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TEN YEAR REVIEW OF LOWER EXTREMITY NETBALL INJURIES IN NEW ZEALAND

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Aim: To review epidemiological data collected for netball lower extremity injuries by the Accident Compensation Corporation (ACC) between 2008 and 2017.

Methods: Data was sourced by the ACC, covering the key search criteria: Count of new netball related claims by body site, cost and age groups. The data was divided into 5 equal year groups (2008/9, 2010/11, 2012/13, 2014/15, 2016/17), and 3 age groups (Group 1= 10 to 14 years, Group 2= 15 to 19 years and Group 3= 20 to 24 years old). These age groups were chosen as they ranked the highest for ankle, knee and lower extremity injuries over the 10-years. Injury incidence and rate of cost was calculated as number of netball injuries per 1000 affiliated membership population. All costs given by ACC were corrected for the effect of inflation using consumer price index (CPI) rates for each year. Affiliated member numbers were sourced by Netball New Zealand (NNZ) and the number of affiliates for each age group calculated to mirror the age brackets displayed in the ACC data. All comparisons between age groups were performed using a Cuzick test (adapted Wilcoxon test for trend) and a Poisson regression test to compare across years for each age group.

Results: In 2017 of all netball injury claims against ACC, 61% were to the lower extremity, costing NZD$20,051,919. Ankle and knee injuries constitute 47% of all injury claims a year, but more significantly in 2017, 66% of the cost to the public at NZD$18,049,370. The youngest age group (10-14 years old) showed the highest percentage increase in injury rate between 2008 and 2017 for both ankle (98% increase) and knee injuries (150% increase), compared to Group 2 ankle (51% increase) and knee injuries (60% increase) and Group 3 ankle (15% decrease) and knee injuries (23% increase). However, the reverse is seen for rate of cost per 1000 members between 2008 and 2017, Group 3 had the highest increase in rate (73%), compared to Group 2 (50%) and Group 1 (42%). There was a statistically significant difference between age groups ($p=0.001$) in the average injury rate across the 10-year period. The older age group (20-24 years) had the highest injury rate (ankle=77.8, knee=71.6 injuries/1000 players) compared to Group 2 (ankle=71.6, knee=34.8 injuries/1000 members) and Group 1 (ankle=38.2, knee=19.4 injuries/1000 members). Finally, there was a significant difference between groups in the average cost of all lower extremity injuries ($p = 0.005$), Group 1 (cost = $21,880/1000 members), Group 2 (cost = $93,731/1000 members) and Group 3 (cost = $182,406/1000 members). There was a noticeable trend pattern for increasing ankle injuries in group 1 and 2 ($p = 0.072$) and knee injuries in group 1 ($p = 0.072$), but no trend pattern was significant.c

Conclusion: These results suggest that for the ACC and NNZ the focus of injury prevention should continue to be directed at prevention of lower extremity injuries. Particular focus should be on younger players (10-14 years) as they have had the highest percentage increase in lower extremity injuries from 2008-2017. Additionally, as they have the highest current injury rate and cost, older players (20-24 years) should also be a key target group. The limitations of ACC database injury definitions and the exposure data used in this study need to be acknowledged.

A 12 MONTH RETROSPECTIVE INJURY SURVEILLANCE OF COMPETITIVE NEW ZEALAND SWIMMERS

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Aim: To quantify the shoulder injury prevalence among New Zealand's nationally competitive swimmers.

Method: A 12 month retrospective self-reporting injury surveillance was conducted among male and female competitive swimmers in New Zealand aged 18 and above. The survey consisted of two parts; firstly questions were asked about swimming profile, rest days, training and race history. Then, questions covered the acute, recurrent and overuse injuries experienced over the past twelve month period.

Results: The survey had a response rate was 33% (27/80) and comprised of 67% male and 33% female swimmers. The responded swimmers had a mean age of 27.8 +- 9.9 years, and 66.7% swimmers mainly competed in distances up to 200 meters. A total of 50 injuries, 52% (27) acute injuries and 48% (24) classified overuse injuries were reported. More than half (59%) of the acute injuries happened during swimming training and 40% of all reported injuries were of soft tissue origin. The most injury prone body areas were the shoulder (45.1%, 23), knee (13.7%, 7) and lower back (9.8%, 5). The shoulder area experienced (27.5%, 14) overuse and (17.6%, 9) acute injuries. Shoulder injuries also had the highest recurrence rate (55.6%).Wrist and hand injuries (52.3%) accounted for the highest number of training and race days missed due to an injury, followed by shoulder injuries (26.8%).

Discussion: We found that New Zealand's nationally competitive swimmers have a high injury prevalence rate and identified the shoulder as the most injury prone area. This survey highlights that swimming training itself is a common cause of shoulder injury. Swimming training logs will help in monitoring the training workload to identify the injury predisposing factors.

