practical implications: Physiotherapy, in addition to RICE, significantly reduced pain in acute ankle sprains, potentially leading to faster recovery. Future studies should have considered potential recruitment challenges and plan accordingly. The water volumetry method used for measuring ankle swelling was found to be highly reliable, making it a useful tool for both clinical and research settings.

Rehabilitation I General

Hing, W., et al. (2007). A comparison of physiotherapy and RICE self treatment advice for early management of ankle sprains. A technical report for Accident Compensation Corporation. Wellington, AUT University: 34.

Aim: To determine if physiotherapy combined with standard first aid (RICE: Rest, Ice, Compression, Elevation) reduces pain, swelling, and functional problems in acute ankle injuries more effectively than RICE alone. The goal was to facilitate a faster return to normal activities and reduce costs for insurers.

Key findings: Recruitment was slower than anticipated, with 24 out of the required 30 participants completed by May 2006. There was a significant reduction in pain for the physiotherapy group compared to the RICE group from Day 1 to Day 24. No significant difference in swelling reduction between the two groups. Compliance with the RICE protocol was generally good, with no significant difference between the groups.

Practical implications: Physiotherapy, in addition to RICE, significantly reduced pain in acute ankle sprains, potentially leading to faster recovery. Future studies should consider potential recruitment challenges and plan accordingly. The water volumetry method used for measuring ankle swelling was found to be highly reliable, making it a useful tool for both clinical and research settings.

Rehabilitation I General

Cheung, K., Hume, P. A., & Maxwell, L. (2003). Delayed onset muscle soreness: Treatment strategies and performance factors. Sports Medicine, 33(2), 145–164. https://doi.org/10.2165/00007256-200333020-0000

Aim: To explore the mechanisms behind Delayed Onset Muscle Soreness (DOMS), its impact on athletic performance, and the effectiveness of various treatment strategies.

Key findings: DOMS is likely caused by a combination of factors, including muscle damage, inflammation, and connective tissue damage. DOMS can reduce joint range of motion, shock attenuation, and peak torque, affecting athletic performance. Treatments like cryotherapy, stretching, and anti-inflammatory drugs show varying results, with exercise being the most effective for pain relief.

Practical implications: Gradual introduction of eccentric exercises or novel activities over 1-2 weeks can reduce DOMS severity. Athletes should consider reducing exercise intensity and duration for 1-2 days following intense DOMS-inducing exercise or focus on less affected body parts to allow recovery. There was a need for further research to fully understand DOMS and develop effective prevention and management strategies.

POPULATIONS

Populations I General

Hardaker, N., et al. (2018). AUT ACC SportSmart-9 Review Project Appendix C: The effect of sex differences on injury risk and recovery in recreational and elite athletes in various study designs: A systematic review. A technical report to ACC. ACC SportSmart-9 Review. P. A. Hume. Auckland, SPRINZ, Auckland University of Technology: 22.

Aims: To determine the impact of sex differences on sports-related injury rates and recovery among recreational and elite athletes.

Key findings: The evidence for sex differences in overall injury risk was mixed, influenced by factors like study design and definitions of injury. Females in low-contact sports had higher overall injury rates and were more prone to overuse injuries. Females showed a greater risk of Anterior Cruciate Ligament (ACL) injuries and Sports Related Concussion (SRC), with a longer recovery period for SRC.

Practical implications: There was a need for sex-specific return-to-play protocols, particularly after concussions. More research to understand the protracted recovery in females from SRC and the effects of neuromuscular warm-up during the menstrual cycle was needed. Recommendations for naturally cycling female athletes to track their menstrual cycles for better injury prevention and training adaptation were needed. There was necessity for tailored approaches in sports medicine that account for sex differences in injury risk and recovery. It was important to consider these differences when developing injury prevention strategies and rehabilitation protocols.

Populations I General

Hardaker, N., et al. (2024). "Differences in injury profiles between female and male athletes across the participant classification framework: A systematic review and meta-analysis." Sports Medicine: 71.

Aim: To identify where differences in injury profiles are most apparent between the sexes across the six-tiered participant classification framework.

Key findings: Female athletes had a greater risk of knee injuries with a relative risk (RR) of 2.72.

