

2018 CASEM Injury Prevention Podium

The Effect of Commercial Aviation on Concussion Recovery in National Hockey League Athletes

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Introduction: Professional athletes in the National Hockey League (NHL) remain a high-risk population for mTBIs due to the nature of the sport. Against this background, we examined whether air travel within six hours following an injury had an effect on an NHL player's recovery from a concussion.

Methods and Data: A retrospective cohort study of all NHL players who suffered a concussion during gameplay in the four seasons 2011 to 2016. For each injury, the number of games the player missed and the number of days it took them return to gameplay was noted (only games missed is reported here, because the 2 variables were so highly correlated $r = 0.96$). Players whose injury required them to miss the remainder of the season, who were traded while recovering, and who suffered another injury during the same game were excluded to limit possible confounding variables. A regression analysis was used to produce age adjusted means for the fly and no fly groups.

Results: A total of 363 athletes were included in this study. Of these, 38 were excluded due to having a more serious TBI, other confounding injuries, and/or an absence from the sport longer than 6 weeks (42 days). These injuries were considered outliers 325 players were included, of which 158 flew within 6 hours of their injury and 167 did not fly. The average number of games missed was 5.54 ($n = 167$, $SE = 0.309$). In cases where the athlete flew within 6 hours' post-injury, the average number of games missed was 6.54 ($n = 158$, $SE = 0.348$). The difference in average games missed increased 1 game ($P = 0.0313$, $P < 0.05$).

Discussion: Injured athletes who fly post mTBI may undergo decreased PaO₂, dehydration, and a lack of rest, all of which are necessary for mTBI recovery. On average, players who did not fly returned to play one game sooner. Our findings corroborate the animal data of Faden and others that suggests air-travel could have a negative effect on concussion recovery. Although a one game difference may seem clinically unimportant, we believe these results have implications for the current NHL concussion protocol, player safety, and post mTBI recovery time.

Risk Factors for Concussion in Youth Soccer

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Objectives: (1) To determine the incidence rate of concussion in youth soccer players (age U12-U18) in the most elite levels of play (tiers 1-3). (2) To evaluate sex, playing up in an older age group or tier and previous history of concussion as risk factors for concussion in youth soccer players. (3) To describe mechanisms of concussion in youth soccer players.

Study Design: Prospective Cohort Study.

Subjects: Youth soccer players ($n = 483$; 10-18 years) who played in CMSA in tiers 1 to 3 during the 2017 outdoor season 2017.

Observational Technique: Participants completed a preseason questionnaire, including demographic and injury history questions. A team safety advocate (TSA) (parent volunteer) collected exposure and injury data. All concussions were referred to a study sport medicine physician for follow-up at the University of Calgary Acute Sport Concussion Clinic.

Outcome Measures: Concussion was defined as per the fifth International Consensus Statement on Concussion in Sport and diagnosed by a physician. Sex, previous history of concussion, and playing up in tier or age group at time of injury were measured on the preseason baseline questionnaire.

Results: Youth soccer players aged 10 to 18 years [$n = 483$, median-age = 13.85 years, interquartile range (IQR) = 12.55 to 15.39, 55.4% Female] participated. Previous concussion history was reported in 26.64% of players. The concussion incidence rate (IR) was 5.18/100 player-season ($n = 25$ concussions). Univariate Poisson regression analysis revealed no difference in risk of concussion between males and females [IRR = 1.84 (95% Confidence Interval (95% CI): 0.76-4.47, $P = 0.178$)]. Players who were playing in an older division or higher tier were 9.61 (95% CI: 2.87-32.22, $P < 0.001$) times more likely to suffer a concussion than those who did not. Players with a previous history of concussion were 4.28 (95% CI: 1.85-9.90, $P = 0.001$) times more likely to sustain a concussion than those who did not. A direct blow to the head was the most commonly reported mechanism of concussion ($n = 18/25$).

Conclusions: The concussion IR in youth soccer was 5.18/100 players, with a direct blow to the head reported as the most common mechanism of concussion. Playing up in a higher tier or age group and previous history of concussion were risk

factors for concussion. Future study to evaluate multiple covariates is warranted.

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Injury and Prevention in Master's Football (Soccer)

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Objective: This study aimed to assess the uptake of pre-participation screening and exercise on injury prevention in physicians attending an amateur international soccer competition.

