

# **Individual physical health risk management of elite athletes: An interdisciplinary approach**

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Jan Bursik, M.Sc.

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1. Betreuerin:

Dr. Jannika John

2. Betreuer:

Prof. Dr. Ansgar Thiel

Tag der mündlichen Prüfung:

27.05.2025

Dekan:

Prof. Dr. Taiga Brahms

Prof. Dr. Dominik Papies

1. Gutachterin:

Dr. Jannika John

2. Gutachterin:

Prof. Dr. Yolanda Demetriou-Rinderknecht

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*„Sometimes you will never know the value of a moment, until it becomes a memory“  
(Theodor Seuss Geisel)*

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## 1. Introduction

### 1.1 Problem Statement

Elite sport constitutes a risky environment, as athletes who pursue peak performance are exposed to multifaceted challenges that arise from physiological strains (e.g., Póvoas et al., 2012), psychological demands and resulting stress (e.g., Bicalho & Da Costa, 2018), social expectations and pressures (e.g., Thiel et al., 2015), and economic uncertainties (e.g., Roderick, 2006b). The structural demands of high-performance environments, combined with these challenges, contribute to an increased likelihood of physical health risks and complicate athletes' ability to effectively manage these risks (cf. Schnell et al., 2014).

Physical health risks emerge in situations where athletes' physical capacities are pushed to or challenged beyond their limits due to factors such as intense training and competition demands, insufficient recovery, psychological stress, and sociocultural norms regarding pain and injury management, as well as demanding expectations and pressures from coaches, teammates, or other stakeholders. Such situations are often marked by injuries, illness, or related symptoms like pain and overexertion, which disrupt the athletic pathway and require adapted behaviors and cognitions (cf. Mayer et al., 2020b).

Consequently, these scenarios call for effective physical health risk management to mitigate the negative consequences of injuries and overexertion, such as prolonged recovery times, performance decline, or career-threatening situations. This management involves athletes' cognitive and behavioral responses to physical health risks, which arise due to the inherent uncertainty of pain and injury progression, recovery, and performance impact (Roderick, 2006b). By effectively managing these risks, athletes aim at reducing uncertainties while continuing to pursue goals (cf. Oliveira & Ribeiro, 2023).

Within the inherently risky environment of elite sport (Roderick, 2006b), athletes strive to manage physical health risks by balancing performance and health (cf. John et al.,

2024). Despite efforts to minimize uncertainties, the high-stakes dynamics of elite sport often result in the prioritization of short-term performance over health concerns (e.g., John et al., 2024; Schnell et al., 2014). This tendency can lead to severe injuries and extended downtime, posing significant challenges to athletes' careers and physical as well as psychological well-being (Chen et al., 2019).

Previous research in elite sports has extensively studied physical health risk management from diverse perspectives. The prevalence of physical health events, such as injuries and pain, alongside methods of assessment and management, has been extensively explored in sports medicine (Raya-González et al., 2020; Tranaeus et al., 2022). Meanwhile, psychological research has focused on individual traits and emotional states that influence the occurrence of health events, such as injuries and pain (Kerr & Minden, 1988) or the likelihood of encountering physical health risks, situations where athletes face increased chances of injury, illness, or overexertion due to high-performance demands (Thompson & Morris, 1994). This research has also explored strategies for managing these risks (Gledhill et al., 2018), and athletes' emotional responses to pain or injuries (Wiese-Bjornstal et al., 1998; Wiese-Bjornstal, 2010). Sociologically informed research on the *culture of risk* (Frey, 1991; Nixon, 1992) has examined the underlying sociocultural dynamics that foster an environment in elite sport where physical health risks are accepted (cf. Theberge, 2008). This research strain reveals how structural pressure, such as the pursuit of competitive success, institutional expectations, and peer reinforcement, contribute to a culture where enduring pain and taking risks are normalized and valorized as necessary for achievement (cf. Overbye, 2021; Roderick et al., 2000).

Taken together, research of physical health risk management has largely remained multidisciplinary (cf. Brewer, 2020), with each disciplinary approach working side by side and mainly employing distinct theoretical frameworks, epistemological perspectives, and

scientific methodologies. These approaches often aim for different scholarly objectives while focusing on distinct stakeholders (i.e. athletes, physicians, coaches; Thiel et al., 2015). Despite considerable advancements within these disciplines, gaps remain in understanding how the physiological, psychological, and sociological factors interact and influence each other in the context of physical health risk management. Existing research tends to examine these aspects separately rather than integrating them into a comprehensive theoretical framework. Additionally, the empirical exploration of biopsychosocial dimensions of physical health risk management remains incomplete, as it has yet to fully incorporate the individual athletes' perspective. Specifically, how sociocultural dynamics, individual perspectives, and subjective experiences amplify the occurrence of physical health risks and shape their individual management remains largely overlooked. Aiming for interdisciplinarity, scholars like Bekker and Clark (2016) advocate for approaches that emphasize the interplay and commonalities among diverse theories and factors, rejecting overly simplistic, and discipline-specific frameworks.

To address these gaps, this dissertation adopts an interdisciplinary approach to investigate how elite athletes individually manage physical health risks. By integrating theoretical and methodological frameworks from medicine, psychology, and sociology, this research aims to comprehensively capture the complex interdependencies that shape athletes' individual physical health risk management. For this purpose, five interrelated studies were conducted, employing interdisciplinary approaches and methodologies, examining various facets of physical health risk management in elite sport.

## **1.2 Structure of the Dissertation**

Within Chapter 2, I review the current state of research on physical health risk management in elite sport, focusing on contributions from three distinct disciplines: sports medicine,

sports psychology, and sports sociology. This exploration begins by assessing the risk-related theories, conceptualizations, methods, and limitations of each field. Sport medicine, with its phenomenon-oriented approach, focuses on the physiological dimensions of risks. Sport psychology expands this focus with an individual-oriented perspective, examining cognitive and emotional factors in relation to physical health risk management. Finally, sports sociology, grounded in a sociocultural orientation, takes the broadest perspective by investigating societal norms, structural pressures, and institutional expectations toward risk-taking. At the end of this chapter, I discuss first attempts of multidisciplinary and interdisciplinary frameworks that seek to connect these domains. Through this process, I illustrate key research gaps, emphasizing the need for a more comprehensive approach to understanding and managing physical health risks in elite athletes.

In Chapter 3, I develop the theoretical perspective that underpins this dissertation. Building on the interdisciplinary opportunities identified in Chapter 2, I construct a theoretical framework for individual physical health risk management that aims to bridge disciplinary boundaries. Constructivism serves as a guiding lens, recognizing the individuality and contextual specificity inherent in how athletes experience and respond to physical health risks. This theoretical orientation informs the development of a comprehensive conceptualization of individual physical health risk management, integrating medical, psychological, and sociological considerations. By grounding this conceptualization in research desiderata and early interdisciplinary attempts, I establish a framework that captures the complex interplay of factors shaping individual physical health risk management in elite sport.

In Chapter 4, I draw preliminary conclusions from the theoretical and empirical insights developed in the earlier chapters. These conclusions inform the articulation of overarching empirical research questions that structure the core of this dissertation. The

questions address key gaps identified in the literature, focusing on advancing empirical understanding based on previous theoretical and methodological approaches. The five papers presented in the subsequent chapter are designed to address these questions, contributing to a nuanced understanding of physical health risk management.

In Chapter 5, I present the full texts of five papers that form the core of this dissertation. Each paper examines specific aspects of physical health risk management, offering theoretical, methodological, and empirical insights.

Finally, in Chapter 6, I synthesize the key findings from the five papers and discuss their implications within this dissertation's conceptualization of individual physical health risk management. By integrating these insights, I demonstrate how they advance the understanding of individual physical health risk management in elite sport and provide recommendations for future research and practical application. This final chapter underscores the value of the interdisciplinary approach and its potential to have an influence on how physical health risks are managed in elite sports settings.

## **2. Previous Research on Physical Health Risk Management in Elite Sport**

Understanding how elite athletes manage physical health risks requires a comprehensive synthesis of previous research on physical health risk management in elite sport, synthesizing theoretical frameworks, methodological approaches, and empirical insights from multiple disciplines. Given the multifaceted nature of physical health risk management, perspectives from sports medicine, sports sociology, and sports psychology are essential, as they collectively address the physiological, sociocultural and psychological dimensions of managing physical health risks in elite sport. For a rigorous and holistic synthesis of previous research, I follow the principles of the Integrated Model of Interdisciplinary Research Process (Repko & Szostak, 2020) by first collecting multidisciplinary knowledge before engaging in interdisciplinary synthesis.

Because sport medicine, sport psychology, and sport sociology employ distinct paradigms and methodologies, they have made significant contributions to understanding aspects of physical health risks in elite sport from their respective perspective on the phenomenon. As research specifically addressing (individual) physical health risk management remains relatively scarce, this chapter also incorporates findings from related fields, such as injury management, pain management, and broader health management, to provide a more comprehensive and nuanced understanding of the topic.

This chapter also reviews first attempts of multi- and interdisciplinary approaches, such as and psychosocial frameworks, which aim to integrate physiological, psychological, and social dimensions of risk, health, and injury. While these approaches have significantly advanced the field, they also reveal challenges in achieving true interdisciplinary integration. The limitations of these frameworks, particularly in addressing the interplay between subjective experiences, cultural norms, and systemic factors, are critically discussed.

## **2.1 Research on Physical Health Risk in Elite Sport: Medicine, Psychology, Sociology**

Elite athletes navigate a complex landscape of physical health risks shaped by the physiological demands of their sport, the sociocultural expectations of their environments, and their own experiences and psychological dispositions. Physiological and structural demands potentially exceed athletes' physical resources, exposing them to physical health risks (cf. Soligard et al., 2016). Additionally, pre-existing health events such as injuries, pain, overexertion, or illness constitute risks for more severe injuries or the development of chronic conditions if not properly addressed. Understanding how physical health risks are managed requires considering both the physiological aspects and the broader psychological and sociocultural influences that shape athlete's cognitions and behaviors. Since physical health risks emerge at the intersection of biological, psychological, and sociocultural factors, an interdisciplinary approach is essential. By integrating perspectives that capture these interconnections, a more comprehensive understanding of how athletes navigate and manage physical health risks can be achieved.

Traditionally, physical health risk-research was mainly conducted within the multidisciplinary field of sport injury and pain research (cf. Brewer, 2020), which has been predominantly shaped by three core disciplines: sport medicine, sport sociology, and sport psychology. While these fields offer distinct perspectives, the disciplinary boundaries are not sharp, rather, they increasingly integrate aspects of theory and methods from other disciplines into their framework. However, sports medicine adopts a primarily nomothetic approach by identifying generalizable risk factors for injuries, focusing on objective and measurable variables such as biomechanics, training loads, and physiological markers that increase the likelihood of injuries. This approach aims to establish universal principles for injury prevention and management across athletic populations. Sport psychology initially aligned closely with sport medicine, adopting biomedical perspectives to study how

cognitive and emotional factors influence injury risk and recovery. Over time, psychologically grounded research has expanded its scope by incorporating insights from sociology, investigating how sociocultural influences shape individuality and risk management in athletes. As a result, sports psychology integrates both nomothetic elements, and idiographic elements (cf. Dunn, 1994). It seeks to identify generalizable psychological risk factors for injuries, such as personality traits, cognitive patterns, and emotional responses, while also recognizing that broader sociocultural influences shape an athlete's individual and subjective experience of physical health risks. Finally, sports sociology takes a more idiographic perspective, exploring the relational and cultural dimensions of risk-taking, and framing individual pain tolerance, and injury management within sociocultural contexts. By examining how collective norms, values, and power dynamics within the sport system influence athletes' behaviors and decisions, sociological perspectives highlight the structural pressures that shape physical health risk management in elite sport.

This chapter is organized into three sections. The first explores how each discipline conceptualizes and addresses physical health risks, starting with the medicalized focus on physiological mechanisms, followed by psychological insights into individual risk behaviors, and concluding with sociological research on cultural and relational dimensions. The second section reviews the evolution of biopsychosocial and psychosocial frameworks, evaluating their strengths and weaknesses. The final section examines the chances and challenges of interdisciplinary research in creating a more holistic understanding of physical health risk management in elite sport.

### **2.1.1 Sports medical perspective**

Sport medicine research investigates risks as inherent aspects of elite sports, arising from physical preconditions and the intense continuous physiological and structural demands

placed on athletes' bodies. Understanding physical health risks and addressing them systematically is a central focus of sports medicine and sport injury research (Brewer, 2020; Fredericson et al., 2021). This section examines the conceptualization of physical health risks within sport medicine research, focusing on how risks are defined and operationalized within models of sport injury prediction. By exploring current methodologies and frameworks, this section provides an overview of physical health risk management research in sports medicine research.

#### *2.1.1.1 Conceptualization of physical health risk within sport medicine research*

In sports medicine research, physical health risks are conceptualized as potential threats to an athlete's physiological and functional integrity (Mathisen et al., 2023). These risks arise when external demands - such as intense training, competition, or environmental conditions - and internal factors - like predispositions, injuries or fatigue - exceed the body's capacity to adapt, cope, or recover (Chen et al., 2019). Certain periods of fluctuating physical demands, such as preseason training, managing injury and pain, and tight schedules are particularly 'high-risk' phases (Jones et al., 2017; Theisen et al., 2014). Abrupt changes in workload or environmental stressors during these phases significantly increase the likelihood of injury or illness, as well as decreased performance or missing games, if not carefully monitored (Jones et al., 2017).

Sport medicine identifies physical health risks as the result of an interaction between intrinsic factors (e.g., biomechanics, predispositions, prior injuries) and extrinsic factors (e.g., training intensity, playing surfaces, protective equipment, substance use) which together contribute to an athletes' vulnerability to pain, injury or other health complications (Bahr & Holme, 2003; Hopkins et al., 2007). The field is driven by a preventive focus,

aiming to identify and manage these risk factors to reduce the occurrence of adverse health events at both individual and collective levels (Tipton, 1997).

Among the primary concerns in sport medicine research on physical health risks are sport injuries, as they represent a major threat to the health and functionality of elite athletes (Theisen et al., 2014). Additionally, injuries not only pose immediate health concerns but also constitute a risk for future and more severe injuries, potentially leading to chronic conditions and prolonged recovery times. The way sport injuries are typically defined, as either “any physical complaint sustained”, the “need for medical attention”, or the inability “to take full part in future [...] training or match” (Fuller et al., 2006, p. 84) shapes how physical health risks are conceptualized in according research. Depending on which definition is used in research and practice, different factors may emerge as particularly relevant for identifying injury risk factors, designing prevention strategies, or determining appropriate medical interventions. Moreover, injuries are further categorized into acute injuries, resulting from sudden events (e.g., sprains, fractures; Finch & Cook, 2014) and overuse injuries, which develop gradually due to repetitive stress (e.g., tendonitis, stress fractures; Neil et al., 2018; Roos & Marshall, 2014). Distinguishing between these injury types is essential for further conceptualization of distinct risk constellations in sports medicine (Bahr & Holme, 2003; Igolnikov et al., 2018).

Beyond injuries, pain is increasingly recognized as a critical element of physical health risk conceptualization in sports medicine. While pain is often directly associated with injury (Igolnikov et al., 2018), it is also understood as an independent risk phenomenon. Defined as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage” (Raja et al., 2020, p. 1972), pain is acknowledged as a subjective experience that may be present independently of physical damage. This challenges nomothetic medical paradigms that prioritize objective measures.

The conceptual overlap between pain and injury suggests that both phenomena share common risk factors (Igolnikov et al., 2018). In some cases, pain itself may serve as a risk precursor to injury by influencing movement patterns, biomechanics, and decision-making (Chaari et al., 2022; Schneider et al., 2019). The recognition of pain as a distinct yet interconnected risk phenomenon highlights its importance in sport medicine research and practice, particularly in understanding its role in injury prevention, athlete monitoring, and rehabilitation strategies.