Females had higher incidences of foot/ankle injuries (RR 1.25) and bone stress injuries (RR 3.4). Female athletes were significantly more likely to sustain sports-related concussions (RR 8.46) compared to males. Male athletes were at increased risk for hip/groin (RR 2.26) and hamstring injuries (RR 2.4). Males were more likely to sustain acute fractures, with the highest risk occurring during competition.

Practical implications: The propensity for bone stress injuries in female athletes highlights the need for developing optimal bone health during adolescence and addressing energy availability. Introducing neuromuscular training programmes early on and modifying skill development could reduce lower limb injury risks in females. For male athletes, key components of neuromuscular training programmes could be beneficial in reducing the risk of hip/groin and hamstring injuries. There may be a need for sex-specific prevention and return-to-sport protocols for sports-related concussion, particularly in female athletes.

Susceptibility and risk to different injuries varied between men and women, therefore, development of injury prevention programmes with a sex specific focus could be beneficial.

Populations I General

Hardaker, N., et al. (2024). "Female RNA Concussion (FeRNAC) study protocol: Assessing Hormone Profiles and Salivary RNA Prospectively for Females with Confirmed Concussion by Emergency Departments in New Zealand." BMC Neurology 24(149): 9. https://doi.org/https://bmcneurol.biomedcentral.com/articles/10.1186/s12883-024-03653-9

Aim: The FeRNAC Study Protocol aimed to investigate the presence of salivary short non-coding Ribonucleic Acids (sncRNAs) in females with concussion and explore how hormone profiles and salivary hormone levels influence sncRNAs, symptom severity, and recovery outcomes. This prospective cohort study recruits participants from New Zealand ED who are biologically female, of reproductive age (16-50 years) and with a diagnosis of concussion/mTBI from ED consulting healthcare professionals.

Key findings: As of August 2023, 14 women had been recruited for the study, which faced interruptions due to COVID-19 but resumed in January 2023. Data collection was ongoing, with completion expected by December 2023 and results by mid-2024.

Practical implications: If sncRNAs are confirmed in saliva samples from females with concussion, it could establish saliva sampling as an objective diagnostic tool for concussion and recovery confirmation. The study assessed if steroid hormones influence sncRNA expression, which could make salivary sncRNAs a reliable clinical tool for females with concussion. The study was significant as it focused on female-specific research, considering the impact of fluctuating sex hormones on concussion and recovery. It was designed to refine protocols for use in emergency departments, potentially enhancing clinical practice.

Populations I General

Wyatt, H. E., et al. (2024). "Prevalence and risk factors for musculoskeletal pain when running during pregnancy: A survey of 3102 women." Sports Medicine: 10.

Aim: To investigate prevalence and risk factors for musculoskeletal pain experienced by women when running during pregnancy.

Key findings: A survey of 3,102 women of 23 ethnicities from 25 countries, 22 to 52 years old when they gave birth, who ran 5-43 km/week for 3-15 years pre-birth, revealed that 86% experienced pain while running during pregnancy, primarily in the pelvis/sacroiliac joint, lower back, abdomen, breast, and hip. Risk factors included previous injury and older maternal age. Running frequency and distance decreased as pregnancy progressed.

Practical implications: Health care practices to support women to run pain-free throughout pregnancy should focus on regions of greatest musculoskeletal change during pregnancy, specifically the pelvis, abdomen, and lower back. Efforts should address pain at the pelvis and breasts, which were significant barriers to running during pregnancy. The study provided valuable insights for healthcare providers to develop educational resources and interventions that enable pregnant women to maintain physical activity safely.

Populations I General

Whatman, C., et al. (2017). AUT ACC SportSmart-9 Review Project Appendix E: The association between specialization and load with injury in youth athletes in various study designs: A systematic review. A technical report to ACC. ACC SportSmart-9 Review. P. A. Hume. Auckland, SPRINZ, Auckland University of Technology: 22.

Aim: To determine the association between sports specialization, training/competition exposure, and injury risk in youth athletes, with the goal of reducing sports-related injuries.