Design: An electronic questionnaire was distributed 2 to 3 months prior to the competition and was used to assess athletes previous medical history, pre-participation screening and training.

Participants: Masters participants in the 2017 World Medical Football Championships in Leogang, Austria.

Assessment of Risk Factors: The harm reduction strategies are aimed at reducing sudden cardiac events and musculoskeletal injury in the population of interest.

Main Outcome Measures: Information gathered was compared to the American College of Sports Medicine (ACSM) recommendations for pre-participation health assessments as well as aerobic, resistance, flexibility and balance exercise for Master's athletes.

Results: The mean age of all participants in the 2017 World Medical Football Championships (n = 136) was 41.1 ± 10.6 years, with a mean BMI of 25.1 ± 2.3. A total of 19.1% (26/136) of the participants had at least one cardiac risk factor, yet only 38.5% (10/136) had a baseline ECG and 15.4% (4/26) had cardiac stress testing done in the 12 months prior to completion of the survey. About 62.5% (86/136) of the participants reported an MSK injury in the past 12 months prior to competition, and 39.0% (53/136) reported a significant acute football-related injury. Pre-game warm up regimens were used by 90.4% (123/136) of participants, but warm down was used by only 30.1% (41/136). Adherence to ACSM exercise recommendations were: aerobic activity 75.7% (103/136), resistance training 44.9% (61/136), flexibility training 54.4% (74/136), balance activities 41.9% (57/136). Only 22.1% (30/136) of participants regularly engaged in all 4 ACSM recommendations.

Conclusions: Among a cohort of amateur physician soccer players preparing for international competition from several countries, the frequency of soccer-related injuries was high.

Injuries occurred despite a high uptake of routine aerobic exercise and pre-game warm up regimens and in the presence of little post-game warm down regimens. Resistance training, flexibility and balance activities were used in almost half of the training regimens. This this group of Master's athletes may benefit from additional harm reduction strategies.

Prospective Study on the Prevalence and Burden of Overuse Injuries in Talented 9 to 14 Year-Old Soccer Players

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Objective: To investigate the prevalence and burden of overuse injuries in children's competitive soccer, as well as player characteristics and their association with the injury risk.

Study Design: Prospective cohort study with 20-week follow-up.

Subjects: Finnish soccer players (n = 730, aged 9-14 years).

Observation Technique: Each week we sent a SMS message to players' parents to ask if the player had sustained any injury during the past week. Injured players were interviewed over the phone using an overuse injury questionnaire. Only overuse injuries were included in the current investigation.

Outcome Measures: The main outcome measures were average weekly prevalence of all overuse injuries and substantial overuse injuries (those leading to moderate or severe reductions in participation or performance) and injury severity.

Results: The average response rate was 95%. In total, 342 players (46.8%) reported an overuse problem while in the study. The average weekly prevalence of all overuse problems and substantial overuse problems was 12.8% and 6.0%, respectively. Injuries affecting the knee had the highest weekly prevalence (5.7% and 2.4% for all and substantial knee overuse problems, respectively), and had the greatest relative impact on participation and performance. Girls had an increased risk of knee problems (OR 2.27; 95% CI: 1.45-3.57), whereas boys had an increased risk of heel problems (OR 3.08; 95% CI: 1.20-7.92). The likelihood of reporting an overuse problem increased with age (OR 1.20; 95% CI: 1.00-1.45).

Conclusions: Overuse injuries are prevalent in children's competitive soccer. Knee overuse injuries represent the greatest burden on participation and performance. Effective strategies to prevent overuse injuries in children's soccer are needed.

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Does Receiving Information About Concussion Affect Concussion Management Knowledge, Beliefs and/or Behaviours of Youth Ice Hockey Players?

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Objective: To determine the association of self-reported exposure to concussion education (within 1 year) with knowledge on concussion, as well as with beliefs about reporting concussions to an adult, in youth ice hockey players (ages 11-17).

Study Design: Cross-sectional.

Subjects: Youth ice hockey players (n = 798, 95.2% male) from all divisions of play in Calgary, Edmonton, and Vancouver were included in this study.