One particularly complex dimension of pain within the conceptualization of physical health risks is the use of analgesics. Commonly employed to manage pain, analgesics present a paradox within sport medicine: While analgesics help athletes to maintain performance by reducing pain-related impairments, they also introduce additional risks (Pedersen et al., 2022). By temporarily suppressing pain signals, analgesics can obscure warning signs of underlying physiological stress, such as muscle strain or joint inflammation, which might otherwise prompt necessary rest and recovery (Warden, 2009). This disruption of the body's natural feedback mechanisms challenges traditional approaches to risk assessment, which often rely on the early detection of symptoms to prevent more severe injuries. Moreover, analgesics themselves constitute a risk factor, as their prolonged use is associated with adverse effects such as gastrointestinal distress and cardiovascular issues (Anderson, 2008; Pedersen et al., 2022). This dual role of analgesics, both mitigating and potentially exacerbating health risks, demonstrates the need for sport medicine research to go beyond identifying direct injury mechanisms and also explore how athletes' responses to pain, and risk factors influence their overall health risk exposure (Holgado et al., 2018; Lundberg & Howatson, 2018).

In summary, physical health risks in sports medicine are conceptualized as potential threats to an athlete's physiological and functional integrity, arising when external or internal

demands exceed the body's adaptive capacity. Building on this conceptual foundation, sports medicine research on physical health risk management employs diverse theoretical frameworks and methodological approaches to identify, evaluate, and mitigate risk factors with a strong emphasis on injury and pain prevention.

#### *2.1.1.2 Sport medicine research on physical health risk management in elite sport: Theories and methodologies*

This section explores the theoretical frameworks and methodologies that underpin research on physical health risk management in sports medicine. Sport medicine research aims to systematically identify, evaluate, and mitigate risk factors to prevent injury and pain and maintain athletes' functionality, both on individual and collective levels (Bahr & Holme, 2003). From a sport medicine perspective, risk is conceptualized as the probability of sustaining an injury or experiencing a health impairment due to factors on intrinsic or extrinsic dimension (Bahr & Holme, 2003; Meeuwisse, 1994). A significant portion of this research is grounded in epidemiological approaches, including cross-sectional, longitudinal studies, prospective cohort designs, and case-control studies, which help to identify associations between risk factors and injury occurrence (e.g., van Mechelen et al., 1992). These methods are sometimes complemented by biomechanical analyses, which assess movement patterns and tissue stresses to understand the mechanisms underlying injuries (McIntosh & McCrory, 2005). Additionally, self-report questionnaires and athlete monitoring tools are increasingly utilized to collect data on workload and fatigue, key predictors of injuries (Halson, 2014). Together, these methodologies establish a robust foundation for analyzing and managing the complex interplay of risk factors for injuries in sport.

Meeuwisse's Multifactorial Model of Athletic Injury Etiology (1994) serves as a foundational framework in sport medicine. It conceptualizes injury risk as a chain of events influenced by predisposing intrinsic factors (i.e., physical attributes, medical history) and extrinsic factors (i.e., environmental conditions, equipment). The model aids in identifying potential risk factors but also guides risk mitigation strategies by informing preventive training programs and injury management protocols. The generalization of identified factors is often achieved through meta-analyses and injury surveillance systems, which track and analyze injury patterns across sports and populations (Junge et al., 2004). For example, video analyses of inciting events have been used to identify biomechanical risk factors, such as joint angles and landing mechanics, that contribute to specific injuries like anterior cruciate ligament tears (Hewett et al., 2010).

Meeuwisse et al. (2007) later expanded this model into a dynamic, recursive model of etiology by incorporating a temporal dimension. This extension recognizes that previous exposure to risk influences future predispositions and susceptibility, emphasizing the need for continuous risk monitoring and adaptive management strategies. Retrospective injury reports (Clarsen et al., 2013) and longitudinal cohort studies (Bittencourt et al., 2016) have been instrumental in assessing this model, as they track athletes' physical, psychological, and behavioral changes over time to evaluate how repeated exposures shape future injury risk. Additionally, predictive analytics, often leveraging machine learning algorithms, are increasingly employed to model the dynamic interactions between variables that influence injury risk (Leckey et al., 2024). By identifying individual risk profiles based on these patterns, such models contribute to more targeted injury prevention strategies and risk mitigation approaches, forming the basis for individualized risk management.

Building on Meeuwisse's foundational models (1994; 2007), explanatory frameworks and models have been introduced to account for contextual factors in risk management, such

as external pressures and timing within a season or career (Fuller & Drawer, 2004; Fuller, 2007). Fuller and Drawer (2004) developed a risk management framework for sport that consists of several key components: risk assessment, risk estimation, risk evaluation, risk mitigation, acceptable levels of risk, and risk communication. They emphasized that while risk assessment helps to identify potential hazards, effective risk management requires proactive mitigation strategies, such as modifying equipment, enforcing safety standards, and educating athletes and stakeholders on risk perception and behavioral responses. Their framework also highlights the interplay between objective and perceived risk, acknowledging that athletes may accept or downplay certain risks. Research applying these frameworks often uses mixed-method approaches, combining quantitative injury data from surveillance systems with qualitative insights from interviews, thereby capturing nuances like coach expectations or team dynamics (cf. Bahr et al., 2018; Bolling et al., 2020)

Shrier's (2015) Strategic Assessment of Risk and Risk Tolerance (StARRT) framework further refines physical health risk management by incorporating multiple dimensions into a decision-making process for risk management. It emphasizes the importance of including objective health risks (i.e., measurable symptoms or medical tests), sport-specific risk aspects (i.e., ability to protect the damaged tissue), and risk tolerance factors (i.e., subjective pressures or ability to mask injury with analgesics) in risk assessment. In research, the StARRT framework is applied through methods such as clinical evaluations, stress testing, and self-report instruments to quantify subjective risk tolerance (Shrier, 2015).

Despite recognizing the subjectivity in risk tolerance (Shrier, 2015), sports medicine research remains largely grounded in positivist, empiricist and reductionist epistemologies. These approaches prioritize the measurement of objective and quantifiable variables, focusing on biomechanical, physiological, and diagnostic data to investigate injury

mechanisms, pain, and risk factors. By seeking to establish generalizable patterns, this research often emphasizes measurable variables at the expense of contextual and subjective influences.

In summary, the primary goal of theoretical frameworks and methodologies in sport medicine is to systematically identify, assess and manage risk factors (Bahr & Holme, 2003). By leveraging data-driven prevention programs (Theisen et al., 2014; van Mechelen et al., 1992), personalized monitoring systems (Halson, 2014), and dynamic injury management strategies (Fuller & Drawer, 2004), researchers and practitioners aim to minimize injuries and optimize recovery. This focus provides standardized insights into injury prevention and risk management, enabling researchers and practitioners to develop evidence-based strategies to reduce injuries and improve recovery outcomes, reflecting a commitment to generalizability and reproducibility.

### **2.1.2 Sport psychological perspective**

While sports medicine provides a physiological and biomechanical perspective on risk factors and risk management, sport psychological research extends this understanding by focusing on the cognitive, emotional, and behavioral dimensions of risk perception and response. Psychological research on physical health risks and risk management in elite sports has evolved significantly, moving from early positivist approaches to more nuanced and multidisciplinary perspectives. Early studies aligned closely with sport medicine conceptualizations, such as those by Coddington and Troxell (1980) who adopted a positivist framework, aiming to establish generalizable patterns by collecting objective data on injury risk factors, including mental factors, behaviors, and external contributing factors (Lavallée & Flint, 1996). These studies took a nomothetic approach, examining quantifiable

psychological predictors (i.e. stress levels) and their correlation with injury incidence (Hanson et al., 1992).

Building on this foundation, early pragmatic frameworks, such as Andersen and Williams (1988) Stress-Injury Model, maintained close alignment with sport medicine by focusing on applied prevention strategies. This model emphasized how psychological stressors, and individual characteristics interact to influence injury vulnerability, reinforcing a positivist framing of risk. It also paved the way for practical interventions to mitigate risks.

Over time, critiques of these models led to an expansion of epistemological orientations within sport psychology. Researchers increasingly recognized the limitations of a purely nomothetic approach and began incorporating constructivist and idiographic perspectives to better account for athletes' subjective experiences and the social contexts shaping injury perception and recovery. This shift distinguished sport psychology from both sport medicine and sport sociology in their focus and scope. While sport medicine treats risk as a biological phenomenon, emphasizing physiological and biomechanical factors in injury risk and recovery, sport psychology examines how cognitive, emotional and behavioral processes influence athlete's perception and response to these risks. In contrast to sport sociology, which explores how social norms, institutional structures and power relations shape risk-taking behaviors, sport psychology focuses on how athletes internalize, interpret, and emotionally respond to these influences (cf. Cardoso-Marinho et al., 2022; Ronkainen & Ryba, 2017). Rather than analyzing risk as a purely socially embedded practice, sport psychology investigates how individual meaning-making and psychological adaptation processes shape cognitive and behavioral responses to physical health risks.

Despite this epistemological diversification of sport psychology, positivist approaches remain dominant, particularly in research aimed at injury prevention and risk reduction through structured interventions. Studies continue to focus on quantifiable factors

and measurable strategies to mitigate injury risk. For example, Ivarsson et al. (2017) explored psychological predictors of injury, emphasizing measurable interventions such as resilience training and mental preparation programs to reduce stress and improve coping mechanisms. Similarly, Gledhill et al. (2018), investigated how risk, injury, and pain can be mitigated through the application of psychological insights into practical interventions, underscoring the continued importance of objective methodologies in this domain.

In contrast, constructivist perspectives emphasize the subjective nature of injury and health risk management. These approaches explore how athletes perceive and interpret risk, injury, and pain within their unique social and cultural contexts. For instance, Cardoso-Marinho et al. (2022) examined how individual athletes construct meaning around their experiences of pain and recovery, illustrating the role of cultural norms and personal narratives in shaping these perceptions. Such research challenges the idea of injury as a purely biological phenomenon, emphasizing instead its socially constructed and personally interpreted dimensions.

This epistemological diversification within sport psychology reflects a broader understanding of health risk management in elite sports, moving beyond a singular, objective focus to incorporate multifaceted and subjective dimensions. This progression has enriched sport psychology, enabling more comprehensive and nuanced approaches to understanding injury risk and developing interventions that consider both measurable factors and individual experiences.

#### *2.1.2.1 Conceptualization of physical health risks in elite sport from a psychological perspective*

Psychological research on physical health risks in elite sport has evolved significantly in its conceptualization and understanding of these risks. Traditionally, sport psychological

oriented research was closely aligned with sport medicine and framed physical health risks objectively by focusing on acute injuries caused by sudden, dramatic events as the primary consequence of physical health risks (cf. Tranaeus et al., 2024; Williams & Andersen, 1998). However, over time, psychological research broadened its focus, increasingly recognizing overuse injuries, arising from repetitive stress, inadequate recovery, or undiagnosed symptoms of pain and illness, as significant risks affecting athletes' physical health, mental state, and performance (Tranaeus et al., 2022). Despite that many researchers in this area have a sports medicine background, their research focus extends beyond physiological mechanisms, incorporating the psychology of injury or psychosocial risk factors and mental aspects of injury prevention and rehabilitation (e.g., Ivarsson et al., 2017; Ivarsson et al., 2013; Johnson & Ivarsson, 2011; Tranaeus et al., 2024). This shift does not replace traditional perspectives but instead reflects a more nuanced and comprehensive understanding of how psychological factors interact with physiological and behavioral elements in injury risk.

Early psychological studies primarily adopted a nomothetic, sport medical framing, conceptualizing physical health risks as objective factors that increase the likelihood of injury (Ivarsson et al., 2014; Johnson & Ivarsson, 2011; Lavallée & Flint, 1996). Research within this perspective focused on identifying and mitigating risk factors, with initial emphasis on physiological and biomechanical variables before expanding to psychological dimensions. Negative mood and anxiety emerged as significant predictors of injury risk (Galambos et al., 2005; Ivarsson et al., 2013; Lavallée & Flint, 1996), while personality traits such as perfectionism and dispositional optimism were linked to heightened injury susceptibility (Madigan et al., 2018; Wadey et al., 2013). Moreover, psychosocial stress, including high levels of life stress, negative life events, and daily hassles, has been consistently associated with increased injury rates (Johnson & Ivarsson, 2011; Van

Mechelen et al., 1996). These findings highlight the nomothetic nature of early psychological research, which sought to establish patterns of injury vulnerability by identifying psychological risk factors across athletic populations.

In recent years, research grounded in constructivist principles has gained momentum, offering new perspectives on how physical health risks are understood and contextualized in elite sport. This idiographic approach does not dismiss earlier models but rather reframes physical health risks as dynamic and context dependent rather than fixed and purely objective phenomena. Even while idiographic approaches sometimes utilize sport sociological concepts, they remain centered on the athletes' cognitive, emotional, and behavioral processes that construct their experiences and personal narratives. For example, Everard et al. (2021) explore physical health risks through the lens of narrative meaning-making, demonstrating how athletes' personal stories about their injuries reveal individualized perceptions of vulnerability, resilience, and recovery. By examining how athletes interpret their experiences, this work positions risk as a subjective construction influenced by the context, emotions, and personal history.

The growing body of constructivist research within sport psychology challenges traditional positivist frameworks by questioning the assumption that physical health risks are purely objective and static. Instead, it emphasizes the dynamic, subjective dimensions of risk, offering a context-sensitive understanding of how athletes navigate the complexities of risk in their social and cultural environments integrating cognitive, emotional, and social influences while maintaining an athlete-centered perspective.

### *2.1.2.2 Psychological research on physical health risk management in elite sport: Theories and methodologies*

Psychological theories provide essential insights into the factors contributing to injury risk in elite sports and approaches to their management. Over time, research has increasingly emphasized the role of psychological processes and individual traits, enriching the understanding of how athletes perceive and respond to risks associated with physical health. Several key theories have emerged, offering distinct yet complementary perspectives on the psychological antecedents of injury risk.

The Revised Stress and Injury Model by Williams and Andersen (1998) has become a cornerstone in the psychological research on injury and risk. This model posits that stress responses play a central role in injury occurrence. High levels of stress can lead to physiological changes, such as increased muscular tension, and attentional disruptions, such as reduced focus on relevant cues, both of which elevate the likelihood of injury. Stress responses are further influenced by moderating factors, including personality traits, coping resources, and levels of social support. Empirical studies have repeatedly validated the model's assumptions (Ivarsson et al., 2017). For instance by showing that athletes experiencing higher levels of life stress are more susceptible to injury, particularly when combined with low coping resources or minimal social support (e.g., Fisher et al., 2020; Williams, 1996).

Methods within the framework often include self-report measures, validated questionnaires, and longitudinal designs, which track athletes over time to establish causal relationships between stress and injury (e.g., Ivarsson et al., 2013). While these methods aim to measure stress through standardized tools, it is important to acknowledge that these measurements are inherently based on athletes' subjective experiences of stress which can vary significantly, influenced by personal, social, and cultural factors.