Key findings: Moderate evidence suggested a significant relationship between exposure and all injuries in 83% of studies. Emerging evidence linked sports specialization with injury risk. Consistent evidence associated overuse injuries with acute:chronic exposure ratio.

Practical implications: Caution was advised for highly specialized youth athletes with high training/competition exposure. Recommendations included delaying specialization as long as possible and monitoring training/competition exposure, especially for those exceeding sixteen hours per week or experiencing spikes in exposure.

Populations I General

Burkett, B. and P. A. Hume (2013). IRB Protective Equipment Project: Review of research presented at the International Paralympic Committee VISTA conference on technology and equipment in sport - Implications for technology and equipment in rugby from the VISTA conference. IRB Protective Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 14.

Aim: To explore how technological advancements in prosthetics and equipment can enhance performance of rugby players, especially those competing in the Paralympics.

Key findings: Standard prosthetic devices limited the performance of highly active amputees in sports. Tailored technology is crucial for optimizing rugby techniques within an athlete's residual function. Innovations like adjustable ankle alignment in prosthetics and "quick change pole" technology for arm amputees could improve grip and handling of the rugby ball. Growing databases on injury patterns among Paralympic athletes could inform risk assessments and equipment design to prevent injuries.

Practical implications: The ability to customize prosthetic components like blade shape, stiffness, and length is essential for meeting the specific demands of rugby positions. If players with disabilities integrated fully with able-bodied players, a minimal classification system is needed, simplifying the grouping of players based on their abilities. There is need for research and development of prosthetic equipment tailored to rugby's requirements, highlighting the potential for improved performance and safety for Paralympic athletes. It underscored the importance of equitable access to these technologies.

Populations I General

Burkett, B. and P. A. Hume (2013). IRB Protective Equipment Project: Review of research presented at the International Paralympic Committee VISTA conference on technology and equipment in sport- Implications for technology and equipment in rugby from the VISTA conference. IRB Protective Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 14.

Aim: To discuss the implications of technology and equipment in rugby, particularly for Paralympic athletes. It summarized research presented at the VISTA conference and explores how advancements in prosthetics and adaptive technology can enhance athletic performance in rugby.

Key findings: Standard prosthetic devices may limit performance of highly active amputees in sports. Technology must be tailored to the individual athlete and sport to optimize rugby techniques within their residual function. There are potential benefits of modifying ankle alignment and prosthetic knees for rugby players, and the use of "quick change pole" technology for players with arm amputations to improve their grip on the rugby ball.

Practical implications: There is a need for prostheses suitable for rugby, which could involve testing and measuring prosthesis components to design tailored equipment. It is important to understand injury patterns and risk factors among elite Paralympic athletes to guide risk assessments in rugby. A minimal classification system is required if players with disabilities are integrated with able-bodied players in rugby union.

Technology development I Rugby union

Searchfield, G. D., et al. (2014). IRB Protective Equipment Project: Feasibility testing of the fit and comfort of four hearing aid designs for rugby. IRB Protective Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 14.

Aim: To evaluate the fit, comfort, and safety of four hearing aid designs during rugby activities.

Key findings: Before exercises, the soft In-The-Ear (sITE) was rated best for fit by audiologists, but after physical activities, the Behind-The-Ear (BTE) design was considered the best fit. Players rated comfort and retention higher before running exercises than after, with no significant difference between hearing aid types. The universal fit In-The-Ear (UFITE) was deemed unsafe for tackling due to poor fit. No ear injuries were observed during the study.

Practical implications: Custom-made hearing aids with a cymba or helix lock were recommended for better retention during rugby. Soft materials were suggested for housing electronics to minimize injury risks. A specialized hearing aid for rugby, considering the study's insights, was recommended to enhance player safety and communication on the field. This study provided valuable insights into the design and use of hearing aids in sports, particularly in contact sports like rugby, where player safety and communication are crucial. while current hearing aid designs pose a low safety risk, there is room for improvement, especially in terms of retention and comfort during intense physical activity. The recommendation for custom-made, soft-material hearing aids could lead to the development of more suitable devices for athletes with hearing impairments.