Observation Technique: During the preseason, players completed a questionnaire developed to measure concussion knowledge and beliefs about reporting suspected concussions.

Outcome Measures: Concussion knowledge was measured using 32 multiple-choice questions. The mean scores on Health Action Process Approach (HAPA) constructs: risk perception, outcome expectancies, action self-efficacy, intention, maintenance self-efficacy, recovery self-efficacy and planning were calculated using subscales containing 2 to 11 items scored on a seven-point Likert scale standardized to a score between 1 and 7.

Results: Of the 798 players who completed the questionnaire, 536 (67.2%) reported receiving concussion education during the last year. Based on a multivariable regression analysis adjusting for age group, previous history of at least one concussion and cluster by team, receiving concussion education was associated with a mean score increase of 1.28 (95% CI: 0.68-1.89) in the knowledge score. A multivariate regression, adjusted for previous concussion history and age group, indicated previous education was not significantly associated with the HAPA constructs.

Conclusions: The findings suggest that receiving concussion education within the past year may be associated with small changes in concussion knowledge but is not associated with significant differences in beliefs of youth ice hockey players about reporting the symptoms of sport related concussion. Concussion policies that do not guide the type and quality of education recommended may not have the intended effects. Further research is needed to examine educational strategies specifically targeting the motivators of behaviour change and that are grounded in health behaviour change theory.

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Evaluation of Body Checking Policy in Bantam Ice Hockey Players: A Multivariable Analysis

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Objective: To evaluate the risk of injury and concussion following policy change disallowing body checking in games in non-elite Bantam players (ages 13-14; lower 55%-70% by division of play), compared to similar leagues still allowing body checking.

Study Design: Prospective cohort study.

Subjects: Bantam players (ages 13-14) were recruited from teams in non-elite divisions of play where policy allowed body checking (Calgary 2014-2015 and Edmonton 2014-2016) in comparison to teams where policy disallowed body checking (Vancouver and Okanagan 2014-2015, Calgary 2015-2016).

Observation Technique: A previously validated injury surveillance system was used to collect preseason, exposure and injury data 2014 to 2016.

Outcome Measures: All suspected ice hockey injuries were identified by a team safety designate. Any player with a suspected concussion was referred to a study sport medicine physician to confirm diagnosis. Multilevel Poisson regression analysis, controlling for covariates [year of play (first/second year), previous injury/concussion] and clustering by team and by participant (offset by exposure hours) was performed for each outcome.

Results: Forty-nine teams (608 players) from body checking leagues and 33 teams (396 players) from non-body checking leagues participated in the study. Sixty players participated in both 2014 to 2015 and 2015 to 2016 seasons. In leagues allowing body checking, there were 123 injuries [crude incidence rate (IR) = 7.61/1000 hours] and 53 concussions (crude IR = 3.28/1000 hours) sustained in games. In leagues that do not allow body checking, 27 injuries (crude IR = 3.19/1000 hours) and 14 concussions (crude IR = 1.65/hours) occurred in games. Using multilevel Poisson regression, the

policy disallowing body checking was associated with a reduced rate of all injury [incidence rate ratio (IRR) = 0.38 (95% CI: 0.23-0.63)], and concussion [IRR = 0.46 (95% CI: 0.23-0.93)]; year of play was associated with a non-significant reduced rate of all injury [IRR = 0.91 (95% CI: 0.63-1.31)], and a non-significant increased rate for concussion [IRR = 1.05 (95% CI: 0.62-1.77)]; and previous injury/concussion was associated with a non-significant increased rate of all injury [IRR = 1.32 (95% CI: 0.92-1.89)], and concussion [IRR = 1.54 (95% CI: 0.93-2.56)].

Conclusions: Introduction of policy disallowing body checking provincially and locally in Bantam non-elite levels of play resulted in a 62% reduction in injury rate and 54% reduction in concussion rate. These findings have important implications for policy change informing a reduction in the public health burden of injury and concussion in youth ice hockey players.

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Utility of Axial Strain Elastography in Youth Basketball Players with Clinical Diagnosis of Patellar Tendinopathy

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Objective: To describe axial strain sonoelastography for clinically diagnosed patellar tendinopathy (PTP) and evaluate its diagnostic accuracy in youth basketball players.

Study Design: Nested case-control study within a larger prospective cohort study.