Research has also investigated personality traits linked to risk-taking behavior, drawing on sociological concepts like the culture of risk (Frey, 1991; Nixon, 1993) while reframing them through an individualized lens. This approach integrates measurable personality traits with cultural heuristics to explain why some athletes are more likely to engage in risky behaviors and understand risk differently than others. Traits like willingness to take risks, athletic identity, or perfectionism have been shown to shape how athletes perceive and manage physical health risks. For example, Schnell et al. (2014) identified sport-specific risk acceptance as a key factor, demonstrating how some athletes rationalize physical and psychosocial risk-taking as a necessary trade-off for success. Athletic identity, the extent to which athletes define themselves through their athletic role, has also been extensively studied for its influence on risk-taking behaviors (Coker-Cranney et al., 2018; Steinfeldt & Steinfeldt, 2012). Athletes with strong athletic identity often prioritize performance over health, downplaying injuries or persisting despite pain to maintain their sense of self. Similarly, perfectionism, characterized by setting unrealistically high standards and a fear of failure, has been linked to increased injury and neglect of recovery protocols (Madigan et al., 2018; Mayer et al., 2018). Methodologically, research in this area often employs psychometric assessments through self-report tools like the Athletic Identity Measurement Scale (Brewer & Cornelius, 2001) and the Multidimensional Perfectionism Scale (Hewitt & Flett, 1996) to quantify these traits and their impact on risk behaviors. Complementary methods, including behavioral observations and thematic analyses, provide deeper insights into how athletes rationalize risk-taking within their personal and cultural narratives (Vergeer, 2006).

A parallel line of research has focused on subjective conceptualizations of physical health risk and physical health risk management, emphasizing how athletes perceive and respond to physical health risks such as injury and pain. The model of psychological

response to injury (Wiese-Bjornstal et al., 1998) expands the focus to how athletes interpret and react to pain and injuries, considering emotions, and factors like identity, career implications, and social support. Injuries are not conceptualized as physical events but are understood within the broader narratives athletes construct about their careers and identities (e.g., Putukian, 2016).

Accordingly, Deroche et al. (2012) emphasized that the athletes' subjective appraisal of health risks plays a crucial role in shaping their behavior and risk management strategies. This perspective gained further traction with the development of the Risk of Injury in Sport Scale (Kontos et al., 2000), which enabled sport psychology researchers to quantitatively examine athletes' attitudes, perceptions, and beliefs about injury risk and its contributing factors (cf. Cardoso-Marinho et al., 2022). Studies employing this scale have explored athletes' perceptions of specific risk factors, such as muscle strength or match intervals (e.g., Liporaci et al., 2022), their beliefs about whether and how injury risk can be mitigated (e.g., Dalen-Lorentsen et al., 2021), and their attitudes toward subjective exposure to injury risks (e.g., McKay et al., 2016).

Beyond these quantitative approaches, qualitative analyses have offered deeper insights into athletes' subjective experience of injury and risk. Drawing from sociological frameworks on cultural narratives and identity construction, Everard et al. (2021) found that cultural narratives surrounding resilience and toughness significantly influence how athletes perceive and manage injuries. These narratives often lead athletes to downplay risks or view injuries as inevitable, thereby reinforcing passive risk management strategies. In highlighting this, their study merges psychological insights on risk appraisal with sociological concepts of cultural influence, illustrating how psychological responses to injury are embedded within broader social contexts and institutional pressures. Qualitative methods help to capture this

depth and complexity of athletes' lived experiences and their responses to risk and injury (e.g., Fagher et al., 2016).

Building on this multidisciplinary perspective, Mayer et al. (2020a) further explored the intersection of psychological decision-making and sociocultural constraints in physical health risk management. Using a quasi-naturalistic scenario study of return-to-play decision-making in team sport athletes, they applied Risk Management Decision Theory (Huber, 2012), to examine how athletes actively negotiate physical health risks. Their study integrates psychological theories of risk management with sociological insights into social pressure and medicalized performance environments, demonstrating how athletes employ risk-defusing operators (RDOs), such as playing with reduced intensity or using painkillers, to justify medically risky decisions like competing despite injury. These strategies are often influenced not only by individual cognitive processes but also by social pressures and the perceived consequences of withdrawing from competition, highlighting the interplay between sociocultural influences and active risk management (Mayer et al., 2020a).

Methodologically, the integration of quantitative and qualitative approaches has proven invaluable in the field of sport psychology, particularly as it increasingly incorporates sociological concepts into risk perception and management. While quantitative tools like surveys and prospective studies provide broad, generalizable insights, qualitative methods such as interviews and narrative analyses offer depth and context, capturing the nuances of individual experiences. Together, these methodologies enable a comprehensive psychological examination of how athletes perceive, interpret, and manage physical health risks in elite sport.

### 2.1.3 Sport sociological perspective

Expanding beyond psychological and biomedical perspectives, sport sociology examines how cultural norms, social and economic pressures, and institutional structures influence athletes' engagement with physical health risks. While sport medicine conceptualizes risk as a biological phenomenon, focusing on physiological and biomechanical factors, sport sociology contextualizes physical health risks within broader sociocultural structures that shape how risk is constructed and perceived, experienced, and managed by stakeholders within this culture. In contrast to sport psychology, which explores individual cognitive and emotional responses to risk, sport sociology situates these experiences within collective social frameworks, offering a more systemic understanding of how risk behaviors are shaped, reinforced, and sustained within elite sport.

The normalization and trivialization of physical health risks and risk-taking in elite sport has been a consistent focus in sociological research for over three decades. Foundational studies by Frey (1991), Curry (1993), Nixon (1993), and Young (1993) laid the groundwork for understanding how cultural and relational frameworks in elite sport sustain risky behaviors over time. Sociological research has predominately examined sociocultural dynamics behind behavioral phenomena related to physical health risk management, such as playing hurt (Mayer & Thiel, 2018; Roderick et al., 2000) or analgesic use (Overbye, 2021). These behaviors are not seen as isolated decision but as manifestations of deeper cultural values (Hughes & Coakley, 1991), relational dynamics (Nixon, 1992) and power structures (Malcolm, 2006; Schubring & Thiel, 2014) that shape athletes' willingness to engage in these risky behaviors.

This chapter explores how sociological research conceptualizes the complex interplay between economic, social, and physical dimensions of risk in elite sport. Grounded in epistemological perspectives such as postmodernism, critical theory, and interpretivism, this

field challenges nomothetic conceptualizations of risk, health, and injury as fixed, objective, or purely subjective categories. Instead, it investigates how these concepts are socially and culturally constructed, shaped by the norms, values and power dynamics of elite sport.

Sociological inquiry emphasizes the ways in which risk, health, and injury are perceived and interpreted by various stakeholders (i.e., athletes, coaches, medical professionals) within the context of elite sport.

### *2.1.3.1 Conceptualization of physical health risks in elite sport from a sociological perspective*

From a sport sociological perspective, risk is neither an objective, purely biological phenomenon nor a purely subjective concept but rather a socially constructed reality that is shaped by institutional structures, cultural norms, and power relations within elite sport (Frey, 1991; Nixon, 1993). Accordingly, physical health risks are conceptualized to emerge at the intersection of individual interpretations, the experience of physiological symptoms or diagnoses, the cultural framing of medical phenomena, and the structural pressures inherent in elite sport environments. Rather than viewing physical health risks as solely physiological measures, this perspective emphasizes how social structures (Nixon, 1992), power relations (Malcolm, 2006), and cultural norms (Hughes & Coakley, 1991) shape athletes' cognitions and behaviors regarding risks.

At the intersection of sport psychology and sociology, Barker-Ruchti et al. (2019) expanded the conceptualization of risk by incorporating socio-narratological methods to examine how athletes construct personal narratives about injury and risk within their broader cultural and institutional contexts. While their approach retains an individual focus on meaning-making processes, it is deeply embedded in a sociological conceptualization, as it illustrates how social expectations, career pressures, and systemic influences shape athletes'

understanding of and responses to injury and physical health risks (Barker-Ruchti et al., 2019). Building upon this sociological perspective, it becomes clear that the conceptualization of physical health risks extends beyond the personal and physiological dimensions. Rather, social and economic factors are integral components of how risk is understood and experienced in the context of elite sport. These factors interact with athletes' physical health and influence their behavior, often in ways that reflect broader cultural and institutional pressures.

First, economic factors such as contractual uncertainties and career instability are increasingly recognized as key contributors to physical health risk in sociological research. Roderick's studies (2006a, 2006b) illustrate how professional soccer players are often forced to navigate precarious career conditions marked by short-term contracts, financial insecurity, and the constant threat of career termination. These economic pressures create a context in which athletes may feel compelled to prioritize performance over their health in order to secure their professional future. Thus, economic instability is not just a separate issue but a central factor that significantly impacts the ways in which athletes assess and engage with physical health risks (Theberge, 2008).

In parallel, sociological studies highlight the importance of social risks, such as the fear of social exclusion, stigmatization, and career interruptions, which are directly linked to the management of physical health risks in elite sport (Frey, 1991; Lavallée & Flint, 1996; Wylleman & Lavallee, 2004). These social pressures are often intertwined with the physical risks athletes face, as concerns about maintaining team selection, social belonging, and public reputation can lead athletes to suppress injuries or overtrain to meet expectations (Roderick, 2006a). Conversely, sustaining an injury can trigger significant social risks, such as exclusion from the team, loss of contracts, or the looming threat of career-ending consequences (Roderick, 2006b; Thiel et al., 2015). From a sociological perspective, these

social and economic dimensions are not merely background factors but are central to the conceptualization of physical health risks in elite sport. They shape athletes' decisions, behaviors, and ultimately their risk management strategies.

This sociological perspective underscores that physical health risks in elite sport are not isolated medical or psychological concerns but are embedded within cultural expectations, institutional structures, and economic pressures that shape athletes' experiences of risk. By recognizing how these risks are socially constructed and maintained, sport sociology offers a critical lens to analyze the mechanisms that normalize, reinforce, and regulate risk-taking behaviors in elite sport environments. Building on this conceptual foundation, the following chapter explores the theoretical frameworks and methodological approaches employed in sport sociological research on physical health risks, further investigating how these risk dynamics are studied and analyzed within the discipline.

#### *2.1.2.2. Sport sociological research on physical health risk management in elite sport: Theories and methodologies*

Central to sociological investigations of health and risk management in elite sports is the concept of a culture of risk (Frey, 1991; Nixon, 1993). The culture of risk describes a collective ethos in which risks, particularly pain, injury, and physical harm, are normalized as necessary sacrifices for athletic success and managed in accordance with this ethos. Within this culture, enduring pain and injuries, and accepting physical health risks are valorized as hallmarks of commitment, and professionalism (Theberge, 2008). Sociologists argue that this perspective on physical health risks often drives athletes to adopt behaviors and collective cognitions that prioritize performance over personal health (Hughes & Coakley, 1991).

While introducing the culture of risk, Frey (1991) and Nixon (1993) drew on fundamentals of social network theory (cf. Wellman & Berkowitz, 1988) and figurational

sociology (Elias, 1978) to analyze how athletes, coaches, and other stakeholders collectively shape and sustain this culture. Social network theory highlights the relational dynamics that normalize risk-taking behaviors, while figural sociology contextualizes these actions within broader social structures. A central feature of this culture is the valorization of toughness, resilience, and perseverance, which are upheld as core values within competitive sport (Howe, 2001; Nixon, 1993; Roderick et al., 2000). The maintenance of these values leads to the reframing of pain and injury. Instead of being treated as warnings of harm, they become markers of commitment and dedication to both the athletes and the sport itself (Joncheray et al., 2022; Theberge, 2008). This symbolic association reinforces the idea that enduring pain and taking risks are not just necessary but also honorable and expected (Mayer et al., 2018; Theberge, 2008). Sociological research further argues that this value system is not only internalized at the individual level but is also institutionalized within the medical system (Safai, 2003; Waddington, 2000) and sporting organizations. This institutionalization is reinforced by broader societal admiration for athletic achievement, which celebrates perseverance and risk-taking in elite sport (Sanderson et al., 2016).

Hughes and Coakley's (1991) concept of *overconformity* to the sport ethic provides a key framework for understanding how athletes are socialized into risk acceptance and risk-taking behaviors. According to this perspective, athletes internalize the expectation that sacrificing personal well-being for performance is necessary, leading to normalized engagement in risk behaviors. Related sociological concepts, such as *hyperinclusion* (cf. Emrich et al., 2013; Schmidt & Göbel, 1998; Thiel et al., 2018a), describe how athletes become deeply embedded within the elite sports system. As their identity becomes almost exclusively tied to their athletic role, the pressure to maintain performance may lead to risk behaviors while reducing opportunities for diversification or exit from the system (Thiel et al., 2018a). In the research context of doping, Bette et al. (2002) describe this dynamic as a

biographical trap, where the pursuit of elite performance creates a narrow life trajectory, amplifying the interplay between economic, social, and physical risks. This framing emphasizes the understanding in sport sociology that physical health risks do not exist in isolation but are interwoven with the broader context of elite sports.

Against the backdrop of theoretical concepts like the culture of risk, overconformity and hyperinclusion, sociological research has explored various risk behaviors that athletes engage in to navigate the tension between performance pressures, social expectations, and their physical and mental health. One prominent behavior is 'playing hurt', a term coined by Nixon (1993) to describe athletes' behavior to train or compete despite injuries. Rather than actively managing risk in a protective sense, this behavior represents a form of risk rationalization, where athletes choose to expose themselves to potential further harm. Playing hurt is often framed as a necessary sacrifice to meet professional obligations, sustain team membership, and maintain social functionality within competitive sport (Mayer et al., 2020b; Roderick et al., 2000). This behavior is reinforced by external pressures from coaches, teammates, and institutional expectations, which normalize perseverance through pain (Nixon, 1992; Roderick, 2006a).

Closely linked to playing hurt is the sociological conceptualization of analgesics use to manage pain and sustain performance. Studies including Mayer et al. (2018) and Overbye (2021) have highlighted how athletes normalize the use of painkillers, viewing them as essential tools for playing hurt, pushing through injuries, and meeting competitive demands. Beyond pain management using analgesics, sociological research has also investigated other risk behaviors such as disordered eating (Papathomas, 2018; Theberge, 2008), injury mismanagement (Law & Bloyce, 2019; Murphy & Waddington, 2007), and doping (Bette, 2008; Pitsch et al., 2007). From a sociological perspective, these behaviors exemplify the

complex interplay between cultural norms, relational dynamics, and structural pressures that shape physical health risk management in elite sport.

Sport sociological research on risks employs a range of methodologies to explore how physical health risks are experienced and managed within elite sports. Ethnography, qualitative interviews, and network analysis are prominent tools used for investigating the intricate dynamics of risk-taking and physical health management behaviors in sport. While quantitative methods are also used, the focus is often on self-reports, which provide insights into athletes' subjective perceptions, attitudes, and behaviors. Aligned with constructivist principles (cf. Schwandt, 1994), sociological research often adopts critical theory (cf. Safai, 2003), or interpretivist (cf. Roderick, 2006a) epistemologies to examine athletes' experiences but also the broader social and institutional structures that shape risk practices in elite sport. These perspectives investigate how medical professionals, coaches, and organizational systems contribute to and manage physical health risks, highlighting the interplay between individual agency and structural constraints (Malcolm, 2006; Mayer et al., 2020b; Safai, 2003)

Ethnography serves as a cornerstone method, allowing researchers to immerse themselves in athletes' daily lives and uncover how risk is normalized and perpetuated within elite sports' contexts. For example, Howe's (2001) ethnographic study of professional rugby, illustrated how athletes internalize pain and injury as routine aspects of their careers. Ethnographic approaches are particularly effective for exploring the embodied dimensions of risk management, revealing how cultural norms surrounding pain and performance are enacted in everyday practice (Howe, 2001; Nixon, 1993; Young, 2019).

Qualitative interviews provide another important methodological approach, offering a platform to examine the perspectives and experiences of athletes, coaches, and other stakeholders on physical health risks (Schubring & Thiel, 2014). Semi-structured interviews,

such as those used in Nixon's (1993) work, explore how athletes' decisions to play through pain are shaped by their interactions within social networks, including coaches, teammates, and medical professionals. These interviews offer valuable insights into the dynamics of the culture of risk, revealing how shared expectations and norms are collectively constructed and maintained.