Technology development I Rugby union

Searchfield, G. D., et al. (2014). IRB Protective Equipment Project: Feasibility testing of the fit and comfort of four hearing aid designs for rugby. IRB Protective Equipment Project. P. A. Hume. Auckland, Sport Performance Research Institute New Zealand, Auckland University of Technology, New Zealand: 14.

Aim: To evaluate the fit, comfort, and safety of four hearing aid designs during simulated rugby exercises.

Key findings: Before exercises, the soft In-The-Ear (sITE) was rated best for fit by audiologists, but after physical activities, the Behind-The-Ear (BTE) was deemed the best fit. No injuries were observed, but hearing aids were dislodged in 7% of tackles, with BTE aids flicking off yet retained on the ear by the ear mould. Players rated comfort and retention higher before exercises. They identified safety, moisture damage, breakage, acoustic feedback, and replacement costs as barriers to hearing aid use in rugby.

Practical implications: Custom-made hearing aids with a cymba or helix lock were recommended for good retention. Soft, impact-resistant, waterproof materials that resist acoustic feedback and are easy to clean or have antimicrobial properties were ideal. Assessment during actual gameplay was necessary to determine increased risks. A hearing aid with all the desired properties was not currently available and should be designed for rugby and other sports. The study provided initial evidence that existing hearing aid designs pose a low risk of ear damage but highlights the need for sport-specific improvements.

Technology development I Snow sports

Costa-Scorse, B. and P. A. Hume (2010). NZ snow safety ski binding standards, education and testing project: Incidence of ski and snowboarding injuries: Analyses of Mountain Safety Council National Incident Database ski patrol data 2005-2009, Sport Performance Research Institute New Zealand, Auckland University of Technology: 13.

Aim: To provide a descriptive epidemiological analysis of snow sports injury trends in New Zealand from 2005 to 2009, using data from the Mountain Safety Council National Incident Database (NID-ski).

Key findings: A total of 25,996 injuries were reported, with the majority involving skiers (45%) and snowboarders (51%). More injuries occurred in males (58%) than females (42%). The most common injuries were to the forearm/elbow (11%) and head/neck (11%). Most injuries were sustained by intermediate and learner participants. The use of safety equipment was low, with 67% of skiers and 54% of snowboarders not using any safety gear.

Practical implications: The findings highlight the need for increased safety measures and equipment use among snow sports participants, especially beginners and intermediates. educational programmes focused on injury prevention and the promotion of safety equipment could potentially reduce the incidence of injuries in snow sports.

Technology development I Snow sports

Costa-Scorse, B. and P. A. Hume (2012). SnowSmart torque testing intervention - Progress report #1 to the Accident Compensation Corporation Sport Performance Research Institute New Zealand, Auckland University of Technology: 9.

Aim: The project's goal was to assess the impact of torque testing and calibrating S-B-B systems to international standards on the frequency of knee and lower limb injuries at two commercial ski areas.

Key findings: Installation of mechanized torque testing equipment was completed, with 100% of the Whakapapa and Turoa ski areas' rental fleets to be tested. An education programme for key staff on the S-B-B system was partially rolled out, with further training and revisions planned.

Mid-season testing and data collection are ongoing, with a focus on case control data collection once all lifts are operational.

Practical implications: The study aimed to provide evidence for the adoption of international ISO standards in rental ski shop practices. It sought to offer recommendations for future educational interventions and public injury prevention campaigns related to ski equipment maintenance and setting correct release values. The report outlined the budget, project management details, and the timeline of activities, highlighting the challenges and adjustments made due to delays in the project's initiation. The intended outcome is to achieve a clear understanding of the relationship between equipment calibration and injury prevention, potentially influencing industry practices and enhancing skier safety.

Technology development I Surf lifesaving

Grobleny, M., Reay, S., Diewald, S., Hume, P. A., Wilson, B. D., Wooler, A., Merrett, R., & Smith, V. (2019). Prototype foot strap design considerations for surf lifesaving inflatable rescue boats: Technical report #7 to Surf Life Saving New Zealand (SLSNZ). SLSNZ research reports by AUT SPRINZ. P. A. Hume. Auckland, New Zealand, Auckland University of Technology: 8.

Aim: To model potential positions and create prototype designs for safer foot straps on IRBs. The study was initiated due to concerns that foot straps were causing lower limb fractures.

