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UNDERSTANDING SPORT INJURY IN YOUTH SPORT

Risk factors, psychological responses, and prevention among youth players in floorball high school contexts

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Abstract

Injuries are common in youth sports, and floorball is no exception, with high injury rates among youth players. However, underlying risk factors are often studied in isolation despite the complex nature of injury risk. Injuries may also negatively affect athletes' psychological well-being, but longitudinal evidence on the association between injuries and changes in mental health remains scarce across athlete populations, including youth athletes. Furthermore, although many injury prevention interventions have proven effective, adherence remains a challenge, highlighting the importance of behavioral and context-specific approaches. The overall aim of this thesis was to advance the understanding of sport injuries in youth athletes by examining combinations of risk factors, psychological responses in relation to injury over time, and injury prevention practices within Swedish elite floorball high schools.

Three studies were conducted. The first two used quantitative designs to follow youth floorball players over the course of a school year, whereas the third explored injury prevention in the school context through qualitative interviews with teachers. Findings from Study 1 suggest that youth floorball players differ in profiles combining physical and psychological factors, and that players with higher physical capacity and moderate mental health reported higher injury occurrence during the season. In Study 2, occasions of higher-than-usual injury severity (defined as impact on participation, performance, and pain) were associated with small increases in anxiety and small decreases in depression symptoms, with notable variation between individuals. Study 3 showed that teachers identified both facilitators and barriers to injury prevention in the school context, particularly related to structural conditions, coordination of training load, and communication between schools and club teams. Teachers described using need-supportive strategies and dialogue to promote engagement in preventive work.

Taken together, the findings highlight that injury risk in youth sports is multifactorial, dynamic, and varies between individuals. Effective understanding, management, and prevention of injuries require coordinated efforts between key stakeholders, including athletes, teachers, coaches, parents, and sport organizations. The school context appears to provide a valuable setting for introducing and practicing preventive behaviors. However, sustained impact depends on supporting students' autonomy and responsibility, as well as strengthening communication within and across contexts.

List of Papers

1. Levin, S., Tervo, T., Ivarsson, A., Hägglund, M., & Stenling, A. (2025). Combinations of psychological and physical risk factors for sport injuries in youth floorball players: a latent profile analysis. *BMJ Open Sport & Exercise Medicine*, *11*(1), e002309. https://doi.org/10.1136/bmjsem-2024-002309

2. Levin, S., Tervo, T., Ivarsson, A., Hägglund, M., & Stenling, A. Mental health trajectories in youth athletes and within-person responses to injury. *Manuscript submitted for publication.*

3. Levin, S., Tengman, E., Stenling, A., Ivarsson, A., & Tervo, T. (2026). From leadership to autonomy: How teachers in school sports (floorball) facilitate students' competence in injury prevention. *International Journal of Sports Science & Coaching*, *0*(0). https://doi.org/10.1177/17479541261435455

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Abbreviations

ACL	Anterior cruciate ligament
BCH	Bolck-Croon-Hagenaars approach
BIC	Bayesian Information Criterion
BLRT	Bootstrap Likelihood Ratio Test
CI	Confidence interval
CrI	Credible interval
DASS-21	Depression Anxiety Stress Scales-21 item
GAD-7	General Anxiety Disorder-7 item scale
FIML	Full Information Maximum Likelihood
LMR	Lo-Mendell-Rubin Test
LPA	Latent profile analysis
NIU	Certified regional elite sport high school
OR	Odds ratio
OSF	Open Science Framework
OSTRC-H2	Oslo Sports Trauma Research Center Questionnaire on Health Problems (updated version)
OSTRC-O2	Oslo Sports Trauma Research Center Overuse Injury Questionnaire (updated version)
QCA	Qualitative content analysis
RIG	National elite sport high school
SABIC	Sample-Adjusted Bayesian Information Criterion

SDT	Self-determination theory
TCM	Trans-contextual Model
TPB	Theory of Planned Behavior
WHO-5	World Health Organization Five Well-Being Index

Sammanfattning på svenska

Bakgrund och syfte

Skador inom ungdomsidrott är ett utbrett problem och svensk innebandy utgör inget undantag. Forskning från det senaste decenniet visar att ungefär hälften av ungdomsspelarna drabbas av minst en skada varje år. Vanligast är skador i nedre delen av kroppen, såsom fotleder, knän, höfter och bäcken, men även ländryggsskador förekommer. Skadorna är både av akut och överbelastningskaraktär.

Att studera idrottsskador är ingen ny företeelse och olika typer av ramverk, teorier och modeller har utvecklats för att förstå prediktion, riskfaktorer, konsekvenser, prevention och rehabilitering. Forskning har visat att såväl fysiska, biologiska och demografiska som psykologiska och sociala faktorer kan påverka risken för skada. Dessa faktorer har dock oftast studerats var för sig eller utifrån ett givet område (till exempel fysiska riskfaktorer), vilket är problematiskt eftersom det riskerar att förbise att flera risk- och skyddsfaktorer kan samverka inom individen. När det gäller konsekvenser av skador lyfts ofta, såväl i praktiken som inom forskningen, prestationseffekter, sociala konsekvenser av att inte kunna vara en del av laget samt försämrat välmående. Dessa aspekter har ofta studerats genom jämförelser mellan skadade och icke-skadade idrottare. Forskning visar att skador kan påverka mental hälsa negativt, men det finns begränsad kunskap om hur detta varierar mellan individer och hur skada och mental hälsa samvarierar över tid. Vidare har skadeprevention länge varit ett centralt fokus inom forskning och praktik. Inom innebandy har såväl neuromuskulära som psykologiska preventiva insatser utvecklats och utvärderats. Generellt sett visar forskning kring skadeprevention att sådana insatser ofta har god effekt när de genomförs regelbundet, i tillräcklig omfattning och med korrekt utförande. En återkommande utmaning är dock långsiktigt vidmakthållande, då tidsåtgång, prioriteringar, motivation och kunskap kan utgöra hinder. Nyare forskning har därför i ökad utsträckning lyft fram vikten av beteendemässiga och kontextspecifika komponenter i utformning, genomförande, implementering och utvärdering av skadepreventiva insatser.

Den här avhandlingens övergripande syfte var att öka förståelsen för idrottsskador hos innebandyspelande gymnasieungdomar. Fokus ligger på att identifiera kombinationer av faktorer som kan relateras till skadeförekomst, undersöka psykologiska reaktioner i samband med skada samt belysa skadepreventiva strategier inom skolverksamheten. Avhandlingen belyser dessa

frågor genom att kombinera flera metodansatser, vilket möjliggör en mer sammansatt förståelse av skaderisk hos unga idrottare. Genom ett praktiknära angreppssätt, i samarbete med relevanta verksamheter, avser avhandlingen bidra med kunskap som är direkt användbar för idrottare, ledare, lärare, föräldrar och idrottsorganisationer, med målet att främja ett hållbart idrottande.

Hur genomfördes studierna?

För att besvara avhandlingens syften samlades data in från elever på nationellt godkända idrottsutbildningar (NIU) med innebandyinriktning samt från Riksinnebandygymnasiet (RIG) under perioden 2020–2023. Eleverna besvarade omfattande enkäter och genomförde fysiska tester två gånger per år. Därutöver rapporterade de varje vecka uppgifter om generell hälsa, träningsrelaterade aspekter och skadeproblematik, samt varannan vecka skattningar av sin mentala hälsa. I denna avhandling har data från skolåren 2021/22 och 2022/23 inkluderats, då data från 2020/21 bedömdes vara alltför påverkad av restriktioner relaterade till covid-19-pandemin.

I studie 1 analyserades data med hjälp av latent profilanalys för att identifiera olika profiler baserade på fysiska och psykologiska variabler, samt undersöka hur dessa relaterade till skadeförekomst. I studie 2 analyserades idrottarnas skattningar av mental hälsa över tid med hjälp av multinivåmodeller, med särskilt fokus på variation över säsongen och i relation till skador. Studie 3 behandlar lärares erfarenheter av och arbete med skadeprevention inom gymnasieverksamheten. Data samlades in genom intervjuer med lärare från skolor spridda över Sverige. Intervjuerna analyserades med kvalitativ innehållsanalys i syfte att identifiera teman och kategorier som beskrev lärarnas erfarenheter samt konkreta och mer implicita strategier i det skadeförebyggande arbetet.

Resultat

Resultaten från studie 1 visade att idrottarna kunde delas in i tre olika profiler som skilde sig åt i både fysisk prestationsförmåga och mental hälsa. Den största gruppen uppvisade medelhög mental hälsa och presterade bäst på de fysiska testerna i jämförelse med de andra profilerna. En mindre grupp rapporterade lägre mental hälsa än övriga och hade resultat på fysiska tester på medelnivå, medan den tredje gruppen kännetecknades av högst skattad mental hälsa men lägst resultat på fysiska tester. Ett oväntat resultat var att gruppen med bäst fysiska testresultat och medelhög mental hälsa också hade högst skadeförekomst under säsongen. En möjlig förklaring är att dessa idrottare har

en fysisk kapacitet som gör att de kan utföra rörelser med större kraft och högre hastighet, vilket är förknippat med ökad skaderisk. Samtidigt är det troligt att idrottare som generellt mår bra, såväl fysiskt som mentalt, också kan prestera på en högre nivå och därmed delta mer frekvent i träning och matchspel, vilket i sin tur ökar exponeringen för situationer där skador kan uppstå.

I studie 2, där symptom på depression, ångest och stress följdes över tid, minskade dessa generellt under säsongen. Tjejer rapporterade högre symptomnivåer än killar, i linje med vad som ses i ungdomsbefolkningen i stort. På gruppnivå framkom inga förhöjda nivåer av psykiska symptom, men det fanns variation både inom och mellan individer över tid. Vid tillfällen då idrottarna var skadade, eller upplevde större skadepåverkan än vanligt, sågs vissa förändringar i symptomnivåer. Symptom på ångest ökade, medan depressionssymptom, något oväntat, minskade. Förändringarna var dock relativt små och varierade mellan individer, och inga tydliga könsskillnader framkom i dessa mönster.

Resultaten från studie 3, som bygger på intervjuer med lärare, visade att det skadeförebyggande arbetet genomfördes regelbundet inom skolornas verksamhet och inkluderade både praktiska och teoretiska inslag. I intervjuerna lyftes flera förutsättningar fram som möjliggjorde arbetet, såsom tillgång till lokaler, avsatt tid och att det ingick i läroplanen. Lärare beskrev att de upplevde att eleverna kunde se värdet av skadeförebyggande insatser, även om dessa ibland upplevdes som mindre motiverande än ordinarie träning. För att öka engagemanget arbetade lärarna med variation och tydliggörande av syfte, samt genom att belysa prestationsrelaterade effekter av att hålla sig skadefri. Vidare bedrevs arbetet genom strategier som byggde på dialog och en successiv progression i ansvarsfördelning för träningens innehåll och genomförande. Kommunikation med klubblag kring belastning, skadekänningar och elevernas totala situation lyftes fram som en viktig men samtidigt svårhanterad del i det skadepreventiva arbetet.

Slutsatser och praktiska implikationer

Skaderisk hos unga idrottare är ett komplext och dynamiskt fenomen som uppstår i samspelet mellan fysisk prestation, psykisk hälsa och idrottens kravmiljö, vilket innebär att effektiva preventiva insatser behöver anpassas till såväl individ som kontext. Den här avhandlingen visar att skaderisk inte enbart kan förstås utifrån enskilda faktorer, utan behöver ses som ett samspel mellan flera dimensioner. Resultaten visar dessutom att idrottare skiljer sig åt i hur dessa faktorer kombineras, vilket understryker vikten av att studera risk som ett multifaktoriellt och individberoende fenomen snarare än som isolerade

riskfaktorer. Samtidigt visar resultaten att hög fysisk prestationsförmåga inte nödvändigtvis innebär ett skydd mot skador. Tvärtom kan idrottare som presterar på hög nivå vara särskilt exponerade för skaderisk, exempelvis genom högre belastning och större deltagande i träning och matchspel. Detta utmanar föreställningen om att skadeprevention främst bör riktas mot individer med uppenbara begränsningar och pekar i stället på behovet av ett bredare och mer nyanserat arbetssätt. Vidare framkommer att mental hälsa varierar över tid och i viss mån påverkas av skador, med variation mellan individer. Även om de förändringar som fångats i avhandlingen är relativt små, belyser det betydelsen av ett dynamiskt perspektiv, där både mående och risk förstås som något som förändras över tid och i relation till kontext. Därtill visar avhandlingen hur skadeförebyggande arbete genomförs i praktiken och att det utifrån lärarnas erfarenheter är viktigt att sådana insatser behöver vara meningsfulla, varierade och integrerade i den ordinarie verksamheten. En återkommande utmaning är att stödja idrottare i att balansera belastning och återhämtning i en miljö där krav från både skola och föreningsidrott samverkar. Detta pekar på ett potentiellt behov av tydligare riktlinjer på organisationsnivå, exempelvis från relevant idrottsförbund, kring hur belastning kan följas och hanteras samt hur kommunikationen mellan skola och föreningsverksamhet kan struktureras för att minska motstridiga krav på individen. Sammantaget pekar resultaten på att skadeprevention och insatser för att hantera uppkomna skador behöver utformas och anpassas till individ och kontext, och att skadeförebyggande insatser bör omfatta samtliga idrottare. Samtidigt kan det finnas skäl att rikta extra uppmärksamhet mot vissa situationer eller faser, exempelvis vid hög belastning eller i samband med en första skada. Detta har potential att bidra till en mer hållbar idrottsutveckling för unga elitidrottande elever.

Introduction

Every year, tens of thousands of Swedish youths lace up their shoes and step onto the floorball court, seeking not only athletic achievement but also community, joy, social interactions, and lifelong health. Youth sport engagement, such as floorball participation, is widely recognized for its positive impact on both immediate and lifelong physical and mental well-being (Bengtsson et al., 2025). In Sweden, floorball is the largest youth indoor team sport in terms of participation (Riksidrottsförbundet, 2024; Svenska Innebandyförbundet, 2026), and many adolescent players choose to pursue their academic and athletic development by enrolling in floorball high schools the year they turn 16. Yet, beneath the benefits of youth sports lie a pressing concern: high injury rates threaten the well-being and future of young athletes. Results from a recent randomized controlled trial indicate that about half of young floorball players experience at least one injury each season (Åkerlund et al., 2020). Acute injuries, such as ankle and knee trauma, and overuse injuries affecting the lower back, pelvis, and knees are particularly common (Leppänen et al., 2015; Tervo et al., 2019). These injuries not only affect individual health and team performance (Hägglund et al., 2013; Ivarsson et al., 2017; Putukian, 2016), but also carry societal costs (Turnbull et al., 2024) and, in some cases, lead to early career termination (Crane & Temple, 2015). These observations lead to a central, and perhaps uncomfortable, question: Are we doing enough to prevent harm in youth sport?

Sport injuries have increasingly been conceptualized as a systemic and ongoing process rather than an isolated event, involving several interconnected phases, including pre-injury processes, injury occurrence and immediate responses, treatment and rehabilitation, and finally return-to-sport or retirement transitions (e.g., Ivarsson et al., 2018; Johnson & Podlog, 2014; Wiese-Bjornstal et al., 2020). Additionally, researchers have argued that understanding and preventing sport injuries requires integrating the identification of risk factors, longitudinal monitoring of athlete health, and the implementation of appropriate prevention strategies (Bahr, 2016). However, despite increasing recognition of sport injury as a complex and dynamic process, studies of injury risk factors have predominantly focused on individual physical, psychological, or demographic characteristics (Bittencourt et al., 2016). Furthermore, psychological factors, particularly stress and stress responses, have shown associations with injury risk, yet less is known about how mental health fluctuates over time in athletes and how injury experiences may relate to such changes (Clement et al., 2021; Tranaeus et al., 2024). Similarly, although prevention programs like neuromuscular training and stress-reduction

interventions can substantially reduce injury rates, low adherence remains a critical concern (Bahr et al., 2015; Chan et al., 2011). Accordingly, greater attention to behavioral and contextual factors has been called for to better understand and improve adherence (Donaldson et al., 2017; Gabriel et al., 2019).

Definition of sport injury used in this thesis

Injury definitions and operationalizations vary across research contexts and study purposes. Sport injury research has traditionally relied on time-loss or dichotomous injury definitions, often capturing acute injuries resulting in absence from training or competition (Fuller et al., 2006). While such definitions remain important and were applied in parts of the present thesis, they may capture only certain aspects of athletes' injury experiences, particularly in relation to overuse injuries developing gradually over time (Clarsen et al., 2013). Accordingly, this thesis draws on multiple conceptualizations of sport injury to capture complementary aspects of injury occurrence, athlete health, and sports participation, as recommended by Clarsen & Bahr (2014).

Injury	Any physical complaint sustained by a player that results from sport training or competition, irrespective of the need for medical attention or time loss from sport activities (Fuller et al., 2006).
Acute injury	Refers to an injury occurring suddenly and resulting from a specific, identifiable event (Fuller et al., 2006).
Overuse injury	An injury caused by repeated microtrauma without a single, identifiable event responsible for the injury (Fuller et al., 2006).
Time-loss injury	An injury that results in a player being unable to take full part in future sport training or games (Fuller et al., 2006).
Injury severity	To what extent an injury impacts participation in regular training or competition, modification of training or game volume, performance in sport, or pain (Clarsen et al., 2020).

Study context - Why floorball?

This thesis focuses on floorball as the empirical context, a choice motivated by both scientific relevance and practical considerations. The project was conducted in close collaboration with the Swedish Floorball Federation and was co-funded by the federation, the Floorball Research and Development Centre at Umeå School of Sport Sciences at Umeå University, together with the Industrial Doctoral School at Umeå University, reflecting a shared interest in understanding and addressing injury-related challenges within youth sport. While the overall research design and specific research questions were developed within an academic framework, representatives from the federation contributed to identifying priority areas of interest, ensuring that the project addresses issues of direct relevance to current practice.

Floorball constitutes a suitable context for studying injury risk and prevention in youth sport. The sport is widely represented across Sweden, including over 30 elite sport high schools with a floorball profile, providing access to a geographically diverse and high-level youth population. This group is of specific interest given known elevated injury rates and the developmental demands associated with dual-career aspirations, combining sport and education. The established collaboration with the federation further enabled large-scale data collection across multiple sites, which would have been difficult to achieve otherwise.

To provide context for the studies included in this thesis, it is essential to describe both the game of floorball, common injuries in floorball, and the Swedish system for elite sports education at the high school (upper secondary school) level.

The sport of floorball

Floorball is an indoor team sport played on a 40 × 20 m pitch surrounded by a 0.5 m high board. Players use lightweight plastic sticks and a hollow plastic ball with holes, and the playing surface is typically synthetic or wooden. Each team consists of five field players and one goalkeeper, who does not use a stick. Games are divided into three periods of 15–20 minutes, depending on age group and competition regulations, and substitutions occur on the fly. In Sweden, the competitive season generally runs from September to April. The sport originated in Sweden in the 1970s, influenced by earlier forms of floor hockey (i.e., Cosom floor hockey), and the first official Swedish Floorball Federation was established in 1981. The International Floorball Federation (IFF) was founded in 1986 by Sweden, Finland, and Switzerland to govern the sport globally (International Floorball Federation, n.d.). Today, floorball is played in more than 80 countries across all continents, with the highest participation

rates in Northern Europe, Switzerland, and the Czech Republic (International Floorball Federation, 2021). Over the past decades, floorball has evolved from a recreational activity into a competitive sport characterized by substantial physical and motor demands. Field players perform repeated high-intensity actions, including rapid accelerations and decelerations, sudden stops, and sharp changes of direction, while simultaneously controlling the stick and ball (Tervo & Nordström, 2014). Goalkeepers primarily play from a kneeling position and require considerable core strength and endurance (Tengman et al., 2025).

Injuries in floorball

Floorball is associated with high rates of both traumatic injuries, most commonly to the ankle and knee, and overuse injuries affecting the lumbar region, pelvis, and knees (Pasanen et al., 2018; Tervo et al., 2019; Tranaeus et al., 2016). Anterior cruciate ligament (ACL) injuries are particularly prevalent, especially among female athletes (Pasanen et al., 2018; Åman et al., 2018), and a population-based study in Sweden showed that youth female floorball players had a sevenfold increased risk of ACL injury compared to sex, age, and municipality-matched controls drawn from the Swedish Total Population Register (Tervo et al., 2019). Severe knee injuries, such as ACL injuries, are considered among the most burdensome in terms of time loss from sport participation, rehabilitation time, and health care costs (Lyon-Monk et al., 2025; Tranaeus et al., 2017). Moreover, research on youth players in Sweden aged 12–17 years, has shown that approximately 50% sustain at least one injury per season, with overuse injuries being more common than acute traumatic injuries in this age group (Åkerlund et al., 2020). Pasanen and colleagues (2018) further demonstrated substantial differences between training and competition exposures: Finnish female youth floorball players experienced 1.5 injuries per 1000 practice hours but 36.5 injuries per 1000 game hours. Corresponding rates for male players were 1.0 per 1000 practice hours and 19.4 per 1000 game hours. These patterns indicate that the risk of injury is substantially higher during competition than during regular training, a trend also reported in other indoor pivoting sports such as handball (Olsen et al., 2006).

Organizational and educational context

In Sweden, two main educational pathways enable students to combine upper secondary studies with elite-level sports: national elite sport high schools (RIG) and certified regional elite sport high schools (NIU). RIGs recruit students nationally, whereas NIUs admit students regionally or locally. Both programs are designed to allow young athletes to pursue their academic education alongside intensive training and competition and has been a part of the school system in Sweden since the 1970s (Ferry et al., 2013). These programs are

regulated by the Swedish upper secondary school ordinance (SFS 2010:2039), particularly Chapter 5, which specifies the requirements for each program type. Approval as a RIG requires evidence of national interest and specific provisions for joint training, while NIUs must demonstrate a clear elite sports profile and collaborate with the relevant sports federation (SFS 2023:654; Riksidrottsförbundet, 2025). The implementation and oversight of these programs involve four principal stakeholders, each with distinct responsibilities: the Swedish Sports Confederation (RF), the Swedish National Agency for Education (Skolverket), the municipality or main organizer, and the relevant sports federation (SF). The National Agency of Education determines the locations and capacity of these programs, based on proposals from RF for RIG and with the endorsement of the specific sports federation for NIU (SFS 2023:654; Skolverket, n.d.). RF holds formal responsibility for RIG and provides support for NIU. The municipality or main organizer is responsible for program implementation, while the sports federation contributes to program development, evaluation, and the admissions process.

A defining feature of both RIG and NIU is the inclusion of the subjects "Specialized Sports" and "Training and Competition Theory" (Lund, 2014; SFS 2023:654). These subjects consist of specific sports training, as well as more general sports and health knowledge (e.g., nutrition, sport psychology, injury prevention, sleep) and are exclusive to RIG and NIU programs, comprising approximately 10-15 % of the students' total amount of credits (SFS 2023:654; Skolverket, n.d.). The integration of these subjects is essential for enabling the dual pursuit of elite sports and academic studies, and their presence is a prerequisite for program classification as RIG or NIU. Within the Swedish sports development context, NIU can be understood as a locally embedded pathway that allows high school-aged athletes to pursue structured sport development while remaining in their home environments. It functions as a complement to the club-based sport system, maintaining close collaboration with local sports clubs rather than replacing them. Within the broader Swedish model, NIU reflects a long-term approach to athlete development, emphasizing sustainable progression over time and enabling a wider group of athletes to combine education with sport. In contrast, RIG represents a more selective and centralized pathway, with national recruitment and a clearer focus on early elite performance. Admission to both RIG and NIU is based on an assessment of the applicant's capacity to benefit from the education, with consideration given to both athletic and academic qualifications. The selection process evaluates sport-specific skills, psychological and social abilities, organizational prerequisites, and academic ambition. Notably, the assessment of future development potential is prioritized over previous achievements (Riksidrottsförbundet, 2025; Svenska Innebandyförbundet, n.d.).

In the context of floorball, Sweden has one national elite sport high school (RIG) and more than 30 certified regional elite floorball high schools (NIU), with a combined annual intake of approximately 400 students. These schools are geographically distributed throughout the country, and the allocation of places is designed to promote gender equality (Svenska Innebandyförbundet, n.d.). Staff at these schools typically consist of a diverse group of professionals, including physical education teachers, subject-specialist sports teachers, sport-specific instructors, and physical trainers and are commonly referred to as "teachers in school sports" (Ferry, 2016). The *Swedish Education Act*, regulating the Swedish school system concludes that to be able to grade students, staff members must have a teacher's degree (SFS 2010:800). These educators are responsible for both the academic and athletic development of the students, often blending teaching and coaching roles.

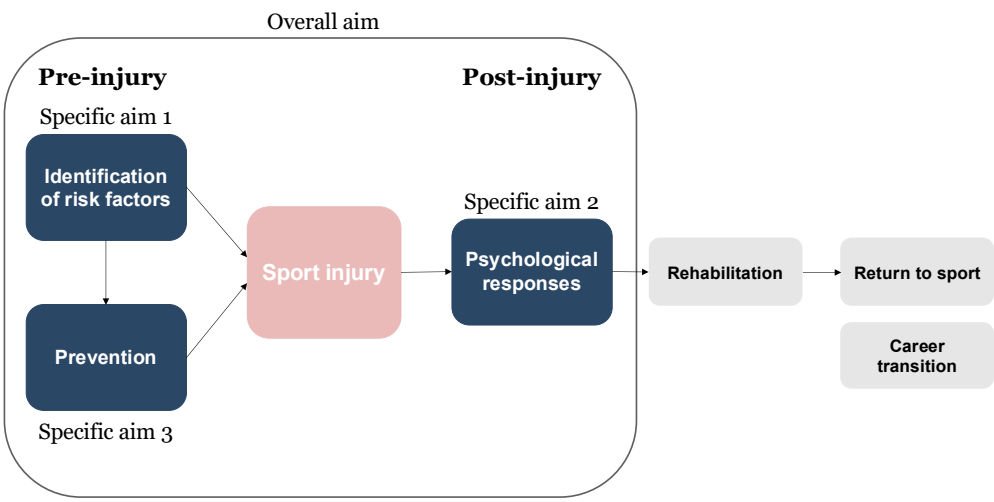
To summarize, the present thesis was conducted in collaboration with the Swedish Floorball Federation and addresses research questions of both scientific and practical relevance. The focus on floorball reflects this collaboration, where injury-related challenges identified in practice define the research context. The project examines pre- and post-injury aspects of sports injuries among athletes at Swedish elite floorball high schools, using both quantitative and qualitative approaches. The findings from this thesis are expected to contribute contextual knowledge to advance the understanding of sport injuries in floorball, and to help inform injury prevention strategies and support mental well-being among youth athletes in the school setting. Although the thesis is grounded in the context of floorball, several of the structural conditions, such as organized youth sport within school settings, performance-oriented environments, and the coexistence of athletic and developmental demands, are shared with other sports and contexts. As such, the findings are likely to have relevance beyond floorball, particularly in relation to injury risk processes and preventive efforts in similar youth sport environments.