These methodologies illuminate how cultural, relational, and institutional factors intersect to normalize and perpetuate risk-taking behaviors. Through these approaches, sociological research advances understanding of the culture of risk in elite sport, providing a nuanced view of how athletes navigate the pressures of performance while managing physical health risks. This body of work underscores the importance of aligning methodological choices with sociological theories to unravel the complexities of risk management in elite sports environments (cf. Thiel et al., 2018b).

## **2.2 Multidisciplinary Research on Health, Injury, and Risk in Sport**

Initial efforts to integrate multiple research perspectives on physical health risks in elite sports primarily centered around psychosocial and biopsychosocial frameworks regarding injury and health. These approaches sought to move beyond isolated disciplinary perspectives, emphasizing the interplay of biological, psychological, and social dimensions in phenomena such as sports injuries and health. While psychosocial approaches emerged from psychological oriented research by incorporating social variables to better understand their role in health outcomes (e.g., Ivarsson et al., 2017), biopsychosocial approaches were rooted mainly in medical research, striving for a holistic understanding of health by uniting biological, psychological, and social perspectives (Engel, 1977).

Psychosocial approaches focus on the interaction between psychological and social factors in shaping injury risk or recovery. These approaches emphasize individual

characteristics, perceptions, and experiences while minimizing the relevance of physiological components. For instance, Ivarsson et al. (2014) investigated how life stress and stress responses predict injuries, highlighting psychological traits and coping mechanisms without directly assessing medical markers beyond physiological outcome of injury. Similarly, psychosocial research has provided rich insights into individual characteristics and subjective experiences through self-report measures, qualitative interviews, and observational data, (Forsdyke et al., 2016; Johnson, 2011). However, while psychosocial research contributes valuable knowledge about individual and social influences on health risk management, it often remains multidisciplinary, primarily employing psychological theories and methods instead of integrating the disciplines to develop a shared understanding that transcend individual disciplines.

Biopsychosocial models, and approaches to health (Thiel et al., 2015), sport injury (Brewer & Redmond, 2016), and sport injury risk (von Rosen et al., 2017) have gained prominence in elite sports research by integrating biological, psychological, and social dimensions. These models and approaches aim to offer a more comprehensive understanding of these complex phenomena. Building on Engel's (1977) foundational work, which argued that health cannot be fully explained by biological factors alone, biopsychosocial approaches emphasize the need to account for psychological states and social contexts to understand health outcomes holistically.

For example, injuries are conceptualized not merely as physical phenomena but as outcomes of stress responses, training regimens, and social contexts or pressures. Researchers employing this model often adopt mixed-method approaches, combining medical findings with self-reported measures to capture a multidimensional view of health phenomena (e.g., Elovainio et al., 2020; Von Rosen et al., 2018). This methodology often

aligns with a positivist focus on observable and measurable phenomena to identify patterns and causation within the elite sport system.

However, Thiel et al. (2015), revisited biopsychosocial approaches from an epistemological perspective, advocating for a constructivist biopsychosocial model, tailored to the unique challenges of elite sports. Their framework integrates three dimensions: the medical finding (diagnosed via natural scientific methods), the subjective condition (individual feelings and attitudes assessed through subjective reports), and social functioning (the subjective ability to fulfill roles within specific sociocultural contexts). Thiel et al. (2015) argue that integrating multiple research perspectives is challenging, due to “paradigmatic incommensurability” (Thiel et al., 2015, p. 242), the inability of different disciplines to align their fundamental assumptions. They also noted that the distinct subjects and objectives of medical, psychological, and sociological research further complicate interdisciplinary work. Despite these challenges, their model lays a foundation for future interdisciplinary research, emphasizing the need to analyze the “different dimensions of health, which have to be integrated on a transdisciplinary level” (Thiel et al., 2015, p. 242).

### **2.3 Interdisciplinary Research on Health and Injury in Sport**

Interdisciplinary research was defined “as a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession.” (Klein & Newell, 1997, p. 3). Unlike multidisciplinary research, which involves multiple disciplines working in parallel on the same problem or topic while maintaining their distinct perspectives, interdisciplinary research actively integrates insights across disciplines to construct a shared and more comprehensive understanding of a complex phenomenon (Van den Besselaar & Heimeriks, 2001). Scholars emphasize that this integrative process is particularly valuable in the domain of physical

health risk management, where injury risk and athlete health are shaped by interconnected physiological, psychological, and sociocultural factors (Hausken-Sutter et al., 2023; Repko & Szostak, 2020).

Interdisciplinary approaches have contributed valuable insights into injury prevention, risk assessment, and rehabilitation strategies (Fisher et al., 2020; Hausken-Sutter et al., 2021). By combining quantitative data on physical performance and health with qualitative insights into athletes' lived experiences, interdisciplinary researchers have developed more holistic models of injury risk and injury management (e.g., Hausken-Sutter et al., 2023). For example, interdisciplinary studies have enhanced injury prevention strategies by integrating biomechanical, psychological, and social aspects to identify not only physical risk factors but also mental and sociocultural drivers of stress and injury occurrence (Fisher et al., 2020). This research has also provided a deeper understanding of pain perception and injury recovery linking physiological healing processes with psychological and social factors in elite sport (cf. Hausken-Sutter et al., 2021). Moreover, athlete-centered rehabilitation approaches have been developed to account for both medical and psychosocial needs, improving long term health (cf. Ragin, 2024)

Despite these advancements, interdisciplinary research on physical health risk management remains limited, leaving critical gaps in understanding the interactions between physiological, psychological, and sociocultural dimensions of risk, health, and injury in elite sport. Building on early interdisciplinary frameworks for understanding sport injuries which were pioneered by Burwitz et al. (1994), more recent studies expanded this perspective, demonstrating the benefits of considering both objective health measures and athletes' subjective experiences (Fisher et al., 2020; Hausken-Sutter et al., 2023). However, challenges persist in effectively bridging the diverse perspectives brought by different disciplines.

One of the primary difficulties of interdisciplinary research is the divergence of paradigms and epistemologies across disciplines (cf. Thiel et al., 2015). Sports medicine, psychology, and sociology, for instance, employ distinct theoretical frameworks and methodologies, which can create barriers to integration. Bridging these paradigms requires researchers to foster mutual understanding and respect for differing approaches, theoretical frameworks and methodologies (Repko & Szostak, 2020). Additionally, the integration of qualitative and quantitative methods within a clear epistemological orientation poses conceptual and analytical challenges.

To address these issues, researchers such as Hausken-Sutter et al. (2023) emphasize the importance of mixed-method approaches. For instance, combining self-reported measures with physiological assessments and sociocultural analyses is thought to offer a more comprehensive understanding of injury risk and management. Such methodological pluralism is increasingly recognized as essential in advancing interdisciplinary research on health and injury in sport.

## **2.4 Research Gaps and Research Desiderata**

Research on physical health risk management in elite sports has made significant progress within the domains of sports medicine, sport sociology, and sport psychology, contributing to the development of first integrated models (Engel, 1977; Thiel et al., 2015) and interdisciplinary approaches (Hausken-Sutter et al., 2023; Ivarsson et al., 2017). However, as Brewer (2020) note, despite promising advancements, the field remains predominantly multidisciplinary and has “not matured to the point it can be considered interdisciplinary” (p. 232).

This observation is particularly relevant to the study of physical health risk management in elite sport, as the complexity of injury risk and health behaviors cannot be

adequately understood through a single disciplinary lens. The interplay between physiological, psychological, and sociocultural factors demands a deeper level of theoretical and methodological integration to capture the interdependent nature of these influences. Current research often examines physiological, psychological, and sociocultural dimensions in isolation, failing to fully account for the complex interplay between these factors. To address these gaps, there is a need for pioneering interdisciplinary approaches that can synthesize and develop insights across disciplines, fostering a more holistic understanding of physical health risk behaviors in elite sports. In the following section, I elaborate on these research gaps and desiderata on a theoretical, methodological, and empirical level to outline specific areas where advancements are needed.

#### **2.4.1 Theoretical research gaps and research desiderata**

The study of physical health risk management in elite sports is hindered by persistent theoretical gaps that restrict a comprehensive understanding of individual risk management approaches. A significant issue is the fragmentation across disciplines, with sports medicine, sociology, and psychology often operating in isolation and pursuing distinct research objectives. Each field employs its own epistemological frameworks: sport medicine predominantly focuses on positivist, nomothetic approaches, identifying universal physiological and biological mechanisms; sociology emphasizes postmodernist and interpretivist perspectives to explore systemic and cultural dynamics; and psychology often adopts individualized orientation, balancing nomothetic inquiries into generalizable psychological traits and cognitions with idiographic explorations of subjective meaning making. This disciplinary divide limits the ability to develop a holistic theoretical model that integrates both nomothetic and idiographic principles to account for the complexity of physical health risk management in elite sport.

Although integrative frameworks, such as Engel's biopsychosocial model (1977), aim to unify these perspectives, they often disproportionately emphasize physiological mechanisms while treating psychological and social factors as secondary (e.g., von Rosen et al., 2017). Furthermore, environmental and sociocultural factors are frequently overlooked (Ragin, 2024) and only considered as add-ons (cf. Armstrong, 1987). Similarly, Thiel et al.'s (2015) constructivist biopsychosocial perspective offers an innovative attempt to integrate medical findings, subjective conditions, and social functioning. However, this model primarily operates at the epistemological level, acknowledging the challenges of uniting disciplinary perspectives but falling short of providing practical strategies for integrating methodologies or reconciling divergent research goals.

One major theoretical gap is the absence of a unified conceptualization of physical health risk management and its sub-facets. Current research frequently examines different aspects of physical health risks separately. Some studies focus on medicalized risk assessment (Shrier, 2015), while others investigate risk management including risk estimation, evaluation, and mitigation (Fuller & Drawer, 2004). Additionally, research has explored individual dimensions, such as risk perception (e.g., Schnell et al., 2014), risk evaluation (e.g., Mayer et al., 2020a), and risk behaviors (e.g., Overbye, 2021). However, these dimensions are rarely integrated into a cohesive framework. This fragmentation limits a holistic understanding of how athletes perceive, evaluate, and respond to physical health risks. Without integrating these dimensions into a cohesive framework, it becomes difficult to develop interdisciplinary approaches that accurately reflect the dynamic interactions between medical, psychological, and sociocultural influences. A more unified conceptualization would enable researchers to bridge disciplinary boundaries, creating more effective strategies for injury prevention and risk management in elite sport.

Another critical gap lies in the limited attention that previous theoretical frameworks have given to athletes' subjective perceptions of physical health risk. While psychological models, such as the Revised Stress and Injury Model (Williams & Andersen, 1998), explore how stress responses predict injury and physical health risks, they fail to account for how athletes interpret injury or manage physical health risks within broader social and cultural contexts. Conversely, sociological approaches, such as the culture of risk heuristic, emphasize systemic pressures (e.g., Roderick, 2006a), social networks (e.g., Nixon, 1992), and collective norms (e.g., Curry, 1993; Malcom, 2006) but lack integration with nomothetic psychological models or medical findings that focus on the identification of underlying patterns. This lack of integration prevents existing theoretical frameworks from adequately reflecting the interplay between objective measures and athletes' lived experiences.

Bridging these theoretical gaps requires interdisciplinary conceptualization underpinned by an epistemological orientation capable of uniting the diverse objectives of sport medicine, sociology, and psychology. Such an approach must balance the generalizable patterns of nomothetic health assessments (e.g., identifying risk factors) with idiographic perspectives. This approach should account for the subjective experiences of identified risk factors and medical diagnoses, while also incorporating sociocultural dimensions that acknowledge how institutional structures, social norms, and power relations shape both the perception and management of physical health risks in elite sport. Moreover, adopting innovative paradigms that reflect the multifaceted realities of risk in elite sport can offer more nuanced insights into the complexities of physical health risk behaviors. It is equally critical to integrate systemic, cultural, and individual perspectives, enabling a comprehensive understanding of the interplay between these dimensions in shaping risk assessment and risk behaviors. These theoretical limitations highlight the need for innovative methodological

approaches that can bridge disciplinary silos and capture the complexity of risk behaviors in elite sports.

#### **2.4.2 Methodological research gaps and research desiderata**

Methodological approaches to studying risk in elite sports exhibit significant limitations, particularly due to their strong alignment with discipline-specific epistemological orientations. This narrow focus restricts the ability to investigate athletes' lived experiences of relevant physical health risks or investigating sociological phenomena from more diverse perspectives.

A primary methodological challenge lies in the disciplinary divide in research methodologies. Sports medicine predominantly employs quantitative techniques, such as injury surveillance and biomechanical analysis and self-report measures (e.g., Meeuwisse, 1994; Soligard et al., 2016). Sociology, on the other hand, favors qualitative approaches like ethnographies or interviews (e.g., Roderick et al., 2000), while psychological research utilizes mostly surveys and self-reports (Schnell et al., 2014) or qualitative approaches (e.g., Putukian, 2016). This methodological fragmentation limits the development of interdisciplinary studies that integrate quantitative and qualitative data to capture the complexity of risk behaviors (Bekker et al., 2020).

Another critical gap is the lack of biographical or longitudinal designs. Much of the existing research provides cross-sectional snapshots of physical health risks or risk management, focusing on discrete *measurable* events such as injuries (Johnson & Ivarsson, 2011). However, biographical studies are essential to understanding how athletes' perceptions of physical health risks and their management develop and evolve over time, particularly as they navigate changing career stages and transitions (cf. John et al., 2024).

Furthermore, many studies fail to prioritize methodologies that emphasize athletes' personal narratives and subjective interpretations of physical health risks or injuries (Fuller et al., 2006). For instance, frameworks like the Model of Psychological Response to Injury (Wiese-Bjornstal et al., 1998) underscore the importance of subjective interpretations, yet much empirical research remains focused on objective measures. Conversely, sociological studies provide in-depth explorations of athletes' subjective experiences, examining how they internalize and navigate risks under systemic pressures and cultural expectations (Roderick et al., 2000; Theberge, 2008). However, these sociological approaches often exclude relevant assessments of generalizable patterns (i.e., epidemiological injury data), potentially limiting the ability to integrate subjective insights with physiological, injury, or risk-related data.

Finally, the adoption of innovative methodologies, such as mixed-methods approaches, remains rare. These approaches offer the potential to apply methods across disciplines, transforming the multidisciplinary field of physical health risk research into a more interdisciplinary framework. By enabling the simultaneous exploration of physiological, psychological, and sociological factors, these methodologies can yield nuanced insights into how these dimensions interact to shape athletes' risk management processes. Addressing these methodological gaps will require deliberate efforts to combine diverse data sources, utilize novel qualitative designs, and adopt emerging analytical tools to capture the multifaceted nature of physical health risk management in elite sports.

### **2.4.3 Empirical research gaps and research desiderata**

A significant empirical gap lies in the underexplored idiographic perspectives of athletes regarding physical health risks. Existing studies often rely on external observations, medical assessments, or quantitative survey, which fail to capture how athletes themselves make

sense of, navigate, and respond to physical health risks (Thiel et al., 2015). Empirical data on the personal and social contexts influencing athletes' subjective perspectives and interpretations of physical health risks remain sparse (e.g., Murray et al., 2022; Ronkainen & Ryba, 2017). This gap limits the ability to understand how subjective interpretations of physical health risks interact with sociocultural factors and medical assessments.

Another major gap in the current literature around physical health risks, particularly within sports medicine and psychology, lies in the predominant focus on injury, often ambiguously defined (cf. Fuller et al., 2006), as the primary outcome variable (Tranaeus et al., 2024). While injury risk remains a critical area of inquiry, this narrow focus neglects the broader dimensions of physical health risk management, such as dealing with pain, overuse syndromes, and chronic physiological consequences that extend beyond acute injury events. Addressing these broader dimensions is crucial for understanding how athletes manage various health risks across their careers.

