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The Risk of Injury Associated With Body Checking Among Pediatric Ice Hockey Players

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Background: Ice hockey has one of the highest participation and injury rates in male youth in Canada. Body checking is generally thought to be the most frequent mechanism of injury.

Objective: To determine if the risk of concussion, concussion severity, all injury, injury severity and mechanisms of injury significantly differ for Bantam ice hockey players (aged 13-14 years) exposed to rules that permit body checking starting at the Pee Wee level (Alberta, Canada) versus players exposed to rules that do not permit body checking starting at the Pee Wee level (Alberta, Canada) versus players exposed to rules that do not permit body checking until Bantam (Quebec).

Design: Prospective cohort study.

Setting: Bantam teams from the top 30% of competitive levels of play in Alberta, Canada and Quebec, Canada. The study period was Oct 2008-Mar 2009.

Subjects: Eighty-nine teams from Alberta and 81 teams from Quebec were randomly approached for recruitment. Twenty teams from Alberta and 18 teams from Quebec declined participation or withdrew from the study. Players from 132 teams participated in the study [69 Alberta teams (n = 1003 players), 63 Quebec teams (n = 924 players)].

Intervention/Observation Technique: Pee Wee ice hockey players are exposed to rules that permit body checking in Alberta and to rules that do not permit body checking in Quebec.

Outcome Measurements: Previously validated injury surveillance was used, including injury assessment by a study therapist and physician referral. The injury definition includes any ice hockey injury that requires medical attention including injury assessment by a study therapist and physician referral. The injury definition includes any ice hockey injury that requires medical attention including injury assessment by a study therapist and physician referral. The injury definition includes any ice hockey injury that requires medical attention including injury assessment by a study therapist and physician referral. The injury definition includes any ice hockey injury that requires medical attention including injury assessment by a study therapist and physician referral. The injury definition includes any ice hockey injury that requires medical attention including injury assessment by a study therapist and physician referral.

Results: Preliminary univariate analysis based on injuries sustained prior to the end of the regular season of play will be presented. Incidence rate ratios (IRR), adjusted for clustering by team, will be reported to estimate risk of concussion, all injury, and all injury resulting in ≥1 week time loss based on experience of body checking (body checking age 11/no body checking until age 13). Further multivariate analysis will include playoff injuries and will also examine other risk factors and mechanisms of injury.
Conclusions: These findings will have important implications for policy decisions related to body checking in minor hockey.

Acknowledgements: This study was funded by the Canadian Institutes of Health Research, Alberta Heritage Foundation for Medical Research and the Max Bell Foundation.

The Effect of Premature Return to Play on Subsequent Injury Risk in Elite Adolescent Ice Hockey and Associated Psychosocial Predictors

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Objective: To determine whether return to play prior to medical clearance affects subsequent injury rates in elite minor hockey. Also, to investigate athletic identity, attitudes toward body checking, anxiety, and rumination as injury risk factors.

Study Design: Prospective cohort study.

Subjects: Three hundred sixteen players from elite (A, AA, AAA) Bantam (aged 13-14 years), and Midget (aged 15-17 years) teams.

Intervention/Observation Technique: Participants completed questionnaire-naireS early in the season: (1) Medical Questionnaire; (2) Body-Checking Questionnaire; (3) Athletic Identity Measurement Scale; (4) Competitive State Anxiety Inventory–2R; and (5) Stress Reactive Rumination Questionnaire. Injury reports, and physicians’ reports for those seeking medical attention, were collected throughout the season.

Outcome Measurements: The injury definition included any injury resulting in medical attention, the inability to complete a hockey session, and/or missing a subsequent hockey session. Medical clearance was determined using physicians’ reports.