Background

In this thesis, sport injury is conceptualized as a process involving pre-injury and post-injury phases. Figure 1 presents a conceptual map illustrating how the main themes addressed in the background, including identification of risk factors, psychological responses to injury, and prevention, relate to the understanding and investigation of sport injuries throughout this thesis. Although the injury process also includes subsequent phases such as rehabilitation, return to sport, and career transition, the present thesis focuses on the earlier stages of this process.

Figure 1

Conceptual map of the thesis



Identification of risk factors

Efforts to understand why sport injuries happen start with identifying the factors that shape athletes' vulnerability to injury (Bahr, 2016). In sport injury research, it is common to use a taxonomy that distinguishes intrinsic (athlete-related) and extrinsic (environmental or exposure-related) risk factors and further separates modifiable from non-modifiable factors (Emery, 2003; Mandorino et al., 2023). Historically, research has placed primary emphasis on physical and demographic characteristics, with growing attention over time to psychological and social determinants, as well as more sport-specific factors.

What do we know about risk factors for sport injury?

Modifiable risk factors are important to detect, as they offer opportunities for intervention in prevention practices. Previous research has found that neuromuscular control deficits (e.g., knee-abduction movement patterns), strength imbalances (e.g., hamstrings–quadriceps ratios), and biomechanical characteristics such as stiff landings (reduced hip/knee flexion), have been associated with increased injury risk (Edison et al., 2022; Emery, 2003; Dai et al., 2012; Jauhiainen et al., 2021). Training load is another known modifiable risk factor (Eckard et al., 2018; Gabett, 2016). Further, psychological factors, primarily stress and stress responses, have been associated with an increased risk of injury (Ivarsson et al., 2017; Tranaeus et al., 2014). In addition, neglecting the need for recovery (Richardson & Andersen, 2008), psychophysiological fatigue (Liederbach & Campagno, 2001), and disturbances in sleep quantity and quality (Johnston et al., 2020; von Rosen et al., 2017) have also been associated with injury. Similarly, emotional states have received attention. For instance, negative mood states such as depression have been proposed as potential contributors to injury risk (Appaneal & Perna, 2014), although empirical findings are mixed. Depressive symptoms have been linked to injury risk in some studies (Yang et al., 2014), whereas other studies report significant associations only when depressive symptoms co-occur with anxiety (Li et al., 2017). Furthermore, preseason anxiety has been associated with increased injury incidence (Li et al., 2017), whereas other studies suggest that anxiety may under certain conditions act as a protective factor (Yang et al., 2014).

Factors commonly referred to as non-modifiable should not be understood as unimportant. A history of previous injury consistently emerges as one of the

strongest non-modifiable predictors of subsequent acute or overuse injuries (Hägglund et al., 2006; Hietamo et al., 2023; Leppänen et al., 2017), underscoring the importance of introducing preventive measures early in an athlete's development (i.e., before the injury happens). Previous research also suggests that biological sex is associated with injury risk, although these associations appear to be injury- and sport-specific (Emery, 2003; Mandorino et al., 2023). Systematic reviews have reported higher risk among females for ankle sprain injuries (Doherty et al., 2014), and non-contact ACL injuries in team sports (Chia et al., 2022), whereas higher risk for groin injuries have been observed among males (Orchard, 2015). Injury risk also tends to increase with age, with a pronounced rise during adolescence (Tervo et al., 2019), when rapid growth and biological maturation, particularly the adolescent growth spurt, may increase vulnerability (Butler et al., 2022; Johnson et al., 2022).

As youth athletes are the focus of this thesis, it is important to highlight that they are exposed to several developmentally unique mechanisms that shape injury risk. Rapid growth and maturation can temporarily alter coordination, strength, and neuromuscular control, increasing susceptibility to both acute and overuse injuries (Johnson et al., 2022; Monasterio et al., 2023; Rommers et al., 2020). In addition, research suggests that adolescent females may experience a neuromuscular lag, in which coordination, strength, and power do not develop at the same pace, potentially increasing vulnerability to certain injury types, including overuse injuries (Butler et al., 2022). Moreover, early sport specialization has also been identified as a risk factor (Myer et al., 2015), particularly when combined with training volumes that exceed recommendations for adolescents (Post et al., 2017). Psychological factors are also important during adolescence. Perceived stress symptoms, daily hassles, and the quality of coach–athlete communication have been shown to influence injury risk (Ivarsson et al., 2014; Steffen et al., 2009). In addition, sleep quality and duration show an association with injury in youth athletes (Abrahamsson et al., 2025; von Rosen et al., 2017).

Risk factors in floorball

As a high-speed, pivoting indoor team sport, floorball places substantial demands on rapid accelerations, decelerations, sudden stops, and sharp changes of direction, all while players manage stick–ball coordination. These movements may contribute to non-contact lower extremity injuries, particularly in the knee and ankle (Pasanen et al., 2018; Tervo et al., 2019). Player position has also gained interest and goalkeepers' unique movements, such as prolonged kneeling, repeated lateral shifts, and frequent floor transitions, may heighten their risk of overuse injuries (Tengman et al., 2025). Previous research on floorball injury risk has focused on physical risk factors related to lower back

pain (Rossi et al., 2018) and knee and ankle injuries (Jauhiainen et al., 2021). Moreover, psychological determinants of overuse injury in elite floorball players have been studied, highlighting communication and cumulative load as important factors (Tranaeus et al., 2014). Regarding extrinsic risk factors, artificial sport flooring, such as rubber or plastic covering, has been associated with increased lower limb injury rates relative to traditional wooden floors, likely due to higher shoe–surface friction (Pasanen et al., 2008). Although most floorball injuries are noncontact, equipment-related impacts, such as being struck by the ball or stick, can cause acute injuries, including severe eye injuries (Tervo et al., 2019). Other extrinsic risk exposures include collisions with other players, contact with goals or boards, and falls (Tervo et al., 2019). However, research that integrates multiple categories of risk factors remains scarce. One notable exception is a recent season-long study by Sonesson et al. (2023), which included both physical and psychological assessments among players aged 12–17 and found that high stress, poor sleep quality, and low well-being were associated with increased injury risk, whereas physical load measures alone did not predict a higher injury risk.

Theoretical perspectives on risk factors and injury risk

Whether one approaches sport injury from a medical, sport psychology, or practitioner perspective, there is broad agreement that injuries rarely occur without underlying causes. Even if athletes, coaches, and spectators may experience it as such in the moment and in the immediate aftermath, injuries seldom “just happen.” In retrospect, there are often identifiable factors that can be associated with the injury. However, by then it is too late. Focusing on identifying risk factors in advance represents an attempt to prevent injuries before they occur, even if it has been debated whether, for example, specific tests will ever be able to accurately predict athletes at risk (Bahr, 2016). The complexity of sport injury has led to the development of theoretical models aimed at capturing the dynamic and multifactorial nature of injury risk. Several models from different fields have been developed to describe the relationship between risk factors and injury occurrence. Within sport medicine, a dynamic, recursive model of etiology in sport injury was proposed by Meeuwisse and colleagues (2007) to move beyond traditional linear approaches by introducing cyclical processes. The model emphasizes that athletes may be predisposed by various intrinsic risk factors and, when encountering extrinsic risk factors, become more susceptible to injury. Importantly, this process is also cyclical, as prior experiences of injury or non-injury in specific situations may influence future risk through processes such as adaptation, maladaptation, and recovery (Meeuwisse et al., 2007).

In sport psychology research, the Model of Stress and Athletic Injury (Andersen & Williams, 1988; Williams & Andersen, 1998), has been widely used to explain the psychological mechanisms related to sustaining an injury. The model is based on the underlying idea that an athlete's stress response to potentially stressful situations, like games or competitions, can influence their injury risk. The model proposes that three categories of psychosocial factors—personality, history of stressors, and coping resources—separately or in combination influence athletes' situation appraisal and the magnitude of stress responses, thereby affecting injury risk (Williams & Andersen, 1998). The theoretical assumptions of the model include that stress contributes to injury risk by heightening muscle tension and impairing attentional processes (e.g., narrowing peripheral vision). Consequently, athletes experiencing high stress, stress-amplifying personality traits, and limited coping resources are thus more likely to perceive situations as stressful and exhibit these risk-enhancing physiological and cognitive responses (Andersen & Williams, 1988; Williams & Andersen, 1998). A vast amount of research has followed using the model as core framework, and a meta-analysis of studies applying the model indicates that stress responses and history of stressors show the strongest associations with injury risk (Ivarsson et al., 2017). One proposed explanation is that heightened stress responses negatively affect athletes' decision-making capacity, increasing vulnerability to sport-related errors, collisions, and impaired motor control, thereby elevating injury risk (Tranaeus et al., 2024). Furthermore, a history of stressors has been suggested to affect stress response magnitude, which may indirectly increase injury risk by intensifying these maladaptive stress responses (Rogers & Landers, 2005). However, the model has also been criticized for its strong cognitive emphasis and relatively limited coverage of emotional, behavioral, and contextual mechanisms (e.g., Appaneal & Perna, 2014; Hackfort & Kleinert, 2007).

Expanded perspectives on injury understanding

To address limitations of stress-centric models, as well as approaches not including risk factors from multiple disciplines, several authors have introduced biopsychosocial perspectives into sport injury research. One influential contribution is Wiese-Bjornstal's biopsychosocial sport injury risk profile (Wiese-Bjornstal, 2009, 2010), which conceptualizes injury risk as emerging from interactions among biological, physical, psychological, and sociocultural domains, utilized to understand athletes' appraisal processes, emotional reactions, and behavioral regulation. It highlights that psychological mechanisms are shaped by physical demands, developmental histories, and social environments (Wiese-Bjornstal, 2009). A related biopsychosocial extension has been proposed by Appaneal and Perna (2014), who expanded the Williams and Andersen model by emphasizing the multidimensional nature of

the stress response. Appaneal and Perna (2014) argue that psychological models should account not only for cognitive appraisals but also for behavioral responses (e.g., impaired self-care, disrupted sleep), physiological consequences, and attentional patterns, all components that may influence injury vulnerability (Ivarsson et al., 2017).

Why patterns and combinations matter in injury risk research

Traditional approaches to sport injury risk factors have generated valuable insights, yet several methodological and conceptual limitations restrict what we currently understand about how injuries actually develop. Although biopsychosocial theories and dynamic models exist and emphasize the combined effects of different risk factors, there is still a tendency within sport injury research to assess single risk factors, or domains of risk factors (e.g., physical, psychological, or demographic), one at a time, using a variable-by-variable approach that often seeks to identify the most prominent predictor of a particular injury. By isolating variables in this way, such approaches risk overlooking that some factors may be harmful only when combined with others, and that certain variables may function as buffers or protective factors rather than contributors to risk. Instead, a growing body of research suggests that injuries emerge from patterns of interacting physical, psychological, contextual, and developmental factors, consistent with biopsychosocial and complex systems models (Bittencourt et al., 2016; Hausken-Sutter et al., 2021; Wiese-Bjornstal, 2009, 2010). These frameworks highlight that the influence of any individual factor, such as stress, training load, neuromuscular control, or sleep, depends on how it combines with the broader constellation of the athlete's characteristics and environment. From this perspective, examining isolated predictors greatly oversimplifies injury epidemiology.

Additionally, the use of variable-centered analyses further reinforces this oversimplification because such approaches estimate associations averaged across all athletes, implicitly assuming that the same risk processes apply to everyone. However, in real-life situations, not all athletes sustain injuries even when exposed to the same conditions, likely because athletes always carry multiple interacting risk and protective factors that shape their individual vulnerability. Recent research within youth sports emphasizes the need for interdisciplinary, complex, and person-centered approaches that integrate physical, psychological, and contextual risk determinants (Hausken-Sutter et al., 2021). Methodological developments and increased access to advanced statistical modeling in many software programs now support this shift, which provides new opportunities to study sport injuries. For example, person-

centered approaches such as latent profile analysis and cluster-based methods enable researchers to identify naturally occurring subgroups who share similar combinations of risk factors (Ivarsson & Stenling, 2019). Instead of testing whether one factor predicts injury, these techniques identify patterns of co-occurring factors that may represent distinct high-risk or low-risk profiles, which are clinically relevant and may be directly applicable in injury prevention work in many youth sport contexts.

In light of the limitations of traditional approaches and the need to better understand co-occurring combinations of risk factors, the first specific aim of this thesis was to identify how combinations of psychological, demographic, and physical capacity factors relate to sport injury occurrence in youth athletes.

Psychological responses

Building on the introduction of biopsychosocial perspectives in explanations of sport injury and injury risk, these perspectives are also central to understanding the psychological responses and consequences of sustaining an injury. Within this framework, sport injury can be understood as a dynamic and systemic phenomenon that unfolds across different phases, where the occurrence of injury may trigger distinct psychological responses (Wiese-Bjornstal et al., 2020). These responses may be negative, including anxiety, depression symptoms, and loss of confidence, but have also been described as positive, such as stress-related growth, renewed motivation, and an increased appreciation of health (Hammer et al., 2021; Wiese Bjornstal et al., 2020).

A central theoretical framework for understanding these processes is the Integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998). In this model, psychological responses are shaped through interactions between cognitive, affective, and behavioral processes, and are influenced by personal characteristics, situational factors, and previously identified psychological risk factors. These processes are reciprocal and unfold over time, such that athletes' cognitive appraisals of the injury and its consequences influence emotional responses (e.g., fear, frustration, or depression), which in turn shape behavioral responses, including rehabilitation adherence, avoidance, or premature return to sport. These behavioral responses subsequently feed back into new appraisal cycles, contributing to an ongoing process of psychological adjustment throughout the injury experience. Through these dynamic cycles, psychological responses are not only consequences of injury, but also influence recovery, return to sport, and subsequent participation (Wiese-Bjornstal et al., 1998).

Extensions of this work further emphasize that psychological responses vary across different phases of the injury process (Wiese-Bjornstal et al., 2020). From this perspective, injury can be understood as a process that includes the phases of preventing, sustaining, treating, rehabilitating, recovering, returning, and potentially retiring from sport, each associated with different psychological demands (Wiese-Bjornstal et al., 2020). Importantly, theoretical perspectives suggest that some responses emerge immediately following injury, whereas others develop over longer periods of time (Johnson & Podlog, 2014; Wiese-Bjornstal et al., 2020). Empirical research supports the existence of an initial phase characterized by immediate reactions to injury (Ivarsson et al., 2018), while also demonstrating that injuries are associated with broader and more long-term mental health implications in both youth athletes and elite athletes

(Gwyther et al., 2024; Lyon-Monk et al., 2025; Putukian, 2016; Reardon et al., 2019; Walton et al., 2021, 2024).

Mental health consequences of sport injury

Sustaining a sport injury can affect athletes in many different ways. In addition to performance-related consequences, injuries can disrupt training and competition, daily routines, and social relationships, and may challenge athletes' sense of athletic identity, all of which are important for understanding athletes' mental health (Putukian, 2016; Reardon et al., 2019; Rice et al., 2019; Tranaeus et al., 2024; von Rosen, Kottorp, et al., 2018). Severe musculoskeletal injuries have been associated with increased symptoms of common mental disorders, such as anxiety and depression, highlighting injury as a key risk factor for compromised mental health in athletes (Gouttebarge et al., 2016; Putukian, 2016). Evidence further suggests that injury severity and time loss play a central role, with more severe injuries associated with poorer physical and emotional quality of life, as well as elevated depression symptoms (Filbay et al., 2015, 2019; Putukian, 2016). At the same time, psychological states may fluctuate across different phases of the injury and rehabilitation process, reflecting ongoing patterns of reaction, adjustment, and return to sport (Ivarsson et al., 2018; Wiese-Bjornstal et al., 2020). Importantly, many of the factors previously identified as influencing injury risk may also shape how athletes respond psychologically once an injury has occurred, reinforcing the relevance of a biopsychosocial perspective that integrates both risk and response processes (Wiese-Bjornstal et al., 1998, 2020).

Methodological challenges and research gaps

Despite a growing body of research linking sport injuries to mental health outcomes, important questions remain regarding the timing of psychological responses and how these responses vary within individuals over time. Much of the existing literature relies on cross-sectional designs (Gouttebarge et al., 2019), and although more recent longitudinal studies have begun to address this limitation, they often operate on relatively broad timescales. For example, Lyon-Monk et al. (2025) analyzed six years of athlete health data and demonstrated a bidirectional relationship between injury and mental ill-health, showing that each additional injury increased the risk of subsequent mental ill-health by approximately 10%. While such findings provide important evidence that injury exposure contributes to the development of mental health problems over time, the reliance on long retrospective assessment windows (e.g., the previous 12 months) limits insight into more immediate and short-term psychological responses following injury, as well as the dynamic processes through which

these responses unfold. Furthermore, mental health status prior to injury is often unknown, making it difficult to determine whether observed psychological outcomes represent consequences of injury or reflect pre-existing vulnerabilities. This limits our understanding of if, and in such cases why, athletes respond differently to injury, despite theoretical models suggesting that individual characteristics play a central role in shaping these responses.

Both mental health and injury are inherently time-varying phenomena, meaning that they may change across contexts and over time. Capturing such variability requires more intensive and temporally sensitive measurement approaches. However, prior sport injury research suggests that increasing the frequency of data collection alone is not sufficient; the statistical methods used to analyze such data must also be appropriate (Windt et al., 2018). In particular, group-level analyses may obscure substantial individual variation, and thus limit their applicability for understanding how different athletes respond to injury (Gaudreau et al., 2020). Instead, when repeated measures are nested within individuals, it is necessary to distinguish between within-person changes and between-person differences to accurately capture these processes (Curran & Bauer, 2011; Hamaker, 2012, 2025).

Taken together, these challenges highlight the need for prospective, longitudinal approaches that can capture both short-term and longer-term changes in psychological responses, while accounting for individual variability. To address some of these issues, the second specific aim of this thesis was to examine mental health trajectories across a competitive floorball season and to investigate within- and between-person associations between injury status and mental health in youth athletes.

Prevention

The central objective of studying sport injuries is to inform efforts to prevent their occurrence. Prevention efforts therefore aim to reduce injury risk by targeting identified risk factors through structured physical or psychological interventions, as well as through safety regulations and policy measures. Although our understanding of how combinations of risk factors interact and relate to injuries remains limited, several prevention initiatives have demonstrated meaningful injury-reducing effects under controlled conditions. Physically oriented injury prevention typically targets neuromuscular control, strength, landing mechanics, and movement quality. One of the most widely used examples is the FIFA 11+, a structured warm-up program combining strengthening, balance, and jumping/landing exercises (Soligard et al., 2008). The program has demonstrated preventive effects across different sport contexts and is widely used in large team sports like soccer (Bizzini & Dvorak, 2015; Thorborg et al., 2017). Psychological injury prevention interventions have primarily focused on managing the magnitude of the stress response, in line with the Model of stress and athletic injury (Williams & Andersen, 1998). Although these programs employ a variety of techniques, including cognitive-behavioral methods, mindfulness and acceptance-based strategies, psychological skills training, and relaxation, they often target similar underlying mechanisms such as stress responses, attentional disruption, and self-regulation (Ivarsson, 2021). Two systematic reviews published in the last decade indicate that athletes who participate in psychological prevention programs sustain fewer injuries than control groups, with particularly strong effects for athletes classified as at risk (Gledhill et al., 2018; Ivarsson et al., 2017). Based on this accumulated evidence, a recent consensus statement argues that psychological interventions should be considered a relevant component of sport injury prevention (Tranaeus et al., 2024).

Prevention strategies in floorball

In Sweden, the neuromuscular warm-up program Knee Control (Knäkontroll®, SISU Idrottsböcker, 2005) is broadly implemented across youth sports such as soccer, handball, and floorball. Studies have shown substantial reductions in injury risk, particularly in relation to ACL injuries, with reported decreases of 64% in youth female soccer (Waldén et al., 2012), and 45% reduction of overall acute injury incidence among youth floorball players (Åkerlund et al., 2020). At the same time, Åkerlund et al. (2020) also observed a higher prevalence of overuse injuries among females in the intervention group and suggested that certain exercises may provoke symptoms in athletes experiencing

patellofemoral pain—a common overuse condition among adolescent female athletes (Foss et al., 2014; Crossley et al., 2016). Recently, to address sport-specific movement demands in floorball, researchers at Linköping University, in collaboration with the Swedish Floorball Federation and the Floorball Research and Development Centre at Umeå University, has developed Knee Control+, an expanded floorball-adapted version of the original program released in 2022. The updated version includes exercises targeting key areas such as neuromuscular control, strength, balance, and core strength, with several tasks incorporating stick and ball handling to enhance contextual relevance. Knee Control+ is now included as part of the national floorball coach education curriculum.

Injury prevention can also be achieved through regulatory measures and equipment-based strategies, which aim to reduce injury risk by modifying the external environment rather than targeting athletes' physical or psychological characteristics. In floorball, protective eyewear is a well-established example of such an approach. The use of mandatory eyewear has been shown to substantially reduce the risk of eye injuries in youth floorball (Bro & Ghosh, 2017; Leivo et al., 2015), leading the Swedish Floorball Federation to implement a regulation requiring players aged ≤ 16 years to wear protective goggles starting in the 2015–2016 season (Tervo et al., 2019). Still, eye injuries remain a concern among older youth and senior players (Bro & Ghosh, 2017; Tervo et al., 2019).

Further, two studies have evaluated psychological interventions in elite adult floorball teams over one or two competitive seasons (Tranaeus, Johnson, Engström, et al., 2015; Tranaeus, Johnson, Ivarsson, et al., 2015). Although no statistically significant group differences in injury occurrence were found, the intervention group reported fewer total injuries and fewer severe injuries, the latter during the second season. The authors highlight that several contextual constraints, such as team-based delivery formats and limited session time, may have affected intervention effects. Nevertheless, they note that the observed reductions, while not statistically significant, may still hold clinical relevance for practitioners and athletes (Tranaeus, Johnson, Engström, et al., 2015; Tranaeus, Johnson, Ivarsson, et al., 2015). Overall, evidence for psychological prevention, both regarding mental health issues and sport injury, among youth athletes remains limited. The recent IOC consensus statement on youth athlete development focusing on health and safe sport participation (Bergeron et al., 2024), identifies psychological prevention as an understudied area.

Implementation and adherence challenges in youth sport

Despite the demonstrated efficacy of several injury prevention programs, maintaining consistent adherence in everyday sport practice is challenging (Bahr et al., 2015; Verhagen et al., 2010). First, practical and organizational barriers frequently interfere with routine implementation. Coaches often describe limited training time and competing priorities within sessions, leading preventive exercises to be deprioritized or moved outside regular practice settings (Åkerlund et al., 2023; Saunders et al., 2010). When exercises are performed in locker rooms, hallways, or shared spaces, supervision is limited and available equipment restricted, which frequently results in reduced fidelity and inconsistent execution quality (Perera & Hägglund, 2020). Adherence may also be affected by physical factors, as preventive routines can include movements that provoke discomfort in athletes with pre-existing symptoms (Åkerlund et al., 2020). When exercises aggravate pain or fatigue, athletes are less likely to complete recommended progressions or maintain the prescribed frequency of preventive work (Åkerlund et al., 2023). In addition, gaps in competence among key implementers might further reduce the implementation. Studies in youth floorball have shown that preventive exercises were often performed incorrectly or at insufficient dosage levels (Perera & Hägglund, 2020), and coaches reported limited training or confidence in delivering neuromuscular injury prevention interventions (Åkerlund et al., 2023). Furthermore, sports medicine practitioners have similarly expressed uncertainty about delivering prevention content related to psychological risk mechanisms (Alexanders et al., 2015). These competence-related barriers might reduce both the quality and consistency of implementation, potentially limiting the impact of otherwise effective programs.

Behavioral and motivational aspects of injury prevention

Even when practical and organizational barriers are addressed, the successful adoption and maintenance of injury-preventive behaviors remain challenging, highlighting the importance of behavioral perspectives. This has led to an increased interest in behavioral approaches to injury prevention, and a systematic review by Gabriel and colleagues (2019) identified several commonly used theoretical frameworks in injury prevention, including the health belief model (Rosenstock et al., 1988), the theory of planned behavior (TPB: Ajzen, 1991), the health action process approach (Schwarzer, 2016), and self-determination theory (SDT: Deci & Ryan, 1985). The intention to participate in and implement injury prevention has been associated with social norms in the

athlete's environment (White et al., 2012), perceived benefits of participation (Martinez et al., 2017), and confidence in the ability to participate (McKay et al., 2016). However, other studies have shown that coaches' intentions do not always translate into actual implementation (Frank et al., 2015). On the other hand, self-determined motivation has been associated not only with intention, but also with performing preventive behaviors (Chan & Hagger, 2012a, 2012b; Lee et al., 2021).