Moreover, existing research often isolates physical health risks from their broader sociocultural contexts, despite evidence that institutional structures, career pressures, or identity foreclosure shape how athletes experience and manage physical health risks (Brewer & Petitpas, 2017; Roderick, 2006b). The predominant focus on observable injury outcomes not only overlooks these crucial determinants but also restricts the ability to develop a comprehensive and empirically grounded understanding of physical health risk management in elite sport. Empirical research has yet to systematically investigate the intersection of different types of risk determinants in elite sport. While sociological studies have illuminated the intricate relationships between physical, social, and economic risks (e.g., Roderick, 2006b), many psychological and medical studies fail to consider these dimensions. The failure to empirically examine these multifaceted landscapes prevents researchers from capturing the complex trade-offs athletes navigate in managing their

physical health. Addressing this gap requires research that systematically examines psychosocial determinants of physical health risks beyond injury, offering a more holistic perspective on risk management in elite sport.

Additionally, the empirical exploration of risk management and coping behaviors in response to physical health risks remains limited. Physical health risks are often equated solely with factors increasing injury risk, overshadowing other interconnected risk management strategies such as analgesic use (Overbye, 2021), playing hurt (Mayer et al., 2018; Roderick et al., 2000), disordered eating (Papathomas, 2018; Theberge, 2008), and doping (Bette, 2008; Pitsch et al., 2007). These behaviors not only stem from high physical demands but also perpetuate a cycle of risk, impacting athletes' physical and mental health in complex ways. While medical research often emphasizes the physiological implications of these behaviors, it often neglects their sociocultural context or psychological drivers. Similarly, psychological research frequently focuses on individual-level determinants and coping mechanisms in isolation (e.g., Schnell et al., 2014), overlooking the broader structural and cultural influences that shape decision-making. In contrast, sociological studies have revealed and discussed how a culture of risk normalizes risky behaviors, reinforcing the expectation that athletes must endure pain and take risks to succeed (e.g., Nixon, 1993; Overbye, 2021). However, empirical studies across all disciplines rarely synthesize their insights, leaving a fragmented understanding of how these behaviors emerge, persist, and interact.

Addressing these empirical gaps requires research that integrates risk perception, evaluation, and behaviors within a cohesive framework, emphasizing athletes' subjective experiences. Combining qualitative insights into athletes' lived experiences with quantitative data from self-reports and epidemiological measures of physical health risk management can provide a more nuanced understanding of how athletes perceive, evaluate, and respond to

physical health risks. To effectively bridge the divide between nomothetic and idiographic approaches, research must prioritize athletes' narratives but also contextualize them within broader patterns identified through quantitative analyses. By integrating individual meaning-making processes with generalizable findings, such research can illuminate both the personal and systemic factors that shape risk-related decision-making.

### **3. An Interdisciplinary Approach to Individual Physical Health Risk Management**

This work proposes an interdisciplinary research approach to studying athletes' individual physical health risk management in elite sport, integrating perspectives from sports medicine, psychology, and sociology. While each discipline provides valuable insights, their isolated approaches have hindered the development of a comprehensive understanding of how athletes manage physical health risks. Previous research has largely been multidisciplinary, addressing diverse research subjects (e.g., athletes, coaches, or medical professionals) and research objectives without achieving full integration. In contrast, the approach within this dissertation focuses on elite athletes as the primary subjects, providing a shared focal point that allows for the integration of individual experiences and the meanings athletes attribute to physical health risks. Athletes' experiences inherently involve physiological, psychological, and sociocultural dimensions, making them an ideal connecting research focus for interdisciplinary research. By examining how these dimensions interact within the experiences of athletes, this interdisciplinary approach enables a more comprehensive understanding of physical health risk management. Placing athletes at the center of the research facilitates interdisciplinary integration by offering a common ground where medical, psychological, and sociological insights intersect. It encourages collaboration and dialogue between disciplines, allowing them to move beyond parallel contributions and synthesize their perspectives. This synthesis is essential for developing a cohesive framework that accounts for the complex interplay of biological, cognitive, emotional, and sociocultural factors influencing athletes' risk perceptions and management strategies.

To achieve this, I propose an Interdisciplinary Framework for Individual Physical Health Risk Management (IPHRM), grounded in constructivism, which synthesizes key contributions from sports medicine, sports psychology, and sports sociology. This

framework provides a theoretical foundation for understanding individual physical health risk management as a multifaceted phenomenon shaped by individual, sociocultural, and medical dimensions. Drawing on the research concepts, epistemologies, risk conceptualizations, and methods reported for the three disciplines in Chapter 2, the framework integrates these perspectives to outline areas of overlap and opportunities for interdisciplinary collaboration.

To make this framework accessible, I present it in the form of a graphical heuristic (Figure 1), which visually represents the connections and interactions between the disciplinary contributions. The figure serves as a tool to illustrate the framework's components and their relationships, enabling readers to understand how this interdisciplinary approach provides a holistic perspective on individual physical health risk management.

Constructivism serves as the cohesive epistemological foundation for this interdisciplinary approach by facilitating the integration of previous multidisciplinary research to establish a unified perspective. It does so by recognizing knowledge not as objective or fixed but “as emergent, developmental, nonobjective, viable constructed explanations by humans engaged in meaning-making in cultural and social communities of discourse” (Fosnot, 2005, p. ix). This perspective allows for the combination of insights from sports medicine, psychology, and sociology as it acknowledges both individual meaning-making and the influence of broader social structures and cultural norms on these constructions of medical phenomenon. By conceptualizing individual physical health risk management as a phenomenon shaped by personal constructions of reality within sociocultural contexts, this framework accounts for the complex interplay between individual perceptions, social influences, and medical diagnoses. This approach avoids reducing risk management to either purely subjective experiences or objective medical facts,

thus maintaining the relevance of how social norms, institutional structures, and power dynamics shape individual constructions of risk.

The constructivist lens also addresses a key critique of interdisciplinary research, namely that disciplines “do not even share the same subjects and objects” (Thiel et al., 2015, p. 242). By uniting sports medicine’s focus on physiological health, sports psychology’s emphasis on cognitive and emotional experiences, and sports sociology’s examination of sociocultural contexts, this approach creates a shared epistemological ground. Elite athletes serve as the unifying subjects of study, with their lived experiences of physical health risk management providing a common research objective (cf. Schwandt, 1994). This integration enables disciplines to move beyond fragmented contributions and collaborate on a cohesive framework that captures the multifaceted nature of physical health risk management in elite sport.

The IPHRM framework aims to integrate diverse theories, methodologies, and frameworks to reflect the complexities of athletes’ experiences and enable a comprehensive conceptualization of physical health risk management. Grounded in constructivism, this work unites previously fragmented insights and demonstrates the potential of interdisciplinary research to offer a holistic understanding of how athletes individually manage physical health risks.

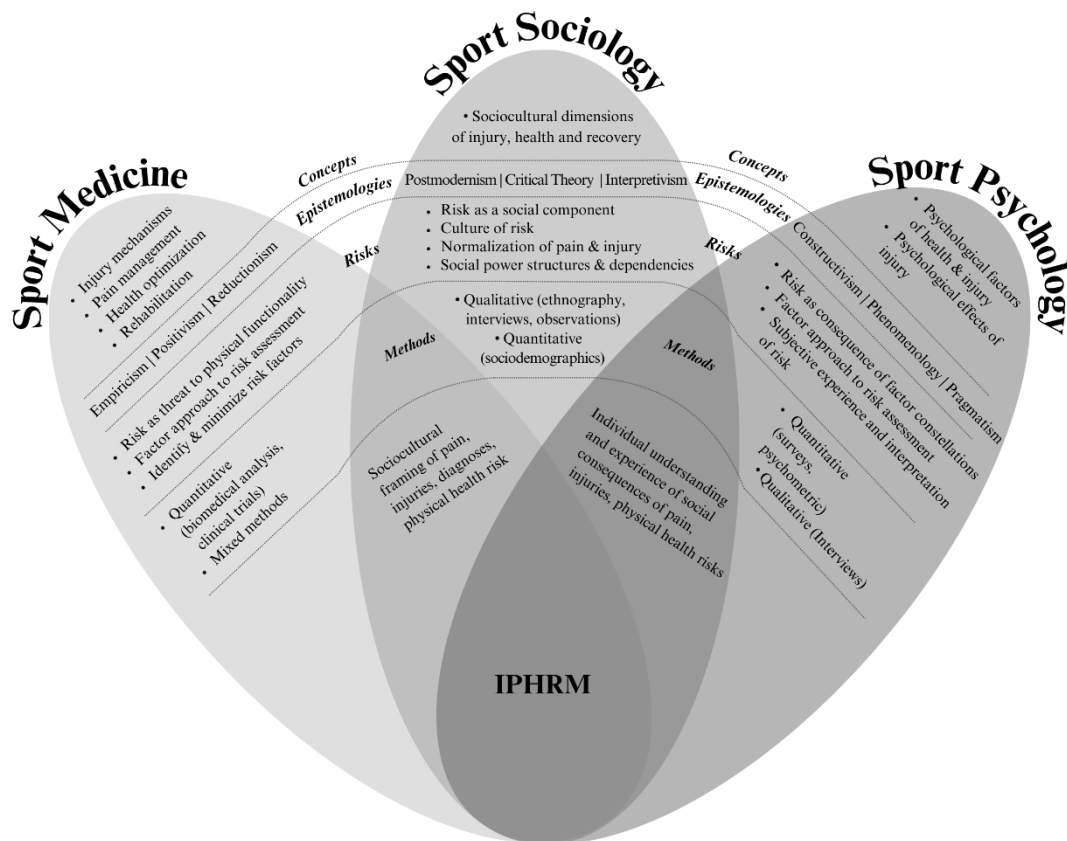


Figure 1: Interdisciplinary Framework for Individual Physical Health Risk Management (IPHRM)

### 3.1 Epistemological Considerations

The study of physical health risk management has predominantly been approached through discipline-specific efforts, with limited attempt to integrate perspectives from multiple fields. While research spans various disciplines, such as sports medicine, psychology, and sociology, these efforts have often remained siloed, reflecting the epistemological orientations unique to each field. To provide clarity and focus for this work, I adopt a constructivist orientation, emphasizing that knowledge about physical health risks is shaped by athletes' experiences, perceptions, and interactions with their sociocultural, and physical environment (cf. Fosnot, 2005). This approach can not only contribute to meaningful knowledge gains but also fosters a more holistic and interdisciplinary understanding of

physical health risk management by integrating theoretical, methodological, and empirical insights from previous research.

A constructivist paradigm provides a foundation for exploring how athletes interpret health events and physical health risks within specific sociocultural and personal contexts, and how these perceptions shape their behavior (cf. Schubring & Thiel, 2014). At its core, constructivism operates on the ontological assumption that reality is neither singular nor fixed, nor can it be objectively measured (Lincoln et al., 2011). Instead, constructivism asserts that multiple realities exist, actively created by individuals as they construct meaning and understanding through their unique contexts, experiences, knowledge, and beliefs (Lincoln et al., 2011; Mann & MacLeod, 2015). As von Glasersfeld (1992) explains, knowledge is not a direct reflection of objective reality but rather the product of cognitive processes that interpret and organize experiences. This perspective underscores that what is considered *real* or *true* is contingent upon individual or collective frameworks of understanding, rather than universal standards (cf. Lincoln et al., 2011).

The epistemological interest of constructivist research lies in investigating how these individually constructed realities emerge, evolve, and influence behavior (von Glasersfeld, 1992). It emphasizes the subjective interpretations that shape, and are shaped by, individuals' experiences, recognizing that knowledge is inherently contextual and relational (Baxter Magolda, 2004). By prioritizing the processes through which meaning is constructed, constructivism enables researchers to explore not only what individuals perceive but also how these perceptions arise and inform their responses (Pouliot, 2004). This theoretical lens highlights the dynamic interplay between individual cognition, sociocultural influences, and lived experiences.

Constructivism's emphasis on subjectivity and context provides a valuable framework for examining the patterns of individual physical health risk management by

recognizing that these patterns are shaped through personal experiences and sociocultural interactions. Using its core principles can help to develop an understanding of how athletes perceive, interpret, and respond to health risks within their unique contexts. A constructive perspective can bridge the gap between nomothetic approaches, using assessments that aim to identify generalizable patterns in athletes' construction of physical health risks, and idiographic perspectives, which investigate subjective experiences of health events (cf. Barta & Tennen, 2008; Dunn, 1994). By emphasizing the dynamic construction of meaning, this framework aims to go beyond idiographic approaches by situating individual experiences within broader social and cultural frameworks, thereby linking personal meaning-making to shared social realities.

Furthermore, constructivism enables the integration of interdisciplinary methodologies (Mann & MacLeod, 2015) by emphasizing the importance of context and the relational nature of knowledge construction. This perspective accommodates qualitative approaches from sociology and psychology, which are particularly effective in examining subjectivity in risk management, allowing for a deeper exploration of the personal experiences associated with seemingly objective physical health risks, such as medical diagnoses. These qualitative insights can be further complemented by quantitative tools (i.e. self-reports) to identify patterns in subjective experiences, behaviors and knowledge. The flexibility of constructivism in integrating diverse methodologies arises from its recognition that knowledge is constructed through multiple lenses, enabling the combination of different disciplinary insights without privileging one over the other (Mann & MacLeod, 2015)

Building on these epistemological considerations, the following chapters will demonstrate how a constructivist perspective on individual physical health risks and their management can integrate theories and empirical insights from sports medicine, sports psychology, and sports sociology. This interdisciplinary approach seeks to develop a person-

centered conceptualization of physical health risk management, highlighting how these disciplines collectively deepen our understanding of the ways in which athletes construct and navigate their individual realities regarding physical health risks.

### **3.2 Physical Health Risks from a Constructivist Perspective**

A constructivist perspective on physical health risks recognizes that while health events and associated risks are often diagnosed or observed through an nomothetic medical lens, their perception, experience, and management are fundamentally shaped by subjective interpretations and social contexts (cf. Thiel et al., 2015). The interplay between objective and subjective dimensions of physical health risks (cf. Hansson, 2010) underscores the complexity of researching and managing these risks in elite sports practice (Fuller, 2007).

From a medical standpoint, health events are typically understood as disruptions to the normal functioning of the body. Diagnoses and risk assessments are grounded in nomothetic principles, relying on objective criteria such as clinical measures, imaging (e.g., X-rays, MRIs), or standardized definitions of injury types (Fuller et al., 2006). These generalizable evaluations serve as the basis for interventions, focusing on recovery and return-to-play protocols. While the interdisciplinary constructivist approach I propose in this dissertation acknowledges the concept of *objective realities* and recognizes that some disciplines and epistemologies aim to identify them, it emphasizes the relevance of subjective dimensions; how athletes perceive, experience, and interpret physical health risks and medicalized concepts such as diagnoses and treatment protocols (cf. Cardoso-Marinho et al., 2022; Wiese-Bjornstal et al., 1998) aiming to integrate nomothetic and idiographic approaches (Barta & Tennen, 2008)

In the same vein, risk can be conceptualized through a dual lens (cf. Hansson, 2010). In medical and psychological terms, risk is often quantified as a probability, defined by the likelihood of adverse outcomes such as injury (cf. Lemmens et al., 2022). This perspective

focuses on measurable predictors, including stress responses, training loads, and physiological predispositions (Ivarsson et al., 2017). However, athletes' subjective interpretations of risk rarely align with pure rational calculations (Hansson, 2010). Instead, these interpretations are imbued with emotional and sociocultural significance, influenced by personal values, societal expectations, and immediate pressures (Deroche et al., 2012).