Results: The injury rate was 51.52 injuries/100 players/season (95% CI, 42.66-60.30) in Bantam, and 40.76 injuries/100 players/season (95% CI, 33.59-48.23) in Midget. The rate of subsequent injury was 17.48 injuries/100 players/season (95% CI, 11.64-24.72). Injury risk was greater in Bantam than in Midget (incidence rate ratio [IRR] = 1.51; 95% CI, 1.03-2.22), and in AAA (vs. A/AA) (IRR = 1.75; 95% CI, 1.14-2.68). The IRR of subsequent injury for those returning prior to medical clearance was 1.58 (95% CI, 1.05-2.22), and scoring above the 75th percentile was associated with subsequent injury (IRR = 2.28; 95% CI, 1.01-6.04). No other variables affected injury risk.

Conclusions: Returning to play prior to medical clearance is not a risk factor for subsequent injury in elite minor hockey. Those with low levels of athletic identity are at greater risk for first injury, but those with high levels are at greater risk for subsequent injury.

Acknowledgements: The authors would like to acknowledge the support of the Canadian Academy of Sport Medicine (CASM), the Alberta Heritage Foundation for Medical Research (AHFMR), and the Social Sciences and Humanities Research Council of Canada (SSHRC).

Exercising Sport Concussion Assessment Tool Rating S for a Pee Wee Hockey Cohort With and Without a History of Concussion

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Affiliation: Faculty of Kinesiology, University of Calgary, Calgary, Alberta, Canada.

Objective: To describe the Sport Concussion Assessment Tool (SCAT) scores for a Pee Wee hockey cohort with and without a history of concussion.

Study Design: This study is a secondary data analysis of a prospective cohort examining the risk of injury associated with body checking among pediatric ice hockey players.

Setting: Community ice hockey arenas in Calgary, Edmonton, Quebec City and Montreal.

Subjects: One hundred fifty teams (n = 2154) of Pee Wee hockey players aged 11 and 12 years were randomly selected by team and consented to participate.

TABLE 1. Normative Values for SCAT in 11- and 12-Year-Old Male Hockey Players

<table>
<thead>
<tr>
<th>Variable</th>
<th>Concussion Median, (Range)</th>
<th>No Concussion Median, (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total symptom score</td>
<td>2 (0-108)</td>
<td>1 (0-75)</td>
</tr>
<tr>
<td>Number of words recalled-immediate</td>
<td>5 (0-5)</td>
<td>5 (0-5)</td>
</tr>
<tr>
<td>Number of words recalled-delay</td>
<td>3 (0-5)</td>
<td>3 (0-5)</td>
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<tr>
<td>Number of digits recalled in reverse order</td>
<td>4 (0, 3-6)</td>
<td>4 (0, 3-6)</td>
</tr>
<tr>
<td>Number of errors in months of the year in reverse order</td>
<td>1 (0-12)</td>
<td>0 (0-12)</td>
</tr>
</tbody>
</table>
participate in the first year of the study. Thirty-three females were excluded. Males who completed a sport concussion assessment tool at baseline (n = 2049/2121 = 96.6%) were included.

**Intervention/Observation Technique:** A pre-season baseline demographic and injury history questionnaire (including a SCAT) was completed.

**Outcome Measurements:** Sport Concussion Assessment Tool.

**Results:** A previous concussion was reported by 314 players (15.3%). Summary statistics from the SCAT are listed in Table 1. After adjusting for cluster by team, subjects with a previous history of concussion at pre-season evaluation were 1.55 times more likely to report balance problems and dizziness (Odds Ratio [OR] = 1.55; 95% CI, 1.05-2.30), 1.59 times more likely to report a headache (OR = 1.59; 95% CI, 1.19-2.12) and 1.62 times more likely to report neck pain (OR = 1.62; 95% CI, 1.16-2.24).

**Conclusions:** From an injury prevention standpoint, an understanding of the normative values for pediatric male hockey players is important as the SCAT is the current standard of practice. Subjects with a history of concussion were more likely to report symptoms of neck pain, headache and balance problems and dizziness.