Conclusion: Increased swimming training workload has been highlighted as a predisposing factor for overuse shoulder injuries.[1] Long term injury surveillance will help understand the correlation between swimming training workload and injury incidence. Implementation of an evidence based shoulder injury prevention programme might also help decrease their injury incidence.

Reference

1 Hellard, P., Avalos, M., Guimaraes, F., Toussaint, J. F., & David, P. (2015). Training-related risk of common illnesses in elite swimmers over a four-year period. Medicine and Science in Sports and Exercise, 47(4), 698-707. doi:10.1249/MSS.0000000000000461

FATIGUE AND VITAL SIGN MONITORING FOR OFFSHORE SAILING CREWS

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Introduction: Cognitive and physical fatigue in multi-day adventure sport is key to performance and safety. Real world testing in the field can incorporate responses to risk and other factors that cannot be simulated in the lab. However, field-based research brings challenges in data collection, validation and practical considerations on support and compliance to the protocol in the presence of work load, danger and fatigue. Monitoring crews while off shore sailing with sensors is challenging as the crew is under stress and confined. Jetlag for international crew and sea sickness adds to the challenges. Multi day cognitive and physical assessment requires a protocol that can be adjusted for work shifts and circadian rhythms.

Aim: To determine challenges of multi-day in-field research using tablet-based assessments, questionnaires and sensor data for a four-person crew over a 12-day offshore sailing passage.

Methods: The Stroop test (Egner & Hirsch, 2005) was used as it has been shown, using functional magnetic resonance imaging (fMRI) testing, to "stimulate left middle front gyrus (GFm) and superior frontal gyrus (GFs), and decreased activity in the bilateral prefrontal and partial cortices" which are indicated in high level perception and motor processes. The Finger Tap Test (FTT) was used for neurological (Amer et al., 2012), motor skills and neuromuscular fatigue measurement (Leyla & Kiziltan, 2016). The Borg Scale for Rating of Perceived Exertion (Borg, 1982) was used to indicate influence of central factors such as heart rate and peripheral factors such as blood lactate. The Borg scale of 16 approximates a heart rate of 160 bpm.). A daily test battery of questions and tests was performed along with prolonged daily donning of a BioHarness (Medtronic MDT, formerly Zephyr) sensor with periods of non-use for charging and data down load. The BioHarness sensor was selected as it was comfortable for long term use by the crew and accurately measures vital signs and has an Inertial Measurement Unit (IMU). The test battery included questions asked and recorded to Excel (Microsoft Corp MSFT) and an iPhone (Apple Inc AAPL) with a different application for each test. Post analysis consisted of concatenating daily files, aligning date and time between sensor and questionnaires, and analysing vital sign data for features such as variability and entropy. A time- based windowing analysis was performed to determine the best length for comparison to questionnaire data points. Sensor features where time aligned to questionnaire data. Correlation analysis between sensor features and questionnaires was performed.

Results: Compliance to the test and sensor protocol was not sufficient for a generalisable model between sensor and questionnaires. The questionnaires were performed by different applications which lead to undue effort for participants and researchers. Some data were lost during the upload process. The study showed a sensor should have sufficient data storage and battery life time for a multiple day event without depending on multi-step uploading and erasing. Vital sign variation and features did not correlate with previously validated cognitive assessments. Each individual adapted to the environment differently, negating any generalisations across the test population. Multi crew events in the field cannot assume subjects adapt in a similar manner and carry out tasks at the same time of day (e.g. sleep cycles, work shifts and circadian rhythms may be misaligned). Assessments need to be regular to capture time sensitivity and variation between subjects.

Conclusions: In multiday field events, research devices and protocols require a simplicity and reliability above that in the lab due to two main factors; there is no support in the field and the subjects and researcher are cognitively fatigued as part of the mission. Cognitive tests and questionnaires need to be hourly to provide sufficient information for correlation to sensor data and capture inter subject differences. Baselining before and after the event is required to separate fatigue effects from training and recovery effects. Cognitive tests should be on a single device with single application, with simple user input and minimisation of redundant steps between sessions, such as single login and only entering demographic data once for the entire research period. Inter-subject testing should minimise the likelihood of cross subject test data contamination. Sensors should be wearable for the entire event with no recharging, donning/doffing or downloading/erasing required. Battery management should ideally not require recharging of tablets and sensors for the entire multiday event.