When confronted with physical health risks, athletes construct individual understandings of the tension between performance demands and health priorities. For some, physical health risks may be framed as inevitable sacrifices necessary for success, fostering a willingness to accept and even embrace risk taking (Mayer et al., 2018; Schnell et al., 2014). For others, physical health risks and potential consequences may represent existential threats that challenge their identities and aspirations, prompting more cautious or defensive behaviors (cf. Ronkainen & Ryba, 2017). These individual interpretations are further shaped by sociocultural influences, such as the normalization of pain and injury in elite sports (Joncheray et al., 2022). A culture that valorizes toughness and sacrifice (Nixon, 1993) often reframes physical health risks as obstacles to overcome rather than warning signs of harm. These dynamics highlight that physical health risks are not static or universally defined but are instead individually constructed concepts within specific social and cultural contexts.

Acknowledging the individuality and context dependency of physical health risk conceptualizations is essential for adopting a person-centered approach to physical health risks management. Viewing physical health risks as subjective interpretations of medical facts and probabilities highlights the importance of interdisciplinary approaches. The integration of medical, psychological, and sociocultural conceptualizations of physical health risks using a constructivist approach can be beneficial for bridging the gap between objective realities and subjective experiences.

### **3.3 Individual Physical Health Risk Management**

The subjective and context-dependent nature of physical health risks necessitates a holistic conceptualization of how these risks are managed by athletes in practice. Athletes continuously navigate tensions between medical guidelines, psychological coping mechanisms, and sociocultural dynamics in their decision-making regarding health risks (Madrigal et al., 2016; Malcolm, 2016; Schubring & Thiel, 2014). Building on the diverse conceptualizations of physical health risk management discussed in Chapter 2, I propose an integrated framework grounded in an athlete-centered constructivist orientation. This framework combines interdisciplinary insights to offer a cohesive understanding of individual physical health risk management, focusing on how athletes perceive physical health risks, evaluate their significance, and adopt behavioral strategies to cope with these risks. By emphasizing the dynamic interplay between perception, evaluation, and action, this approach offers a nuanced perspective on how athletes manage physical health risks while striving to minimize uncertainties and achieve their goals.

At the core of this interdisciplinary approach is a constructivist framework that centers on the individual athlete's subjectively constructed realities of physical health risks. This approach integrates sociological, psychological, and medical dimensions to prioritize athletes' lived experiences, their interpretation, and management strategies. A holistic perspective needs to address how individual athletes perceive, evaluate, and cope with physical health risks, including their risky behavior. By situating the individual athlete at the center of analysis, this framework conceptualizes physical health risk management as a deeply individual process shaped by cultural norms, psychological traits, and medical assessments.

Sport medicine provides a foundational dimension to understanding physical health risk management by addressing the tangible physical consequences of risk management

behaviors and the classification of risk factors and medical phenomena. Pain severity, injury diagnoses, and recovery times, typically regarded as generalizable and objective medical concepts (cf. Igoznikov et al., 2018), directly shape athletes' subjective experiences of physical health risks. These medical phenomena (i.e. diagnoses) are subjectively interpreted through an athlete's personal lens, influenced by their context, knowledge, and experiences. For instance, the perception of pain or the evaluation of an injury is not solely determined by the medical diagnosis but is also influenced by the athlete's understanding of their condition and the circumstances surrounding it. When integrated into an athlete-centered approach, medical insights become part of a broader understanding of how athletes navigate physical health challenges.

Complementing the medical perspective, sport psychology emphasizes the individual differences in physical health risk management. Psychological research explores how personal traits, such as perfectionism, athletic identity, or coping mechanisms, mediate athletes' response to both medical realities and sociocultural influences (cf. Schnell et al., 2014). These individual characteristics shape how athletes internalize risk and influence their cognitions and behavior when managing physical health risks.

The psychological perspective highlights the subjective nature of risk management, showing how athletes' attitudes, traits, and prior experiences contribute to their personal construction of risk within the cultural framework. By focusing on these individual constructions, psychological research not only explains variability among athletes but also identifies recurring patterns in how they perceive, evaluate, and manage physical health risks.

Finally, sport sociology provides a crucial lens for understanding the broader cultural and societal influences that shape how athletes engage with physical health risks. The heuristic of the "culture of risk" in elite sports, introduced by Nixon (1992, 1994), provides a

foundational framework for understanding how physical health risks are experienced and managed in high-performance environments. This framework highlights how elite sports cultures valorize toughness, resilience, and sacrifice, framing physical health risks as integral and often admirable aspects of athletic success (e.g., Madrigal et al., 2016; Theberge, 2008). Athletes internalize these cultural values and norms through socialization and interactions with coaches, teammates, medical professionals, and the broader sports community. As a result, behaviors such as playing hurt (e.g., Roderick et al., 2000), overtraining (e.g., Theberge, 2008), and using painkillers (e.g., Overbye, 2021) are normalized and even celebrated, despite their potential to exacerbate injuries or cause long-term health consequences (cf. Tranaeus et al., 2022). While this sociological perspective provides critical insights into the cultural factors shaping athletes' engagement with physical health risks, it does not fully account for individual variability in how athletes perceive and respond to such risks. Integrating this perspective into an athlete-centered framework brings individual interpretations and risk management to the forefront.

By synthesizing these medical, psychological, and social dimensions, the interdisciplinary constructivist framework achieves a holistic perspective on individual physical health risk management. This approach captures the complexity of how athletes subjectively construct, perceive, evaluate, and manage physical health risks while acknowledging the sociocultural influences and objective medical realities they face. It moves beyond disciplinary silos, offering a cohesive understanding that bridges cultural norms, psychological traits, and medical assessments.

This interdisciplinary constructivist framework provides a comprehensive lens through which to understand the nuanced ways athletes manage physical health risks in elite sport. It emphasizes the importance of integrating athletes' subjective experiences with objective medical realities, grounded in the cultural context of elite sport. In the following

chapters, I will elaborate on this athlete-centered understanding of physical health risk management by exploring its core facets: risk perception, risk evaluation, and behavioral coping. Drawing on research from sport sociology, sport psychology, and sport medicine, this interdisciplinary approach aims to achieve a holistic understanding of how athletes manage physical health risks in elite sport.

### **3.3.1 Risk perception: Subjective perceptions of medical phenomena**

Athletes routinely face situations that can be considered as significant physical health risks, potentially disrupting their athletic careers and prompting individual risk management (Nixon, 1992; Wiese-Bjornstal, 2010). In sports medicine practice and research, the occurrence of these events is often linked to extrinsic or intrinsic risk factors (cf. Bahr & Holme, 2003), emphasizing their physiological and tangible nature (Malcolm, 2016; Thiel et al., 2015). For example, injuries are typically framed as medical conditions requiring specific treatments or management strategies (Fredericson et al., 2021). While this medical framing provides critical insights into the physiological dimensions of risk, it frequently overshadows the psychological and sociological aspects that influence how athletes subjectively perceive physical health risks (Mayer et al., 2020b; Schnell et al., 2014; Thiel et al., 2015).

The Interdisciplinary Framework for Individual Physical Health Risk Management proposed in this dissertation underscores that integrating medical, psychological, and sociological perspectives is essential for understanding athletes' individual perception of physical health risks in elite sports. Medical evaluations and quantitative psychological studies (e.g., Forsdyke et al., 2016) provide objective insights into injury risks and their potential outcomes. In contrast, qualitative psychological studies (e.g., Everard et al., 2021), quantitative self-reports (Schnell et al., 2014), and sociological investigations (e.g., McNarry

et al., 2020) explore how and why these risks are perceived and acted upon (Boholm & Corvellec, 2011). A comprehensive understanding of risk perception must account for these subjective dimensions, recognizing that athletes' decisions are shaped by their unique interpretations of medical phenomena, which are, in turn, influenced by personal experiences (Thiel et al., 2015).

Physical health risk perception can be contextualized as a context-dependent process shaped by athletes' subjective awareness and the sociocultural environments in which they operate. Athletes' perception of physical health risks are tied to their priorities and values, which are critical for understanding subsequent behavioral risk management strategies (Wiese-Bjornstal, 2010). For instance, athletes often perceive that certain physical sensations are 'normal' within the situational contexts of elite sports (Theberge, 2008). This perception is influenced by social norms and expectations, which shape athletes' awareness of either sport-specific or health-related priorities.

The Relational Theory of Risk proposed by Boholm and Corvellec (2011) provides a valuable framework for understanding in which risk-situations individuals perceive risk. On the basis of this theory, it can be assumed that athletes perceive physical health risks when a risk object (e.g., an injury or pain) appears to threaten an object at risk (e.g., physical health or career progression). For a risk to be perceived, the relationship between the risk object and the object at risk must be viewed as causal, contingent, and undesirable. Thus, young athletes may more often disregard medically apparent relationships between physical sensations like pain or exertion and physical health, even when these connections are medically apparent. Their focus remains on immediate performance, rendering them less receptive to health risk connections. However, as athletes gain experience over the course of their careers, their perceptions of risk might evolve. While some experienced athletes may become more aware of risk-consequence relationships and increasingly receptive to potential

long-term health implications (Schnell et al., 2014), others may find themselves in a biographical trap, where the pressures of maintaining their identity make it more difficult to be receptive of those risks (Bette et al., 2002). This evolution in risk perception reflects its dynamic and situational nature (cf. Hughes & Coakley, 1991), wherein athletes' evaluation and awareness of what is at risk, whether health, career, or social status, adapt in response to changing life stages, priorities and experiences.

In conclusion, a comprehensive understanding of risk perception in elite sports requires moving beyond a nomothetic perspective to incorporate idiographic approaches that account for individual subjectivity. While medical evaluations provide critical insights into the objective probabilities and consequences of health risks, subjective investigations reveal how athletes perceive these risks within their specific contexts (cf. Boholm & Corvellec, 2011; Thiel et al., 2015). Integrating these perspectives enables a more holistic understanding of how athletes perceive physical health risks.

### **3.3.2 Risk evaluation: Subjective interpretations and evaluations**

Risk evaluation is the critical step that follows risk perception, serving as the foundation for subsequent behavioral coping strategies. Like risk perception, athletes' risk evaluation is often influenced by medical frameworks in both research and practice (e.g., Creighton et al., 2010; Fuller, 2018). These frameworks often provide a generalized perspective on injury severity and treatment options. However, they seldomly account for the psychological and social dimensions that shape how athletes' individual differences and subjective experiences influence their evaluations of risk (Liporaci et al., 2022; Schnell et al., 2014). Physical health risks are rarely neutral events, rather, they are embedded within athlete's subjective judgment about their potential consequences. While risk perception involves recognizing the present risks, risk evaluation is the process of assessing their severity and implications based

on two key dimensions: the perceived likelihood of the risk occurrence and the degree of its undesirability (cf. Boholm & Corvellec, 2011). Psychological and sociological approaches emphasize the subjective nature of this risk evaluation process (cf. Kontos, 2004)

From a constructivist perspective, athletes in elite sports do not merely perceive risks, they actively evaluate their magnitude and relevance within specific contexts. This evaluative process is often shaped by medical diagnoses and how these are communicated (Malcolm, 2006; Safai, 2003). However, evaluations remains profoundly subjective, shaped by individual experiences with previous health risks, career goals, and the broader sociocultural environment (Mayer et al., 2020b; Nixon, 1992) as well as individual traits and dominant coping strategies (Schnell et al., 2014). For example, an athlete might perceive a minor injury as negligible if its likelihood of escalation appears low and its impact on their career appears as insignificant. Conversely, an injury with a high perceived probability of developing into a chronic condition may be evaluated as highly undesirable, particularly if it threatens long-term career prospects.

The sociocultural environment of elite sports plays a critical role in shaping risk evaluations. Cultural norms that glorify toughness and resilience often frame these attributes as essential to athletic success (Joncheray et al., 2022; Overbye, 2021). Such norms can lead athletes to minimize the perceived severity of certain health risks in the evaluation process (cf. Schnell et al., 2014). Contextual factors, such as the timing of an injury within the season, the stakes of a competition, and dynamics within a team, also affect how athletes evaluate the undesirability of physical health risks (Hammond et al., 2014; Madrigal et al., 2015). For instance, an athlete may downplay certain pain signals during a championship game but take the same pain more seriously during off-season recovery periods.

Subjective evaluations are further shaped by the meanings athletes assign to physical health risks. Pain and injuries are not merely biomedical events but carry personal

significance that evolves depending on individual circumstances, career stage, and sociocultural influences. While some athletes may perceive injuries as career-threatening, others may view them as opportunities for growth or as an inherent aspect of their sport (Howe, 2001; Howells et al., 2017; John et al., 2019). Likewise, pain is not always regarded as negative. In certain contexts, it has been found to be perceived as a sign of progress, particularly when associated with successful training sessions or attributed to physical development success (Howe, 2003; McNarry et al., 2020). However, these interpretations are fluid, shaped by personal experiences, social interactions, and external pressures.

Risk evaluation served as the bridge between risk perception and the subsequent development of coping strategies. It is not sufficient to investigate whether athletes recognize risks; it is essential to explore how they evaluate the likelihood and undesirability of these risks. Without this evaluative step, the understanding of how athletes manage physical health risks remains incomplete.

### **3.3.3 Individual coping with physical health risks**

The evaluation of risks is a critical precursor to the stage of individual coping with physical health risks, where athletes translate the result of their evaluations into tangible behaviors (cf. Mayer et al., 2020a). These behavioral coping strategies, whether aligning with or resisting the norms of elite sport (Schubring & Thiel, 2014), often prioritize mitigating immediate uncertainties or threats to athletes' careers, even when such actions may carry significant long-term health consequences (Mayer & Thiel, 2018; Roderick et al., 2000). A range of risky behaviors has been identified as mechanisms for managing physical health risks, maintaining social integration, and securing sporting success. These behaviors include disordered eating to meet weight-related performance demands (Papathomas, 2018; Theberge, 2008), injury mismanagement due to performance pressures (Law & Bloyce,

2019; Murphy & Waddington, 2007) and doping as a complex and ethically fraught form of performance enhancement (Bette, 2008; Pitsch et al., 2007). While these behaviors demonstrate the broader spectrum of risk-related behaviors in sports, this dissertation focuses on two key behaviors that directly relate to the management of physical health risks: *playing hurt* and the *use of analgesics*.

Both playing hurt and analgesic use exemplify how athletes navigate the tension between performance demands and their physical health (Mayer et al., 2018; Overbye, 2021). Understanding these behavioral coping strategies requires analyzing both individual decision-making processes of athletes and the broader cultural and structural factors that shape these behaviors. Rather than viewing risk-related decisions as reactive or purely instinctual, they can be understood as structured processes, in which internal priorities (e.g., performance goals, pain tolerance) interact with external factors (e.g., social expectations, competitive stakes). This section aims to illuminate these dynamics by exploring why athletes engage in behavioral coping strategies and the dynamics underlying these behaviors.

To understand how athletes potentially arrive at risk-related coping behaviors, it is useful to consider both sport-specific and general risk management theories. A sport-specific framework is provided by Mayer et al. (2020b), who developed the Process-structure Model of Competing Hurt Decision-Making to explain why and how athletes engage in playing hurt following a multifaceted decision making process. Their model highlights interrelated factors, including the nature of the health event (i.e. severity of pain), how it is communicated by medical professionals, the athlete's individual priorities (i.e., performance goals), and social expectations placed on them by coaches, teammates, and other stakeholders. These components align with the broader conceptualization of behavioral coping as an outcome of context-dependent individual evaluations of physical health risks within the proposed framework of individual physical health risk management. By

emphasizing the interaction between the characteristics of the health-event, the context in which it occurs, and personal factors, the Process-structure Model of Competing Hurt Decision-Making provides a foundation for understanding behavioral coping in response to physical health risks in elite sport (Mayer et al., 2020b).

While Mayer et al.'s model (2020a) explains sport-specific decision-making, more focused theories of risk management offer additional perspectives on how individuals actively regulate the perceived risk across different contexts. Huber's (2012) Theory of Active Risk Management provides such a perspective, explaining how individuals enhance their perceived control over risk situations through searching for Risk Diffusion Operators (RDOs), strategies that involve additional actions or cognitive adjustments to reduce perceived risk. These RDOs enable individuals to rationalize and pursue what they perceive as the most promising course of action.