Youth athletes across different sports frequently describe injury-preventive exercises as less enjoyable and less engaging than regular sport activities (Åkerlund et al., 2024; Chan & Hagger, 2012a; Lee et al., 2019). From an SDT perspective, these perceptions are meaningful because motivation is shaped by the extent to which athletes' basic psychological needs for autonomy, competence, and relatedness are supported and satisfied. SDT further proposes that motivation varies along a continuum from controlled to autonomous forms of regulation, with amotivation reflecting a lack of intentionality and engagement (Ryan & Deci, 2017). According to SDT, adherence to behaviors that are not inherently enjoyable, such as many preventive routines might be perceived, depends on the degree to which athletes internalize the value of the behavior and experience support for their psychological needs of autonomy, competence, and relatedness (Standage & Ryan, 2020). Injury-preventive behavior is therefore more likely when athletes feel that prevention is personally meaningful or beneficial (i.e., autonomously motivated), and less likely when they engage out of pressure, obligation, or external demands (i.e., controlled motivation). Empirical work supports this pattern: autonomous motivation positively predicts both intention and adherence in rehabilitation and injury-preventive contexts, whereas controlled motivation tends to show weak or negative associations (Chan et al., 2009; Chan et al., 2011). However, some prevention studies report that controlled motivation can still contribute indirectly to intention when it reflects more internalized forms of extrinsic motivation, such as introjected regulation, where athletes act to avoid guilt or maintain approval (Chan & Hagger, 2012a). This aligns with the idea that motivational types adjacent on the continuum may overlap and co-occur (Ryan & Connell, 1989; Chan & Hagger, 2012a). In youth athletes specifically, research suggests that identified regulation (e.g., recognizing the personal value of prevention) may be particularly relevant, as it supports persistence even when tasks are not inherently enjoyable (Lee et al., 2019).

The role of coaches and why context matters

Following ideas in SDT, the social environment plays a central role in shaping athletes' motivation, and coaches and teachers are recognized as influential

social agents in youth sport. Several studies have highlighted coaches' influence on athletes' intention and adherence to preventive behaviors (e.g., Chan & Hagger, 2012a, 2012b; Parker et al., 2021). A need-supportive coaching style, including leader behaviors such as providing meaningful rationales, acknowledging athletes' perspectives, offering choices where possible, and supporting competence through clear structure and constructive feedback, can foster autonomous motivation (Liu et al., 2026; Standage & Ryan, 2020). Beyond motivation, coaches also influence the practical delivery of prevention, determining when and how preventive routines are integrated into training.

Although coaches play a key role, prevention does not occur in isolation but within the broader context of youth sport environments. Need-supportive environments are suggested to increase athletes' willingness to persist with injury-preventive behaviors (Parker et al., 2021). However, many schools and clubs operate under significant time pressure, limited access to facilities, or shared spaces, which restrict opportunities for high-quality implementation (Åkerlund et al., 2023, 2024; Jacobsson et al., 2023). These contextual barriers can limit fidelity even when motivation is high, and they often necessitate compromises such as conducting preventive routines in hallways or abbreviated formats. As highlighted in implementation research, contextual fit, the degree to which prevention strategies align with the realities of the training environment, is crucial for long-term success (Donaldson et al., 2017; Gabriel et al., 2019). Ecologically valid prevention requires not only effective exercises but also delivery formats that can be sustained alongside the competing demands of youth sport practice. This includes understanding how key individuals interpret, adapt, and integrate prevention strategies into existing routines, and recognizing that the broader environment can either support or hinder both coaches' efforts and athletes' motivation (Bolling et al., 2020).

Transfer across contexts

For many youth athletes, sport participation includes multiple settings, perhaps most notably in school-based and club-based activities. This raises the question of how motivation and competence developed in one context may influence behaviors in another. The trans-contextual model (TCM: Hagger et al., 2003) offers a framework for understanding such cross-contextual transfer by integrating SDT with TPB. According to TCM, autonomy support provided in one context (e.g., school sport) enhances autonomous motivation through satisfaction of the needs for autonomy, competence, and relatedness. This motivational state can then transfer to another context (e.g., from the school setting to club training), influencing intentions and behaviors through mechanisms such as perceived behavioral control, attitudes, and social norms

(Hagger & Chatzisarantis, 2016). Empirical support for the model is largely derived from educational contexts, where motivation generated in school-based physical activity has been shown to transfer to out-of-school behaviors (Hagger & Chatzisarantis, 2016), as well as from studies indicating that motivation for injury-preventive behaviors can also transfer across contexts (Chan & Hagger, 2012b; Lee et al., 2019; 2021). In environments where athletes navigate multiple motivational climates, such as school-based sport and club environments, TCM is particularly relevant for understanding how prevention behaviors can be promoted beyond the context in which they are introduced.

Overall, while substantial evidence exists regarding effective injury prevention, far less is known about how these strategies are interpreted, adapted, and sustained in the real-world environments where athletes train and learn (Bolling et al., 2020; McCall et al., 2016). In addition, there has been a call for approaches to sport injury prevention that take both behavioral and contextual factors into account when designing, implementing, and evaluating preventive interventions (Donaldson et al., 2017; Gabriel et al., 2019; Keats et al., 2012). To address this gap, the final specific aim of this thesis was to explore high-school floorball teachers' experiences and strategies related to injury prevention in the school setting.

Aims of the thesis

The overall aim of this thesis was to advance the understanding of sport injury in youth athletes by examining combinations of risk factors, psychological responses in relation to injury over time, and injury prevention practices within Swedish elite floorball high schools. This aim was addressed by combining longitudinal quantitative designs, with in-depth interviews capturing experiences, behaviors, and prevention strategies within the school context.

The specific aims of the thesis were:

- To identify how combinations of psychological, demographic, and physical capacity factors relate to sport injury occurrence in youth athletes (Study 1).
- To examine mental health trajectories across a competitive floorball season and to investigate within-person and between-person associations between injury status and mental health in youth athletes (Study 2).
- To explore high-school floorball teachers' experiences and strategies related to injury prevention in the school setting (Study 3).

Together, these aims address sport injury as a multifaceted and context-dependent process by integrating perspectives on injury etiology, athlete experiences in relation to injury, and prevention practices. The findings from this thesis are expected to contribute contextual knowledge to advance the understanding of sport injuries in floorball, and to help inform injury prevention strategies and support mental well-being among youth athletes in the school setting. The findings are also likely to have relevance beyond floorball, particularly in relation to injury risk processes and preventive efforts in similar youth sport environments.

Transparency section

My perspective on Open Science

Open science refers to a set of research practices aimed at increasing transparency, rigor, and credibility in scientific work through openness in planning, analysis, and reporting (Nosek et al., 2015). These practices have gained prominence in response to concerns about limited reproducibility of research findings, selective reporting, and publication bias across several scientific disciplines (Ioannidis, 2005; Nosek et al., 2015). In psychology, this has been particularly notable in light of the "replication crisis" (Open Science Collaboration, 2015). One key issue is that flexibility in data analysis and reporting can blur the distinction between confirmatory and exploratory research, increasing the risk of practices such as hypothesizing after results are known (HARKing; Kerr, 1998) and inflating the likelihood of false-positive findings (Simmons et al., 2011). Open science recommendations therefore emphasize making key research decisions explicit in advance, transparently documenting analytic choices, and clearly distinguishing confirmatory from exploratory elements of a study, preferably through preregistration on an independent platform (Banks et al., 2019; Nosek et al., 2018).

In this thesis, I have tried to incorporate such transparency-enhancing practices in ways that were appropriate to the design, data type, and ethical context of each study. In addition, I have viewed this process as an opportunity to learn more about open science practices and therefore used different platforms and strategies. One reflection along the way has been that while preregistration takes a considerable amount of time, perhaps especially when one is new to the methods being used and when each decision requires consulting a number of papers to determine the most appropriate choice, the time spent thinking ahead was worthwhile once the analyses were conducted and key decisions had already been made. Another lesson learned is that preregistration can feel like a very definitive step, where every "mistake" (i.e., correction or change to the original registration) is visible to others. As a result, researchers, including senior ones, might refrain from preregistering their studies. Rather than viewing such changes as problematic, from my perspective as a psychologist I see this as enhancing both trust in research and psychological safety within academia, and I find it encouraging that an increasing number of scholars are being transparent about the research process and about the fact that changes often occur. These changes may reflect revisions in the underlying reasoning or, more commonly, the realities of conducting social science research on human behavior in real-life settings, where data collection seldom unfolds exactly as planned and adjustments to sample size, timelines, or analyses may be necessary. Ultimately, it is not about doing everything right, but about being transparent regarding how the research was conducted. I recognize that I could

have done more, but this represented a starting point for my engagement with open science and transparency practices, which are outlined below.

Study 1 was preregistered on the Open Science Framework (OSF; https://osf.io/) using a template for secondary data analysis. The preregistration specified the research questions, key variables and operationalizations, inclusion and exclusion criteria, and the planned analytic strategy. In addition to the preregistration form, a project description and complementary documentation describing the estimated models were uploaded to the platform to increase transparency in the analytic process.

Study 2 was preregistered on aspredicted.org. This preregistration specified the research questions, primary outcomes, sample characteristics, inclusion criteria, and planned analyses. While AsPredicted offers more limited options for storing supplementary materials than OSF, the platform allows for clear documentation of core research and analysis decisions made in advance of data analysis, supporting transparency and distinguishability between confirmatory and exploratory components.

Study 3 was not preregistered. Although preregistration is possible for qualitative research designs, alternative transparency practices were applied for this study. Transparency was promoted through the provision of a translated interview guide, a detailed description of the analytic approach, and explicit attention to reflexivity and analytic decision-making during the qualitative analysis. These measures were intended to enhance transparency in the research process and interpretive steps, given the inductive and iterative nature of the study.

Quantitative data included in this thesis are not publicly available; however, requests for access to pseudonymized data may be directed to the project coordinator. Qualitative interview data are not available due to the small population of potential interviewees and associated ethical and confidentiality considerations.

AI use in the thesis work

To follow the ethical research principles of transparency and accountability (World Medical Association [WMA], 2024), I hereby disclose my use of large language models in the work on this thesis. The most recent version of the World Medical Association's Declaration of Helsinki (WMA, 2024), as well as official documents for doctoral students at Umeå University, do not provide specific guidance on the use of generative artificial intelligence or how such use should be declared. I therefore rely on the American Psychological Association's policy on generative AI (2025) and guidance provided to doctoral students by Karolinska Institutet (2025).

The large language model Microsoft® 365 Copilot (provided by Umeå University) was used for language editing during the writing process, with the aim of improving readability and linguistic clarity (Microsoft, 2026). I have also used the application for producing code and syntax for the statistical analysis programs SPSS and R, and for generating illustrations included in the thesis. The cover of this thesis was produced using ChatGPT (Open AI, 2026).

Ethically, it is essential to continuously reflect on the use of artificial intelligence and large language models in research (Resnik & Hosseini, 2025), as well as on the potential implications for doctoral learning outcomes (Karolinska Institutet, 2025), and environmental effects (e.g., Valdivia, 2025). Authors remain responsible for critically reviewing and editing content generated by artificial intelligence, as such output may be inaccurate, incomplete, or biased (Resnik & Hosseini, 2025). Prior to submission, I carefully revised and edited all parts of the thesis and take full responsibility for the originality, accuracy, and integrity of the work.

Materials and Methods

The doctoral work presented in this thesis is part of the larger longitudinal project *Risk factors for sport injury in floorball players*, a collaboration between the Swedish Floorball Federation, the Floorball Research and Development Centre at Umeå School of Sport Sciences, and researchers from Umeå University, Halmstad University, and Linköping University. The project has a multidisciplinary focus, integrating psychology, sports medicine, and nutrition, and its overall aim is to generate knowledge about how exercise load, health habits, and psychological and physical factors relate to sport injury occurrence in young floorball players. The project included youth floorball players aged 16–19 years enrolled in Swedish floorball high schools between 2020 and 2023. It was designed to include the entire population of students enrolled in these programs during the study period, corresponding to approximately 1,000 athletes annually. Each year, newly enrolled students were eligible to enter the study, whereas graduating students no longer contributed data. Data were collected using the smartphone application XPS Network (Sideline Sports), through which participants completed questionnaires and reported study data. Twice each season, athletes completed comprehensive surveys and participated in physical field tests conducted at their schools, with results recorded in the application. In addition, weekly and biweekly (i.e., every other week) longitudinal data were collected throughout each season. Participation was voluntary for both schools and athletes. Consequently, some schools declined participation for practical or organizational reasons, and not all eligible athletes chose to participate. The number of participants also varied across measurement waves due to attrition and cohort turnover associated with student graduation. In addition, disruptions related to the COVID-19 pandemic affected recruitment of both schools and athletes, contributing to lower participation during parts of the study period.

In this thesis, Study 1 and Study 2 used quantitative designs based on longitudinal data collected from youth athletes between 2021-2022 and 2022-2023, while Study 3 used qualitative design based on interviews from an additional data collection with floorball teachers during 2024. Together, these studies apply complementary methodological approaches to address different aspects of the aims of this thesis. An overview of the purposes, designs, participants, and analytical procedures for the three studies is provided in Table 1. Ethical approval for the data collections was obtained from the Swedish Ethical Review Authority (Reference numbers: 2020-02469 for the youth studies; 2023-06730-02 for the teacher interviews).

Table 1

Overview of studies

	Study 1	**Study 2**	**Study 3**
Study purpose	To identify how combinations of psychological, demographic, and physical capacity factors relate to sport injury occurrence	To examine mental health trajectories across a competitive floorball season and to investigate within-person and between-person associations between injury status and mental health in youth athletes	To explore high-school floorball teachers' experiences and strategies related to injury prevention in the school setting
Design	Two-wave survey, preseason and postseason 2021/2022	Longitudinal design (biweekly measures) during the 2022/2023 season	Semi-structured interviews
Participants	Youth floorball players (16-19 years old) at NIU/RIG (n = 222)	Youth floorball players (16-19 years old) at NIU/RIG (n = 350)	Teachers employed at NIU/RIG (n = 15)
Analysis	Latent profile analysis	Bayesian multilevel models	Qualitative content analysis

Study I

Sample and Procedure

A total of 222 youth floorball players (97 females, 125 males) enrolled in Swedish nationally certified elite floorball high schools (NIU and RIG) participated in the study. Participants were 16–19 years old (M = 16.67, SD = 0.78) and had, on average, 9 years of floorball experience (SD = 1.87). Their competitive levels ranged across regional and national youth and senior divisions, and they were distributed across 22 different floorball high schools in Sweden. Data collection took place during the 2021/2022 competitive season. At the beginning of the season (September 2021), participants completed a baseline survey targeting demographic information, sporting experience, mental health, previous injury history, and current injury status, and provided informed consent. Data were collected using the XPS Network smartphone application (Sideline Sports), customized for research purposes. The app is commonly used in floorball for training planning and activity registration, so many participants were already familiar with it. For the study, participants used a dedicated research version alongside their regular training version, with separate login credentials.

Baseline physical field tests were conducted at the participants' high schools and were instructed and monitored by their teachers in school sports. The teachers attended information meetings prior to testing, covering test procedures, documentation, and safety aspects. In addition, they received written instructions and were informed that they could contact the project coordinator with any questions during data collection, including test sessions. The field tests used in this study are commonly implemented in youth athlete settings (e.g., Moseid et al., 2019) and were therefore familiar to most of the teachers. During the 2021/2022 season, Swedish youth floorball activities for this age group proceeded with only minor COVID-19 restrictions.

A follow-up survey was administered in April 2022, at the end of the competitive season, in which participants reported any acute or overuse injuries sustained during the season. All data entry (i.e., surveys, field test results, and injury reporting) were completed using pseudonymized IDs, and all information was securely transferred and stored on a university platform.

Measures

To capture both psychological and physical aspects relevant to youth athlete health and development, a combination of self-report questionnaires and physical field tests was used. These measures are described below.

Self-Reported Mental Health Questionnaires

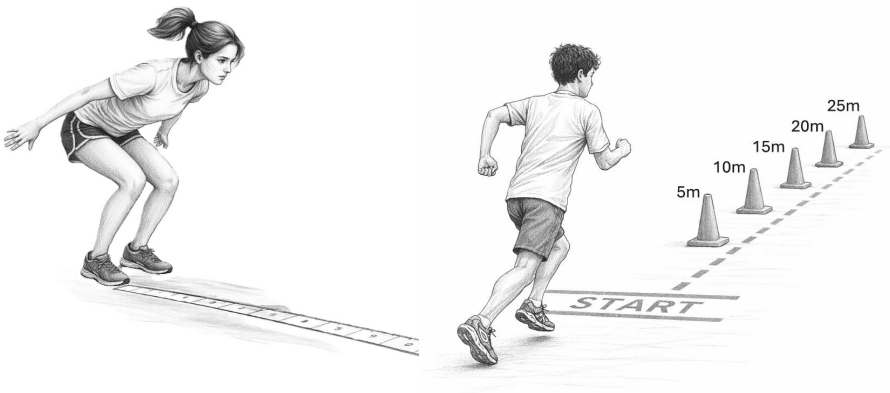
To measure depression symptoms the World Health Organization Well Being Index (WHO-5), a five-item measure of subjective well-being was used (World Health Organization, 1998). Participants rated how they had felt over the past two weeks on a 6-point Likert scale, ranging from 5 (*All of the time*) to 0 (*At no time*). A total raw score (0–25) was multiplied by four to produce a percentage score (0–100). The WHO-5 is widely used as a screening tool for mental well-being and depressive symptoms, with recommended cutoffs of ≥50 (satisfactory well-being), ≤50 (likely depression), and ≤28 (likely major depression; Topp et al., 2015). The scale has demonstrated adequate reliability, construct validity, and applicability in youth populations (Blom et al., 2012; Topp et al., 2015). Anxiety symptoms were measured by the General Anxiety Disorder-7 item scale (GAD-7), which is a seven-item screening instrument for generalized anxiety disorder and broader anxiety symptoms (Spitzer et al., 2006; Kroenke et al., 2007). Participants rated how often they experienced symptoms over the past two weeks on a 4-point scale, ranging from 0 (*Not at all*) to 3 (*Nearly every day*), yielding a total score between 0 and 21. A cutoff of ≥8 has been recommended when screening for a range of anxiety disorders (Plummer et al., 2016). The GAD-7 has demonstrated strong internal consistency and test–retest reliability (Spitzer et al., 2006; Plummer et al., 2016), as well as measurement validity in adolescent samples (Romano et al., 2022).

Physical Field Tests

All teachers followed a standardized test protocol, including test order, oral test instructions, and were encouraged to follow a standardized warm-up consisting of running and mobility exercises. The test battery was administered across two days (Figure 2 and Figure 3).

Figure 2

Day 1 physical field tests: Standing Long Jump and 150 m Shuttle Test



Note. Illustrations generated using AI, Microsoft® 365 Copilot (Microsoft Corporation, 2025).

Day 1

Lower Body Strength

Standing Long Jump

This test, part of the Ironman Jr. test battery, assesses horizontal lower-body power in youth athletes (Moseid et al., 2019). From a standing position, participants performed a maximal horizontal jump following a countermovement and coordinated arm swing (Figure 2). The landing was required to occur on both feet in a stable position. Jump distance was measured from the rear edge of the start line to the heel closest to the line. Participants completed at least three attempts, with additional attempts permitted as long as performance continued to improve. The longest jump (in centimeters) was recorded as the result.

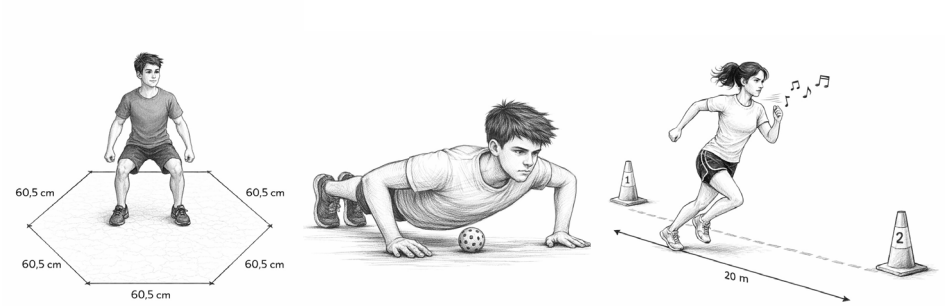
Anaerobic Capacity

150 m Shuttle Test

This test is a modified version of the 5-m multiple shuttle run test described by Boddington et al. (2001) and was previously used within the Swedish Olympic Committee's field test battery *Fysprofilen*. Five cones were placed at 5-meter intervals (5, 10, 15, 20, and 25 m), and participants ran repeated shuttles totaling 150 m (Figure 2). The test was performed twice with three minutes of rest. Participants were instructed to complete each run as fast as possible. In the present study, the fastest of the two runs was used in the analysis.

Figure 3

Day 2 physical field tests: Hexagon Test, Push-ups and 20 m Multistage Shuttle Run Test (Beep Test)



Note. Illustrations generated using AI, Microsoft® 365 Copilot (Microsoft Corporation, 2025).

Day 2

Speed, Coordination, and Balance

Hexagon Test

The Hexagon Test assesses multidirectional speed, coordination, and dynamic balance (Beekhuizen et al., 2009). A hexagon with 60.5 cm sides and 120-degree angles was taped on a hard surface floor (Figure 3). Starting in the center, participants completed a sequence of two-footed jumps over each side and back to the center in a clockwise direction, repeating the cycle three times (18 jumps total). The test was repeated up to three times in each direction (clockwise first, then counterclockwise). Attempts were repeated if the participant initiated before the command or stepped on a line. The best time in each direction was recorded, and the mean value of the best clockwise and counterclockwise times was used for analysis.

Upper Body and Core Strength

Push-ups

This test, also part of the Ironman Jr. test battery, measures upper body and core muscular endurance (Moseid et al., 2019). Participants performed pushups at a standardized pace of 60 beats per minute (BPM). After a technique focused warm-up (5–10 repetitions), the test began from a plank position supported on hands and toes, with a floorball placed below the chest (Figure 3). A repetition was counted when the participant lowered the body until the upper arm was parallel to the ground and then returned to full elbow extension while

maintaining a straight body alignment. The result was the maximum number of correctly performed repetitions.

Aerobic Power

20 m Multistage Shuttle Run Test (Beep Test)
Aerobic power was assessed using the 20-meter multistage shuttle run test (Léger et al., 1988). Participants ran between two markers placed 20 m apart in time with prerecorded audio signals (Figure 3). The initial speed was 8.5 km/h, increasing by 0.5 km/h each minute. Participants were required to reach the marker at each beep, and the test ended when they could no longer do so. The result was recorded as the total number of shuttles completed.

Baseline measures

Baseline information was collected through self-report items assessing demographic characteristics, anthropometrics, and injury background. Participants reported their biological sex and year of birth, the latter used to calculate age. Height (cm) and weight (kg) were self-reported to provide basic anthropometric data. To capture previous injury experience, participants were asked whether they had ever sustained a severe sports-related injury, defined as an injury resulting in more than four weeks of absence from sport. Current injury status was assessed using an item asking whether they were completely injury free, defined as being able to participate in sport without any symptoms at the time of the survey.

Injury measures

Injury occurrence was assessed with two items in the follow-up survey. Regarding acute injuries, participants were asked: “During the floorball season 2021/2022, have you suffered any traumatic injury (a sudden injury, e.g., a joint sprain or muscle strain) that caused you to miss training or competition?” Additionally, for overuse injuries: “During the floorball season 2021/2022, have you suffered any overuse injury (slowly evolving pain that has interfered with sporting activity) that caused you to miss training or competition?”

Definitions were consistent with common epidemiological distinctions between acute (sudden onset) and overuse (gradual onset) injuries in sport (Fuller et al., 2006).

Data analysis

In the current study, the aim was to capture combinations of risk factors to investigate how psychological and physical factors interact and how these patterns relate to demographic variables and injury risk in youth floorball players across a competitive season. Based on the person-centered rationale

outlined in the Background, a latent profile analysis (LPA) was conducted. LPA identifies subgroups (profiles) based on individuals' values on indicator variables, allowing for the detection of distinct patterns across multiple predictors (Masyn, 2013; Ivarsson & Stenling, 2019). The primary hypotheses and analytic plan for this study were preregistered on the OSF (https://osf.io/z3x48). Descriptive analyses were conducted in SPSS version 28. Two non-response analyses were carried out for excluded participants. Only individuals with no missing values on baseline predictors and outcome variables, and with at least one measurement per construct (depression symptoms, anxiety symptoms, and physical field tests), were included in the analyses. Outlier detection followed recommendations by Leys et al. (2019) and was performed using the R package *Routliers* (version 0.0.0.3). A few outliers were identified but were retained because they were considered to reflect the diversity of the sample.

The main analyses were conducted using Mplus 8.10 (Muthén & Muthén, 1998–2017). The robust full-information maximum likelihood estimator (FIML; MLR in Mplus) was used to handle item-level missing data, consistent with prior recommendations (Fergusson et al., 2020). FIML incorporates all available information in the estimation process without requiring imputation or case deletion (Enders, 2022). Following recommended guidelines for latent profile analysis, the analytic procedure adhered to the general structure proposed by Fergusson et al. (2020), which includes six main stages. First, the data were inspected to evaluate distributions, missingness, and the suitability of indicators for mixture modeling. Second, a series of theoretically plausible LPA models were iteratively estimated and evaluated. Third, model fit and interpretability were assessed using established fit indices. Fourth, emerging patterns within the profiles were examined. Fifth, covariates were incorporated to assess associations with profile membership. Finally, as the sixth step in line with Fergusson et al. (2020), the results were presented alongside relevant theoretical and empirical considerations. Because the current study also examined distal outcomes, additional steps were carried out prior to the final step to evaluate injury outcomes across the extracted profiles. The following section describes how these stages were implemented in the current study.

After the initial data inspection, LPA was conducted using two mental health variables (depression and anxiety symptoms) and five physical capacity variables (lower body strength, upper body and core strength, aerobic power, anaerobic capacity, and speed, coordination, and balance) as input indicators. All indicators were standardized (*z*-scores) to facilitate estimation and interpretation given differing measurement scales. Model estimation followed recommendations by Muthén and Muthén (1998-2017), including the use of multiple sets of random starting values to identify the global maximum and increasing iterations to optimize convergence. Recommendations from Masyn

(2013) in estimating models with different within-profile variance–covariance specifications were used, beginning with the most constrained structure and progressively increasing complexity. The first models used a class-invariant diagonal structure, assuming conditional independence, covariances fixed to zero within profiles, and variances constrained to be equal across profiles. Next, models allowing variances to vary freely across profiles were estimated. Subsequently, models in which indicator variables were allowed to covary within profiles while variances remained equal between profiles were tested. Finally, a full mixture model was estimated, allowing both variances and covariances to vary freely within and across profiles.