**Risk Factors and Mechanisms of Injury Among Female Youth Ice Hockey Players**

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**Affiliation:** Sport Medicine Centre, University of Calgary, Calgary, Alberta, Canada.

**Objective:** The objectives of this study were: 1) To examine the incidence of injury in female youth ice hockey, 2) To examine the type and severity of injury associated with female youth ice hockey participation, and 3) To identify risk factors for injury in female ice hockey players.

**Study Design:** Prospective cohort study.

**Subjects:** Twenty-nine teams in the Girls Hockey Calgary Association (GHCA) including Atom (aged 9-10 years), Pee Wee (aged 11-12 years), Bantam (aged 13-14 years) and Midget (aged 15-16 years) age groups.

**Intervention/Observation Technique:** This study is utilizing a validated prospective Injury Surveillance System consisting of a pre-season questionnaire, weekly exposure sheets, injury report forms, the Buss-Perry Aggression Questionnaire, the Empathy Index for Children and Adolescents and a body contact questionnaire. Injury assessments are completed by study therapists and physician referral. The dependant variable is ice hockey injury and independent variables include risk factors for injury.

**Outcome Measurements:** The primary outcome measure is ice hockey injury, defined as any injury occurring in ice hockey during the 2008/09 season that required medical attention, and/or removal from a session, and/or missing a subsequent session.

**Results:** At the time of this preliminary analysis, 315 players on 28 teams had 315 injuries during the season (6 injuries/1000 hours) than in training (7.1 injuries/1000 hours) (P = 0.05). Most injuries were located at the lower limb (87.1% of all injuries) with the hip/thigh being the most frequently injured body region (43.6%), followed by the ankle/foot (21.5%) and the knee/lower leg regions (20.2%). Regarding the type of injury, 38.7% were muscle problems (strains), 26.4% contusions and 19.0% sprains. Twenty percent of the injuries were classified as moderate injuries, preventing the athlete from normal training from 8 to 28 days, 7% were severe (>28 days absence). Almost one fifth of the injuries were recurrent injuries. External violence was the cause of injury in 37%, while 58% and 5% had no external cause or were progressive in nature, respectively. Neither personal data nor variables from the pre-season tests were significantly related to increased injury risk (P > 0.05).

**Conclusions:** The context of competition is coupled with a greater injury risk compared to training in youth soccer. The absence of a relationship between player-related variables and injury risk warrants further investigation.

**Bilateral Isokinetic Peak Torque Ratios in Youth Soccer Players**

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**Affiliation:** Sports Faculty, University of Porto, Porto, Portugal.

**Objective:** This study aims to examine the peak torque in the knee extensor and flexor muscle groups, as well as the hamstrings to quadriceps (H/Q) ratios on the right and left lower limbs in youth soccer players according to age level and positional role.

**Study Design:** Cross-sectional study.

**Subjects:** Two hundred fifty-one youth Portuguese male soccer players from two different age groups (G1: n = 104; G2: n = 147), training 2–4 times per week (mean ± SD; age, G1 = 12.5 ± 0.6; G2 = 14.3 ± 0.6). Players were divided according to usual positional role on the field: central-defenders, fullbacks, midfielders, forwards, goalkeepers.

**Intervention/Observation Technique:** Players were divided according to usual positional role on the field: central-defenders, fullbacks, midfielders, forwards, goalkeepers.

**Outcome Measurements:** Subjects were evaluated using an isokinetic dynamometer at angular velocities 1.57 rad.s-1. Differences by age levels and positional roles were tested with an independent measures t-test and factorial analysis of variance. Bonferroni adjusted alfa levels for multiple comparisons test was used to check for specific differences by positional role and age.

**Results:** Significant differences (P < 0.001) were found between G1 and G2 concerning peak torque of the knee extensor and flexor muscles in both lower limbs. No significant differences were found (P > 0.05) in reciprocal balance about the knee for both limbs. Despite central defenders from both groups appearing to present higher peak torque of the knee extensor and flexor muscles in both lower limbs than all the other players, the analysis of variance according to positional role revealed that no significant differences were found in any of the variables between all the positional roles considered (P > 0.05).