Mayer et al. (2020a) extended this theory to sports, illustrating how athletes employ individual risk management strategies by searching for RDOs to mitigate the perceived risks. These RDOs can constitute preventive strategies (e.g., additional warm-up routines) to minimize the likelihood of further harm or compensatory strategies (e.g., play with reduced intensity) to make a risky alternative, such as playing hurt, more acceptable. In decision-making, athletes may attempt to manage both sporting consequences (e.g., losing a game, losing the sport on the first team) and medical consequences (e.g., exacerbating an injury) to maintain a sense of control over the situation.

If an athlete perceives the risk of losing their spot on the team (sporting consequence) as high or the risk of exacerbating an injury (medical consequence) as low, they may rationalize playing hurt with analgesic use. Conversely, if the risk of losing the game (sporting consequence) is low and the risk of long-term damage (medical consequence) appears high, they may prioritize withdrawal from competition to recover. This process

highlights how athletes focus on maintaining perceived control rather than engage in objective probability assessment when deciding on coping in response to physical health risks. However, while RDOs can help justify a decision, they do not inherently alter the objective risk, as the actual probability of worsening the injury may remain unchanged (Huber, 2007; Mayer et al., 2020a).

Empirical research across sport sociology, psychology, and medicine highlights specific factors that influence athletes' decision-making process and coping behaviors in response to physical health risks. To fully understand these behaviors, it is essential to examine both the subjective reasons for engaging in risky behaviors and the medical and contextual factors shaping their decisions. This includes analyzing their experiences before, during, and after engaging in risky behaviors.

The following sections explore two key behavioral coping strategies that are particularly relevant to the management of physical health risks in elite sport: (1) Playing hurt, competing despite pain, illness, or injury and (2) analgesic use, utilizing medication to facilitate continued participation. These behaviors exemplify how athletes navigate the tension between performance expectations and health considerations, often prioritizing immediate sporting demands over long-term health outcomes. By analyzing these behaviors within the interdisciplinary framework presented in this dissertation, the next sections provide a deeper insight into how these risk-related coping strategies emerge, persist, and are experienced by elite athletes.

#### *3.3.3.1 Coping through health risk behaviors: Playing hurt*

Playing hurt, which is defined as continuing to compete or practice despite injuries, pain, or illness, is a widespread behavior among elite athletes (Mayer et al., 2018; Roderick et al., 2000). Athletes often perceive playing hurt as the most promising option within their

situational and social contexts. While this strategy may address immediate concerns, such as meeting performance expectations or maintaining social roles (Curry, 1993), it entails significant long-term health risks including severe injuries, prolonged recovery, and chronic health consequences (DiFiori et al., 2014). Despite these tangible medical risks, athletes exhibit a high willingness to play hurt (Mayer et al., 2018), justifying their decisions through reframed evaluations of medical consequences and perceived social obligations (Mayer et al., 2020a; Roderick, 2006a).

Playing hurt is an individual coping strategy that is deeply embedded in cultural values of elite sport where resilience and the ability to endure physical adversity are celebrated as markers of athletic excellence (Nixon, 1993). Social interactions and experiences within the “sportsnets” (Nixon, 1993, p. 190) significantly shape how athletes behaviorally manage physical health risks (Mayer et al., 2020b), creating a normative framework that normalizes and even valorizes playing hurt. Hughes and Coakley (1991) describe behaviors as “positive deviance” (Hughes & Coakley, 1991, p. 307) where athletes manage physical health risks by overconforming to the norms of the elite sport culture. In doing so, they perceive physical health risk-taking as essential for achieving athletic success and maintaining their social role (Hughes & Coakley, 1991; Schnell et al., 2014). Through a process of socialization, athletes internalize social expectations, which then shape their risk evaluation and coping in response to physical health risks (Bette et al., 2002). The concept of *hyperinclusion* highlights how elite sports dominates an athlete’s life, prioritizing sport performance above all else (cf. Schmidt & Göbel, 1998). This immersion can lead to what Bette et al. (2002) describe as a *biographical trap*, in which athletes feel unable to reverse their commitment despite the inherent uncertainties and physical health risks. By aligning their behaviors with internalized and external expectations, athletes reinforce the belief that

taking physical health risks is integral to their identity and success in elite sport (Barrette & Harman, 2019; Coker-Cranney et al., 2018; Kabiri et al., 2021a).

Psychological research complements this sociological understanding of playing hurt by examining how individual traits, and emotions shape athlete's attitudes towards playing hurt (Madrigal et al., 2016; Schnell et al., 2014). For example, athletes' perfectionistic performance expectations, or a strong athletic self-identification can amplify the self-expectation to conform with the sociocultural norms (Brewer & Petitpas, 2017; Schnell et al., 2014). Additionally, emotions such as fear of losing status or experiencing guilt over letting down teammates further motivate athletes to endure pain and play hurt (Kabiri et al., 2021b).

These medical, psychological, and sociological perspectives collectively provide valuable insights into how athletes evaluate physical health risks and why athletes manage these risks by playing hurt. The proposed framework (Figure 1) visually represents the intersection of these perspectives. By integrating insights from sports sociology, psychology, and medicine, this interdisciplinary framework facilitates a more comprehensive analysis of the multifaceted influences that contribute to the persistence of playing hurt in elite sports.

### *3.2.3.2 Coping through health risk behavior: Analgesic use*

The widespread use of analgesics in elite sports (Harle et al., 2018; Pedersen et al., 2022) exemplifies a strategy which is deeply intertwined with the practice of playing hurt.

Analgesics seem to serve as a critical mechanism for managing physical health risks, enabling athletes to compete despite pain or injury (Harle et al., 2018; Overbye, 2021). Like playing hurt, analgesic use is deeply embedded in the sociocultural norms of elite sports, where resilience and sacrifice are celebrated as markers of professionalism and commitment (Overbye, 2021). Athletes often perceive the use of analgesics as essential to fulfilling their roles and meeting performance demands within the team (cf. Mayer et al., 2018). However,

while playing hurt reflects an athlete's willingness to endure discomfort to meet performance expectations (Nixon, 1993; Roderick et al., 2000), analgesic use introduces a medicalized dimension to this coping behavior by actively mitigating pain and enabling pain-reduced participation even in the face of physical impairments.

Sociological and psychological dimensions of analgesic use strongly overlap with those of playing hurt. Both behaviors are shaped by cultural narratives that normalize risk-taking and prioritize performance over health. Athletes internalize these norms, often rationalizing analgesic use as a necessary tool to meet social and competitive expectations (Overbye, 2021). Medical staff sometimes unintentionally reinforce this behavior by framing analgesics as acceptable solutions for sustaining performance (cf. Malcolm, 2006; Safai, 2003). This medical framing lends analgesics an added legitimacy, distinguishing them from playing hurt. Psychological traits, such as perfectionism and strong athletic identity, further amplify athletes' willingness to rely on analgesics to sustain performance and avoid perceived failures (Coker-Cranney et al., 2018; Madigan et al., 2018). Emotional factors, including fear of losing status or guilt over letting down teammates, also motivate this behavior (Overbye, 2021; Roderick, 2006a)

What distinguishes analgesic use as a unique coping strategy is its medical implications. From a medical perspective, analgesics are primarily framed as therapeutic tools for treating symptoms and aiding recovery (Holgado et al., 2018; Mottram & Mottram, 2010). However, their use in elite sports often shifts toward masking pain and discomfort during practice and competitions, which allows to sustain performance under demanding conditions (Fernando et al., 2017; Warden, 2009). This shift creates a gray area between legitimate pain management and the masking of injury severity, making it difficult for athletes to accurately assess their physical condition (Lundberg & Howatson, 2018; Mayer & Thiel, 2018; Tricker, 2000). While analgesics can alleviate immediate pain, their use

introduces significant health risks, including gastrointestinal and cardiovascular complications and potential dependency (Pedersen et al., 2022) which are commonly disregarded by athletes (Tricker, 2000). Furthermore, by numbing pain, athletes may unknowingly exacerbate injuries by continuing to compete without adequate recovery, potentially leading to long-term harm.

Viewed through a constructivist lens, the behaviors of playing hurt and using analgesics are co-constructed behaviors shaped by the interplay of medical, psychological, and social factors. Medically, analgesics are tools for pain management, but athletes often interpret their value more broadly, using them to maintain control, meet performance expectations, and fulfill social obligations. These subjective evaluations reflect how individual priorities, and cultural contexts influence athletes' pain medication behavior, blending medical advice with their personal experiences and goals. This dynamic seems to create a self-perpetuating cycle: the normalization of playing hurt encourages the use of analgesics, while the availability and use of analgesics further normalize playing hurt. Together, these behaviors sustain a culture where these coping strategies become standard behaviors for navigating physical health risks in elite sports.

#### 4 Preliminary Conclusion

This dissertation adopts an interdisciplinary approach to investigate individual physical health risk management in elite sports, integrating research insights and methodologies from sport medicine, sport sociology, and sport psychology. Each discipline offers distinct yet complementary perspectives on the phenomenon: sports medicine contributes an objective understanding of risk assessment, diagnoses, and medical recommendations; sports psychology explores individual mental processes, personality traits, and emotional responses to risk, and sports sociology examines the influence of cultural norms, social structures, and interpersonal dynamics on risk-related management behaviors. By synthesizing these perspectives, this dissertation aims to move beyond a fragmented understanding of physical health risk management, advancing a holistic framework that recognizes both the shared and unique contributions of each discipline. This interdisciplinary integration enables a nuanced exploration of how athletes individually manage physical health risks, addressing persistent gaps in knowledge caused by disciplinary silos (cf. Brewer, 2020).

The constructivist framework underpinning this dissertation supports its interdisciplinary focus by emphasizing that athletes' interactions with physical health risks are deeply subjective and context dependent. Rather than treating health risks as fixed, objective phenomena, constructivism highlights how athletes actively interpret and engage with risks based on their personal experiences, sociocultural environment, medical framings and evolving priorities. While constructivism doesn't account for all aspects of interdisciplinarity, its focus on individual meaning-making and context aligns with the need to integrate diverse disciplinary insights. By recognizing risk as a dynamic, individually constructed reality, this perspective allows for a synthesis of medical, psychological and sociological approaches, ensuring that relevant aspects from each discipline contribute to a comprehensive understanding of individual physical health risk management.

The concept of individual physical health risk management is framed around three interconnected components: risk perception, risk evaluation, and behavioral coping. Risk perception involves an athlete's recognition and awareness of potential health risks, which are shaped by their subjective interpretation of medical diagnoses, symptoms, and external feedback. Risk evaluation builds on this perception by assessing the significance of the identified risks, weighing potential consequences against personal and professional priorities. Behavioral coping refers to the strategies athletes employ to manage these risks, which involve physical actions, such as playing hurt or using analgesics. These components of individual physical health risk management operate dynamically rather than in isolation, reflecting the complexity and fluidity of athletes' lived experiences.

Through a constructivist lens, physical health risk management is not merely a reaction to external circumstances but a dynamic process in which athletes construct their own realities. This perspective highlights the need for integrative research that fully captures the multifaceted nature of risk management. By bridging the disciplinary divides between sports medicine, psychology, and sociology, this dissertation seeks to offer a comprehensive understanding of how athletes perceive, evaluate, and respond to the physical health risks inherent in elite sports.

#### **4.1 Situating Research Questions within the Interdisciplinary Framework**

This dissertation integrates theoretical, methodological, and empirical contributions from sports medicine, sports psychology, and sports sociology to address significant gaps in understanding the subjectivity of individual physical health risk management. These contributions are synthesized into a comprehensive interdisciplinary framework, which is graphically represented in Figure 1. This figure provides a visual representation of the key contributions and interactions among sport medicine, sport psychology, and sport sociology

emphasizing their interconnected roles in exploring the complexities of individual physical health risk management in elite sports.

To further contextualize this framework within the scope of this dissertation, Figure 2 extends the graphic representation by mapping the individual papers and their corresponding research question. Each paper is represented as a numbered circle, situated within the framework to illustrate its disciplinary focus and its connection to the interdisciplinary exploration of physical health risk management. This mapping visually demonstrates how the papers collectively address critical theoretical, methodological and empirical aspects of the disciplines, highlighting the unique contributions and areas of integration.

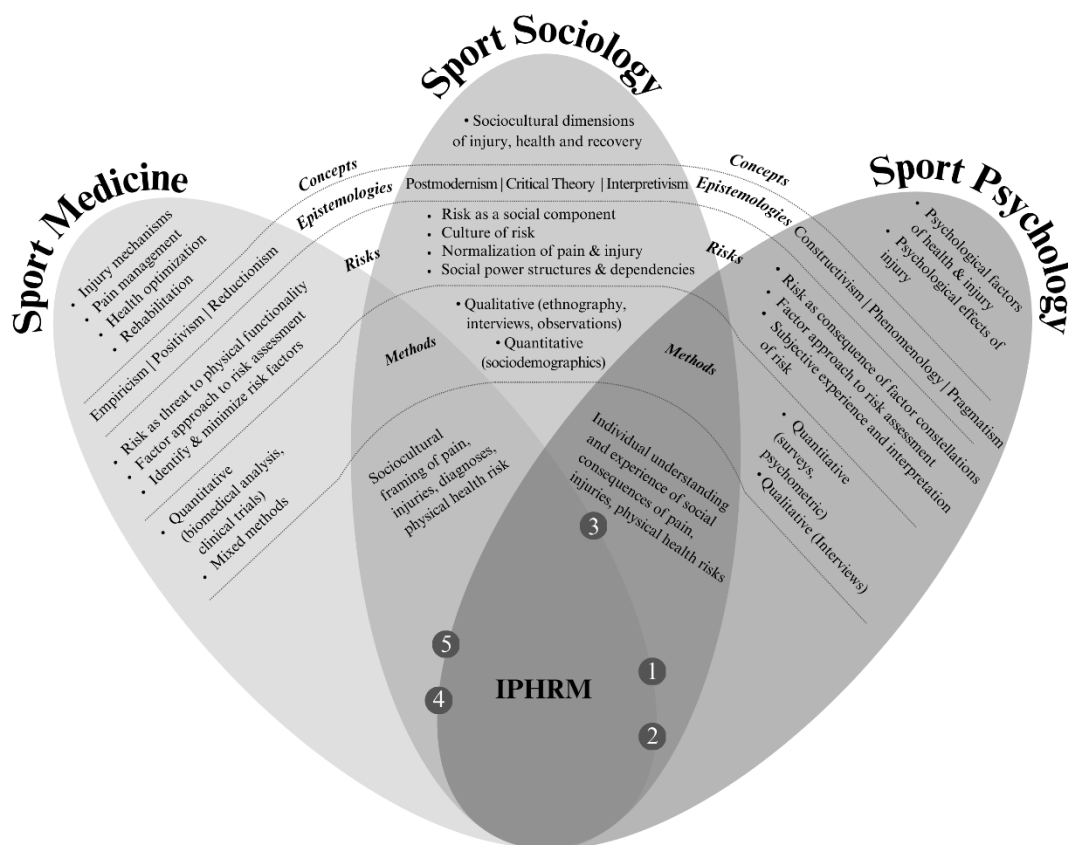


Figure 2: Interdisciplinary Framework for Individual Physical Health Risk Management (IPHRM) Research

*Numbers indicate papers and corresponding research questions.*

*1: How do elite handball players manage physical health risks throughout their careers?*

*2: What is the meaning of injuries to the elite athlete?*

*3: What role do psychosocial factors play in performing hurt?*

*4: What is the prevalence of analgesic use in elite handball players, and how do sport-specific and demographic factors influence its use?*

*5: What are the risk-profiles for preventive and therapeutic self-medication with analgesics in elite handball, and what are athletes' intentions for self-medicating?*

Paper 1 investigates how athletes manage physical health risks using a qualitative method rooted in sports psychology and sociology. This study examines athletes' individual experiences with injury and pain throughout their careers, exploring the mechanisms shaping risk perception, evaluation, and behavioral responses. While the method is rooted in psychology and sociology, this study primarily applies psychological theories of risk perception and active risk management through coping behaviors, intersecting with sociological concepts that consider the influence of social context and interactions on risk perceptions. Additionally, medical aspects are indirectly integrated by considering how athletes interpret medical symptoms and diagnoses within their subjective understanding of risk.