Across all specifications, profile solutions were compared based on model convergence and information criteria. Decisions regarding model fit and profile enumeration were guided by the Bayesian Information Criterion (BIC), Sample-Adjusted BIC (SABIC), Bootstrap Likelihood Ratio Test (BLRT), Lo–Mendell–Rubin test (LMR), and entropy, following recommendations by Nylund et al. (2007) and Fergusson et al. (2020). Lower BIC and SABIC values indicated better fit. For the BLRT and LMR, statistical significance ($p < .05$) suggested that a model with k profiles fit better than a model with $k - 1$ profiles. Entropy values above .80 have been suggested to indicate adequate classification accuracy (Celeux & Soromenho, 1996; Tein et al., 2013), although no formal cut-offs exist. Final models were evaluated based on substantive meaning, theoretical coherence, interpretability, and the size of the smallest profile (Fergusson et al., 2020; Lindwall et al., 2017).

To incorporate covariates and distal outcomes, the manual three-step Bolck–Croon–Hagenaars (BCH) approach was used, following methodological advances in the inclusion of auxiliary variables in mixture models (Asparouhov & Muthén, 2014; Nylund-Gibson et al., 2019; Fergusson et al., 2020). The BCH method allows auxiliary variables to be included without altering latent profile membership derived in the first step. The BCH step includes multinomial logistic regression, with results reported as odds ratios (OR) and 95% confidence intervals (CI). Covariates included age, sex, height, weight, injury history, and injury status at baseline. Distal outcomes were analyzed separately for any injury (acute or overuse), acute injury, and overuse injury to assess potential group differences in injury occurrence.

Study 2

Sample and Procedure

In Study 2, data collection was conducted during the 2022/2023 competitive school year season. The study included a total of 350 youth floorball players (178 females, 172 males), aged 16–19 years ($M = 16.83$, $SD = 0.81$). As in Study 1, all data were collected using the XPS Network smartphone application, with participants submitting information using pseudonymized IDs.

Participants completed the baseline survey, including informed consent, at the start of the season. In addition, every two weeks, throughout the season (i.e., 16 occasions), participants also responded to additional questions about mental health, training exposure and injury occurrence, following consensus definitions and procedures from established sport injury surveillance frameworks (e.g., Clarsen et al., 2020; Fuller et al., 2006). Completing the biweekly questions took less than 10 minutes. Data were securely transferred and stored on a university platform. The research questions, material and methods, and analytical approaches for Study 2 were preregistered on AsPredicted (aspredicted.org), reference number #275798.

Measures

Mental Health

Mental health symptoms were assessed using the Depression Anxiety Stress Scales–21 (DASS-21; Lovibond & Lovibond, 1995). The scale measures symptoms of depression, anxiety, and stress over the past week. Each subscale consists of seven items rated on a 4-point Likert scale (0 = *Did not apply to me at all* to 3 = *Applied to me very much or most of the time*). Subscale scores range from 0 to 21, with higher scores indicating more symptoms. DASS-21 has been validated in both adult and youth samples (Evans et al., 2021; Lovibond & Lovibond, 1995; Mellor et al., 2015).

Injury Severity

Injuries and their consequences for sport participation, training modification, pain, and performance were measured using a modified and combined version of the Oslo Sports Trauma Research Center Questionnaire on Health Problems and the Oslo Sports Trauma Research Center Overuse Injury Questionnaire (OSTRC-H2, OSTRC-O2; Clarsen et al., 2020). The questionnaire consists of four items, scored from 0 to 25, producing a total injury severity score ranging from 0 to 100. The repeated longitudinal design enabled tracking of health problems and injury severity across the season. In the analysis both a continuous injury severity score and a binary variable (injury = a severity score higher than 0) were used.

Baseline measures

As in Study 1, biological sex, previous injury history, and current injury status were assessed at baseline at the start of the season (September). Previous injury history was assessed using the question: “Have you suffered any severe injuries (injuries resulting in more than four weeks of absence from sport) caused by your sport at any time in your career?” Current injury status at baseline was assessed using the question: “Are you completely injury-free (able to play sports without any symptoms) today?”

Data analysis

The aim of the second study was to investigate youth athletes' mental health, how it varies and fluctuates over the course of a school-year season, and whether these patterns are influenced by injury status. A multilevel framework was employed to examine both between-person differences and within-person changes in mental health across the season.

Descriptive analyses were conducted using SPSS version 28 and RStudio version 2025.09.2+418. Cases with missing data on between-person predictors (biological sex, prior injury history, and injury status at baseline) were excluded from the analyses.

To model change in depression, anxiety, and stress symptoms across the season, Bayesian multilevel models were estimated in Mplus version 8.10 using Markov chain Monte Carlo (MCMC) sampling (Muthén & Muthén, 1998–2017). This modeling approach allows repeated biweekly measurements to be nested within individuals and enables the separation of within-person and between-person sources of variation (Curran & Bauer, 2011). For each model, four MCMC chains with 10,000 iterations were run, with the first 5,000 iterations discarded as burn-in (Asparouhov & Muthén, 2021). Convergence was assessed using the potential scale reduction factor (PSR), with values below 1.05 indicating acceptable convergence (Brooks & Gelman, 1998). Default priors in Mplus were applied, and parameter estimates were evaluated using 95% Bayesian credible intervals (CrI), with intervals not including zero considered credible (Zyphur & Oswald, 2015). Missing data at the within-person level were handled implicitly by the Bayesian estimation, allowing all available observations to contribute to parameter estimation (Muthén & Muthén, 1998–2017).

In the first step, multilevel growth modeling was applied to examine individual trajectories of depression, anxiety, and stress symptoms across the competitive season. For each outcome, models included random intercepts as well as linear and, where supported, quadratic slope components, with the intercept anchored at the first measurement occasion. Quadratic slopes were retained only when supported by their 95% Bayesian credible intervals. Between-person baseline characteristics (biological sex, prior injury history, and injury status at baseline) were subsequently included as predictors to account for individual differences in baseline symptom levels and rates of change over time.

Subsequent analyses focused on associations between injury status and symptoms of depression, anxiety, and stress at both within-person and between-person levels. Two alternative operationalizations of injury were considered, binary injury status and injury severity. To decompose within-person variation from between-person variation, latent person-mean centering was applied to time-varying predictors (Asparouhov & Muthén, 2019). Time was included at the within-person level to account for overall temporal trends (cf.

Wang & Maxwell, 2015). This modeling framework enabled assessment of whether athletes experience higher depression, anxiety, and stress symptoms than usual when reporting higher injury severity levels than usual, or when reporting being injured compared to when they report being not injured, whether individual differences in injury-related symptom reactivity were present (modeled via random slopes), and whether between-person level moderators such as biological sex and prior injury history were associated with variability in these effects. Between-person differences in injury were operationalized as each individual's proportion of measurement occasions with reported injury in models where a binary injury variable was used. In models using the injury severity score, the between-person differences represent individuals' mean injury severity scores across measurement occasions.

Study 3

Sample and Procedure

Fifteen floorball teachers were recruited using purposive sampling to obtain variation in age, gender, and geographical representation across Sweden. Recruitment invitations were emailed to 20 nationally certified regional elite floorball high schools (NIU) and the national elite floorball high school (RIG), all of which participated in the larger project *Risk factors for sport injuries in floorball players*, described in the introduction to the Materials and Methods section. All individuals who responded (n = 15) met the inclusion criteria of at least one year of experience working at a NIU or RIG school and fluency in Swedish. Participants provided informed consent and completed a brief online demographic questionnaire prior to the interview.

The sample included four women and eleven men, aged 29–60 years (median = 47). Participants had a minimum of two years' experience at their current school, with total school experience ranging from 3 to 24 years and floorball coaching experience ranging from 5 to 30 years. Most participants had previously played floorball themselves, with experience spanning youth to elite senior levels; several had competed at the national elite level, including representing the Swedish national team. Twelve participants had completed university level education, and the majority had undertaken coaching education programs provided by the Swedish Floorball Federation, including components on coaching skills, sport-specific competencies, age-appropriate strength training, and injury prevention principles tailored to floorball.

Data collection

All interviews were carried out individually via videoconferencing during the spring semester of 2024 and were scheduled at a time convenient for each participant. Semi-structured interviews (Kvale & Brinkmann, 2013) were used, guided by an interview guide developed by the author in collaboration with two

co-authors. The guide consisted primarily of open-ended questions, and the main topic areas included utilization, preconditions, perceived competence, motivation, and attitudes. Examples of opening questions were: “Can you tell me what injury prevention is to you?” and “What are your experiences of conducting injury prevention in the school context?”. Additional open-ended follow-up questions and probes were used to elicit detailed accounts of experiences and strategies related to injury-preventive work in the high school setting.

The interview guide was piloted once with a coach working with a similar athlete group to evaluate the clarity and relevance of the questions. Although no major structural changes were required, the pilot indicated the importance of prompting participants to provide concrete examples. Minor adjustments were therefore made to the phrasing of certain questions to better encourage elaboration and exemplification. All interviews were conducted by the author, a psychologist with prior research experience in floorball and sports injuries and personal experience of attending a certified elite sport high school. This background may have facilitated rapport with participants and informed follow-up probes during interviews. Interviews lasted between 32 and 50 minutes (M = 44 minutes) and were audio-recorded with participants’ consent. Recordings were transcribed verbatim by the author or a professional transcriptionist. All interviews were conducted and transcribed in Swedish. Quotations used in the article were translated into English by the author, with attention to preserving the original meaning and nuances.

Data analysis

In this thesis, advanced statistical modeling is combined with an interest in exploring individuals’ perspectives and lived experiences. Pragmatism (Dewey, 1938) aligns with the overall research approach of the thesis by supporting methodological flexibility and allowing different forms of evidence to contribute meaningfully to the research aims. Reflecting this orientation, Study 3 adopted a qualitative, inductive design guided by pragmatism, which emphasizes practical relevance and seeks to understand how and why individuals experience and respond to real-world challenges (Giacobbi et al., 2005; Morgan, 2014; Zyphur & Pierides, 2020). Given that the aim of Study 3 was to explore high-school floorball teachers’ experiences and strategies related to injury prevention in the school setting, qualitative content analysis (QCA) as described by Graneheim and Lundman (2004) was selected as the analytic approach. QCA is theoretically flexible and can be used to explore both manifest content and more latent, interpretative meanings at varying levels of abstraction (Lindgren et al., 2020). Consistent with a pragmatic perspective, QCA is not tied to a specific paradigm but instead provides a set of analytic tools whose theoretical orientation is shaped through their application within a particular study (Braun & Clarke, 2021).

Established guidelines for QCA (Graneheim & Lundman, 2004) and later developments concerning interpretation, abstraction, and trustworthiness (Graneheim et al., 2017; Lindgren et al., 2020) guided the analytic process. NVivo 12 (Lumivero, 2024) was used to support data management, coding, and structuring of the analysis. Following recommended procedures (Dahlgren et al., 2019; Erlingsson & Brysiewicz, 2017; Lindgren et al., 2020), the analysis proceeded through six steps: (1) familiarization with the data, (2) dividing the text into meaning units and condensing them, (3) generating codes, (4) grouping codes into categories, (5) abstracting categories into sub-themes and themes, and (6) relating the results to existing knowledge. A meaning unit was considered a coherent segment of text—such as words, sentences, or paragraphs—that shared a common content and contextual meaning (Graneheim & Lundman, 2004). Categories captured manifest content with a low degree of interpretation, whereas themes represented a higher level of abstraction, functioning as a unifying "red thread" across categories (Graneheim et al., 2017). Our analysis involved a moderate level of abstraction and latent interpretation (Graneheim et al., 2017; Lindgren et al., 2020).

The analysis began with all transcripts being read and reread by the author to gain a deeper understanding of the material. Thereafter, the author and two co-authors independently coded one interview to compare approaches, discuss similarities and differences, and strengthen the analytic rigor through triangulation. Following this collaborative step, the author continued identifying meaning units in the remaining interviews. Meaning units were then condensed and coded, resulting in codes covering a wide range of content, such as school facilities, injury occurrences, attitudes, motivational aspects, and communication practices. Codes were subsequently sorted into categories based on similarities and differences (Graneheim & Lundman, 2004). The categories reflected school-specific conditions, responsibility structures, motivational processes, and communication strategies. These categories were then interpreted and abstracted into sub-themes that captured teachers' strategies for navigating internal (e.g., school curriculum) and external (e.g., club coach expectations) demands, and one overarching theme that reflected the broader pattern of striving for enhancing autonomy and self-leadership in students. The analytic process was iterative rather than linear, characterized by repeated movement between transcripts, codes, categories, and themes. Throughout this process, categories, sub-themes, and themes were continuously refined through team discussions.

Trustworthiness is a central quality criterion in qualitative research, ensuring that the interpretations are credible, dependable, and grounded in the participants' accounts (Lindgren et al., 2020). To address this, several strategies were applied during the analytic process. First, trustworthiness was strengthened through repeated discussions and triangulation among researchers with diverse competencies, including psychology, sports medicine, and physiotherapy, as well as applied experience in youth sport (Carter et al.,

2014; Graneheim & Lundman, 2004). In addition, the authors actively reflected on how their backgrounds, experiences, and prior knowledge might shape interpretation, in line with recommendations on reflexivity (Braun & Clarke, 2019). The team also included one researcher who had not been involved in the larger project or previously studied this participant group, offering an outside perspective that supported critical examination of emerging interpretations (Hayfield & Huxley, 2015). Furthermore, the feedback gained through the pilot interview supported trustworthiness by informing refinements to the interview guide and strengthening credibility, dependability, and transferability. It ensured that the questions were clear, contextually appropriate, and feasible for participants to engage with in the digital format (Kallio et al., 2016). Finally, a member check was conducted with both original participants and individuals from a similar population. Their feedback supported the credibility and confirmability of the results, as no participants indicated misrepresentation or missing aspects of importance.

Ethical considerations

This project was designed to ensure that societal benefits outweighed potential risks for individual participants, in accordance with the Declaration of Helsinki (WMA, 2024), the Swedish Research Council (Vetenskapsrådet, 2017), and the European Code of Conduct for Research Integrity (ALLEA, 2023). Ethical approval was obtained from the Swedish Ethical Review Authority (ref: 2020-02469), including a separate approval for the teacher interviews (ref: 2023-06730-02). The study was partially funded by the Swedish Floorball Federation, which encouraged participation from athletes and teachers and contributed to identifying practice-relevant research questions but had no influence over data analysis.

Participants in Study 1 and 2 were youth athletes aged 16 years and older, who could legally provide consent without parental approval (SFS 2003:460). Informed consent was obtained through written and oral information tailored to adolescents, emphasizing voluntariness and the right to withdraw at any time without consequences. Participants were also informed that they could opt out of reminders related to questionnaires or testing without any effect, including any impact on school-related assessments or grades. To protect confidentiality, teachers were not informed about which students had consented, instead they were asked to remind all students about study activities. This approach was chosen to avoid indirect pressure and maintain privacy.

The chosen physical field tests were assessed as safe and posing minimal additional risk compared to regular training (Cruz-Léon et al., 2025). Instructors were thoroughly prepared, and medical equipment was available on-site. All participants were covered by personal injury insurance. Psychological data and injury reporting were collected frequently to be able to capture variations in mental health and injury status, an approach that can be burdensome and time-consuming for participants (Bolger & Laurenceau, 2013).

To handle this, efforts such as carefully considering the number of questions, the timing of survey distribution (e.g., day of the week and time of day), and recommending that teachers allocate time for survey completion within lessons when possible were made to minimize participant burden.

Teachers received oral information about the interview study during a national staff meeting and provided written informed consent prior to participating in the semi-structured interviews. A form of member checking was offered after analysis, inviting all teachers to review the findings of Study 3. Interview data were de-identified, and some quotes were slightly modified to protect confidentiality in this small population prior to publication.

All data were handled in accordance with Umeå University's information security guidelines and applicable data protection regulations, including the General Data Protection Regulation (European Union, 2016). When participants registered data via the smartphone application, these data were immediately transferred to a secure research platform at Umeå University and subsequently deleted from the XPS Network smartphone application and Sideline Sports servers. Quantitative data were pseudonymized and stored securely, with access restricted to the project coordinator and the author of this thesis. Following transcription, the audio recordings of the interviews were deleted, and verbatim transcripts were stored on the secure platform at Umeå University. All publications adhered to the Vancouver guidelines (International Committee of Medical Journal Editors, 2023), with clear authorship contributions and careful protection of participant confidentiality.

Summary of studies

Study 1

Background and aim

Sport injuries are prevalent in youth sports and can affect both individual short- and long-term health, sport participation, and increase health care costs on a societal level. Considerable research has therefore focused on identifying risk factors that precede injury. Several physical (e.g., strength, neuromuscular control), psychological (e.g., stress), and demographic (e.g., age, sex) factors have been linked to injury risk (e.g., Emery, 2003; Tranaeus et al., 2024). However, much less is known about how such factors interact within individuals, and whether combinations of factors may increase or reduce injury risk (Bittencourt et al., 2016). The first study in this thesis addressed this gap by examining whether distinct profiles could be identified among youth floorball players using both physical and psychological indicators, and how these profiles relate to injury occurrence.

Methods

At the beginning of the competitive season, 222 youth players enrolled at NIU and RIG completed standardized physical field tests at their schools and responded to an app-based survey assessing mental health and injury history. Injury outcomes were recorded through a follow-up survey at the end of the season. To capture combinations and patterns of risk factors within individuals, latent profile analysis was used to form subgroups based on players' psychological and physical characteristics. Group differences in demographic and anthropometric variables, as well as previous and current injuries, were examined. Finally, differences in injury occurrence between profiles were evaluated. The study protocol, including aims, primary hypotheses, measures, and analytic strategy were preregistered on the OSF.

Findings and conclusions

Three profiles were identified that differed in both the level and shape of mental health and physical performance. Relative to the other profiles, one profile was characterized by moderate mental health and the highest physical performance, another by the lowest mental health and average physical performance, and a third by the highest mental health and the lowest physical performance. Following previous studies, profile labelling was based on standardized *z*-scores (i.e., standard deviations from the sample mean; Gustafsson et al., 2018). The profiles were labelled "Moderate mental health/High physical performance" (Profile 1), "Very low mental health/Average physical performance" (Profile 2), and "High mental health/Low physical performance" (Profile 3). Having an

injury at baseline increased the likelihood of belonging to the profile with very low mental health, while age, sex, height, weight, and earlier injury history did not significantly predict profile membership. Contrary to expectations, the profile with the highest physical performance and moderate mental health reported the highest occurrence of injuries by the end of the season. A likely explanation is that athletes with relatively good mental health and strong physical capacity tend to perform well and, as both a consequence and driver of this performance, may train more, play more games, and participate at higher intensities. Consequently, these higher levels of exposure increase the number of situations in which injuries might occur. Interpreting the findings in this way suggests that injury prevention efforts should not focus solely on athletes with apparent health deficits or performance limitations but also consider each player's overall context and total load.

Study 2

Background and aim

Mental health in youth sport is shaped by ongoing interactions between athletic participation, academic demands, and social contexts, and should therefore be understood as a process that evolves over time (Stambulova et al., 2015; von Rosen & Heijne, 2021; Walton et al., 2024). Within the sporting domain, sustaining an injury is commonly viewed as a notable psychological challenge and is frequently perceived as a negatively impactful life event (Chang et al., 2020; Gouttebarge et al., 2019). Given that both injury status and mental health vary throughout a competitive season, methodological approaches that capture within-individual change are essential complements to between-person analyses. Accordingly, the aim of this study was to examine mental health trajectories across a competitive floorball season and to investigate within- and between-person associations between injury status and mental health in youth athletes.

Methods

During the 2022/2023 season, 350 youth floorball players enrolled at NIU and RIG completed app-based surveys every other week assessing symptoms of depression, anxiety, and stress, as well as injury severity (i.e., injury-related consequences for participation, performance, and pain). To examine within-person change over time while accounting for between-person differences, multilevel models were used. Baseline characteristics, time-varying injury status, and between-person variations in within-person associations were examined using Bayesian estimation. Research questions and analytic strategies were preregistered on aspredicted.org.

Findings and conclusions

At baseline, males reported lower levels of depression, anxiety, and stress symptoms than females. However, none of the baseline predictors, including sex, prior injury history, or baseline injury status, were associated with changes in mental health over time. At the within-person level, fluctuations in injury severity relative to athletes' usual levels were associated with concurrent changes in mental health. Time points characterized by higher injury severity were associated with lower depression symptoms, whereas anxiety symptoms were higher when higher injury severity was reported. These within-person associations varied across athletes and were slightly weaker among those reporting higher average injury severity or more frequent injury occurrence across the season. Taken together, the findings indicate that psychological responses to injury are dynamic and heterogeneous. These results underscore the importance of studying injury and mental health as within-person processes over time, rather than relying solely on baseline risk factors or between-person comparisons.

Study 3

Background and aim

Injury prevention interventions of various kinds (e.g., focused on neuromuscular control, stress-reduction, or protective equipment) have proven effective. Still, although injury reductions of nearly 50% have been reported (Åkerlund et al., 2020), keeping adherence to preventive behaviors over time is challenging (Bahr et al., 2015). A call for integration of behavioral, motivational, and contextual aspects has been suggested both when studying injury prevention as well as in the implementation of applied practice. In youth sport, coaches and teachers have been identified as key figures in the injury prevention process. To contribute with knowledge of how injury prevention is used in a real-world setting, the aim of the final study was to explore high school floorball teachers' experiences and strategies related to injury prevention in the school context.

Methods

To gain in-depth understanding of how teachers apply injury prevention in the school context, semi-structured interviews (Kvale & Brinkmann, 2013) were conducted with 15 teachers in school sports working at NIU or RIG. Purposive sampling was used to mirror age, gender, and geographical aspects of the broader population of elite floorball high school teachers. Interviews covered prevention-related aspects such as utilization, facilities, perceived competence, motivation, and attitudes. Data were then analyzed using qualitative content analysis (Graneheim & Lundman, 2004; Lindgren et al., 2020), with iterative

interpretation and abstraction into categories, sub-themes and themes. A form of member-checking was also conducted to ensure that the analysis reflected areas of relevance for practitioners.

Findings and conclusions

The analysis revealed a broad range of experiences and strategies, with both shared and unique elements. The main theme, *" Facilitating students' development to become their own best coach"*, captured teachers' student-centered approaches aimed at supporting progression and growth.

The first sub-theme, *"Navigating challenges and opportunities in the school context"* highlighted teachers' everyday experiences of implementing preventive work within the structures and constraints of the school setting, including interactions with external stakeholders such as club teams. The second sub-theme, *"Promoting students' own learning and sense of responsibility"*, described pedagogical strategies aimed at fostering students' autonomy and informed engagement in their own injury prevention. The third sub-theme, *"Leading with intentionality"* illustrated how teachers used dialogue, motivational strategies, and their own ongoing learning to strengthen the learning process for students. A major challenge in school-based injury prevention was helping students balance their total load, including high physical training volumes during school and club activities, as well as psychological load related to stress and academic demands. Strategies such as role modeling, dialogue, and providing rationales were used to create a motivational climate that supports autonomy and competence (Standage & Ryan, 2020), making it easier for students to transfer these routines across contexts (Hagger & Chatzisarantis, 2016).

To conclude, teachers in Swedish elite floorball high schools approached injury prevention as part of a development-focused teaching strategy, combining (a) introduction and integration of prevention into regular training, (b) supporting autonomy, competence and progression of responsibility, (c) using routines to enhance habit formation, (d) framing injury prevention also as performance-enhancing to strengthen perceived value, and (e) active—though sometimes demanding—coordination with club environments to manage students' overall training and recovery demands. To improve the implementation of injury prevention in the school context, strengthened collaboration among schoolteachers, team coaches, and athletes is needed, ideally supported by coordinated efforts and guidelines from the sport federation to manage athletes' total load and well-being and facilitate shared responsibility for injury prevention.

Discussion

The overall aim of this thesis was to advance the understanding of sport injury in youth athletes by examining combinations of risk factors, psychological responses in relation to injury over time, and injury prevention practices within Swedish elite floorball high schools. The specific aims were to: a) identify how combinations of psychological, demographic, and physical capacity factors relate to sport injury occurrence; b) examine mental health trajectories across a competitive floorball season and to investigate within-person and between-person associations between injury status and mental health in youth athletes; and c) explore floorball teachers' experiences and strategies related to injury prevention in the school setting. In the following discussion, the findings are integrated and discussed by conceptualizing sport injury as a dynamic process shaped by biopsychosocial factors within the context of Swedish elite floorball high schools.

Main findings in relation to each aim

In Study 1, three subgroups of youth floorball players were identified based on shared characteristics of physical performance and psychological factors. One subgroup demonstrated a higher injury occurrence than the others; notably, this group had the highest physical performance and moderate mental health compared to the other groups.

In study 2, the association between injury and mental health differed among youth athletes at the between-person and within-person levels. At the within-person level, athletes reporting higher injury severity than their usual level also reported higher anxiety during the same week. Interestingly, higher injury severity was also associated with lower levels of depression symptoms. Biological sex predicted baseline levels of mental health symptoms (i.e., females reported more symptoms) but did not moderate the within-person relationships between injury and mental health.

In Study 3, teachers used context-specific facilitators and employed a range of need-supportive strategies in injury prevention teaching to promote learning and adherence, including scaffolding and individual adjustments. While a clear intention to transfer injury-preventive behaviors to other contexts (e.g., club teams) existed, challenges at the system and organizational levels remain.

The use of a person-centered approach to identify combinations of risk factors

In the background section of this thesis, leading up to the first specific aim, I argued for the use of approaches that allow us to examine combinations of risk factors within individuals (i.e., person-centered approaches). The rationale for this was that sport injuries, like many human characteristics and behaviors, are complex and unlikely to be sufficiently explained by isolated factors only. The findings from Study 1 support this assumption and suggest that combinations and patterns of characteristics may contribute important information in understanding injury occurrence among youth athletes.

By using latent profile analysis, three distinct profiles differing in both level and shape across mental health and physical performance indicators were identified, suggesting that some athletes are more alike than others across multiple dimensions. From a methodological standpoint, person-centered approaches shift the focus from estimating average effects across groups to identifying combinations of characteristics within individuals, thereby providing a complementary perspective to traditional variable-centered analyses (Fergusson et al., 2020). This is particularly relevant in applied contexts where individuals rarely differ on only one dimension (Ivarsson & Stenling, 2019). However, it must be acknowledged that statistical clustering approaches will, by definition, identify some form of grouping. Consequently, a critical step in this analysis involved assessing whether the identified profiles were meaningful and recognizable within a sporting context (Fergusson et al., 2020). During the project, the profiles were presented to teachers at NIU/RIG who largely described them as familiar constellations among their students. This suggests that the identified profiles may have ecological relevance despite being statistically derived.