**Conclusions:** This study indicates that isokinetic muscle strength of the knee extensor and flexor muscles changes according to age level. Positional role on the field does not influence isokinetic strength of the knee muscles. Youth soccer players also appear to present normal values of H/Q ratio. Future studies should...
focus on the influence of maturation factors, height, weight and training experience in isokinetic strength.

Acknowledgements: The first author acknowledges the Fundação para a Ciência e a Tecnologia regarding the grant SFRH/BD/44702/2008.

Interventions to Decrease the Risk of Ankle Injuries in Basketball Players

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Introduction: Basketball is one of the most popular sports in the world (played by 11% of the world population). Lower limb injuries in basketball are common and ankle injury seems most frequent. Ankle sprains constitute the majority of ankle injuries in basketball players both during practice and game, and at all levels of play. Ankle injuries have both immediate and long-term effects on the health and morbidity of the player.

Objective: To identify and understand risk factors for ankle injuries in basketball players and to formulate interventions to decrease them.

Search Strategy: We systematically searched MEDLINE, PubMed, EMBASE, CINAHL, SPORTDiscus and National Library for Health using the terms ankle injury, prevention, basketball and risk factors.

Results: Our search revealed 137 articles including 21 reviews. Very few articles were specific to ankle injury in basketball. Risk factors were divided into intrinsic and extrinsic risk factors and potentially modifiable risk factors were identified. Potentially modifiable risk factors are the area of focus in our review. Balance and proprioception training is the most important potentially modifiable factor. Other factors like skills training, joint strength and stability, overall fitness level, warm up, right footwear and ankle support are also important. The strongest predictor of ankle injury is a history of ankle injury (fivefold). Air cells may decrease rear foot stability and players with air cells in their heels are 4.3 times more likely to injure their ankles. Use of warm up decreases the risk of ankle injury by 2.7 times. Forty-five percent of ankle injuries were sustained during landing, and another 30% occurred during cutting or twisting maneuver. Centers playing inside the key tended to be at greatest risk for injury. Rate of injury during game situation is 2 times higher than practice. Ankle taping and ankle braces reduce ankle sprain injury in basketball. We must not ignore the importance of preparticipation evaluation by physicians, physiotherapists, and coaches.

Conclusions: Balance and proprioception training seems to be the most important potentially modifiable factor. Further prevention strategies need to be developed and validated. RCT and economic evaluation should be conducted to measure the impact of these prevention strategies.

The Effect of Helmets on the Risk of Head and Neck Injury Among Snowboarders and Skiers: A Systematic Review

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Objective: To review the literature on helmet effectiveness in snowboarders and skiers.

Study Design: This is a systematic review and meta-analysis. Comprehensive literature searches were conducted in: MEDLINE, Academic Search Complete, SPORTDiscus, EMBASE, ERIC, PubMed, and SafetyLit. Relevant conference proceedings and the reference lists of all included studies were hand searched. The titles and abstracts were independently screened by two reviewers and potentially relevant studies were independently assessed to determine if they: (1) were a controlled trial, cohort, case-control, or case-crossover study; (2) compared snowboarders or skiers with and without helmets; and (3) measured at least one objective outcome, such as head injury, neck injury, or severity of head/neck injury. Methodological quality was assessed using the Downs and Black checklist. Data were extracted and the results were checked for accuracy and completeness by a second reviewer. Extracted data included study design, demographic characteristics, data source, and results. Summary odds ratios (OR) and 95% confidence intervals (CI) were calculated using random-effects modeling.

Subjects: Ten studies were included.

Intervention/Observation Technique: Helmet use while snowboarding or skiing.

Outcome Measurements: Head or neck injury.

