analysis. Key stakeholder engagement at each stage and video tagging by researchers and clinicians were undertaken. To identify suspected injury and concussion, operationally defined criteria were used. These criteria were face and content validated. Four suspected injury and 15 suspected concussion criteria were used. Each coder was required to complete inter-rater reliability, using the group consensus as the gold standard response for comparison.

Results 225 suspected injuries and 59 suspected concussions were identified. The median number of injury criteria met was 3/4, with medical attention being required in 81% of cases, yet only 29% required removal from the field. Median number of concussion criteria was 2/15. Medical attention was the injury criteria with the highest level of agreement between unique coders (78–100% agreement).

Conclusion Video-analysis is an underused tool for capturing suspected injury/concussion events. When undertaken using clearly operationalised definitions and in consultation with medical experts, vital information can be acquired to inform prevention strategies. The implications of this are wide-ranging and offer new opportunities for surveillance and prevention in under-reported and/or under-resourced sporting environments, particularly youth and female sport.

99 LONG-TERM PROGNOSIS OF INDIVIDUALS WITH PLANTAR HEEL PAIN

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Introduction Plantar heel pain (PHP) used to be considered a self-limiting condition, where pain was thought to resolve within a year after onset. A number of studies with varying quality of oucomes and small sample-sizes have questioned the benign nature of PHP. The aim of this study was to explore the long-term prognosis of individuals treated for PHP.

Materials and Methods Patients treated for PHP at Aalborg University Hospital between 2011–2018 were in 2020 asked to complete online questionnaires. Questionnaires included demographic and patient characteristics, heel pain during the past 4 weeks, mean pain intensity during the past week (0–10 numerical rating scale), work situation, comorbidities, and the EQ5D.

Results So far, 254 individuals completed the questionnaires (38% response rate). Mean age was 54 years (±12) and median period of heel pain was 20.5 months (IQR 9–60). At follow-up, 55% (95%CI 49–61%) still reported heel pain during the past 4 weeks with a median pain intensity of 5 (IQR 3–7). 76–86% of these reported concomitant musculoskeletal pain. During follow-up, 18% changed their work assignments due to heel pain, 25% reported sick leave due to heel pain (median days off work 21 (IQR 7–90)) and 27% reported depressive symptoms on the EQ5D.

Conclusion Despite specialized care, more than half still reported PHP up to 10 years after treatment. The condition was associated with sick leave and changed work assignments among several patients. These results emphasise the large impact PHP may have on individuals and highlights the need for more effective treatments.

100 LOCAL NEUROMUSCULAR CHARACTERISTICS ASSOCIATED WITH PATELLOFEMORAL PAIN: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Introduction Local neuromuscular deficits have been reported in people with patellofemoral pain. To help identify interventional targets, we synthesized the neuromuscular characteristics associated with patellofemoral pain persistence.

Materials and Methods Five databases were searched for case-control studies. Muscle electromyography, flexibility, performance and cross-sectional area data were extracted from reports of functional or isolated tasks and synthesised. An evidence gap map was constructed.

Results Sixty-seven studies were retained. In functional tasks, electromyographic investigations showed moderate evidence of small effect for vastus medialis onset-delays relative to vastus lateralis (0.44 [0.03, 0.85]) during stepping/stair negotiation tasks, and higher biceps femoris mean excitation amplitudes (0.55 [0.06, 1.04]) in single-leg triple-hop test. In isolated tasks, we found moderate evidence of medium effect for lower Hoffman-reflex amplitude of vastus medialis (-1.12 [-1.56, -0.67]). Muscle performance investigations showed: strong evidence with medium and small effects for lower extensors concentric (-0.61 [-0.81, -0.40]) and eccentric (-0.56 [-0.79, -0.33]) strength; and moderate evidence of medium effect of lower isometric (-0.64 [-0.87, -0.41]) strength; moderate evidence with small effect for rate of force development to 30% (-0.55[-0.89, -0.21]), 60% (-0.57[-0.90, -0.25]) and medium effect to 90% (-0.76[-1.43, -0.10]) of maximum voluntary contraction; and small effect for lower flexors concentric strength (-0.46 [-0.74, -0.19]) and extensors total work (-0.48 [-0.90, -0.07]). Flexibility investigations showed tighter hamstrings (-0.57 [-0.99, -0.14]).

Conclusion Quadriceps and hamstring motor-control, flexibility and weakness are robustly associated with patellofemoral pain, so these parameters should be used to guide investigations of treatment effect mechanisms.

106 USABILITY OF PAPER AND ELECTRONIC PAIN DRAWINGS IN ASSESSING MUSCULOSKELETAL PAIN: A SCOPING REVIEW

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Background COVID-19 has accelerated the implementation of online consultations thus creating the need to assess usability of electronic-pain-annotation tools. We aimed to learn from

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the pandemic and generate practice recommendations from assessing electronic-pain-annotation and pen-to-paper-annotation by producing a detailed usability framework.