The primary purpose of Study 1, however, was not merely to identify profiles, but to examine how these profiles related to injury occurrence. Somewhat surprisingly, and contrary to the initial hypothesis derived from the literature, the profile characterized by high physical performance and moderate mental health (Profile 1) showed the highest injury occurrence at the end of the season. These findings challenge assumptions that injury risk is primarily associated with deficits in physical or psychological functioning. Instead, the findings suggest that injury risk may be better understood as a dynamic interplay between individual characteristics, performance capacity, and contextual demands. Several explanations may account for these findings. Athletes with high physical capacity may be able to perform potentially risky movements at higher speed or intensity (Pasanen et al., 2018; Soligard et al., 2016). High

physical capacity and relatively good mental well-being may also facilitate performance, which in turn could lead to selection for more playing time and participation across multiple teams (Moseid et al., 2019), thereby increasing overall exposure (Gabbett, 2016). Together, these findings indicate that high-performing athletes should not be overlooked in injury prevention and recovery strategies, as substantial injury risk may also be present among athletes who otherwise appear well-functioning.

In addition to examining injury outcomes, and to further integrate biopsychosocial perspectives, several well-established risk factors (age, biological sex, prior injury history, injury status at baseline, height, and weight) were analyzed both as predictors of profile membership and, in complementary analyses, as direct predictors of injury in the full sample. These findings highlight a key distinction between variable-centered associations and person-centered differentiation. In the full sample, baseline injury status was associated with sustaining an injury during the season, and predicted membership in Profile 2 ("Very low mental health/Average physical performance"). In contrast, prior injury history was associated with acute injury occurrence at the sample level, in line with previous research (e.g., Hägglund et al., 2013), but did not differentiate profile membership. Furthermore, biological sex, age, height, and weight neither predicted injury occurrence in the full sample nor distinguished between profiles. These findings contrast previous findings in floorball, where biological sex has repeatedly been associated with different injury rates for females and males (Pasanen et al., 2018; Tervo et al., 2019; Åkerlund et al., 2020). From a person-centered perspective, this underscores that predictors identifying injury risk at the group level may not necessarily explain heterogeneity between individuals when injury risk is understood as combinations of interacting characteristics within athletes.

Interestingly, athletes in Profile 2, who to a greater extent were injured at baseline, reported fewer injuries by the end of the season. This may relate to previous findings suggesting that previously injured athletes often engage more in injury-preventive behaviors (Åkerlund et al., 2023; Janssen et al., 2016), also resembling findings from Study 3 in this thesis were teachers described previously injured students as the ones who were most positive and motivated towards injury prevention. An additional explanation may be reduced exposure among athletes in this profile, either due to avoidance behaviors related to fear of re-injury (Kvist & Silbernagel, 2022) or because the baseline injury resulted in participation in fewer training sessions and games at the start of the season. This is interesting in relation to qualitative findings from this thesis, where teachers highlighted that, in their experience, injury occurrence was typically highest at the start of the school-year season. They described this period as characterized by increased training load and academic demands, particularly

during the first year of high school, which is consistent with previous research (Heiestad et al., 2025; Stambulova et al., 2015; von Rosen, Heijne, et al., 2018). In addition, results from Study 2 also indicate that the students had the highest levels of depression, stress, and anxiety symptoms at the start of the season. Together, these findings may indicate that periods of elevated psychological and physical load are particularly important to consider in understanding injury risk within the elite sport high school context. However, Study 1 did not allow direct control for training exposure, game exposure, or academic demands across the season, limiting conclusions regarding the relative contribution of these contextual factors. An attempt was made to retrospectively calculate game exposure with data provided by the Swedish Floorball Federation, however, due to the nature of the data, it was not feasible to do in relation to this study.

One additional aspect requiring consideration is that the high or low values characterizing each profile in Study 1 are defined relative to the other profiles, rather than against clinical cutoffs or age-specific physical recommendations. For example, “very low mental health” in Profile 2 should be interpreted as very low relative to profiles 1 and 3, not as indicative of a clinical level of mental health problems. At the sample level in Study 1, mean values and standard deviations for depression and anxiety did not indicate elevated symptom levels. However, the range of responses told a partly different story and showed that some athletes had scores indicating likely depression (9.9 %), likely major depression (2.3%), and anxiety (8.6%) using clinical cut-offs for WHO-5 and GAD-7 (Topp et al., 2015; Plummer et al., 2016), further illustrating how group averages can obscure meaningful variation between individuals.

Mental health trajectories and the role of injury

Beyond the identification of risk profiles and their association with injury occurrence, the thesis examined mental health as a process unfolding over the school-year season and how injury is associated with potential changes in depression, anxiety, and stress symptoms.

Findings from Study 2 showed clear baseline differences in mental health symptoms, primarily predicted by biological sex, with males reporting lower baseline levels of depression, anxiety, and stress symptoms, consistent with findings that female athletes often experience higher levels of mental health issues during adolescence (e.g., Gwyther et al., 2024; Walton et al., 2024). In contrast, none of the baseline predictors, including sex, prior injury history, or baseline injury status, predicted changes in mental health over time. Thus, suggesting that fluctuations in mental health may be more strongly influenced by time-varying factors than by stable individual characteristics and

highlighting the importance of within-person approaches in athlete mental health research (Gaudreau et al., 2020; Hamaker, 2025).

To be able to better understand athletes' responses to injury, the focus of Study 2 was on within-person associations between injury and mental health. Biopsychosocial models suggest that responses to injuries differ depending on previous experiences, coping skills, personality traits and several other stable or time-varying factors, and thus will not be the same for everyone (Wiese-Bjornstal et al., 1998). In support of these assumptions, findings from Study 2 show that at the within-person level, there was an association between anxiety and injury severity such that on occasions characterized by higher injury severity compared to athletes' usual level they also reported higher levels of anxiety symptoms than usual. Previous studies have demonstrated associations between injury and anxiety (e.g., Gulliver et al., 2015; Junge & Feddermann-Demont, 2016) but have primarily relied on cross-sectional designs. The findings in this thesis extend our current knowledge by demonstrating that the injury–anxiety association is evident not only between individuals, but also within individuals over time.

Contrary to previous literature on injury and depression (Gouttebarge et al., 2016; Lyon-Monk et al., 2025; Putukian, 2016), findings from Study 2 indicated that occasions characterized by higher injury severity than usual were associated with lower levels of depression symptoms. One possible explanation is that Study 2 captured more immediate responses to injury than many previous studies, potentially reflecting an earlier phase in the injury process. Whereas prior studies have often examined psychological outcomes months after injury occurrence, the repeated-measures design used in this thesis may better reflect initial reactions to injury. It is possible that initial responses to injury may involve heightened alertness or mobilization rather than withdrawal or low mood, with depression symptoms potentially emerging later if the injury is severe, recovery is prolonged or complications arise (Clement et al., 2015; Putukian, 2016; Filbay et al., 2019). In line with biopsychosocial models, injury responses are also likely influenced by individual appraisal processes, coping strategies, and contextual factors, which may contribute to considerable heterogeneity in psychological outcomes following injury (Hammer et al., 2021; Wiese-Bjornstal et al., 2020). Moreover, no credible associations were observed between injury severity and stress symptoms. One possible explanation is that perceived stress reflects a broader range of concurrent demands in athletes' lives, including academic, social, and sport-related pressures, making it less sensitive to injury-related fluctuations alone (Wiese-Bjornstal et al., 1998).

Although the observed associations were small, their magnitude should be interpreted in relation to the measurement of injury severity. Because injury

severity was assessed on a 0–100 scale, the estimated effects represent changes associated with a one-point increase in injury severity. Such a change is likely to reflect only a minor difference in an athlete's injury experience. Consequently, small coefficients do not necessarily imply that injury severity is of limited practical importance. More substantial increases in injury severity, such as moving from no injury to an injury that substantially restricts participation, performance, and causes pain may be associated with more meaningful changes in psychological symptoms. In other words, injuries may need to be perceived as sufficiently severe, entailing substantial consequences for participation and performance and representing a marked deviation from athletes' usual functioning, before they influence mental health to a detectable or practically relevant extent (Filbay et al., 2019; Putukian, 2016; Wiese-Bjornstal et al., 1998).

Furthermore, the analyses demonstrated substantial heterogeneity in the within-person associations, indicating that athletes differed considerably in their psychological responses to changes in injury severity. This finding aligns with biopsychosocial models proposing that injury responses are shaped by individual, contextual, and situational factors (Wiese-Bjornstal et al., 1998). Consequently, the average within-person effects reported here should not be interpreted as representative of all athletes, as some individuals may experience substantially stronger psychological responses to injury than others. One potential explanation for the observed heterogeneity is athletes' overall injury exposure. Interestingly, the results tentatively suggest that within-person associations between injury severity and mental health may differ depending on athletes' overall level of injury exposure. Although these effects were small and uncertain, the association between injury severity and anxiety appeared weaker among athletes reporting higher average injury severity across the season. One possible interpretation is that athletes with more extensive injury experience have developed coping resources or more realistic expectations regarding injury and recovery, resulting in less pronounced emotional reactions to injury fluctuations. Conversely, athletes with limited prior injury experience may perceive injuries as more disruptive or uncertain. While speculative, this interpretation is broadly consistent with theoretical perspectives emphasizing the role of appraisal and coping processes in shaping injury responses (Hammer et al., 2021; Wiese-Bjornstal et al., 1998, 2020). Further, the association between injury severity and decreased depression symptoms was slightly weaker among athletes with higher average injury severity. One possible explanation is that potential immediate adaptive responses, such as mobilization efforts following an increase in injury severity, may be less pronounced among athletes who experience more severe or long-lasting injuries. This could indicate that athletes with a higher average injury severity experience a later phase of the injury process and therefore react differently to

changes in injury severity, consistent with previous suggestions that injuries affecting participation and performance over extended periods of time may influence the magnitude of depression symptoms (Filbay et al., 2019; Gouttebarge, 2016; Putukian, 2016). However, given the uncertainty surrounding these findings, they should be interpreted cautiously and warrant further investigation.

Importantly, responding to an injury with changes in mental health symptoms is not equivalent to experiencing mental health problems. It should be noted from a psychological perspective, that it is natural to respond to any given life event with some degree of change in mental health status, and most clinical diagnoses require a substantial impact on functioning for at least 14 days to be classified as a mental health disorder (American Psychiatric Association, 2022). When considering sport injury as a process with different phases, it has also been acknowledged that, in order to progress through rehabilitation and the return-to-play process, athletes must reconcile with and work through negative emotions (Wiese-Bjornstal et al., 2020).

Injury prevention within the school context

A vast amount of research has examined the effectiveness of different injury-preventive interventions, and many have shown promising results, suggesting that we know quite a lot about what to do to reduce sport injuries (Åkerlund et al., 2020; Gabriel et al., 2019; Tranaeus et al., 2024). Findings from the qualitative interviews with teachers also underscore this. Overall, the knowledge of what to do and why to do it was generally high among the teachers, particularly regarding physical injury prevention. They described using standardized interventions such as Knee Control, modified programs combining neuromuscular exercises with floorball-related warm-up exercises, and basic strength training. However, it has been argued that effective implementation and long-term sustainability of such interventions require more than simply knowing what to do (Bolling et al, 2020; Gabriel et al., 2019; Moore & Evans, 2017). Increasing adherence has repeatedly been highlighted as a central challenge in both theoretical and applied injury prevention research (Bahr et al., 2015; Bolling et al., 2020; Chan et al., 2011; Lee et al., 2021; Åkerlund et al., 2023, 2024), and the floorball high school population studied in this thesis is not an exception to this. Teachers described that youth athletes, although often acknowledging the importance of injury prevention, still perceived preventive exercises as “not real floorball” and were therefore less motivated to engage in them. Unpublished data collected in the larger project which this thesis is a part of, suggest that few of the participants use protective eyewear, and reasons for not using it after the age of 16 spans reasons such as not being required to,

considered uncomfortable, or as suggested by some, “because it is ugly.” This highlights an important aspect of adherence to behaviors and behavioral change; our behaviors are often impacted by our own and the social surroundings’ perceptions, attitudes, and norms (Ajzen, 1991; Ryan & Deci, 2017; Chan & Hagger, 2012b).

Strategies in teaching and enhancing learning

When changing behaviors, the urge to do so based on personal interest, values, and enjoyment has repeatedly been linked to more positive and sustainable results across contexts and behaviors (Ryan & Deci, 2017). Need-supportive behaviors and environments, that is behaviors and environments which support autonomy, competence, and relatedness are understood to facilitate the satisfaction of basic psychological needs and, in turn, more self-determined forms of motivation, and well-being (Standage & Ryan, 2020; Teixeira et al., 2020). Findings from Study 3 suggest that teachers used autonomy-supportive strategies such as variation in exercises, providing sense-making through rationales, and offering choices. In addition, competence was supported through progression of exercises and responsibility, whereas relatedness was targeted through group format, student-led exercises, and to enable students to learn together and help each other. Although student adherence or effectiveness of the provided injury prevention was not evaluated in this thesis, the use of similar need-supportive strategies have been linked to increased autonomous motivation and sustainable prevention in prior studies (Chan & Hagger, 2012b; Chiu et al., 2023; Lee et al., 2021; Parker et al., 2021). Aligning with SDT, the teaching strategies described by the teachers in Study 3 can be interpreted as an important prerequisite for students internalization of injury prevention, a necessary foundation for behaviors that are wanted to persist when the school-based structure is less present, as in after-school activities such as club-team practices or in post-graduation senior elite floorball participation (Chan & Hagger, 2012b; Hagger & Chatzisarantis, 2016; Lee et al., 2019). In further support of this, Lee and colleagues (2021) used the trans-contextual model to show that perceived need-supportive behaviors from teachers, similar to the ones found in this thesis, were associated with students’ autonomous motivation for injury prevention in school and indirectly transferred to autonomous motivation for injury prevention outside of school.

Moreover, teachers found communication to be one of the most important tools in their injury-preventive efforts. A recurring element was teachers’ reliance on frequent, brief check-ins with students throughout the school week. These micro-interactions served several preventive functions at once: they helped teachers calibrate students’ current readiness and perceived strain, identify early signs of problems, and maintain an ongoing sense of students’ physical

and mental well-being. This teaching approach, focusing on relational support, is likely to support students' experience of being taken seriously and supported in their development, and thus also contributing to more autonomous motivation (Standage & Emm, 2014).

Another finding of practical importance from Study 3 is how teachers worked with progression and responsibility for injury prevention. Teachers described a deliberate shift from relatively intensive guidance in the first year toward greater student autonomy and self-management later on, students were first supported to acquire "the basics", including knowledge, skill, and understanding, and were then increasingly expected to plan, monitor, and take ownership of parts of their development. Moreover, findings from Study 3 suggest that as students mature, they were expected to take a more active role in interpreting bodily signals, deciding when recovery or adjustment was warranted, and communicating this to relevant others across contexts (e.g., teachers, club coaches, parents). On the other hand, an important barrier that needs consideration was also highlighted as teachers explicitly noted that not all students were ready to take on this responsibility. This matters because too much responsibility can unintentionally overburden students who lack either the skills, confidence, or contextual permission to adjust load or speak up to teachers in school or coaches in club teams. In SDT terms, responsibility transfer without adequate structure may compromise competence experiences and reduce sustained engagement (Ryan & Deci, 2017). This suggests that the transition from teacher-led to student-led prevention during the learning process must be sensitive to students' readiness, resources, and the surrounding environment's capacity to support boundary settings, adjusting plans, and tolerating short-term trade-offs for long-term development (e.g., prioritizing recovery over games or practice). This need for individual adjustments aligns with perspectives from Study 1 and 2, implying that there is a need for consideration of individual variability also in injury prevention. Hence, fostering autonomy does not mean withdrawing support at a specific time point, rather it means providing the right form of support at the right time, including structure that makes self-regulation possible.

Context-specific opportunities and challenges

Teachers highlighted that the organizational context, guided by injury prevention as a part of the curriculum for the subjects required to be granted a RIG or NIU status (SFS 2023:654), provided facilitators such as allocated time, including enough time to conduct prevention exercises and to communicate with students, appropriate facilities, and the opportunity for regular practices. In contrast, all these factors, particularly different kinds of time-constraints, are known barriers to injury prevention in club-contexts across sports (Andersson

et al., 2019; Barden et al., 2021; Donaldson et al., 2017; Ivarsson, 2021; O'Brien et al., 2021). This suggests that the school context may provide more feasible opportunities for sport injury prevention implementation and learning than the club context.

Although motivational aspects are important for behavioral change, the formation of preventive behaviors, strategies, and exercises into habits is also central to behavioral change theories (Hagger, 2019). This may be especially important in contexts where youth athletes perceive preventive components as less sport-relevant than sport-specific training and therefore not sufficiently enjoyable to support autonomous motivation (Lee et al., 2019; Åkerlund et al., 2023, 2024). As such, the school context with regular lessons every week may be an optimal context for habit formation, providing repeated use of exercises in stable contexts, paired with cues (e.g., consistent placement in a session), to reduce reliance on moment-to-moment motivation and support maintenance (Hagger, 2019; Orbell & Verplanken, 2020). Also, it is likely that different kinds of injury-preventive behaviors need different kinds of learning strategies due to the diverse nature of injuries. Thus, some need repetition of specific exercises to strengthen muscles or improve balance, and in such cases habit formation may be useful, whereas other injuries are prevented by recovery practices or rest and in such cases the use of dialogue and competence support by increased knowledge and awareness might be more beneficial. Further, teachers highlighted the role of feedback, with correcting technique, reinforcing quality, and sometimes using technology to visualize progress and support learning. In a prevention context, this is highly relevant because doing exercises regularly and doing exercises correctly are not equivalent behaviors, yet both are important for preventing injuries (Perera & Hägglund, 2020).

A challenge communicated across interviews and shared by most teachers related to the organization of floorball high schools and club teams in Sweden, where students typically train in one practice environment at school and in one or more separate practice environments outside school. In many cases, the club coaches and schoolteachers are not the same individuals. This makes it difficult for teachers to maintain a full picture of cumulative exposure. In practice, this had implications for school-based load decisions: teachers reported needing to be cautious in how much additional load they imposed during school lessons because students might already be fatigued from evening practices and games. This observation underscores that load and athlete well-being management is not merely an individual athlete behavior but a coordination problem dependent on information flow and shared decision-making across contexts (Bergeron et al., 2024; O'Brien et al., 2021; Soligard et al., 2016). Teachers also described communication with club coaches as essential for keeping students' best interests, health, and development in focus, but they highlighted barriers

that made such communication difficult to establish and sustain. A recurring theme was the presence of competing priorities, as club-level incentives to prioritize practices and games could conflict with school demands such as attendance and academic grading requirements. Additionally, teachers described cross-context dialogue as constrained by limited time, especially given the voluntary nature of many coaching roles in club sport. Critically, findings also suggested that the feasibility of school–club coherence varied substantially across settings depending on the context. Some teachers worked with students spread across many clubs, making systematic communication highly time-consuming, whereas others operated in environments with high overlap between school and club teams, which reduced coordination demands. In some cases, dual roles (e.g., teachers also being part of the club coaching environment) naturally facilitated shared understanding and easier coordination. From a behavioral perspective and with implementation strategies such as knowledge-to-action perspective, this points to sustainable injury prevention in school and outside of school as a system that benefits from routinised collaboration mechanisms adapted to the local context (Graham et al., 2006; Donaldson et al., 2017; Moore & Evans, 2017). For example, in environments where each school has students from many different clubs, systematic communication routines may be needed to reduce coordination burden, whereas in high-overlap environments, shared principles around load decisions and communication behaviors may be easier to establish and maintain. Across settings, the focus may be less on adding new content and more on creating structures that support maintenance such as predictable routines for exercise completion and quality feedback, shared expectations for when to adjust load, and legitimized pathways for students to communicate needs both within school and in club contexts.

Practical implications for youth floorball

Collectively, the results highlight that responsibility for athlete health, injury prevention, and well-being is distributed across individuals, relationships, and organizational structures rather than residing with any single actor.

At the athlete level, the findings suggest that good physical performance and mental health do not necessarily protect against injury. This indicates that injury prevention efforts should not focus solely on athletes displaying clear deficits or difficulties but also consider athletes who are perceived as highly capable and resilient. From an individual perspective, the results underscore the importance of supporting youth athletes in developing knowledge and awareness related to sustainable sport participation, including injury prevention, training load, recovery, psychological aspects, and early signs of

overload. However, responsibility for managing these demands cannot reasonably be placed on the athlete alone.

Gender differences in mental health symptoms were observed, with female students reporting higher average scores. While this pattern reflects broader societal trends and population-based findings, it remains relevant within a sport context where demands related to performance, evaluation, and comparison are central. Although it should be noted that in general, the athlete population in this thesis express positive mental well-being, and sport may function as an important arena for promoting mental health through physical activity, positive relationships, and personal development, it may also increase vulnerability to symptom escalation under conditions of sustained pressure (Henriksen et al., 2026). In addition, previous studies have highlighted stigma and gendered expectations that may discourage the reporting of psychological distress among males, underscoring the need not to dismiss males' symptoms as absent or non-existent (Doherty et al., 2016; Rice et al., 2018). The finding that all youth athletes do not respond equally to injury further underscores the need for individualized approaches. This places particular responsibility on adults in the athletes' close environment, such as parents, coaches, and teachers, to recognize varied responses to injury and to adjust support accordingly rather than assuming uniform reactions or needs.

At an organizational level, the findings also point to important implications for injury prevention practice. The Swedish Floorball Federation has invested substantial resources in injury prevention education for coaches and practitioners, and previous research has demonstrated positive preventive effects in youth floorball athletes (Åkerlund et al., 2020, 2024). Results from this thesis suggest that NIU and RIG environments may serve as valuable arenas for repeatedly practicing preventive exercises and for developing knowledge about recovery and psychological aspects that need to accompany physical training. Teachers described the use of need-supportive strategies that align with key components of the federation's coach education programs, suggesting a degree of conceptual consistency across contexts.

At the same time, teachers highlighted challenges related to shared responsibility and communication when sporting activities are distributed across school and club settings. Although these experiences are reported from the teachers' perspective, similar challenges are likely to be present among club coaches, who may face different constraints but share responsibility for the same athletes. This fragmentation underscores the need for structured and supported communication pathways across contexts. From a system perspective, sport federations may therefore play an important role in facilitating context-specific communication through guidelines and

recommendations that clarify roles and expectations related to athlete development and health. Highlighting the importance of coordinated responsibility across individual, relational, and organizational levels represents one way in which this thesis may contribute to ongoing efforts to support sustainable participation and health in youth elite sport.

Methodological considerations

The present thesis is based on a longitudinal mixed-methods design to examine injury risk, psychological responses to injury, and injury prevention in elite youth sport. Detailed descriptions of analytic decisions, methodological cutoffs, and study-specific limitations are provided in the individual papers. Accordingly, the purpose of this section is not to repeat those technical considerations, but to reflect on broader methodological choices, their implications for interpretation, and the boundaries of the conclusions that can be drawn from the thesis.

First, the consensus sport injury definitions from Fuller et al. (2006) were used in this thesis. In Study 1, the definition of acute and overuse injury was combined with the definition for time-loss injury, measured by single-item questions (one for acute injury, one for overuse). In Study 2, injury was conceptualized as any physical complaint affecting participation in regular training, modification of training, pain, or performance in relation to sport (Clarsen et al., 2020; Fuller et al., 2006), measured as a continuous variable of injury severity but also analyzed as a binary variable. This allowed for investigation of injury as both an on-off state and a continuous spectrum with gradual effect on athletes, as it has been noted in the literature that an athlete's recognition and psychological response to an injury might differ between types of injury (Clement et al., 2015; Tracey, 2003), and severity of injury, including aspects related to time loss (Putukian, 2016; Filbay et al., 2019). Still, although this provides a theoretically clear definition and conceptualization of injury, how the individual athlete defines injury might differ substantially, and be affected by norms formed and reinforced in the sport context (Jacobsson et al., 2023). This might have resulted in over-, but probably more underreporting of injuries, particularly in the postseason retrospective measures in Study 1.

The next consideration concerns what a risk factor is. It is not straightforward to answer even with prior research support, technology, statistical approaches, or a large sample size. It will also depend on how you conceptualize it, define it, and decide to measure it. Take mental health as an example, it has been argued that the use of different definitions and a mix-up of symptom ratings (self-reports) or clinical diagnosis (assessed by professionals), makes comparisons of mental

health problems in athletes hard (Ekelund et al., 2022; Lyon-Monk et al., 2025). In the present thesis, mental health was conceptualized as depression symptoms (Study 1 & 2), anxiety symptoms (Study 1 & 2), and stress symptoms (Study 2) measured by self-reports using validated questionnaires. This comes with pros and cons, and the results in this thesis should be interpreted with those in mind. First, the results say nothing about clinical diagnosis, and it should be noted that there was no intention of doing so, which made self-reports a feasible, convenient measure for a nationwide data collection. Nonetheless, self-report measures are subject to well-known potential limitations, including common method bias, recall bias, and social desirability effects (Podsakoff et al., 2024; Tourangeau et al., 2000). Several attempts were made to reduce these limitations, including the use of repeated measures separated over time, biweekly assessments conducted in close proximity in time to potential events, and anonymity of participating students in relation to teachers.