Results: The pooled odds ratio indicated that skiers and snowboarders wearing a helmet were significantly less likely to have a head injury than those not wearing a helmet (OR, 0.65; 95% CI, 0.54-0.79). The protective effect of helmets was observed in case-control studies using non-injured controls (OR, 0.58; 95% CI, 0.36-0.92) as well as controls with injuries other than to the head or neck (OR, 0.64; 95% CI, 0.52-0.80). Compared with no helmet or a knit hat, wearing a helmet also significantly reduced the odds of severe head injury versus a minor head injury (OR, 0.55; 95% CI, 0.42-0.72). The protective effect of helmets was observed among children < 13 (OR, 0.37; 95% CI, 0.22-0.61). There was no evidence for an association between neck injury and helmets (OR, 0.84; 95% CI, 0.69-1.03).

Conclusions: The evidence suggests that helmets reduce the risk of head injury among snowboarders and skiers without increasing the risk of neck injury.

Mechanism of Injury and Probability of Head Injury Among Children Hospitalized for a Ski/Snowboard or Ice Hockey Injury

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Affiliation: School of Kinesiology & Health Science. University of Calgary, Calgary, Alberta, Canada.

Objectives: The objectives of this study were 1) to compare the likelihood of head injury between skiers and snowboarders who fall compared to those who sustain a collision, and 2) to compare children injured in hockey by being struck by an object (puck, stick, board) to those who collided with another player.

Study Design: Cross-sectional study.

Subjects: All Canadian children hospitalized from 2001 to 2005 in provinces with ICD-10 coding were included if they were classified based on the ICD-10 injury-specific codes for skiing/snowboarding and for ice hockey.

Intervention/Observation Technique: Injuries were classified based on the ICD-10 injury-specific mechanism of injury codes for skiing/snowboarding (fall = W0201, collision = W0204, W2200, W5100) and for hockey (struck by an object = W2102, W2103, W2202, collided with a person = W5102). In addition, demographic data included age and gender.

Outcome Measurements: Skiing/snowboarding and ice hockey injuries based on ICD-10 injury-specific codes resulting in hospitalization. In addition, head injuries as classified by the primary diagnosis falling within the ICD coding S00 to S09 range.

Results: Over the 4-year period, 5255 children from included provinces were hospitalized. Of these, 3061 were skiing or snowboarding and 2194 were playing hockey when the injury was sustained. Males were more frequently injured than females (78% and 95% were male skiers and hockey players, respectively). In both sports, 12% of injuries were head injuries. Multivariate logistic regression analysis found that those who fell while skiing were significantly less likely to have a head injury (OR, 0.44; 95% CI, 0.33-0.59) than those injured in a collision after controlling for age and sex. In ice hockey, those who struck or were struck by an object (ie, puck, stick, boards) were significantly more likely to have a head injury than those who collided with another player (OR, 1.32; 95% CI, 1.03-1.69).

Conclusions: Head injuries among children involved in winter sports are common. Many head injuries are associated with striking or being struck by an object. These results suggest that ongoing strategies to promote helmet use in skiing/snowboarding are likely to reduce the likelihood of head injuries. Strategies to promote a safe ice hockey environment and reduce the risk of head injury should be examined and evaluated in ongoing studies.

Is Body Mass Index a Risk Factor for Sport Injury in Adolescents?

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Affiliation: Sport Medicine Centre, University of Calgary, Calgary, Alberta, Canada.
Objective: The objective of this study was to investigate the relationship between body mass index (BMI) and sport injury in adolescents.

Study Design: This was a secondary data analysis examining a cross-sectional survey from a combined junior high and senior high population in the Calgary area (n = 4343) in 2005-2006.

Subjects: Adolescents were between 12-19 years of age from junior and senior high schools in the Calgary area.

Intervention/Observation Technique: A multivariate logistic regression analysis, controlling for clustering by school, was used to examine the relationship between BMI and sport injury. Gender, age, and hours of sport participation as potential effect modification and confounding were also examined. BMI percentile as the exposure was stratified as healthy weight (< 85th percentile for gender and age), overweight (85th-95th percentiles) and obese (> 95th percentile).