Findings: Measurements from an SLSNZ boat were used to model various foot placements. Three concepts were prototyped: a camlock adjustment, a quick release clasp, and a raised foam pad. The study raised several questions about foot placement and strap design, emphasizing the need for adjustable straps to accommodate different crew members. It highlighted the importance of maintaining three points of contact with the boat for crew safety.

Practical implications: Further research was needed to determine optimal foot placements focused on optimizing IRB design to minimize injury and ensure three points of contact. The practical implications of this research are significant for the safety and efficiency of surf lifesaving operations. By re-evaluating the design of foot straps, the risk of injury can be reduced, and the performance of lifesavers can be improved. The study advocated for a collaborative approach to design, involving testing and feedback from actual users to ensure the solutions are practical and effective in real-life scenarios.

Technology development I General

Croft, J., et al. (2007). Validity of BioHarness™ ECG generated by filtering and algorithmic processing versus heart rate output from 3-lead ECG. Technical Report for Zephyr Technology Project #1: BioHarness study 1 part A., Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 32.

Aim: To assess the validity of the BioHarness system in measuring heart rate compared to a 3-lead ECG.

Key findings: The BioHarness showed a mean bias of 7.6 beats and a standard error of estimate (SEE) of 2.8 beats. The BioHarness tended to overestimate heart rate. The BioHarness had a mean bias of -0.4 beats and an SEE of 1.2 beats, indicating better accuracy compared to the dry condition. There was substantial variability in the BioHarness performance among participants and tasks, especially in the dry condition.

Practical implications: The BioHarness' overestimation of heart rate in the dry condition could have led to athletes training at lower intensities than intended. Wetting the strap improved the accuracy of the BioHarness, making it more reliable for practical use. Additional testing was recommended to address the positive bias and variability issues, ensuring more consistent performance across different conditions and participants.

Technology development I General

Sheerin, K., et al. (2012). The reliability and usability of the IRL dynamometer and inclinometer: A technical report for Industrial Research Limited. Auckland, Sports Performance Research Institute New Zealand, AUT University.: 14.

Aim: To assess the within-day reliability of the IRL dynamometer in measuring passive lower limb flexibility in rugby players and isometric strength in children.

Key findings: The study found 'very good' to 'excellent' reliability (ICC 0.79-0.96) for flexibility measures in rugby players, indicating that the dynamometer provided consistent force application across trials. The dynamometer showed 'good' to 'moderate' reliability for isometric strength measures in children, suggesting it could be a useful tool for clinical assessments.

Practical implications: the IRL dynamometer is a reliable tool for measuring muscle strength and flexibility in different populations. It could be particularly useful for sports physiotherapists and clinicians for screening and monitoring athletic development. However, the study recommended improvements to the device's design and testing protocols to enhance its usability and consistency in measurements.

Technology development I General

Sheerin, K., et al. (2012). The reliability and usability of the IRL dynamometer and inclinometer: A technical report for Industrial Research Limited. Auckland, Sports Performance Research Institute New Zealand, AUT University.: 14.

Aim: To assess the within-day reliability of the IRL handheld dynamometer for measuring passive lower limb flexibility in rugby players and isometric strength in children.

Key findings: The dynamometer showed 'very good' to 'excellent' reliability (ICC 0.79-0.96) for flexibility measures. The device demonstrated 'good' to 'moderate' reliability for isometric strength measures in children.

Practical implications: The IRL dynamometer could be a useful clinical tool for assessing muscle strength and flexibility. Modifications were recommended for the device to improve measurement consistency, such as developing different shaped attachments for the force transducer and having a flat edge for the inclinometer. The report concluded that the IRL dynamometer has potential as a reliable tool for muscle strength and flexibility assessment, but further development is needed to enhance its consistency and usability.

Technology development I General

Sheerin, K., et al. (2008). Comparison of vibration characteristics of Terrax, modified Terrax and a standard demolition tool: A case study. Report to Terrax, Institute of Sport and Recreation Research New Zealand, Auckland University of Technology: 10.

Aim: To compare the vibration characteristics of the Terrax tool, a modified Terrax tool, and standard demolition tools to assess their impact on user fatigue and injury risk.