Third, the intensity of the longitudinal measurements needs to be considered. Weekly and biweekly assessments were chosen as an addition to the traditional preseason and postseason measures, to reduce the long "black boxes" characteristic of many injury and mental health studies (Gouttebarge et al., 2019). The number of questions were chosen based on providing enough information on the topic of interests, but not to be too intrusive or time-demanding, which is often a reason for drop-out and missing data in longitudinal studies (Bolger & Laurenceau, 2013). Importantly, a feasibility evaluation conducted toward the end of the project suggested that most participating athletes experienced the repeated measurements as manageable and, in some cases, even engaging. Further, the questionnaires were completed in a smartphone application designed for research purposes but similar to an app commonly used for training planning in Swedish floorball contexts. This was done to increase feasibility for youth athlete participation as previous studies of similar populations have suggested that this generation may be more familiar with smartphone applications than responding to emails (von Rosen, 2017). To prevent participants from forgetting to report data, reminders were sent out weekly, and in addition, teachers were encouraged to remind all students at-site in schools. Further, regularly, federation-supported reminders were sent to schoolteachers, and twice during the project a specific reminder with a video from a member of the national floorball team was sent to students to encourage them to fill out weekly and biweekly questionnaires. Despite these efforts, missing data were present at the item level, at biweekly occasions, and across measurement waves. This is a common challenge in longitudinal field studies, especially in school-based settings and over extended time periods. However, both Study 1 and Study 2 used estimation methods (FIML and Bayesian estimation) well suited to handle missing data in longitudinal studies (Enders, 2022; Gelman et al., 2013; Muthén & Muthén, 1998-2017).

Moreover, this thesis employed advanced analytical approaches, including person-centered methods and multilevel longitudinal models, to better capture heterogeneity and within-person change over time. While such approaches allow for more nuanced analyses than traditional cross-sectional or single-level models, they do not eliminate limitations related to measurement sensitivity. The self-report instruments used were validated for assessing mental health symptoms; however, they were not specifically designed to detect subtle, short-term fluctuations assessed at relatively short intervals (Bond & Wickham, 2023). The changes observed over time were generally small in magnitude, which may partly reflect that the questionnaires were designed to capture more stable aspects of mental health rather than fluctuations in symptoms. Going forward, using single-item or abbreviated measures specifically developed for intensive longitudinal designs might better capture such fluctuations (Ekelund et al., 2025; Reifsteck et al., 2021).

When thinking about time, the temporal relationship between injury and psychological responses investigated in Study 2 also needs consideration. The longitudinal design allowed for examination of associations across repeated measures over time, but the analyses conducted were not designed to identify precise time-lags or causal ordering between events. Associations were examined contemporaneously, reflecting an initial aim to establish whether meaningful relationships existed at all. The optimal temporal lag between injury occurrence and changes in mental health remains poorly understood, with prior research suggesting both short-term and longer-term processes. Given that research on optimal time-lags for detecting cross-level effects recommends shorter intervals to capture dynamic processes (Dormann & Griffin, 2015) and considering the lack of studies designed to investigate fluctuations in mental health and injury consequences throughout competitive seasons (Clement et al., 2018, 2021; Lyon-Monk et al., 2025), in Study 2, a biweekly time-interval during one competitive season was chosen. Biweekly assessments were considered frequent enough to detect short-term variations in mental health symptoms and injury severity, while also allowing time for psychological states to change and injuries to manifest or evolve (Gabbett, 2016; Lin et al., 2024; Tranaeus et al., 2024). Hence, the chosen assessment interval represents a theoretically informed but ultimately pragmatic compromise. Consequently, observed associations should be interpreted as time-linked rather than temporally directional, and claims regarding causal sequences cannot be made.

Another source of potential variability and bias in this thesis stems from physical field test administration. Although efforts were made to standardize test procedures through common protocols, recommended warm-up routines, and guidance to test administrators, data collection necessarily relied on multiple teachers in school sport across different schools. Despite limited

reported deviations from recommended procedures, unreported variation may have influenced test reliability. This potential limitation should be considered alongside the familiarity of these tests among teachers and students, which likely supported ecological validity and feasible implementation across settings. In addition, at a more conceptual level, the interpretation of physical field tests as indicators of injury risk warrants caution. Although such tests are routinely used in team sports and are often assumed to reflect underlying injury susceptibility, empirical evidence relating field test performance to injury occurrence is mixed. In several team sports, both lower and higher performance characteristics have been associated with injury risk (Gabbett & Domrow, 2005; Chalmers et al., 2013), while other studies report no clear associations (Moseid et al., 2019). Thus, inconsistencies across sports, age groups, and study designs indicate that field test performance alone is unlikely to provide reliable predictions of injury risk. Instead, these measures are likely to represent one component within a broader constellation of risk factors, as used in this thesis.

The qualitative component of the thesis focused on teachers' experiences of and strategies for implementing injury prevention in the school context. Incorporating the teachers' perspectives into the thesis, in addition to the quantitative studies of youth athletes, was a deliberate choice in line with the thesis idea that injury-related questions in the school context are best understood through multiple perspectives. Teachers occupy a central organizational and pedagogical role in elite sport high schools and are key actors in shaping everyday practices (Ferry, 2016). Focusing on this group allowed for in-depth exploration of contextual constraints, priorities, and behavioral strategies. At the same time, the absence of athletes or club coach perspectives limits the breadth of qualitative insight. Athlete and club coach experiences of prevention and cross-context coordination may differ in important ways from those of teachers. Hence, these perspectives would address complementary research questions and could be an important avenue for future research.

Finally, it is important to clarify what the present thesis design does not allow. The thesis does not establish causal relationships, identify specific psychological mechanisms, or determine which intervention strategy is better than another. Taken together, the methodological choices made in this thesis reflect a deliberate attempt to address a complex, multifaceted problem using complementary approaches. While each method has limitations in isolation, their combination allows for a more comprehensive understanding of injury risk, psychological responses, and prevention in elite youth sport.

Transferability of findings

The empirical work in this thesis was conducted within the context of certified elite sport high schools in Sweden, a system characterized by municipal governance, national educational regulation, and an explicit emphasis on balancing academic and sport development rather than producing professional athletes (Ferry et al., 2013; Lund, 2014). It has been acknowledged in recent research that sports schools across Europe share some common ground in their ambition to develop both sport performance and academic skills, as well as in their strategies to do so, for example through flexible scheduling and the possibility of prolonged study time by adding an extra year, which is more common in Sweden for individual sports than for team sports. However, large differences between educational systems and school curricula make comparisons difficult (Andersson, 2024). Some findings in this thesis might therefore be context-specific, particularly those related to organizational opportunities, time resources, and the role of teachers in school sports in injury prevention. However, several core processes identified in this thesis, such as dynamic injury risk, variability in psychological responses, challenges in monitoring load, and strategies for promoting and sustaining preventive behaviors, are unlikely to be unique to this context. Similar dynamics can be expected in other elite sport education systems, in club-based youth sport environments, and potentially in adult team sport contexts as well.

Conclusion

To conclude, this thesis demonstrates that injury processes in youth elite sport are multifactorial and shaped by the interaction of physical, psychological, and contextual factors. The findings further suggest that athletes differ in how these factors combine, highlighting the importance of understanding injury risk as a dynamic within-person process rather than as a set of isolated risk factors. At the same time, the results show that high physical performance does not necessarily protect against injuries. Rather, high-performing athletes may be particularly exposed to injury risk owing to factors such as higher training loads and greater participation in training and competition. This challenges the notion that injury prevention should primarily target individuals with deficits and instead highlights the need for a broader and more nuanced approach that includes all athletes. The findings also suggest that mental health in youth athletes varies over time and is associated with injury experiences, although the strength of these associations differs between individuals. While the observed associations were relatively small, they indicate that injuries may influence psychological well-being and that changes in injury severity can co-occur with changes in mental health. Together, these findings emphasize the value of adopting a within-person perspective in which both injury risk and well-being

are understood as processes that change over time and in relation to an athlete's contextual circumstances.

Overall, the results suggest that both injury prevention and the management of injuries that have already occurred needs individual adaptions. At the same time, the findings indicate that certain situations and phases may warrant particular attention, such as periods of high training load or the occurrence of a first-time injury. In addition, this thesis provides insight into how injury prevention is conducted in practice within elite floorball high schools, with teachers emphasizing that successful injury prevention efforts need to be meaningful, varied, and integrated into everyday activities. A recurring challenge was helping youth athletes balance training load and recovery in an environment where demands from both school and club sport interact. These findings point to a need for clearer organizational guidelines regarding load management and communication between schools and clubs to reduce conflicting demands on athletes.

Future recommendations – What's next?

An important area for future investigation concerns the role of load in understanding both injury risk and mental health outcomes among students at elite floorball high schools. The results from Study 1 may, at least in part, be influenced by differences in training and competition load experienced by students across profiles. Findings from Study 2, indicate higher levels of depression, anxiety, and stress symptoms early on in the school-year season, potentially related to findings in other studies of high school athletes in Sweden where both academic demands and training frequency has been shown to increase during this period (Stambulova et al., 2015; von Rosen, Heijne et al., 2018). In parallel, findings from Study 3 indicate that managing overall load, including both physical and psychological aspects, represents one of the most significant challenges encountered by teachers. Together, these findings raise questions about how total load should be conceptualized, measured, and managed in this context. Many students experience training loads typically involving an average of three weekly school-based training sessions in special sports, in addition to two to three regular physical education lessons each week within the school context. This is further compounded by extensive club-based training and competition, with most students practicing several evenings per week and participating in one or multiple games during weekends. Teachers described that overall load often increases rapidly during the first year, when additional school-based training effectively duplicates the amount of practice exposure for some students. Such rapid increases in load have previously been associated with elevated injury risk (Gabbett, 2016). Although teachers reported

attempts to manage these demands by introducing flexibility and reducing training intensity or content for students experiencing high load, it remains unclear whether such strategies are effective. While extensive research supports an association between load and injury risk, suggesting that inappropriate loading may impair decision-making, coordination, and neuromuscular control (Soligard et al., 2016), simply reducing training volume may not represent a straightforward solution (Gabbett, 2016). Both excessive training loads that compromise recovery and insufficient loads that leave athletes unprepared for competitive demands have been linked to increased injury risk (Gabbett, 2016). Future research is therefore needed to examine how different load-modification strategies influence injury risk, recovery, and psychological well-being over time.

Another important direction for future work concerns communication and responsibility related to athlete health and development. Findings from Study 3 suggest that responsibility for regulating load is often fragmented, as teachers and club coaches are typically not the same individuals. In the current Swedish youth floorball context, there are no formal regulations governing the number of games youth players are allowed to participate in each week. As a result, responsibility for managing overall load and recovery frequently falls on individual players, club coaches, or, in the case of school sports, teachers. From a broader systems perspective, future research should therefore also consider the role of sport federations in supporting coordination across contexts. Federations may have an opportunity to facilitate context-specific communication by providing guidelines, recommendations, or regulatory frameworks that clarify roles, responsibilities, and expectations related to athlete health across school and club environments. Such structures could support schools, clubs, and athletes in aligning training and competition demands, in combination with ongoing academic demands, while still allowing for local adaptation. Investigating how federation-level guidelines or rules influence communication, shared responsibility, and load-related decision-making represents an important avenue for future research, particularly in youth elite sport systems that aim to promote both performance development and long-term health.

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The journey is the destination, they say. This has certainly been a journey—an adventure on some days, and on others, more like traveling through rough seas with a generous dose of motion sickness. The kind of trip where the destination is clear enough, but the route somehow remains a mystery until long after you have set off. It has also been the kind of journey that would never have been possible without travel funds, tickets, guides, fellow travelers, the occasional safe harbor, and perhaps most importantly, people willing to point you in the right direction when you have absolutely no idea where you are going. Before thanking all who made this journey possible, I would like to thank you, the reader. Perhaps you have carefully followed every step of the trip, perhaps you have only visited a few selected destinations, or perhaps you scrolled directly to this section—as one checks the photos of a hotel room before deciding whether the place is worth booking or not. Whatever brought you here, thank you for opening this thesis.

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References

Abrahamson, J., Sandstedt, E., Sansone, M., & Lindman, I. (2025). Female sex, training volume, and sleep amount are risk factors for sports-related injuries: A 1-year prospective cohort study on adolescent elite athletes. *BMJ Open Sport & Exercise Medicine, 11*, e002699. https://doi.org/10.1136/bmjsem-2025-002699

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Åkerlund, I., Sonesson, S., Lindblom, H., Hagelin, E., Carlfjord, S., & Hägglund, M. (2024). *"I'd rather do that (Knee Control) than be injured and not able to play": A qualitative study on youth floorball players' and coaches' perspectives of how to overcome barriers for injury prevention exercise programme use. BMJ Open Sport & Exercise Medicine, 10*(3), e001953. https://doi.org/10.1136/bmjsem-2024-001953

Åkerlund, I., Sonesson, S., Lindblom, H., Waldén, M., & Hägglund, M. (2023). Perceptions, facilitators, and barriers regarding use of the injury prevention exercise programme Knee Control among players and coaches in youth floorball: A cross-sectional survey study. *BMC Sports Science, Medicine and Rehabilitation, 15*, 56. https://doi.org/10.1186/s13102-023-00660-0

Åkerlund, I., Waldén, M., Sonesson, S., & Hägglund, M. (2020). Forty-five per cent lower acute injury incidence but no effect on overuse injury prevalence in youth floorball players (aged 12–17 years) who used an injury prevention exercise programme: Two-armed parallel-group cluster randomised controlled trial. *British Journal of Sports Medicine*, *54*(17), 1028–1035. https://doi.org/10.1136/bjsports-2019-101295

Alexanders, J., Anderson, A., & Henderson, S. (2015). Musculoskeletal physiotherapists' use of psychological interventions: a systematic review of therapists' perceptions and practice. *Physiotherapy*, *101*(2), 95–102. https://doi.org/10.1016/j.physio.2014.03.008

ALLEA. (2023). *The European Code of Conduct for Research Integrity*. Revised edition. https://doi.org/10.26356/ECOC

Åman, M., Forssblad, M., & Larsén, K. (2018). Incidence and body location of reported acute sport injuries in seven sports using a national insurance database. *Scandinavian Journal of Medicine & Science in Sports*, *28*(3), 1147–1158. https://doi.org/10.1111/sms.12956

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed., text rev.). https://doi.org/10.1176/appi.books.9780890425787

American Psychological Association. (2025). *APA journals policy on generative AI: Additional guidance*. https://www.apa.org/pubs/journals/resources/publishing-tips/policy-generative-ai

Andersen, M. B., & Williams, J. M. (1988). A model of stress and athletic injury—prediction and prevention. *Journal of Sport and Exercise Psychology, 10*(3), 294–306. https://doi.org/10.1123/jsep.10.3.294

Andersson, F. (2024). Sport schools in Europe: a scoping study of research articles (1999–2022). *Sport in Society*, *27*(5), 721–743. https://doi.org/10.1080/17430437.2023.2273856

Andersson, S. H., Bahr, R., Olsen, M. J., & Myklebust, G. (2019). Attitudes, beliefs, and behavior toward shoulder injury prevention in elite handball: Fertile ground for implementation. *Scandinavian journal of medicine & science in sports*, *29*(12), 1996–2009. https://doi.org/10.1111/sms.13522

Appaneal, R., & Perna, F. (2014). Biopsychosocial model of injury. In R. Eklund, & G. Tenenbaum, *Encyclopedia of sport and exercise psychology* (pp. 74-77). Thousand Oaks: SAGE Publications, Inc

Asparouhov, T. & Muthén, B. (2014). Auxiliary variables in mixture modeling: Using the BCH method in Mplus to estimate a distal outcome model and an arbitrary secondary model. *Web Note 21*. May 14, 2014. Revised February 4, 2021. https://www.statmodel.com/examples/webnotes/webnote21.pdf

Asparouhov, T., & Muthén, B. (2019). Latent variable centering of predictors and mediators in multilevel and time-series models. *Structural Equation Modeling, 26*(1), 119–142. https://doi.org/10.1080/10705511.2018.1511375

Asparouhov, T., & Muthén, B. (2021). *Bayesian analysis of latent variable models using Mplus* (Version 6) [Technical report]. https://www.statmodel.com/download/BayesAdvantages18.pdf

Bahr R. (2016). Why screening tests to predict injury do not work-and probably never will...: a critical review. *British journal of sports medicine*, *50*(13), 776–780. https://doi.org/10.1136/bjsports-2016-096256

Bahr, R., Thorborg, K., & Ekstrand, J. (2015). Evidence-based hamstring injury prevention is not adopted by the majority of Champions League or Norwegian Premier League football teams: the Nordic Hamstring survey. *British journal of sports medicine*, *49*(22), 1466–1471. https://doi.org/10.1136/bjsports-2015-094826

Banks, G. C., Field, J. G., Oswald, F. L., O'Boyle, E. H., Landis, R. S., Rupp, D. E., & Rogelberg, S. G. (2019). Answers to 18 questions about open science practices. *Journal of Business and Psychology, 34*(3), 257–270. https://doi.org/10.1007/s10869-018-9547-8

Barden, C., Watkins, R., Stokes, K. A., & McKay, C. D. (2022). Barriers and facilitators to implementing the Activate injury prevention exercise programme – A qualitative study of schoolboy rugby coaches. *International Journal of Sports Science & Coaching*, *17*(6), 1317-1330. https://doi.org/10.1177/17479541221115021

Beekhuizen, K. S., Davis, M. D., Kolber, M. J., & Cheng, M. S. (2009). Test-retest reliability and minimal detectable change of the hexagon agility test. *Journal of strength and conditioning research*, *23*(7), 2167–2171. https://doi.org/10.1519/JSC.0b013e3181b439f0

Bengtsson, D., Svensson, J., Wiman, V., Stenling, A., Lundkvist, E., & Ivarsson, A. (2025). Health-related outcomes of youth sport participation: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *22*(1), 89. https://doi.org/10.1186/s12966-025-01792-x

Bergeron, M. F., Côté, J., Cumming, S. P., Purcell, R., Armstrong, N., Basilico, L., Burrows, K., Charrin, J. B., Felix, A., Groesswang, H., Iwasaki, Y., Kocher, M. S., Martowicz, M., McConnell, K., Moran, J., Holm Moseid, C., Mountjoy, M., Soligard, T., Tetelbaum, E., Thiel, A., ... Erdener, U. (2024). IOC consensus statement on elite youth athletes competing at the Olympic Games: essentials to a healthy, safe and sustainable

paradigm. *British journal of sports medicine*, *58*(17), 946–965. https://doi.org/10.1136/bjsports-2024-108186

Bittencourt, N. F. N., Meeuwisse, W. H., Mendonça, L. D., Nettel-Aguirre, A., Ocarino, J. M., & Fonseca, S. T. (2016). Complex systems approach for sports injuries: Moving from risk factor identification to injury pattern recognition-narrative review and new concept. *British Journal of Sports Medicine*, *50*(21), 1309–1314. https://doi.org/10.1136/bjsports-2015-095850

Bizzini, M., & Dvorak, J. (2015). FIFA 11+: an effective programme to prevent football injuries in various player groups worldwide-a narrative review. *British journal of sports medicine*, *49*(9), 577–579. https://doi.org/10.1136/bjsports-2015-094765

Blom, E. H., Bech, P., Högberg, G., Larsson, J. O., & Serlachius, E. (2012). Screening for depressed mood in an adolescent psychiatric context by brief self-assessment scales – testing psychometric validity of WHO-5 and BDI-6 indices by latent trait analyses. *Health and Quality of Life Outcomes*, *10*(1), 149. https://doi.org/10.1186/1477-7525-10-149

Boddington, M. K., Lambert, M. I., Gibson, A. S. C., & Noakes, T. D. (2001). Reliability of a 5-m multiple shuttle test. *Journal of Sports Sciences*, *19*(3), 223-228. https://doi.org/10.1080/026404101750095394

Bolger, N., & Laurenceau, J.-P. (2013). *Intensive longitudinal methods: An introduction to diary and experience sampling research*. Guilford Press.

Bolling, C., Delfino Barboza, S., van Mechelen, W., & Pasman, H. R. (2020). Letting the cat out of the bag: athletes, coaches and physiotherapists share their perspectives on injury prevention in elite sports. *British journal of sports medicine*, *54*(14), 871–877. https://doi.org/10.1136/bjsports-2019-100773

Bond, M. H., & Wickham, R. E. (2023). Using Dynamic Structural Equation Modeling to Examine Between- and Within-Persons Factor Structure of the DASS-21. *Assessment*, *30*(7), 2115-2127. https://doi.org/10.1177/10731911221137541

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, *11*(4), 589–597. https://doi.org/10.1080/2159676X.2019.1628806

Braun, V., & Clarke, V. (2021). Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Counselling and Psychotherapy Research*, *21*(1), 37–47. https://doi.org/10.1002/capr.12360

Bro, T., & Ghosh, F. (2017). Floorball-related eye injuries: The impact of protective eyewear. *Scandinavian Journal of Medicine & Science in Sports, 27*(4), 430–434. https://doi.org/10.1111/sms.12653

Brooks, S. P., & Gelman, A. (1998). General methods for monitoring convergence of iterative simulations. *Journal of Computational and Graphical Statistics*, 7(4), 434–455. https://doi.org/10.1080/10618600.1998.10474787

Butler, L. S., Janosky, J. J., & Sugimoto, D. (2022). Pediatric and Adolescent Knee Injuries: Risk Factors and Preventive Strategies. *Clinics in sports medicine*, *41*(4), 799–820. https://doi.org/10.1016/j.csm.2022.05.011

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncology nursing forum*, *41*(5), 545-547. https://doi.org/10.1188/14.ONF.545-547

Celeux, G., & Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of classification, 13*, 195-212. https://doi.org/10.1007/BF01246098

Chalmers, S., Magarey, M. E., Esterman, A., Speechley, M., Scase, E., & Heynen, M. (2013). The relationship between pre-season fitness testing and injury in elite junior Australian football players. *Journal of Science and Medicine in Sport, 16*(4), 307–311. https://doi.org/10.1016/j.jsams.2012.09.005

Chan, D. K., Lonsdale, C., Ho, P. Y., Yung, P. S., & Chan, K. M. (2009). Patient motivation and adherence to postsurgery rehabilitation exercise recommendations: the influence of physiotherapists' autonomy-supportive behaviors. *Archives of physical medicine and rehabilitation*, *90*(12), 1977–1982. https://doi.org/10.1016/j.apmr.2009.05.024

Chan, D. K. C., & Hagger, M. S. (2012a). Self-determined forms of motivation predict sport injury prevention and rehabilitation intentions. *Journal of science and medicine in sport*, *15*(5), 398–406. https://doi.org/10.1016/j.jsams.2012.03.016

Chan, D. K. C., & Hagger, M. S. (2012b). Transcontextual Development of Motivation in Sport Injury Prevention Among Elite Athletes. *Journal of Sport and Exercise Psychology, 34*(5), 661-682. https://doi.org/10.1123/jsep.34.5.661

Chan, D. K. C., Hagger, M. S., & Spray, C. M. (2011). Treatment motivation for rehabilitation after a sport injury: Application of the trans-contextual model. *Psychology of Sport and Exercise, 12,* 83–92. https://doi.org/10.1016/j.psychsport.2010.08.005

Chang, C., Putukian, M., Aerni, G., Diamond, A., Hong, G., Ingram, Y., & Wolanin, A. (2020). Mental health issues and psychological factors in athletes: Detection, management, effect on performance and prevention: American Medical Society for Sports Medicine position statement – Executive summary. *British Journal of Sports Medicine*, *54*, 216–220. https://doi.org/10.1136/bjsports-2019-101583

Chia, L., De Oliveira Silva, D., Whalan, M., McKay, M. J., Sullivan, J., Fuller, C. W., & Pappas, E. (2022). Non-contact Anterior Cruciate Ligament Injury Epidemiology in Team-Ball Sports: A Systematic Review with Meta-analysis by Sex, Age, Sport, Participation Level, and Exposure Type. *Sports medicine (Auckland, N.Z.)*, *52*(10), 2447–2467. https://doi.org/10.1007/s40279-022-01697-w

Chiu, R. M. Y., Zhang, L., Teng, J., Ip, P., Lai, A. Y. K., & Chan, D. K. C. (2023). Motivation, injury prevention, and the incidence of sports injuries: A three-wave longitudinal test of self-determination theory. *Scandinavian journal of medicine & science in sports*, *33*(7), 1254–1261. https://doi.org/10.1111/sms.14348

Clarsen, B., & Bahr, R. (2014). Matching the choice of injury/illness definition to study setting, purpose and design: one size does not fit all!. *British journal of sports medicine*, *48*(7), 510–512. https://doi.org/10.1136/bjsports-2013-093297

Clarsen, B., Bahr, R., Myklebust, G., Andersson, S. H., Docking, S. I., Drew M., Finch, C. F., Fortington, L. V., Harøy, J., Khan, K. M., Moreau, B., Moore, I. S., Møller, M., Nabhan, D., Nielsen, R. O., Pasanen, K., Schwellnus, M, Soligard, T., & Verhagen, E. (2020). Improved reporting of overuse injuries and health problems in sport: an update of the Oslo Sport Trauma Research Center questionnaires. *British Journal of Sports Medicine*, *54*, 390-396. https://doi.org/10.1136/bjsports-2019-101337

Clarsen, B., Myklebust, G., & Bahr, R. (2013). Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: the Oslo Sports Trauma Research Centre (OSTRC) overuse injury questionnaire. *British journal of sports medicine*, *47*(8), 495–502. https://doi.org/10.1136/bjsports-2012-091524

Clement, D., Arvinen-Barrow, M., & Fetty, T. (2015). Psychosocial responses during different phases of sport-injury rehabilitation: A qualitative study. *Journal of Athletic Training*, *50*, 95–104. https://doi.org/10.4085/1062-6050-49.3.52

Clement, D., Ivarsson, A., Tranaeus, U., Johnson, U., & Stenling, A. (2018). Investigating the influence of intraindividual changes in perceived stress symptoms on injury risk in soccer. *Scandinavian journal of medicine & science in sports*, *28*(4), 1461–1466. https://doi.org/10.1111/sms.13048

Clement, D., Tranaeus, U., Johnson, U., Stenling, A., & Ivarsson, A. (2021). Profiles of psychosocial factors: Can they be used to predict injury risk? *Scandinavian Journal of Medicine & Science in Sport*, *32*(4), 782–788. https://doi.org/10.1111/sms.14110

Crane, J., & Temple, V. (2015). A systematic review of dropout from organized sport among children and youth. *European Physical Education Review*, *21*(1), 114–131. https://doi.org/10.1177/1356336X14555294

Crossley, K. M., Stefanik, J. J., Selfe, J., Collins, N. J., Davis, I. S., Powers, C. M., McConnell, J., Vicenzino, B., Bazett-Jones, D. M., Esculier, J. F., Morrissey, D., & Callaghan, M. J. (2016). 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 1: Terminology, definitions, clinical examination, natural history, patellofemoral osteoarthritis and patient-reported outcome measures. *British journal of sports medicine*, *50*(14), 839–843. https://doi.org/10.1136/bjsports-2016-096384

Cruz-León, C., Expósito-Carrillo, P., Sánchez-Parente, S., Jiménez-Iglesias, J., Borges-Cosic, M., Cuenca-Garcia, M., & Castro-Piñero, J. (2025). Feasibility and Safety of Field-Based Physical Fitness Tests: A Systematic Review. *Sports medicine - open*, *11*(1), 8. https://doi.org/10.1186/s40798-024-00799-1

Curran, P. J., & Bauer, D. J. (2011). The disaggregation of within-person and between-person effects in longitudinal models of change. *Annual*

review of psychology, *62*, 583–619. https://doi.org/10.1146/annurev.psych.093008.100356

Dahlgren, L., Emmelin, M., Hällgren Graneheim, U., Sahlén, K. G., Winkvist, A. (2019). *Qualitative methodology for international public health* (3rd edition). Department of Epidemiology and Global Health, Umeå University.