Outcome Measurements: Sport injury as the outcome was defined as any self-reported sport injury sustained in the previous year. Medically treated injury was defined as an injury that was treated by a medical professional (i.e., physician, physiotherapist).

Results: The incidence proportion for all sport injury in the previous year was 65.69% (95% CI, 64.23-67.15). There was an increased risk of injury in overweight compared to healthy BMI, adjusted for hours of sport participation (odds ratio [OR], 1.3; 95% CI, 1.01-1.73). There was also an increased risk of injury with increasing hours of participation, where the OR associated with the highest participation group was 4.53 (95% CI, 2.91-7.37), compared to the lowest. There was no significant difference in injury risk by gender (OR, 1.01; 95% CI 0.89-1.15), or by age group (OR, 14-15y), 1.05; 95% CI, 0.85-1.30; (16-17y), 0.95; 95% CI, 0.78-1.18; (18–19y), 0.77; 95% CI, 0.54-1.09 compared to the youngest group (12-13y).

TABLE 1. Multivariate Main Effect Logistic Regression Model Predicting Injury

<table>
<thead>
<tr>
<th>Injury</th>
<th>All Sport Medically Treated Injury</th>
<th>Adj OR (95% CI)</th>
<th>P-value</th>
<th>Adj OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI Percentile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 85th</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>85th-95th</td>
<td>(1.01-1.72)</td>
<td>0.04*</td>
<td>0.99 (0.76-1.29)</td>
<td>0.954</td>
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<tr>
<td>&gt;95th</td>
<td>(0.84-1.73)</td>
<td>0.302</td>
<td>0.96 (0.68-1.35)</td>
<td>0.823</td>
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<tr>
<td>Exposure (hrs/wk)</td>
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<td></td>
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<td></td>
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<tr>
<td>&lt; 1</td>
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<td>1.00</td>
<td>1.00</td>
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<tr>
<td>1-2</td>
<td>(1.12-2.12)</td>
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<td>1.55 (0.81-1.83)</td>
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<tr>
<td>&gt;2-4</td>
<td>(1.45-2.86)</td>
<td>&lt;0.001*</td>
<td>1.61 (1.12-2.36)</td>
<td>0.013*</td>
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<td>&gt;4-7</td>
<td>(1.75-3.38)</td>
<td>&lt;0.001*</td>
<td>2.46 (1.70-3.58)</td>
<td>&lt;0.001*</td>
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<td>&gt;7-10</td>
<td>(3.26-5.97)</td>
<td>&lt;0.001*</td>
<td>4.62 (2.64-5.32)</td>
<td>&lt;0.001*</td>
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<tr>
<td>&gt;10</td>
<td>(5.91-7.53)</td>
<td>&lt;0.001*</td>
<td>6.39 (4.95-11.04)</td>
<td>&lt;0.001*</td>
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<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>(0.89-1.15)</td>
<td>0.465</td>
<td>0.97 (0.83-1.15)</td>
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<td>Age Category</td>
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<td>1.00</td>
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<tr>
<td>14-15</td>
<td>(0.85-1.30)</td>
<td>0.985</td>
<td>1.06 (0.82-1.37)</td>
<td>0.636</td>
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<tr>
<td>16-17</td>
<td>(0.78-1.18)</td>
<td>0.617</td>
<td>1.07 (0.83-1.37)</td>
<td>0.614</td>
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<tr>
<td>18-19</td>
<td>(0.54-1.09)</td>
<td>0.095</td>
<td>0.91 (0.59-1.42)</td>
<td>0.683</td>
<td></td>
</tr>
</tbody>
</table>

*Significance based on P < 0.05

Conclusions: There is an increased risk of sustaining a sport injury in overweight adolescents compared to those of healthy weight. There is also a greater risk of injury with increasing hours of sport participation. There is a need for research that will lead to both sport injury prevention and promotion of healthy weights in adolescents.
Effectiveness of a Primary School-Based PA Injury Prevention Program: a Randomized Controlled Trial

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Objective: To study the effects of a 1-year school-based injury prevention program on acute physical activity injury incidence and severity in primary school children.