Observation Techniques: 22 players (ages 13-18 years; 21.7% females) with a clinical diagnosis of PTP and 22 matched controls were recruited during the 2016-2017 high school and 2017 club basketball season in Calgary. Subjects were diagnosed by a sports medicine physician or physiotherapist and underwent a sonographic assessment of bilateral patellar tendons by a medical sonographer and a fellowship-trained musculoskeletal radiologist, both blinded to case-control status of the study participants (PTP unilateral, bilateral, no PTP). Assessments included axial strain sonoelastography.

Images were partitioned, randomized, and archived for interpretation by a single musculoskeletal radiologist.

Outcome Measurements: Using a graduated colour strain map (red-yellow-green-blue), the axial strain elastograms of the proximal (attachment to inferior pole of patella), middle, and distal third (at tibial tuberosity insertion) of the patellar tendon regions were recorded on a 100-point continuous visual analog scale (VAS), using red "0" (soft) and blue "100" (hard), as anchors. Tendon stiffness based upon the VAS were stratified as hard/elastic (67-100), intermediate (34-66), and soft/less elastic (0-33). The soft and intermediate categories were considered "pathological tendon" and hard considered "non-pathological tendon". Results from three tendon regions were described in PTP cases and the proximal region was cross-tabulated with clinically diagnosed PTP and controls to calculate accuracy, sensitivity, and specificity (with 95% CI).

Results: The proximal tendon region recorded the highest proportion of tendon abnormality (83%) compared to other regions (73% at the middle region and 52% at the distal region). Considering the proximal tendon region, accuracy of axial strain sonoelastography in comparison with clinical evaluation was 83% (95% CI: 72%-90%); sensitivity was 87% (95% CI: 71%-95%) and specificity 21% (95% CI: 10%-37%).

Conclusions: Axial strain sonoelastography is comparable to clinical evaluation of patellar tendinopathy, especially in the proximal portion of the patellar tendon where symptom is experienced. However, its ability to rule out PTP in asymptomatic individuals is low. Sonoelastography may be a good supplement in routine clinical practice for clinically diagnosed patellar tendinopathy.

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A School-Based Program to Reduce Injuries Through Neuromuscular Training. iSPRINT: A Cluster-Randomized Controlled Trial

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Objective: To evaluate the effectiveness of iSPRINT, a neuromuscular training (NMT) warm-up program implemented in junior high school physical education (PE) classes, designed to prevent sport and recreational (S&R) injuries.

Study Design: Cluster-randomized controlled trial.

Subjects: 1,067 grade 7-9 students (53.7% female, 46.3% male) from 12 Calgary junior high schools between 2014-2017.

Intervention: iSPRINT is a 15-min NMT warm-up including aerobic, agility, strength, and balance exercises. Teachers in intervention schools (n=6) implemented the iSPRINT program at the beginning of PE classes over a 12-week period, while control schools (n=6) implemented a standard-of-practice warm-up. All teachers participated in a pre-program workshop; only intervention school teachers participated in practical NMT components, receiving a NMT video and posters.

Outcome Measures: A Certified Athletic Therapist, blinded from study group allocation, visited participating schools on a weekly basis to assess injuries sustained during S&R over the 12-week study period. Injuries were those that resulted in the inability to complete a session, time loss and/or medical attention. Incidence rate ratios (IRR) were estimated based on multivariable Poisson regression analyses (adjusting for sex and clustering by class, offset by S&R participation hours).

Results: The S&R injury incidence rates (IR) for all injury for the intervention and control groups respectively were 1.5 and

1.8 injuries/1000 participation hours (IRR=0.73, 95% CI 0.46-1.16), for medical attention injuries were 0.7 and 1.3 (IRR=0.59, 95% CI 0.42-0.82), and 0.9 and 1.3 for lower extremity injuries (IRR=0.81, 95% CI 0.56-1.19). The injury incidence rate was significantly higher in females compared to males (IRR=1.59, 95% CI 1.12-2.22).

Conclusions: The iSPRINT NMT warm-up was effective in preventing medically treated S&R injuries in junior high school students and suggests a protective effect for overall and lower extremity S&R injuries. Further analyses will consider program adherence, including utilization frequency, time, and fidelity.

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