Dai, B., Herman, D., Liu, H., Garrett, W. E., & Yu, B. (2012). Prevention of ACL injury, part I: injury characteristics, risk factors, and loading mechanism. *Research in sports medicine (Print)*, *20*(3-4), 180–197. https://doi.org/10.1080/15438627.2012.680990

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum

Dewey, J. (1938). *Logic: The theory of inquiry*. New York, NY: Henry Holt & Company.

Doherty, C., Delahunt, E., Caulfield, B., Hertel, J., Ryan, J., & Bleakley, C. (2014). The incidence and prevalence of ankle sprain injury: a systematic review and meta-analysis of prospective epidemiological studies. *Sports medicine (Auckland, N.Z.)*, *44*(1), 123–140. https://doi.org/10.1007/s40279-013-0102-5

Doherty, S., Hannigan, B., & Campbell, M. J. (2016). The experience of depression during the careers of elite male athletes. *Frontiers in Psychology, 7*, 1069. https://doi.org/10.3389/fpsyg.2016.01069

Donaldson, A., Lloyd, D. G., Gabbe, B. J., Cook, J., & Finch, C. F. (2017). We have the programme, what next? Planning the implementation of an injury prevention programme. *Injury Prevention, 23*(4), 273–280. https://doi.org/10.1136/injuryprev-2015-041737

Dormann, C., & Griffin, M. A. (2015). Optimal time lags in panel studies. *Psychological Methods*, *20*(4), 489–505. https://doi.org/10.1037/met0000041

Eckard, T. G., Padua, D. A., Hearn, D. W., Pexa, B. S., & Frank, B. S. (2018). The Relationship Between Training Load and Injury in Athletes: A Systematic Review. *Sports medicine (Auckland, N.Z.)*, *48*(8), 1929–1961. https://doi.org/10.1007/s40279-018-0951-z

Edison, B. R., Pandya, N., Patel, N. M., & Carter, C. W. (2022). Sex and Gender Differences in Pediatric Knee Injuries. *Clinics in sports medicine*, *41*(4), 769–787. https://doi.org/10.1016/j.csm.2022.06.002

Ekelund, R., Holmström, S., & Stenling, A. (2022). Mental health in athletes: Where are the treatment studies? *Frontiers in Psychology, 13*, 781177. https://doi.org/10.3389/fpsyg.2022.781177

Ekelund, R., Holmström, S., & Stenling, A. (2025). Feasibility of ecological momentary assessment during cognitive behavioural therapy in athletes: a single-case study. *International Journal of Sport and Exercise Psychology*, 1–22. https://doi.org/10.1080/1612197X.2025.2563323

Emery C. A. (2003). Risk factors for injury in child and adolescent sport: a systematic review of the literature. *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*, *13*(4), 256–268. https://doi.org/10.1097/00042752-200307000-00011

Enders, C. K. (2022). *Applied missing data analysis*. The Guilford Press. New York, NY

Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African journal of emergency medicine : Revue africaine de la medecine d'urgence*, *7*(3), 93–99. https://doi.org/10.1016/j.afjem.2017.08.001

European Union. (2016). *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation). Official Journal of the European Union*, L 119, 1–88. https://eur-lex.europa.eu/eli/reg/2016/679/oj

Evans, L., Haeberlein, K., Chang, A., & Handal, P. (2021). Convergent validity and preliminary cut-off scores for the anxiety and depression subscales of the DASS-21 in US adolescents. *Child Psychiatry & Human Development*, *52*, 579–585. https://doi.org/10.1007/s10578-020-01050-0

Ferguson, S. L., Moore, W. H., & Hull, D. M. (2020). Finding latent groups in observed data: A primer on latent profile analysis in Mplus for applied

researchers. *International Journal of Behavioral Development, 44*(5), 458-468. https://doi.org/10.1177/0165025419881721

Ferry, M. (2016). Teachers in school sports: Between the fields of education and sport? *Sport, Education and Society*, *21*(6), 907–923. https://doi.org/10.1080/13573322.2014.969228

Ferry, M., Meckbach, J., & Larsson, H. (2013). School sport in Sweden: what is it, and how did it come to be? *Sport in Society*, *16*(6), 805–818. https://doi.org/10.1080/17430437.2012.753530

Filbay, S. R., Culvenor, A. G., Ackerman, I. N., Russell, T. G., & Crossley, K. M. (2015). Quality of life in anterior cruciate ligament-deficient individuals: a systematic review and meta-analysis. *British journal of sports medicine*, *49*(16), 1033–1041. https://doi.org/10.1136/bjsports-2015-094864

Filbay, S., Pandya, T., Thomas, B., McKay, C., Adams, J., & Arden, N. (2019). Quality of Life and Life Satisfaction in Former Athletes: A Systematic Review and Meta-Analysis. *Sports medicine (Auckland, N.Z.)*, *49*(11), 1723–1738. https://doi.org/10.1007/s40279-019-01163-0

Foss, K. D., Myer, G. D., Magnussen, R. A., & Hewett, T. E. (2014). Diagnostic Differences for Anterior Knee Pain between Sexes in Adolescent Basketball Players. *Journal of athletic enhancement*, *3*(1), 1814. https://doi.org/10.4172/2324-9080.1000139

Frank, B. S., Register-Mihalik, J., & Padua, D. A. (2015). High levels of coach intent to integrate a ACL injury prevention program into training does not translate to effective implementation. *Journal of science and medicine in sport*, *18*(4), 400–406. https://doi.org/10.1016/j.jsams.2014.06.008

Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Dvorak, J., Hägglund, M., McCrory, P., & Meeuwisse, W. H. (2006). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *British Journal of Sports Medicine*, *40*(3), 193–201. https://doi.org/10.1136/bjsm.2005.025270

Gabbett T. J. (2016). The training-injury prevention paradox: should athletes be training smarter *and* harder?. *British journal of sports medicine*, *50*(5), 273–280. https://doi.org/10.1136/bjsports-2015-095788

Gabbett, T. J., & Domrow, N. (2005). Risk factors for injury in subelite rugby league players. *The American Journal of Sports Medicine, 33*(3), 428–434. https://doi.org/10.1177/0363546504268407

Gabriel, E. H., McCann, R. S., & Hoch, M. C. (2019). Use of Social or Behavioral Theories in Exercise-Related Injury Prevention Program Research: A Systematic Review. *Sports medicine (Auckland, N.Z.), 49*(10), 1515–1528. https://doi.org/10.1007/s40279-019-01127-4

Gaudreau, P., Schellenberg, B., & Gareau, A. (2020). Multilevel designs and modeling in sport and exercise psychology. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (4th ed.). Wiley. https://doi.org/10.1002/9781119568124.ch52

Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). *Bayesian Data Analysis* (3rd ed.). Chapman and Hall/CRC. https://doi.org/10.1201/b16018

Giacobbi, P. R., Jr., Poczwardowski, A., & Hager, P. (2005). A Pragmatic Research Philosophy for Sport and Exercise Psychology. *The Sport Psychologist*, *19*(1), 18-31. https://doi.org/10.1123/tsp.19.1.18

Gledhill, A., Forsdyke, D., & Murray, E. (2018). Psychological interventions used to reduce sports injuries: a systematic review of real-world effectiveness. *British journal of sports medicine*, *52*(15), 967–971. https://doi.org/10.1136/bjsports-2017-097694

Gouttebarge, V., Aoki, H., Ekstrand, J., Verhagen, E. A. L. M., & Kerkoffs, G. M. M. J. (2016). Are severe musculoskeletal injuries associated with symptoms of common mental disorders among male European professional footballers? *Knee Surgery, Sports Traumatology and Arthroscopy*, *24*, 3934–3942. https://doi.org/10.1007/s00167-015-3729-y

Gouttebarge, V., Castaldelli-Maia, J. M., Gorczynski, P., Hainline, B., Hitchcock, M. E., Kerkhoffs, G. M., Rice, S. M., Reardon, C. L. (2019). Occurrence of mental health symptoms and disorders in current and former elite athletes: A systematic review. *British Journal of Sports Medicine*, *53*, 700–706. https://doi.org/10.1136/bjsports-2019-100671

Graham, I. D., Logan, J., Harrison, M. B., Straus, S. E., Tetroe, J., Caswell, W., & Robinson, N. (2006). Lost in knowledge translation: Time for a map?

Journal of Continuing Education in the Health Professions, 26(1), 13–24. https://doi.org/10.1002/chp.47

Graneheim, U. H., Lindgren, B-M. & Lundman, B. (2017) Methodological challenges in qualitative content analysis: A discussion paper. *Nurse Education Today*, *56*, 29-34. https://doi.org/10.1016/j.nedt.2017.06.002

Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today, 24*(2), 105-112. https://doi.org/10.1016/j.nedt.2003.10.001

Gulliver, A., Griffiths, K. M., Mackinnon, A., Batterham, P. J., & Stanimirovic, R. (2015). The mental health of Australian elite athletes. *Journal of science and medicine in sport*, *18*(3), 255–261. https://doi.org/10.1016/j.jsams.2014.04.006

Gustafsson, H., Carlin, M. E., Podlog, L., Stenling, A., & Lindwall, M. (2018). Motivational profiles and burnout in elite athletes: A person-centered approach. *Psychology of Sport and Exercise, 35*, 118–125. https://doi.org/10.1016/j.psychsport.2017.12.007

Gwyther, K., Pilkington, V., Bailey, A. P., Mountjoy, M., Bergeron, M. F., Rice, S. M., & Purcell, R. (2024). Mental health and well-being of elite youth athletes: a scoping review. *British journal of sports medicine*, *58*(17), 1011–1019. https://doi.org/10.1136/bjsports-2024-108244

Hackfort, D., & Kleinert, J. (2007). Research on sport injury development: Former and future approaches from an action theory perspective. *International Journal of Sport and Exercise Psychology*, *5*(4), 324–339. https://doi.org/10.1080/1612197X.2007.9671839

Hagger, M. S. (2019). Habit and physical activity: Theoretical advances, practical implications, and agenda for future research. *Psychology of Sport and Exercise*, *42*, 118–129. https://doi.org/10.1016/j.psychsport.2018.12.007

Hagger, M. S., & Chatzisarantis, N. L. (2016). The Trans-Contextual Model of Autonomous Motivation in Education: Conceptual and Empirical Issues and Meta-Analysis. *Review of educational research*, *86*(2), 360–407. https://doi.org/10.3102/0034654315585005

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The Processes by Which Perceived Autonomy Support in Physical Education Promotes Leisure-Time Physical Activity Intentions and Behavior: A Trans-Contextual Model. *Journal of Educational Psychology, 95*(4), 784–795. https://doi.org/10.1037/0022-0663.95.4.784

Hägglund, M., Waldén, M., & Ekstrand, J. (2006). Previous injury as a risk factor for injury in elite football: A prospective study over two consecutive seasons. *British Journal of Sports Medicine*, *40*(9), 767–772. https://doi.org/10.1136/bjsm.2006.026609

Hägglund, M., Waldén, M., Magnusson, H., Kristenson, K., Bengtsson, H., & Ekstrand, J. (2013). Injuries affect team performance negatively in professional football: An 11-year follow-up of the UEFA Champions League injury study. *British Journal of Sports Medicine*, *47*(12), 738–742. https://doi.org/10.1136/bjsports-2013-092215

Hamaker, E. L. (2012). Why researchers should think "within-person": A paradigmatic rationale. In M. R. Mehl & T. S. Conner (Eds.). *Handbook of Research Methods for Studying Daily Life*, 43-61, New York, NY: Guilford

Hamaker, E. L. (2025). Analysis of intensive longitudinal data: Putting psychological processes in perspective. *Annual Review of Clinical Psychology, 21*, 379–405. https://doi.org/10.1146/annurev-clinpsy-081423-022947

Hammer, C., Podlog, L., & Gledhill, A. (2021). The upside of sports injury and disability: Personal growth following adversity. In A. Gledhill & D. Forsdyke (Eds.), *The psychology of sport injury: From risk to retirement* (pp. 76–89). Routledge.

Hausken-Sutter, S. E., Pringle, R., Schubring, A., Grau, S., & Barker-Ruchti, N. (2021). Youth sport injury research: A narrative review and the potential of interdisciplinarity. *BMJ Open Sport & Exercise Medicine*, *7*(1), e000933. https://doi.org/10.1136/bmjsem-2020-000933

Hayfield, N., & Huxley, C. (2015). Insider and outsider perspectives: Reflections on researcher identities in research with lesbian and bisexual women. *Qualitative Research in Psychology*, *12*(2), 91–106. https://doi.org/10.1080/14780887.2014.918224

Heiestad, H., Myklebust, G., Bahr, R., & Moseid, C. H. (2025). Making, not breaking the young, aspiring athlete: The development of Prep to be PRO (Nærmere Best) – a Norwegian school-based educational programme. *BMJ Open Sport & Exercise Medicine, 11*, e002388. https://doi.org/10.1136/bmjsem-2024-002388

Henriksen, K., Huang, Z., Bartley, J., Kenttä, G., Purcell, R., Wagstaff, C. R. D., Si, G., Ge, Y., & Schinke, R. (2026). The role of high-performance sport environments in mental health: An International Society of Sport Psychology consensus statement. *International Journal of Sport and Exercise Psychology, 24*(2), 269–291. https://doi.org/10.1080/1612197X.2024.2437923

Hietamo, J., Rantala, A., Parkkari, J., Leppänen, M., Rossi, M., Steffen, K., Kannus, P., Mattila, V. M., & Pasanen, K. (2023). Injury history and perceived knee function as risk factors for knee injury in youth team-sports athletes. *Sports Health, 15*(1), 26–35. https://doi.org/10.1177/19417381211065443

International Committee of Medical Journal Editors. (2023). *Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals*. https://www.icmje.org/icmje-recommendations.pdf

International Floorball Federation. (2021, April 22). *Number of licensed floorball players in 2020*. https://archive.floorball.sport/2021/04/22/number-of-licensed-floorball-players-in-2020/

International Floorball Federation. (n.d.). *History in short*. Retrieved January 7, 2026, from https://archive.floorball.sport/this-is-floorball/history-in-short/

Ioannidis J. P. (2005). Why most published research findings are false. *PLoS medicine*, *2*(8), e124. https://doi.org/10.1371/journal.pmed.0020124

Ivarsson, A. (2021). Prevention is better than cure: The role of psychological interventions in sports injury risk reduction. In A. Gledhill & D. Forsyke (Eds). *The psychology of sports injury: from risk to retirement*. (1st ed., pp. 16-29). Milton Park, Abingdon, Oxon; New York, NY: Routledge.

Ivarsson, A., Johnson, U., Andersen, M. B., Tranaeus, U., Stenling, A., & Lindwall, M. (2017). Psychosocial Factors and Sport Injuries: Meta-

analyses for Prediction and Prevention. *Sports Medicine (Auckland, N.Z.)*, *47*(2), 353–365. https://doi.org/10.1007/s40279-016-0578-x

Ivarsson, A., Johnson, U., Lindwall, M., Gustafsson, H., & Altemyr, M. (2014). Psychosocial stress as a predictor of injury in elite junior soccer: a latent growth curve analysis. *Journal of science and medicine in sport*, *17*(4), 366–370. https://doi.org/10.1016/j.jsams.2013.10.242

Ivarsson, A., Stambulova, N., & Johnson, U. (2018). Injury as a career transition: Experiences of a Swedish elite handball player. *International Journal of Sport and Exercise Psychology*, *16*(4), 365–381. https://doi.org/10.1080/1612197X.2016.1242149

Ivarsson, A., & Stenling, A. (2019). Prediction of Injury Risk in Sports. In *Wiley StatsRef: Statistics Reference Online* (pp. 1–6). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118445112.stat08141

Jacobsson, J., Mirkovic, D., Hansson, P. O., Lundqvist, C., Mann, R. H., & Tranaeus, U. (2023). Youth athletes at Swedish sports high schools with an athletics specialism emphasise environmental support for injury risk management: a focus group study. *BMJ open sport & exercise medicine*, *9*(2), e001527. https://doi.org/10.1136/bmjsem-2022-001527

Janssen, K. W., van der Zwaard, B. C., Finch, C. F., van Mechelen, W., & Verhagen, E. A. (2016). Interventions preventing ankle sprains; previous injury and high-risk sport participation as predictors of compliance. *Journal of science and medicine in sport*, *19*(6), 465–469. https://doi.org/10.1016/j.jsams.2015.06.005

Jauhiainen, S., Kauppi, J.-P., Leppänen, M., Pasanen, K., Parkkari, J., Vasankari, T., Kannus, P., & Äyrämö, S. (2021). New Machine Learning Approach for Detection of Injury Risk Factors in Young Team Sport Athletes. *International Journal of Sports Medicine*, *42*(2), 175–182. https://doi.org/10.1055/a-1231-5304

Johnson, D. M., Cumming, S. P., Bradley, B., & Williams, S. (2022). The influence of exposure, growth and maturation on injury risk in male academy football players. *Journal of sports sciences*, *40*(10), 1127–1136. https://doi.org/10.1080/02640414.2022.2051380

Johnson, U., & Podlog, L. (2014). Sports injuries. In A. Papaioannou & D. Hackfort (Eds.), *Routledge companion to sport and exercise psychology* (pp. 877–891). Routledge.

Johnston, R., Cahalan, R., Bonnett, L., Maguire, M., Glasgow, P., Madigan, S., O'Sullivan, K., & Comyns, T. (2020). General health complaints and sleep associated with new injury within an endurance sporting population: A prospective study. *Journal of science and medicine in sport*, *23*(3), 252–257. https://doi.org/10.1016/j.jsams.2019.10.013

Junge, A., & Feddermann-Demont, N. (2016). Prevalence of depression and anxiety in top-level male and female football players. *BMJ open sport & exercise medicine*, *2*(1), e000087. https://doi.org/10.1136/bmjsem-2015-000087

Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of advanced nursing*, *72*(12), 2954–2965. https://doi.org/10.1111/jan.13031

Karolinska Institutet. (2025). *Using generative AI when writing academic texts within doctoral education*. https://staff.ki.se/doctoral-education/time-to-defend-your-thesis/using-generative-ai-when-writing-academic-texts-within-doctoral-education

Keats, M. R., Emery, C. A., & Finch, C. F. (2012). Are we having fun yet? Fostering adherence to injury preventive exercise recommendations in young athletes. *Sports medicine (Auckland, N.Z.)*, *42*(3), 175–184. https://doi.org/10.2165/11597050-000000000-00000

Kerr, N. L. (1998). HARKing: Hypothesizing after the results are known. *Personality and Social Psychology Review, 2*, 196–217. https://doi.org/10.1207/s15327957pspr0203_4.

Kroenke, K., Spitzer, R. L., Williams, J. B. W., Monahan, P. O., & Löwe, B. (2007). Anxiety disorders in primary care: Prevalence, impairment, comorbidity, and detection. *Annals of Internal Medicine*, *146*(5), 317–325. https://doi.org/10.7326/0003-4819-146-5-200703060-00004

Kvale, S., & Brinkmann, S. (2013). *InterViews: Learning the Craft of Qualitative Research Interviewing* (3rd ed.). Sage Publications.

Kvist, J., Silbernagel, K. G., (2022), Fear of Movement and Reinjury in Sports Medicine: Relevance for Rehabilitation and Return to Sport, *Physical Therapy*, *102*(2), pzab272. https://doi.org/10.1093/ptj/pzab272

Lee, A. S. Y., Standage, M., Hagger, M. S., & Chan, D. K. C. (2019). Sport injury prevention in-school and out-of-school? A qualitative investigation of the trans-contextual model. *PloS one*, *14*(9), e0222015. https://doi.org/10.1371/journal.pone.0222015

Lee, A. S. Y., Standage, M., Hagger, M. S., & Chan, D. K. C. (2021). Predictors of in-school and out-of-school sport injury prevention: A test of the trans-contextual model. *Scandinavian journal of medicine & science in sports*, *31*(1), 215–225. https://doi.org/10.1111/sms.13826

Léger, L. A., Mercier, D., Gadoury, C. & Lambert, J. (1988) The multistage 20 metre shuttle run test for aerobic fitness. *Journal of Sports Sciences, 6*(2), 93-101. https://doi.org/10.1080/02640418808729800

Leivo, T., Haavisto, A. K., & Sahraravand, A. (2015). Sports-related eye injuries: the current picture. *Acta ophthalmologica*, *93*(3), 224–231. https://doi.org/10.1111/aos.12633

Leppänen, M., Pasanen, K., Krosshaug, T., Kannus, P., Vasankari, T., Kujala, U. M., Bahr, R., Perttunen, J., & Parkkari, J. (2017). Sagittal plane hip, knee, and ankle biomechanics and the risk of anterior cruciate ligament injury: A prospective study. *Orthopaedic Journal of Sports Medicine, 5*(12), 2325967117745487. https://doi.org/10.1177/2325967117745487

Leppänen, M., Pasanen, K., Kujala, U. M., & Parkkari, J. (2015). Overuse injuries in youth basketball and floorball. *Open access journal of sports medicine*, *6*, 173–179. https://doi.org/10.2147/OAJSM.S82305

Leys, C., Delacre, M., Mora, Y. L., Lakens, D., & Ley, C. (2019). How to Classify, Detect, and Manage Univariate and Multivariate Outliers, With Emphasis on Pre-Registration. *International Review of Social Psychology*, *32*(1), Article 1. https://doi.org/10.5334/irsp.289

Li, H., Moreland, J. J., Peek-Asa, C., & Yang, J. (2017). Preseason Anxiety and Depressive Symptoms and Prospective Injury Risk in Collegiate Athletes. *The American Journal of Sports Medicine*, *45*(9), 2148–2155. https://doi.org/10.1177/0363546517702847

Liederbach, M., & Compagno, J. M. (2001). Psychological aspects of fatigue-related injuries in dancers. *Journal of Dance Medicine & Science, 5*(4), 116–120. https://doi.org/10.1177/1089313X0100500403

Lin, T., Anderson, T., Erekson, D. M., & Ogles, B. M. (2024). Trajectories of change in weekly and biweekly therapy. *Journal of Counseling Psychology, 71*(1), 77–87. https://doi.org/10.1037/cou0000711

Lindgren, B-M., Lundman, B., & Graneheim, U. H. (2020). Abstraction and interpretation during the qualitative content analysis process. *International Journal of Nursing Studies*, *108*, 1-6. https://doi.org/10.1016/j.ijnurstu.2020.103632

Lindwall, M., Ivarsson, A., Weman-Josefsson, K., Jonsson, L., Ntoumanis, N., Patrick, H., Thøgersen-Ntoumani, C., Markland, D., & Teixeira, P. (2017). Stirring the motivational soup: within-person latent profiles of motivation in exercise. *The international journal of behavioral nutrition and physical activity*, *14*(1), 4. https://doi.org/10.1186/s12966-017-0464-4

Liu, H. J., De Jonge, K. M., Den Hartigh, R. J., & Van Yperen, N. W. (2026). Basic psychological need support, need satisfaction, and autonomous motivation in coach-athlete relationships: A systematic review and meta-analysis. *International Journal of Sports Science & Coaching*, *21*(2), 1178-1191. https://doi.org/10.1177/17479541251400621

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the Depression Anxiety Stress scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335-343. https://doi.org/10.1016/0005-7967(94)00075-u

Lumivero (2024). *NVivo* (Version 12), www.lumivero.com

Lund, S. (2014). Regulation and deregulation in education policy: New reforms and school sports in Swedish upper secondary education. *Sport, Education and Society*, *19*(3), 241–257. https://doi.org/10.1080/13573322.2012.664127

Lyon-Monk, O., Arnold, R., Williams, S., Cleave, L. J., Cumming, S., Currie, A., Wass, J., & Moore, L. J. (2025). Understanding the bi-directional relationship between injury and mental ill-health in elite athletes: A six-

year, retrospective cohort study. *Journal of science and medicine in sport*, *29*(4), 368–375. https://doi.org/10.1016/j.jsams.2025.10.002

Mandorino, M., J. Figueiredo, A., Gjaka, M., & Tessitore, A. (2023). Injury incidence and risk factors in youth soccer players: a systematic literature review. Part I: epidemiological analysis. *Biology of Sport*, *40*(1), 3-25. https://doi.org/10.5114/biolsport.2023.109961

Martinez, J. C., Mazerolle, S. M., Denegar, C. R., Joseph, M. F., Pagnotta, K. D., Trojian, T. H., & DiStefano, L. J. (2017). Female adolescent athletes' attitudes and perspectives on injury prevention programs. *Journal of science and medicine in sport*, *20*(2), 146–151. https://doi.org/10.1016/j.jsams.2016.06.009

Masyn, K. E. (2013). Latent class analysis and finite mixture modeling. In T. Little (Eds.), *The Oxford handbook of quantitative methods* (pp. 551–611). New York, NY: Oxford University Press

McCall, A., Dupont, G., & Ekstrand, J. (2016). Injury prevention strategies, coach compliance and player adherence of 33 of the UEFA Elite Club Injury Study teams: a survey of teams' head medical officers. *British journal of sports medicine*, *50*(12), 725–730. https://doi.org/10.1136/bjsports-2015-095259