Key findings: Despite subjective feedback favouring Terrax tools, the acceleration data revealed inconsistencies, with some results nearly significantly different, suggesting the drop technique used in testing was not reliable for valid comparisons.

Practical implications: The study concluded that using a participant to drop the tools introduced measurement errors, making the test procedure invalid for comparing tools. Future tests should have used a mechanical arm for more accurate **Results:** The study's limitations included small sample size and manual tool dropping method. It recommended using a mechanical arm in future testing to eliminate human error and improve reliability.

GENERAL

General I General

Gianotti, S. M., Hume, P. A., & Quarrie, K. L. (2004). "Implementation of a community level sport concussion management system in New Zealand. (Abstract)." British Journal of Sports Medicine 38(5): 660-661.

Aim: To discuss the implementation of a Community Level Sport Concussion Management System (SCC) in New Zealand, aimed at encouraging early treatment and management of concussion to reduce long-term adverse outcomes.

Key findings: The distribution of 60,000 SCC cards from July 2003 to June 2004 coincided with a 17% decrease in new sport concussion/brain injury (CBI) entitlement claims. In contrast, non-sport CBI claims increased by 2.8%, and medical treatment only CBI claims increased. The average cost of a new sport CBI claim was $USD24,096, and the SCC implementation resulted in cost savings of $USD1,012,016 for the Accident Compensation Corporation (ACC).

Practical implications: The SCC proved to be a useful tool for community coaches and managers in managing suspected concussions. It is not intended to replace comprehensive neuropsychological testing but to promote early intervention and referral to health professionals. The success of the SCC in reducing CBI claims and providing cost savings suggested that it has helped in the effective management of concussions at the community sport level in New Zealand.

General I General

Hume, P. A. (2008). 2008 International convention on science, education and medicine in sport - Guangzhou, China 1st August to 5th August 2008. Kinanthreport. New Zealand, ISAK. XX1: 24.

Aim: The 2008 International Convention on Science, Education, and Medicine in Sport aimed to share knowledge among international scholars and practitioners, focusing on sport sciences and harmonious society in the 21st century.

Key findings: Structured prehabilitation and rehabilitation plans reduced lower limb injuries. Motivation was crucial for performance improvement, alongside traditional talent identification. Athletes met nutritional needs through a balanced diet; specific guidelines for carbohydrate and protein intake were provided. Emphasis on injury prevention, rehabilitation, and the role of genetics in sports.

Practical implications: Implementing structured injury prevention programmes significantly reduced the risk of common sports injuries. Incorporating implicit learning models and motivation-based talent identification can enhanced athlete performance. Adhering to specific dietary guidelines optimized athletes' performance and recovery. Combining traditional and modern medical practices improved treatment outcomes for sports-related injuries.

General I Rugby union

Gianotti, S. M. and P. A. Hume (2007). "Concussion sideline management intervention for rugby union leads to reduced concussion entitlement claims." NeuroRehabilitation 22(3): 181-189.

Aim: To evaluate the effectiveness of CMEP, which includes a RugbySmart™ educational video and a sideline concussion check (SCC) tool, in reducing the number and cost of moderate to serious concussion/brain injury (CBI) claims among community-level rugby players.

Key findings: From 2003 to 2005, new rugby CBI moderate to serious claims (MSC) reduced by 10.7% (actual) and 58.2% (forecast). Despite a 13.6% increase in rugby player numbers, the reduction in claims was observed. The median number of days between CBI injury and players seeking medical treatment decreased from six to four days. The CMEP resulted in cost savings of $USD 690,690 (actual) to $USD 3,354,780 (forecast). For every $USD 1 invested in CMEP, the return was $USD 12.60 (actual) and $USD 61.21 (forecast).

Practical implications: The CMEP provided community coaches and managers with education on best practices for managing suspected concussions. The programme contributed to ROI and savings for CBI MSC in rugby. The study suggested extending the SCC to all sports, updating SCC and insert cards with return to play guidelines, and including a tear-off return to play strip for medical clearance.