Study Design: Cluster randomized controlled trial.

Subjects: Subjects included 2210 Dutch primary school children aged 10-12 years.

Intervention/Observation Technique: Schools were randomized to receive or not receive the intervention program targeting acute physical activity injuries which consisted of a teacher manual, informative newsletters and posters, a website, and simple exercises to be carried out during physical education classes (n = 1117) or receive the regular curriculum (n = 1093).

Outcome Measurements: Incidence and severity of acute physical activity injuries per 1000 hours of physical activity participation.

Results: Data from 1015 children in the intervention and 996 children in the control group were analyzed. After one school year, the overall physical activity injury incidence per 1000 hours of physical activity participation was significantly reduced in the intervention group compared to the control group (hazard ratio [HR], 0.68; 95% CI, 0.49-0.95). The largest intervention effect was observed on injury incidence during organized sports activities (HR, 0.55; 95% CI, 0.31-0.98). In boys, the severity of the overall physical activity injuries was significantly lower in the intervention group compared to the control group (OR, 0.12; 95% CI, 0.02-0.72).

Conclusions: Our school-based intervention-program was effective in reducing acute physical activity injury incidence in primary school children. The program also decreased the severity of physical activity injuries in boys.

Acknowledgements: The iPlay-study is supported by a grant from the Heritage Foundation for Medical Research.

A Pilot Study Examining the Effectiveness of a Combined Obesity and Sport Injury Prevention Program in Junior High Schools

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Objective: The objective of this study is to investigate the effectiveness and feasibility of a combined sport injury and obesity prevention program in junior high schools (adolescents aged 11-15 years).

Study Design: This is a randomized controlled trial design. Schools were randomized to the prevention program or control group by school.

Subjects: The subjects in this study are adolescent boys and girls aged 11-15 years recruited from 2 public schools in the North and South areas of Calgary. All grade 7-9 students enrolled in physical education (PE) classes were recruited for participation in the study.

Intervention/Observation Technique: The intervention program is 15 minutes in duration, and involves both high intensity and neuromuscular training which precedes each PE class. The program mimics a warm up and is designed to combine physical activity at greater than 75% maximum heart rate, with prescribed lower extremity and core strength, agility and balance training exercises. The control program utilizes the current standard of practice in PE classes, a 15-minute dynamic warm up.

Outcome Measurements: Primary outcome measures are waist circumference (cm) and all sport injury. This is defined as any injury occurring during a sporting activity that requires medical attention and/or cessation of the sporting activity, and/or resulting in at least 1 day loss from sporting activity. Secondary outcomes include: body composition [triceps skin fold (mm), BMI percentile (kg/m² by age and gender), aerobic fitness [VO₂ maximum (mL/kg/min)]] and musculoskeletal fitness (push ups, curl ups, grip strength, trunk flexibility, vertical jump, unipedal dynamic balance, and vertical drop jump). Timelines for assessment are at baseline and 3 months following initiation of program.

Results: There were 349/481 (72.56%) participants in the intervention school and 334/653 (51.15%) participants in the control school who agreed to participate. Preliminary results for baseline characteristics at baseline are presented in Table 1. The primary between group comparisons for injury rates (# of injuries/1000 participation hours) will be estimated using incidence rate ratios based on multivariate Poisson regression analysis. A between group comparison of physical measures including body composition, aerobic and musculoskeletal fitness will made using multivariate linear regression analysis.

Conclusions: The future direction for this research includes determining the effectiveness of such a neuromuscular prevention program in PE classes based on individual level analysis in this pilot study. In addition, the feasibility of a larger cluster RCT will be determined.

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