NEW ZEALAND RUGBY COMMUNITY CONCUSSION STRATEGY

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Concussions are currently one of the most prominent medical concerns in contact/collision sports at all ages and levels of competition due to increased susceptibility of concussed players to future injuries and potential for long-term health problems[1,2] including memory problems, depression, and cognitive impairments.[3,4] Concussions in rugby have recently been documented as the most common match injury (RFU Report, 2016), with an overall incidence rate of 2.43 - 6.8 concussions per 1000 player match hours at the community level.5,6 In NZ, ACC data indicates that the highest rates of concussion are sustained in the 13-18 year old demographic, with 1 in 4 concussions in school sports related to rugby. Since 2011 concussion in NZ high school sports has increased by 128 per year, except for high school in low socioeconomic areas. This finding likely reflects an under reporting of concussion in these areas, due to financial restrictions around accessing medical doctors (2016 ACC Concussion Report). Concussion in young athlete is particularly concerning due to the developmental stage of the brain at this age and the potential increased risk these individuals may have while participating in collision based sports.

To help address these concussion related concerns NZR and ACC are taking a pro-active stance to better manage concussions that occur at the community level. We have modelled this community strategy off the current Head Injury Assessment protocol employed at the professional level of the game. The goals of this pilot project are to inform players and parents around the need to see a doctor, to provide doctors with a tools to assist with their clinical decision making around concussions and to provide resources to doctors around the NZR concussion guidelines and mandatory stand down period.

The concussion management pathway includes an electronic health record-based clinical decision support tool designed to streamline the concussion management process, from identification of a suspected concussion through to diagnosis and treatment. The clinical decision support tool can be accessed both in a field setting (during play) through a smartphone application and in a clinical setting for primary care providers through an online web-based portal. The concussion management process includes: 1) initial player concussion baseline testing (modified child SCAT5); 2) identification and reporting of a suspected rugby-related concussion by the designated team lead using smartphone application; 3) automated concussion email notifications to the player (and their parents or caregivers), coaches, team leads, and regional sport or rugby representatives; 4) providing players and/or parents/caregivers with a unique identifier code that they are able to pass along to their PCP which will enable them to access that players' baseline concussion score through the online portal; 5) clinical concussion diagnosis by the PCP; 6) and eventual medical clearance and safe return-to-play.

References

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AN UPDATE ON SPRINZ SPORTS RELATED TRAUMATIC BRAIN INJURY RESEARCH

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The demand for information about how to prevent and manage mild traumatic brain injury (mTBI) in sport is unprecedented. Researchers aim to develop better understanding of injury mechanisms and identification of risk factors, to help guide development of injury prevention countermeasures. AUT's SPRINZ staff, postgraduate students, and science and medicine collaborators, actively engage in applied injury biomechanics, injury prevention and rehabilitation research with the aim of understanding sports related head impacts.

Concussions may have adverse long-term health implications as indicated in results from the NZ Rugby Health study. It is thought that linear and rotational head accelerations resulting from an impact are the main injury mechanisms. Head impacts in sport can be monitored with wearable sensors. However, the use of acceleration measurements is not validated and therefore is currently not supported by the Concussion in Sport Group. From a biomechanical point of view, head movement resulting from an impact can damage the brain. The question is: Are acceleration measurements useful for detecting, monitoring or predicting sports related head impacts and brain injury? Enora Le Flao has been developing new methods for analysis of acceleration signals for head impacts monitoring in rugby. Analysis of laboratory impact data, collected on an instrumented headform equipped with head impact sensors, is providing validation of the sensors. Prospectively collected field head impact acceleration data of rugby games using instrumented mouthguards is allowing comprehensive and innovative analysis of injurious and non-injurious impacts. The research will help to establish the link between head accelerations and concussion.

There is an increasing body of evidence that balance and cognitive deficits, and the symptoms of a concussion, will return to normal within 14 days for much of the population. From the Axis Clinic data the number of patients that are asymptomatic within 14 days is 70%, with 30% still symptomatic at that time. The number still symptomatic and requiring on-referral at 6-8 weeks post injury after the Axis Clinic standardized concussion protocol care is currently 6%. People may have clinically recovered from a concussion (i.e. no signs or symptoms), however, some may not have physiologically recovered (e.g. cerebral blood flow, cortical excitability). The period of physiological recovery may outlast clinical recovery time, but the duration of this is unknown. For some people abnormalities that occur as a result of a concussion can remain for up to 45 days post injury despite being clinically cleared to return to their normal activities. The question is: What factors influence time to recovery following sports-related mTBI? Joshua McGeown is aiming to optimise mTBI assessment practices, and exercise/nutrition therapy prescription in order to provide clinicians with more detailed information to manage their patients. Prospective objective assessments integrated within Axis Clinic standards of care is allowing comparisons between objective neurophysiological assessments (e.g. two-digit vibro-tactile stimulation hand held Brain Gauge), and more subjective clinical tools in quantifying mTBI symptomology used to guide return to play decisions. The effect of creatine supplementation in combination with Axis Clinic standard of care is being evaluated by randomizing consenting patients to either creatine supplement, or placebo supplement groups to determine if combined exercise and nutrition therapy is associated with better time to recovery outcomes than exercise treatment alone. Information gained from these studies should assist clinicians by providing more insight into mTBI assessment and treatment methods.