General I Rugby union

Gianotti, S. M., et al. (2009). "Evaluation of RugbySmart: A rugby union community injury prevention programme." Journal of Science and Medicine in Sport 12: 371-379.

Aim: The study evaluated the effectiveness of RugbySmart, an injury prevention programme launched in New Zealand in 2001, in reducing rugby-related injuries and promoting safe playing behaviours.

Key findings: The programme led to a decrease in injury claims per 100,000 players in areas it targeted, such as the neck/spine, shoulder, knee, and leg. There was an increase in safe behaviour during contact situations like tackling, scrummaging, and rucking, as reported by player surveys.

Non-targeted injury sites did not see a significant decrease, indicating the specific impact of RugbySmart.

Practical implications: workshops can effectively disseminate injury prevention information nationwide. Community-focused injury prevention strategies can be successful when content is tailored with clear, actionable messages. Future programme designs should include plans for evaluation to measure impact accurately. This summary captured the essence of the RugbySmart evaluation, highlighting its objectives, the significant findings regarding injury reduction, and the practical takeaways for implementing similar programmes .

General I Touch Rugby

Hume, P. A., et al. (2024). ACC SportSmart Assessment Learning (SAL) Project: Task 2b "Touch New Zealand injury prevention policy, plans and key activities audit" - Technical report to ACC and Touch NZ. Auckland, New Zealand, Hume Management Consultants Limited: 61.

Aim: To assess the effectiveness of the ACC-TNZ partnership agreement plan implementation, focusing on the SportSmart Assessment-Learning (SAL) project. It evaluated the return on investment (ROI), quarterly reporting, staff interviews, surveys, and alignment with SWOT analysis.

Key findings: The ROI showed a positive trend towards targets with a calculated ROI of 1.27, indicating a good return on investment. However, benefits were less than 90% of the 2023 target. Key themes from staff interviews included Technology, Development, Funding, Consistency, Recognition, Opportunities, and Contract. The report highlighted TNZ's reliance on volunteers due to limited funding and resources, suggesting a need for paid expertise to lead initiatives.

Practical implications: Recommendations for 2024 focus on education strategies, delivery improvements, and increasing player compliance to a 5-minute warmup before games. The report suggested TNZ could trial new injury prevention initiatives and employ digital channels for better reach and engagement. It emphasized the need for clear objectives, measurable targets, and multi-year data to assess the sustained impact of the programmes . The report concluded with proposed contract negotiations for 2024, reflecting the need for a clearer process and realistic expectations given TNZ's resource limitations. It advocated for a long-term partnership plan with ACC, less transactional and more quality engagement-focused, to effectively implement and evaluate injury prevention strategies.

General I Football

Hume, P. A., et al. (2023). ACC SportSmart Assessment Learning (SAL) Project: Task 1a "Football plan and actions audit" - Technical report to ACC and NZ Football. Auckland, New Zealand: 81.

Aim: To assess the effectiveness of the SportSmart injury prevention programme and identify opportunities for improvement in injury prevention strategies. The focus was on evaluating NZF's IP plan against ACC's performance metrics.

Key findings: The report highlighted several areas, including the need for better data sharing, improved warmup compliance, and enhanced injury prevention culture. It points out the strong relationship between ACC and NZF and the leadership in embedded education and digital platforms for injury prevention. Suggested focus areas for the 2024 ACC-NZF partnership include investing in people to increase delivery capacity, providing quality metrics for decision-making, strengthening policies around the IP programme, improving data sharing, and expanding neuromuscular training reach.

Practical implications: While the ACC-NZF partnership is strong, there is room for improvement in warmup compliance, data transparency, and injury prevention measures. Implementing the recommendations could lead to more effective injury prevention strategies and better outcomes for football players in New Zealand.

General I Netball

Hume, P. A. and J. R. Steele (2000). "A preliminary investigation of injury prevention strategies in netball: are players heeding the advice?" Journal of Science and Medicine in Sport 3(4): 406-413.

Aim: The study investigated whether netball players follow injury prevention advice during championships. All netball players who sought treatment for injury during the three-day 1995 New South Wales State Netball Championships were surveyed. Of 940 participants, 131 incurred injuries (139.4 injuries per 1000 players; 23.8 injuries per 1000 playing hours).