McKay, C. D., Merrett, C. K., & Emery, C. A. (2016). Predictors of FIFA 11+ Implementation Intention in Female Adolescent Soccer: An Application of the Health Action Process Approach (HAPA) Model. *International journal of environmental research and public health*, *13*(7), 657. https://doi.org/10.3390/ijerph13070657

Meeuwisse, W. H., Tyreman, H., Hagel, B., & Emery, C. (2007). A dynamic model of etiology in sport injury: the recursive nature of risk and causation. *Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine*, *17*(3), 215–219. https://doi.org/10.1097/JSM.0b013e3180592a48

Mellor, D., Vinet, E. V., Xu, X., Bt Mamat, N. H., Richardson, B., & Román, F. (2015). Factorial invariance of the DASS-21 among adolescents in four countries. *European Journal of Psychological Assessment, 31*(2), 138–142. https://doi.org/10.1027/1015-5759/a000218

Microsoft. (2026). Microsoft Copilot (GPT-5–based large language model) [Generative artificial intelligence tool]. https://www.microsoft.com/copilot

Monasterio, X., Gil, S. M., Bidaurrazaga-Letona, I., Lekue, J. A., Santisteban, J. M., Diaz-Beitia, G., Lee, D. J., Zumeta-Olaskoaga, L., Martin-Garetxana, I., Bikandi, E., & Larruskain, J. (2023). The burden of injuries according to maturity status and timing: A two-decade study with 110 growth curves in an elite football academy. *European journal of sport science*, *23*(2), 267–277. https://doi.org/10.1080/17461391.2021.2006316

Moore, G. F., & Evans, R. E. (2017). What theory, for whom and in which context? Reflections on the application of theory in the development and evaluation of complex population health interventions. *SSM - population health*, *3*, 132–135. https://doi.org/10.1016/j.ssmph.2016.12.005

Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry*, *20*(8), 1045-1053. https://doi.org/10.1177/1077800413513733

Moseid, C. H., Myklebust, G., Slaastuen, M. K., Bar-Yaacov, J. B., Kristiansen, A. H., Fagerland, M. W., & Bahr, R. (2019). The association between physical fitness level and number and severity of injury and illness in youth elite athletes. *Scandinavian Journal of Medicine & Science in Sports*, *29*(11), 1736–1748. https://doi.org/10.1111/sms.13498

Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus user's guide* (8th ed.). Los Angeles, CA: Muthén & Muthén. (Original work published 1998)

Myer, G. D., Jayanthi, N., Difiori, J. P., & Faigenbaum, A. D. (2015). Sport Specialization, Part I: Does Early Sports Specialization Increase Negative Outcomes and Reduce the Opportunity for Success in Young Athletes? *Sports Health*, *7(5)*, 437–442. https://doi.org/10.1177/1941738115598747

Nosek, B. A., Alter, G., Banks, G. C., Borsboom, D., Bowman, S. D., Breckler, S., Buck, S., Chambers, C., Chin, G., Christensen, G., Contestabile, M., Dafoe, A., Eich, E., Freese, J., Glennerster, R., Goroff, D., Green, D. P., Heese, B., Humphreys, M., Ishiyama, … Yarkoni, T. (2015). Promoting an open research culture: Author guidelines for journals to promote

transparency, openness, and reproducibility. *Science, 348*, 1422–1425. https://doi.org/10.1126/science.aab2374

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). The preregistration revolution. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(11), 2600–2606. https://doi.org/10.1073/pnas.1708274114

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation Study. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(4), 535–569. https://doi.org/10.1080/10705510701575396

Nylund-Gibson, K., Grimm, R. P., & Masyn, K. E. (2019). Prediction from Latent Classes: A Demonstration of Different Approaches to Include Distal Outcomes in Mixture Models. *Structural Equation Modeling: A Multidisciplinary Journal*, *26*(6), 967–985. https://doi.org/10.1080/10705511.2019.1590146

O'Brien, J., Santner, E., & Kröll, J. (2021). Moving Beyond One-Size-Fits-All Approaches to Injury Prevention: Evaluating How Tailored Injury Prevention Programs Are Developed and Implemented in Academy Soccer. *The Journal of orthopaedic and sports physical therapy*, *51*(9), 432–439. https://doi.org/10.2519/jospt.2021.10513

Olsen, O. E., Myklebust, G., Engebretsen, L., & Bahr, R. (2006). Injury pattern in youth team handball: a comparison of two prospective registration methods. *Scandinavian journal of medicine & science in sports*, *16*(6), 426–432. https://doi.org/10.1111/j.1600-0838.2005.00484.x

Open AI. (2026). *ChatGPT (GPT-5.5)* [Large language model]. https://chatgpt.com

Open Science Collaboration (2015). PSYCHOLOGY. Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. https://doi.org/10.1126/science.aac4716

Orbell, S., & Verplanken, B. (2020). Changing behavior using habit theory. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (pp. 178–192). Cambridge University Press.

Orchard J. W. (2015). Men at higher risk of groin injuries in elite team sports: a systematic review. *British journal of sports medicine*, *49*(12), 798–802. https://doi.org/10.1136/bjsports-2014-094272

Parker, J., Johnson, U., & Ivarsson, A. (2021). Is Perceived Autonomy Support Provided by a Coach Related to the Intention of Injury Preventative Behavior Among National and International Level Golfers? *Frontiers in Sports and Active Living*, *3*, 569590. https://www.frontiersin.org/articles/10.3389/fspor.2021.569590

Pasanen, K., Hietamo, J., Vasankari, T., Kannus, P., Heinonen, A., Kujala, U. M., Mattila, V. M., & Parkkari, J. (2018). Acute injuries in Finnish junior floorball league players. *Journal of Science and Medicine in Sport*, *21*(3), 268–273. https://doi.org/10.1016/j.jsams.2017.06.021

Pasanen, K., Parkkari, J., Rossi, L., & Kannus, P. (2008). Artificial playing surface increases the injury risk in pivoting indoor sports: A prospective one-season follow-up study in Finnish female floorball. *British Journal of Sports Medicine*, *42*(3), 194–197. https://doi.org/10.1136/bjsm.2007.038596

Perera, N. K. P., & Hägglund, M. (2020). We have the injury prevention exercise programme, but how well do youth follow it?. *Journal of science and medicine in sport*, 23(5), 463–468. https://doi.org/10.1016/j.jsams.2019.11.008

Plummer, F., Manea, L., Trepel, D., & McMillan, D. (2016). Screening for anxiety disorders with the GAD-7 and GAD-2: A systematic review and diagnostic metaanalysis. *General Hospital Psychiatry*, *39*, 24–31. https://doi.org/10.1016/j.genhosppsych.2015.11.005

Podsakoff, P. M., Podsakoff, N. P., Williams, L. J., Huang, C., & Yang, J. (2024). Common Method Bias: It's Bad, It's Complex, It's Widespread, and It's Not Easy to Fix. *Annual Review of Organisational Psychology and Organisational Behavior*, *11*(1), 17-61. https://doi.org/10.1146/annurev-orgpsych-110721-040030

Post, E. G., Trigsted, S. M., Riekena, J. W., Hetzel, B. S., McGuine, T. A., Brooks, M. A., & Bell, D. R. (2017). The association of sport specialization and training volume with injury history in youth athletes. *The American Journal of Sports Medicine*, *45*(6), 1405–1412. https://doi.org/10.1177/0363546517690848

Putukian, M. (2016). The psychological response to injury in student athletes: A narrative review with a focus on mental health. *British Journal of Sports Medicine*, *50*(3), 145–148. https://doi.org/10.1136/bjsports-2015-095586

Reardon, C. L., Hainline, B., Aron, C. M., Baron, D., Baum, A. L., Bindra, A., Budgett, R., Campriani, N., Castaldelli-Maia, J. M., Currie, A., Derevensky, J. L., Glick, I. D., Gorczynski, P., Gouttebarge, V., Grandner, M. A., Han, D. H., McDuff, D., Mountjoy, M., Polat, A., Purcell, R., … Engebretsen, L. (2019). Mental health in elite athletes: International Olympic Committee consensus statement (2019). *British journal of sports medicine*, *53*(11), 667–699. https://doi.org/10.1136/bjsports-2019-100715

Reifsteck, E. J., Anderson, S. N., Newton, J. D., & Maher, J. P. (2021). A practical guide and empirical example for implementing ecological momentary assessment in sport psychology research with athletes. *Sport, Exercise, and Performance Psychology, 10*(3), 408–422. https://doi.org/10.1037/spy0000252

Resnik, D. B., & Hosseini, M. (2025). The ethics of using artificial intelligence in scientific research: new guidance needed for a new tool. *AI and ethics*, *5*(2), 1499–1521. https://doi.org/10.1007/s43681-024-00493-8

Rice, S. M., Gwyther, K., Santesteban-Echarri, O., Baron, D., Gorczynski, P., Gouttebarge, V., Reardon, C. L., Hitchcock, M. E., Hainline, B., & Purcell, R. (2019). Determinants of anxiety in elite athletes: a systematic review and meta-analysis. *British journal of sports medicine*, *53*(11), 722–730. https://doi.org/10.1136/bjsports-2019-100620

Rice, S. M., Purcell, R., & McGorry, P. D. (2018). Adolescent and Young Adult Male Mental Health: Transforming System Failures Into Proactive Models of Engagement. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, *62*(3S), S9–S17. https://doi.org/10.1016/j.jadohealth.2017.07.024

Richardson, S.O., Andersen, M.B., Morris, T. (2008) *Overtraining athletes: personal journeys in sport*. Champaign: Human Kinetics; 2008.

Riksidrottsförbundet. (2024). *Idrottsrörelsen i siffror*. Riksidrottsförbundet. https://www.rf.se/download/18.5979385c197a1f9eed0641fd/17510139

03742/2024%20Idrottsro%CC%88relsen%20i%20siffror%20-%20RF.pdf

Riksidrottsförbundet. (2025, November 20). *Elitidrott på gymnasiet*. https://www.rf.se/rf-arbetar-med/elitidrott/elitidrott-pa-gymnasiet

Rogers, T. J., & Landers, D. M. (2005). Mediating Effects of Peripheral Vision in the Life Event Stress/Athletic Injury Relationship. *Journal of Sport & Exercise Psychology*, *27*(3), 271–288. https://doi.org/10.1123/jsep.27.3.271

Romano, I., Ferro, M. A., Patte, K. A., & Leatherdale, S. T. (2022). Measurement Invariance of the GAD-7 and CESD-R-10 Among Adolescents in Canada. *Journal of Pediatric Psychology*, *47*(5), 585–594. https://doi.org/10.1093/jpepsy/jsab119

Rommers, N., Rössler, R., Goossens, L., Vaeyens, R., Lenoir, M., Witvrouw, E., & D'Hondt, E. (2020). Risk of acute and overuse injuries in youth elite soccer players: Body size and growth matter. *Journal of science and medicine in sport*, *23*(3), 246–251. https://doi.org/10.1016/j.jsams.2019.10.001

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health education quarterly*, *15*(2), 175–183. https://doi.org/10.1177/109019818801500203

Rossi, M. K., Pasanen, K., Heinonen, A., Myklebust, G., Kannus, P., Kujala, U. M., Tokola, K., & Parkkari, J. (2018). Incidence and risk factors for back pain in young floorball and basketball players: A Prospective study. *Scandinavian Journal of Medicine & Science in Sports*, *28*(11), 2407–2415. https://doi.org/10.1111/sms.13237

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*(5), 749–761. https://doi.org/10.1037/0022-3514.57.5.749

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: basic psychological needs in motivation, development, and wellness*. Guilford Press.

Saunders, N., Otago, L., Romiti, M., Donaldson, A., White, P., & Finch, C. (2010). Coaches' perspectives on implementing an evidence-informed

injury prevention programme in junior community netball. *British journal of sports medicine, 44*(15), 1128–1132. https://doi.org/10.1136/bjsm.2009.069039

Schwarzer, R. (2016). Health Action Process Approach (HAPA) as a Theoretical Framework to Understand Behavior Change. *Actualidades En Psicología*, *30*(121), 119–130. https://doi.org/10.15517/ap.v30i121.23458

SFS 2003:460. *Lag om etikprövning av forskning som avser människor*. https://www.riksdagen.se/sv/dokument-och-lagar/dokument/svensk-forfattningssamling/lag-2003460-om-etikprovning-av-forskning-som_sfs-2003-460/

SFS 2010:800. *Skollagen* [Swedish Education Act]. https://www.riksdagen.se/sv/dokument-och-lagar/dokument/svensk-forfattningssamling/skollag-2010800_sfs-2010-800/#K3

SFS 2010:2039. *Gymnasieförordningen* [Swedish upper secondary school ordinance]. https://www.riksdagen.se/sv/dokument-och-lagar/dokument/svensk-forfattningssamling/gymnasieforordning-20102039_sfs-2010-2039/

SFS 2023:654. *Förordning om ändring i gymnasieförordningen* (2010:2039). https://svenskforfattningssamling.se/sites/default/files/sfs/2023-11/SFS2023-654.pdf

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological science*, *22*(11), 1359–1366. https://doi.org/10.1177/0956797611417632

Skolverket. (n.d.). *Sports Programme—Utbildningsguiden*. Retrieved January 7, 2026, from https://utbildningsguiden.skolverket.se/in-english/upper-secondary-school/programmes-in-upper-secondary-school/other-programmes-2/sports-programme

Soligard, T., Myklebust, G., Steffen, K., Holme, I., Silvers, H., Bizzini, M., Junge, A., Dvorak, J., Bahr, R., & Andersen, T. E. (2008). Comprehensive warm-up programme to prevent injuries in young female footballers: cluster randomised controlled trial. *BMJ (Clinical research ed.)*, *337*, a2469. https://doi.org/10.1136/bmj.a2469

Soligard, T., Schwellnus, M., Alonso, J. M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T., Gleeson, M., Hägglund, M., Hutchinson, M. R., Janse van Rensburg, C., Khan, K. M., Meeusen, R., Orchard, J. W., Pluim, B. M., Raftery, M., Budgett, R., & Engebretsen, L. (2016). How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *British journal of sports medicine*, *50*(17), 1030–1041. https://doi.org/10.1136/bjsports-2016-096581

Sonesson, S., Dahlström, Ö., Panagodage Perera, N. K., & Hägglund, M. (2023). Risk factors for injury and illness in youth floorball players – A prospective cohort study. *Physical Therapy in Sport, 59,* 92–102. https://doi.org/10.1016/j.ptsp.2022.11.008

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Standage, M., & Emm, L. G. (2014). Relationships within physical activity settings. In N. Weinstein (Ed.), *Human motivation and interpersonal relationships* (pp. 239–262). Springer. https://doi.org/10.1007/978-94-017-8542-6_11

Standage, M., & Ryan, R. M. (2020). Self-determination theory in sport and exercise. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (4th ed., Vol. 1, pp. 37–56). Wiley.

Stambulova, N. B., Engström, C., Franck, A., Linnér, L., & Lindahl, K. (2015). Searching for an optimal balance: Dual career experiences of Swedish adolescent athletes. *Psychology of Sport And Exercise, 21*, 4-14. https://doi.org/10.1016/j.psychsport.2014.08.009

Steffen, K., Pensgaard, A-M., & Bahr, R. (2009). Self-reported psychological characteristics as risk factors for injuries in female youth football. *Scandinavian Journal of Medicine and Science in Sport*, *19*, 442–451. https://doi.org/10.1111/j.1600-0838.2008.00797.x

Svenska Innebandyförbundet. (2026). *Licensutvecklingen*. Svenska Innebandyförbundet. https://www.innebandy.se/om-oss/licensutvecklingen

Svenska Innebandyförbundet. (n.d.). *Innebandygymnasier*. Retrieved June 29, 2026, from https://innebandy.se/utbildning/innebandygymnasier

Tein, J. Y., Coxe, S., & Cham, H. (2013). Statistical Power to Detect the Correct Number of Classes in Latent Profile Analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, *20*(4), 640–657. https://doi.org/10.1080/10705511.2013.824781

Teixeira, P. J., Marques, M. M., Silva, M. N., Brunet, J., Duda, J. L., Haerens, L., La Guardia, J., Lindwall, M., Lonsdale, C., Markland, D., Michie, S., Moller, A. C., Ntoumanis, N., Patrick, H., Reeve, J., Ryan, R. M., Sebire, S. J., Standage, M., Vansteenkiste, M., . . . Hagger, M. S. (2020). A classification of motivation and behavior change techniques used in self-determination theory-based interventions in health contexts. *Motivation Science, 6*(4), 438–455. https://doi.org/10.1037/mot0000172

Tengman, E., Pettersson, A., Jönsson, L., & Tervo, T. (2025). *Floorball goaltending movements during a game: A quantitative observational study*. *BMC Sports Science, Medicine and Rehabilitation, 17*(1), 147. https://doi.org/10.1186/s13102-025-01202-6

Tervo, T., & Nordström, A. (2014). *Science of floorball: A systematic review*. *Open Access Journal of Sports Medicine, 5*, 249–255. https://doi.org/10.2147/OAJSM.S60490

Tervo, T., Nyström, H., & Nordström, A. (2019). Injuries in Swedish floorball players: A nationwide matched cohort study. *Cogent Medicine*, *6*(1), 1673087. https://doi.org/10.1080/2331205X.2019.1673087

Thorborg, K., Krommes, K. K., Esteve, E., Clausen, M. B., Bartels, E. M., & Rathleff, M. S. (2017). Effect of specific exercise-based football injury prevention programmes on the overall injury rate in football: A systematic review and meta-analysis of the FIFA 11 and 11+ programmes. *British Journal of Sports Medicine, 51(7),* 562–571. https://doi.org/10.1136/bjsports-2016-097066

Topp, C. W., Østergaard, S. D., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A Systematic Review of the Literature. *Psychotherapy and Psychosomatics*, *84*(3), 167–176. https://doi.org/10.1159/000376585

Tourangeau, R., Rips, L. J., & Rasinski, K. (Eds.). (2000). *The psychology of survey response*. Cambridge University Press. https://doi.org/10.1017/CBO9780511819322

Tracey, J. (2003). The emotional response to the injury and rehabilitation process. *Journal of Applied Sport Psychology*, *15*(4), 279–293. https://doi.org/10.1080/714044197

Tranaeus, U., Gledhill, A., Johnson, U., Podlog, L., Wadey, R., Wiese-Bjornstal, D., & Ivarsson, A. (2024). 50 Years of Research on the Psychology of Sport Injury: A Consensus Statement. *Sports medicine (Auckland, N.Z.)*, *54*(7), 1733–1748. https://doi.org/10.1007/s40279-024-02045-w

Tranaeus, U., Götesson, E., Werner, S. (2016). Injury Profile in Swedish Elite Floorball. *Sports Health*, *8(3)*, 224-229. https://doi.org/10.1177/1941738116628472

Tranaeus, U., Heintz, E., Johnson, U., Forssblad, M., & Werner, S. (2017). Injuries in Swedish floorball: a cost analysis. *Scandinavian journal of medicine & science in sports*, *27*(5), 508–513. https://doi.org/10.1111/sms.12675

Tranaeus, U., Johnson, U., Engström, B., Skillgate, E., & Werner, S. (2014). Psychological antecedents of overuse injuries among Swedish elite floorball players. *Athletic Insight*, *6(2)*, 155–172.

Tranaeus, U., Johnson, U., Engström, B., Skillgate, E., & Werner, S. (2015). A psychological injury prevention group intervention in Swedish floorball. *Knee Surgery, Sports Traumatology, Arthroscopy, 23*(11), 3414–3420. https://doi.org/10.1007/s00167-014-3133-z

Tranaeus, U., Johnson, U., Ivarsson, A., Engström, B., Skillgate, E., & Werner, S. (2015). Sports injury prevention in Swedish elite floorball players: Evaluation of two consecutive floorball seasons. *Knee Surgery, Sports Traumatology, Arthroscopy, 23*(3), 899–905. https://doi.org/10.1007/s00167-014-3411-9

Turnbull, M. R., Gallo, T. F., Carter, H. E., Drew, M., Toohey, L. A., & Waddington, G. (2024). Estimating the cost of sports injuries: A scoping review. *Journal of science and medicine in sport*, *27*(5), 307–313. https://doi.org/10.1016/j.jsams.2024.03.001

Valdivia, A. (2025). The *supply chain capitalism of AI*: a call to (re)think algorithmic harms and resistance through environmental lens. *Information, Communication & Society*, *28*(12), 2118–2134. https://doi.org/10.1080/1369118X.2024.2420021

Verhagen, E. A., van Stralen, M. M., & van Mechelen, W. (2010). Behaviour, the key factor for sports injury prevention. *Sports medicine (Auckland, N.Z.)*, *40*(11), 899–906. https://doi.org/10.2165/11536890-000000000-00000

Vetenskapsrådet. (2017). *God forskningssed*. https://www.vr.se/analys/rapporter/vara-rapporter/2017-08-29-god-forskningssed.html

von Rosen, P. (2017). *Injuries, risk factors, consequences and injury perceptions in adolescent elite athletes* (Doctoral dissertation). Karolinska Institutet. https://hdl.handle.net/10616/45942

von Rosen, P., Frohm, A., Kottorp, A., Fridén, C., & Heijne, A. (2017). Too little sleep and an unhealthy diet could increase the risk of sustaining a new injury in adolescent elite athletes. *Scandinavian journal of medicine & science in sports*, *27*(11), 1364–1371. https://doi.org/10.1111/sms.12735

von Rosen, P., & Heijne, A. (2021). Subjective well-being is associated with injury risk in adolescent elite athletes. *Physiotherapy Theory and Practice*, *37*(6), 748–754. https://doi.org/10.1080/09593985.2019.1641869

von Rosen, P., Heijne, A., Frohm, A., Fridén, C., & Kottorp, A. (2018). High Injury Burden in Elite Adolescent Athletes: A 52-Week Prospective Study. *Journal of athletic training*, *53*(3), 262–270. https://doi.org/10.4085/1062-6050-251-16

von Rosen, P., Kottorp, A., Fridén, C., Frohm, A., & Heijne, A. (2018). Young, talented and injured: Injury perceptions, experiences and consequences in adolescent elite athletes. *European journal of sport science*, *18*(5), 731–740. https://doi.org/10.1080/17461391.2018.1440009

Waldén, M, Atroshi, I, Magnusson, H, Wagner, P, & Hägglund, M. (2012) Prevention of acute knee injuries in adolescent female football players: cluster randomized controlled trial. *BMJ, 344:e3024.* https://doi.org/10.1136/bmj.e3042

Walton, C. C., Purcell, R., Henderson, J. L., Kim, J., Kerr, G., Frost, J., Gwyther, K., Pilkington, V., Rice, S., & Tamminen, K. A. (2024). Mental Health Among Elite Youth Athletes: A Narrative Overview to Advance Research and Practice. *Sports health*, *16*(2), 166–176. https://doi.org/10.1177/19417381231219230

Walton, C. C., Rice, S., Hutter, R. I. (Vana), Currie, A., Reardon, C. L., & Purcell, R. (2021). Mental health in youth athletes: A clinical review. *Advances in Psychiatry and Behavioral Health, 1*(1), 119–133. https://doi.org/10.1016/j.ypsc.2021.05.011

Wang, L. (P.), & Maxwell, S. E. (2015). On disaggregating between-person and within-person effects with longitudinal data using multilevel models. *Psychological Methods, 20*(1), 63–83. https://doi.org/10.1037/met0000030

White, P. E., Ullah, S., Donaldson, A., Otago, L., Saunders, N., Romiti, M., & Finch, C. F. (2012). Encouraging junior community netball players to learn correct safe landing technique. *Journal of science and medicine in sport*, *15*(1), 19–24. https://doi.org/10.1016/j.jsams.2011.08.004

Wiese-Bjornstal, D. M. (2009) Sport injury and college athlete health across the lifespan. *Journal of Intercollegiate Sport*, *2*, 64–80. https://doi.org/10.1123/jis.2.1.64

Wiese-Bjornstal D. M. (2010). Psychology and socioculture affect injury risk, response, and recovery in high-intensity athletes: a consensus statement. *Scandinavian journal of medicine & science in sports*, *20 Suppl 2*, 103–111. https://doi.org/10.1111/j.1600-0838.2010.01195.x

Wiese-Bjornstal, D. M., Smith, A. M., Shaffer, S. M., & Morrey, M. A. (1998). An integrated model of response to sport injury: Psychological and sociological dynamics. *Journal of Applied Sport Psychology*, *10*(1), 46–69. https://doi.org/10.1080/10413209808406377

Wiese-Bjornstal, D. M., Wood, K. N., & Kronzer, J. R. (2020). Sport injuries and psychological sequelae. In G. Tenenbaum & R. C. Eklund (Eds). *Handbook of Sport Psychology*. (4th ed., pp. 711-737). Hoboken, NJ: Wiley.

Williams, J. M., & Andersen, M. B. (1998). Psychosocial antecedents of sport injury: Review and critique of the stress and injury model. *Journal of*

Applied Sport Psychology, 10, 5–25. https://doi.org/10.1080/10413209808406375

Windt, J., Ardern, C. L., Gabbett, T. J., Khan, K. M., Cook, C. E., Sporer, B. C., & Zumbo, B. D. (2018). Getting the most out of intensive longitudinal data: a methodological review of workload-injury studies. *BMJ open*, *8*(10), e022626. https://doi.org/10.1136/bmjopen-2018-022626

World Health Organization. Regional Office for Europe. (1998). Wellbeing measures in primary health care/the DepCare Project: report on a WHO meeting: Stockholm, Sweden, 12–13 February 1998. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/349766

World Medical Association. (2024). *Declaration of Helsinki: Ethical principles for medical research involving human participants*. https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/

Yang, J., Cheng, G., Zhang, Y., Covassin, T., Heiden, E. O., & Peek-Asa, C. (2014). Influence of Symptoms of Depression and Anxiety on Injury Hazard among Collegiate American Football Players. *Research in Sports Medicine*, *22*(2), 147–160. https://doi.org/10.1080/15438627.2014.881818

Zyphur, M. J., & Oswald, F. L. (2015). Bayesian estimation and inference: A user's guide. *Journal of Management*, 41(2), 390–420. https://doi.org/10.1177/0149206313501200

Zyphur, M. J., & Pierides, D. C. (2020). Making quantitative research work: From positivist dogma to actual social scientific inquiry. *Journal of Business Ethics, 167*(1), 49–62. https://doi.org/10.1007/s10551-019-04189-6