Materials and Methods This study followed the PRISMA scoping review guidelines. Online databases were searched from January 2015 to February 2021 for studies evaluating pain diagram usability in adults with musculoskeletal pain. Study quality was assessed using STROBE. An evidence gap map, framework and infographic were constructed.

Results 22 observational studies, 1 systematic review and 1 app review were included; of which 9 were high quality, 13 medium and 1 low (App review not assessed). 9 studies reviewed pen-to-paper-annotation, 14 reviewed electronic-pain-annotation and 1 both. Pen-to-paper-annotation and electronic-pain-annotations were found to be highly reliable (ICC 0.81–0.998), valid, and successful communication tools. Both had a positive relationship with outcome measures assessing psychological comorbidities, such as the widespread pain index. Gender specific electronic-pain-annotations enable better identification with the diagram and enhance communication about pain. Barriers involved lack of technology, interpretation, age, and pain experience. Automated weekly reminders were a completion facilitator. There were no studies directly comparing electronic-pain-annotation to pen-to-paper-annotation.

Conclusion Electronic-pain-annotation and pen-to-paper-annotation were both effective at communicating pain with electronic-pain-annotation allowing for more accurate quantification of pain extent. Gender specific electronic-pain-annotation allowed for better reporting of pain. Gaps included responsiveness in both modes and usability in electronic-pain-annotations which needs to be addressed to optimise integration into electronic health records.

108 PROTECTIVE EQUIPMENT IN YOUTH ICE HOCKEY: ARE MOUTHGUARDS AND HELMET AGE RELEVANT IN EVALUATING CONCUSSION RISK?

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Introduction The high concussion burden in youth ice hockey is concerning. An important yet understudied area for prevention is protective equipment (e.g., wearing a mouthguard, age of helmet). Therefore, the objective of this study was to compare incidence rates of concussion between players based on mouthguard use and helmet age.

Materials and Methods This prospective cohort collected concussion information and player participation over five seasons (2013/14–2017/18) in male and female youth ice hockey players (ages 11–18). Baseline assessments were completed near the season start and collected reports on mouthguard use (yes, no), helmet age (newer/<2 years old, older/≥2 years old), and other important covariables (i.e., weight, age group, position of play, concussion history, body checking). Moreover, each player's participation hours and the number of therapist-suspected and physician-diagnosed concussions were collected throughout each season. A multilevel negative binomial regression model was used to estimate the concussion incidence rate and incidence rate ratio (IRR) for equipment.

Results The model included 426 player concussions (suffered by 369 players) with 271,148.7 player-hours and was adjusted for covariables, clustered by team, and offset by player-hours. Results showed that players who reported wearing a mouthguard had a 28% lower concussion rate compared with non-wearers (IRR=0.72, 95%CI: 0.55–0.93) while no differences in the concussion rate between newer and older helmet ages (IRR=0.94, 95%CI: 0.76–1.16) were detected.

Conclusions Wearing a mouthguard was associated with significantly lower concussion rates; thus, policy mandating use should be considered in youth ice hockey. More specific helmet age categories may require further investigation.

114 PREDICTORS OF RESPONSE TO NEUROMUSCULAR TRAINING WARM-UP PROGRAMS AMONG YOUTH

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Introduction Neuromuscular training (NMT) warm-ups are effective in reducing injury risk in youth. Factors predicting the response to NMT in reducing injury risk are unknown, making this the objective of the present study.

Materials and Methods This is a secondary analysis of the intervention groups of randomized controlled trials evaluating NMT warm-ups among youth (11–18 years) [basketball (n=494), soccer (n=380), physical education (PE; n=919)]. Response was predicted based on age, sex, height, weight, sport/PE, one-year injury history, adherence (weekly sessions) to NMT, and balance ability (timed single-leg on balance pad). Generalized estimating equation analysis was used to estimate odds ratios (OR) with clustering on team/class, exchangeable correlation structure, robust variance estimator, and offset for exposure hours.

Results Adjusting for age, balance, injury history, sex and sport/PE, balance ability reduced the odds of injury [OR=0.955, (95%CI: 0.912–0.999)]. Predictors of non-response include previous injury [OR=1.895, (95%CI: 1.335–2.691), female sex [OR=1.595, (95%CI: 1.119–2.274), and playing basketball [OR=3.151, (95%CI: 1.616–6.142)]. Stratifying by sex, weekly NMT sessions did not predict injury in females, however injury history [OR=2.148, (95% CI: 1.394–3.311)] and basketball [OR=3.677, (95% CI: 1.558–8.679)] were associated with increased odds. Stratifying by sex and sport, female soccer players had lower odds associated with

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