Key findings: Despite available resources and advice, many players still engaged in behaviours that increase injury risk, such as wearing inappropriate footwear and not seeking immediate treatment.

Practical implications: The study suggested a need for more effective promotion of injury prevention strategies and further research to encourage their adoption by players. The article emphasized the importance of proper education and resources to prevent injuries in netball, highlighting the gap between available advice and player behaviour. It called for targeted initiatives to improve adherence to injury prevention methods.

General I Netball

Gianotti, S. M., et al. (2010). "Efficacy of injury prevention related coach education within netball and soccer." Journal of Science and Medicine in Sport 13: 32–35.

Aim: To assess the efficacy of integrating sports injury prevention into coach education for netball and soccer. It evaluated the impact of NetballSmart and SoccerSmart programmes on coaching practices and injury prevention behaviours.

Key findings: after attending NetballSmart courses, 89% of coaches changed their coaching methods, with 95% using and passing on the knowledge. Similarly, 96% of soccer coaches altered their coaching, focusing on warm-up/cool-down, technique, fitness, and nutrition/hydration practices. coach education can effectively deliver injury prevention strategies in community sports.

Practical implications: Integrating injury prevention into coach education was viable for delivering injury prevention in community sports. The study recommended that organizations should consider coach education as a means to promote injury prevention to reach community-level players.

General I Rugby league

King, D., et al. (2010). "First-aid and concussion knowledge of rugby league team management, administrators and officials in New Zealand." New Zealand Journal of Sports Medicine 37(2): 57-68.

Aim: To evaluate the knowledge of first-aid, concussion recognition, management, and injury prevention among rugby league community members. A descriptive study using a questionnaire divided into two parts: first-aid assessment and knowledge, and concussion recognition, management, and prevention knowledge.

Key findings: Out of 95 respondents, only 55% had an up-to-date first-aid certificate, and just 2% passed the knowledge questionnaire. The average score for first-aid knowledge was 56%, and for concussion symptom recognition, it was 33%. Overall, sports-related concussion knowledge was low at 42%. Common misconceptions included the belief that loss of consciousness is required for a concussion and that all concussions recover at the same rate.

Practical implications: Given the lack of understanding in sports-related first-aid and concussion knowledge, injury prevention and care programmes should emphasize first-aid and concussion knowledge to improve safety in amateur rugby league in New Zealand.

General I Netball

Gianotti, S. M., et al. (2010). "Efficacy of injury prevention related coach education within netball and soccer." Journal of Science and Medicine in Sport 13: 32–35.

Aim: To assess if coach education programmes that include injury prevention strategies were useful and relevant for community coaches in netball and soccer, leading to the incorporation of these strategies into coaching practices.

Key findings: NetballSmart evaluated via a telephone survey of coaches who attended the course. 89% changed their coaching methods, with 95% using and sharing the knowledge from the course. SoccerSmart evaluated through an internet questionnaire. 96% of soccer coaches changed their coaching, focusing on warm-up/cool-down, technique, fitness, and nutrition/hydration practices.

Practical implications: Integrating injury prevention into coach education was effective for community sports. Coaches found the resources valuable and applied the information in their sessions. Emphasizing core sport aspects like warm-up, technique, and conditioning in education may have led to the adoption of other injury prevention strategies. The study concluded that incorporating injury prevention content into coach education resources may help reduce the risk of injury among community players. such integration is a viable strategy for delivering injury prevention messages effectively.

CATEGORY CODING

A	Profile
C	Conditioning
S	Psychology
T	Technique
N	Nutrition
W	Wear
E	Environment
I	Injury
P	Populations
G	General
R	Rehabilitation
D	Technology development

Sport

A	Athletics
B	Basketball
C	Cycling
D	Defence force
E	Golf
F	Soccer
G	Gymnastics
H	Hockey
I	Cricket
J	Combat sport
K	Triathlon
L	Rugby league
M	Manu
N	Netball
O	Other
P	Badminton
Q	Tennis
R	Rowing
S	Snow sports
T	Touch rugby
U	Rugby union
V	Volleyball
W	Swimming
X	General
Y	Yachting
Z	Surf life saving

Contents