Paper 2 extends the focus on risk evaluation, emphasizing how athletes construct individual meanings of injury within varying circumstances and social contexts. This study covers personal experiences, emotions, and external influences shape athletes' subjective interpretations of injury, highlighting the dynamic nature of meaning-making. While Paper 2, like Paper 1, is primarily positioned within sport psychology, it incorporates sociological concepts by considering how social interactions and cultural expectations shape individual experiences of injury. However, psychological theories remain central to understanding the cognitive and emotional process of meaning-making, with medical aspects providing the contextual backdrop for these interpretations.

Paper 3 provides an integrative analysis of key factors in athletes' risk evaluation and behavioral coping with pain and injury, drawing from both sport psychology and sports sociology. It examines why athletes choose to perform hurt, incorporating psychological constructs such as athletic identity, fears and feelings of responsibility, alongside sociological concepts related to the social trivialization of pain and injuries. While the study is not confined to a single discipline, its primary contribution lies in the psychosocial

integration of factors. This positioning places it at the intersection of sports psychology and sociology, with the connection to medical phenomena such as pain and injury.

Paper 4 shifts toward sports medicine by examining sociodemographic and sport-specific predictors of sport-related analgesic use through quantitative methods. While its primary orientation is medical, given its focus on analgesic use and its according risk factors, the study slightly incorporates sociological and psychological insights by considering how employment status and the perceived role in the team influence the prevalence of analgesic use.

Paper 5 is methodologically positioned within sports medicine, but its theoretical framing integrates largely sociological and psychological elements. This study applied quantitative survey data and classification tree analysis to identify risk profiles for self-medication. While the medical methodology is dominant, the research questions engage with psychosocial determinants of this risk-taking behavior, making it interdisciplinary in scope.

The placement of the papers within the framework demonstrates how this dissertation aims to bridge disciplinary silos by integrating perspectives from sports medicine, psychology, and sociology to address foundational research questions on individual physical health risk management. By synthesizing insights from these diverse fields, the dissertation aims to advance the theoretical conceptualization of risk management as a dynamic process encompassing risk perception, risk evaluation, and behavioral coping in response to physical health risks. Through empirical investigation, this work proposes a structured interdisciplinary approach that examines the medical, individual, and social factors shaping athletes' physical health risk management. Building on this foundation, the following sections will outline the empirical research questions that guide this dissertation and the associated papers, aiming to empirically validate the conceptualization of individual physical health risk management.

## **4.2 Research Questions on Risk Perception**

Risk perception is the initial stage of physical health risk management, where athletes become aware of potential health risks based on personal experiences, medical feedback, and sociocultural influences. The way athletes perceive risks determines how they subsequently evaluate and respond to them, making this an essential area of inquiry.

This dissertation investigates the factors shaping individual risk perception, considering personal, sociocultural and contextual factors that shape their experiences and behaviors. Paper 1 examines these elements, exploring how elite athletes perceive and interpret physical health risks and evaluate their consequences within their professional and personal lives. The paper adopts a career-time perspective, investigating how risk perception within risk management manifests and evolves throughout elite handball players' careers. These investigations address the following empirical research questions:

- How do elite athletes perceive physical health risks, and how are these perceptions influenced by their own traits and the sociocultural environment? (Paper 1)
- What role does elite athletes' risk perception play in their individual management of physical health risks? (Paper 1)
- How do elite handball players manage physical health risk throughout their professional careers? (Paper 1)

## **4.3 Research Questions on Risk Evaluation**

Risk evaluation builds upon perception by determining how athletes assess the significance of identified risks. This process involves weighing the likelihood and severity of consequences, considering both medical knowledge and social pressures. Athletes'

evaluations shape their decision-making, influencing whether they take precautionary actions or engage in risk-taking behaviors.

Papers 1, 2, and 3 examine how athletes subjectively evaluate physical health risks by examining various dimensions of psychological, sociocultural, and medical factors. Risk evaluation involves the interpretation of significant risks, weighing potential consequences and determining how they align with professional and personal priorities. Paper 1 investigates how athletes' risk evaluations develop over time, highlighting the influence of individual priorities, changing situational context, and social circumstances. Paper 2 focuses on how athletes construct meaning around injuries, exploring how experiences, emotions, and social interactions shape injury evaluation. Paper 3 reveals how psychosocial factors contribute to athletes' risk evaluation surrounding playing hurt. The three papers address the following research questions:

- How do athletes evaluate potential consequences of physical health risks? (Paper 1)
- What patterns of physical health risk management emerge from athletes' subjective evaluation of physical health risks? (Paper 1, 2)
- What meanings do athletes assign to injuries, and how do these meanings shape their future behaviors? (Paper 2)
- How do psychological and sociocultural factors shape athletes' evaluations of pain and injury severity and their risk-taking behavior? (Paper 1, Paper 3)

#### **4.4 Research Questions on Behavioral Coping**

Behavioral coping refers to the strategies athletes adopt to manage physical health risks, balancing short-term performance demands with long-term health implications. These

behaviors range from preventive measures (e.g., injury rehabilitation) to risk-taking strategies (e.g., playing hurt or using analgesics to suppress pain).

This dissertation investigates the factors influencing athletes' coping behaviors, examining psychological motivations, social pressures, and medical implications. Papers 1, 3, and 5 examine how athletes actively cope with physical health risks. These strategies include the transfer of responsibility or calculated risk taking (Paper 1), playing hurt to cope with pain, injuries, and illness (Paper 3) and preventive or therapeutic self-administered analgesic use (Paper 5). These behaviors are analyzed within the broader social and professional context of elite sport. The key empirical research questions are:

- How do athletes use behavioral coping strategies to manage physical health risks? (Paper 1, 3, 5)
- Why do athletes engage in playing hurt and analgesic use as behavioral coping strategies? (Paper 1, 3, 5)

Paper 3 synthesizes findings from multidisciplinary studies through a systematic review, investigating how psychological and social factors shape athletes' behavioral coping (i.e., performing hurt) in response to physical health risks. This study delves into the motivations and contextual influences behind this behavior, providing insights into how cultural pressures and individual factors intersect to drive risk-taking in elite sports. Papers 4 and 5 extend this analysis to the use of analgesics as a behavioral coping strategy using survey-based quantitative methods. Paper 4 examines demographic and sport-specific variables influencing athletes' likelihood of engaging in analgesic use, offering a data-driven perspective on the prevalence and correlates of this practice. Building on this, Paper 5 identifies risk profiles for self-administered analgesic use, distinguishing between preventive

and therapeutic usage patterns among elite German handball players using machine learning-based statistical modeling. The research questions guiding this inquiry are:

- What demographic, sport-specific, and psychosocial factors influence athletes' likelihood of engaging in behaviors like performing hurt and analgesic use? (Paper 3, 4, 5)
- What role do psychosocial factors play in performing hurt? (Paper 3)
- How prevalent is sport-specific self-medication with analgesics? (Paper 3, 4)
- Why do elite German handball players engage in therapeutic and preventive self-medication with analgesics? (Paper 5)
- What are the risk profiles for therapeutic and preventive self-medication among elite German handball players? (Paper 5)

## **5 Collection of Papers**

### **5.1 Tabular List of Papers**

## Paper 1

Bursik, J., Mayer, J., Thiel, A., Kühnle, F., & John, J. M. (2025). “Anyone who weighs up risks doesn’t belong here”: how do elite handball players manage physical health risk throughout their professional careers?. *Frontiers in Sports and Active Living*, 7. <https://doi.org/10.3389/fspor.2025.1553948>

Title	Authors	Journal	Topic	Status
“Anyone who weighs up risks doesn’t belong here”: How do elite handball players manage physical health risk throughout their professional careers?	<b>Jan Bursik</b> , Jochen Mayer Ansgar Thiel, Felix Kühnle, Jannika M John	Frontiers in Sports and Active Living  IF (2023): 2.3	Biographical interview study  - Understanding the cultural, social, and individual dynamics shaping athletes' risk- management.  - Use of biographical mapping interviews and reflexive thematic analysis to explore how elite handball players perceive, evaluate, and manage injury-related health risks throughout their professional careers.  - Identification of key risk management patterns.  - Recommendations for interventions to enhance proactive risk management.	Published
Contribution to Paper 1 by Jan Bursik				
<ul style="list-style-type: none"> <li>- First author</li> <li>- Conception of the study, supervised by Jannika John and Ansgar Thiel</li> <li>- Theoretical consideration with the co-authors</li> <li>- Design of the interview guide, supervised by Jannika John</li> <li>- Data Collection (conducting 8 of 11 interviews)</li> <li>- Reflexive Thematic Analysis; Jannika John acted as a critical friend and supported in the refinement of themes</li> <li>- Writing the original draft of the manuscript</li> <li>- Revision of the manuscript together with the co-authors</li> </ul>				

## Paper 2

Reussner, A. K., Bursik, J., Kuehnle, F., Thiel, A., & John, J. M. (2024). The meaning of injury to the elite athlete: A systematic review. *Psychology of sport and exercise*, 71. <https://doi.org/10.1016/j.psychsport.2023.102571>

Title	Authors	Journal	Topic	Status
The meaning of injury to the elite athlete: A systematic review.	Reussner, A. K., <b>Jan Bursik</b> , Felix Kühnle, Ansgar Thiel, Jannika M John	Psychology of Sport and Exercise  IF (2023): 3.1	Systematic review  - Categorization of injuries as critical life events with significant emotional, psychological, and social impacts on athletes.  - Identification of five overarching themes regarding how elite athletes perceive and interpret injuries.  - Application of qualitative synthesis techniques guided by constructivist epistemology to interpret study findings.  - Exploration of how elite sports culture and individual career stages shape the construction of injury meanings and responses.	Published
Contribution to Paper 2 by Jan Bursik				
<ul style="list-style-type: none"> <li>- Co-author</li> <li>- Discussions with Anna Reussner and Jannika John with regard to the theoretical considerations and the search strategy</li> <li>- Support during the screening process, acting as a critical friend</li> <li>- Revision of the manuscript before publication together with co-authors</li> </ul>				

### Paper 3

Bursik, J., Thiel, A., Mayer, J., & John, J. M. (2025). The role of psychosocial factors in performing hurt: a systematic review covering the high-performance domains of sport, music, and dance. *International Review of Sport and Exercise Psychology*, 1-25.  
<https://doi.org/10.1080/1750984X.2025.2450791>

Title	Authors	Journal	Topic	Status
The role of psychosocial factors in performing hurt: A systematic review covering the high-performance domains of sport, music, and dance	<b>Jan Bursik,</b> Ansgar Thiel, Jochen Mayer, Jannika M John	International Review of Sport and Exercise Psychology  IF (2023): 6.4	Systematic Review  - Analysis of personal, social and situational influences contributing to performing hurt in high-performance settings (sports, music, and dance).  - Discussion of theoretical frameworks and their relevance in understanding health-risk behaviors.  - Identification of common patterns and domain-specific factors influencing performing hurt  - Strategies for addressing the cultural and organizational factors that encourage performing hurt, emphasizing health and well-being.	Published
Contribution to Paper 3 by Jan Bursik				
<ul style="list-style-type: none"> <li>- First Author</li> <li>- Conceptualization of the systematic review supervised by Jannika John</li> <li>- Conception of the overarching research goals</li> <li>- Screening process; Jannika John acted as the second researcher during the screening process</li> <li>- Analysis of study results and quality assessment</li> <li>- Conceptualization and visualization of study results</li> <li>- Writing the original draft of the manuscript supervised by Jannika John</li> <li>- Review and editing of the manuscript with the co-authors</li> </ul>				

#### Paper 4

John, J. M.\*, Bursik, J. \*, Burgstahler, C., Büsch, D., Luig, P., Kühnle, F., Mayer, J., Reussner, A. & Thiel, A. (2023). Prevalence of Sport-Related Analgesic Use in German Elite Handball Players. *German Journal of Sports Medicine/Deutsche Zeitschrift für Sportmedizin*, 74(5). <https://doi.org/10.5960/dzsm.2023.568>

\* equal first authors

Title	Authors	Journal	Topic	Status
Prevalence of Sport -Related Analgesic Use in Elite German Handball Players	Jannika M John*, <b>Jan Bursik*</b> , Christof Burgstahler, Dirk Büsch, Patrick Luig, Felix Kühnle, Jochen Mayer, Anna Reussner, Ansgar Thiel,	Deutsche Zeitschrift für Sportmedizin  IF (2024): 1.7	Quantitative empirical paper  - Investigation of the prevalence and frequency of painkiller use among youth and senior elite German handball players.  - Analysis of pain management strategies in competition and training  - Use of a systematic survey to assess career and season prevalence, supplemented with demographic and role-based analyses.  - Assessment of differences in the frequency of painkiller use on practice days versus competition days.	Published
Contribution to Paper 4 by Jan Bursik				
<ul style="list-style-type: none"> <li>- Shared First Author</li> <li>- Conception of the overarching research goals with Jannika John</li> <li>- Conception of the quantitative survey with Jannika John and the Co-authors</li> <li>- Development and software integration of the quantitative survey</li> <li>- Data curation, analysis and visualization</li> <li>- Writing the original draft with Jannika John</li> <li>- Review and editing of the manuscript with Jannika John and the co-authors</li> </ul>				

## Paper 5

Bursik, J., John, J. M., Mayer, J., Thiel, A., & Kühnle, F. (2024). Risk profiles for self-medication with analgesics among elite German handball players. *International Review for the Sociology of Sport*. <https://doi.org/10.1177/101269022412801>

Title	Authors	Journal	Topic	Status
Risk profiles for self-medication with analgesics among elite German handball players	<b>Jan Bursik</b> , Jannika M John, Jochen Mayer, Ansgar Thiel, Felix Kühnle,	International Review for the Sociology of Sport  IF (2024): 2.5	Quantitative empirical paper  - Investigation into therapeutic and preventive self-medication behaviors among elite German handball players.  - Analysis of self-medication as a risk management behavior.  - Use of classification tree analysis to identify psychosocial risk profiles for analgesic self-medication.  - Recommendations for education and organizational changes to address the risks of self-medication and promote athlete health and well-being.	Published
Contribution to Paper 5 by Jan Bursik				
<ul style="list-style-type: none"> <li>- First Author</li> <li>- Conception of the overarching research goals supervised by Jannika John</li> <li>- Development of theoretical considerations with Jannika John and Felix Kühnle</li> <li>- Conception of the quantitative survey with Jannika John and the Co-authors</li> <li>- Development and software integration of the quantitative survey</li> <li>- Data curation, analysis and visualization</li> <li>- Writing the original draft supervised Jannika John and Felix Kühnle</li> <li>- Review and editing of the manuscript with Jannika John and the co-authors</li> </ul>				

**5.2 Paper 1: ““Anyone who weighs up risks doesn’t belong here”: How do elite handball players manage physical health risk throughout their professional careers?”**

Bursik, J., Mayer, J., Thiel, A., Kühnle, F., & John, J. M. (2025). “Anyone who weighs up risks doesn’t belong here”: how do elite handball players manage physical health risk throughout their professional careers? *Frontiers in Sports and Active Living*, 7. <https://doi.org/10.3389/fspor.2025.1553948>

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## EDITED BY

Christian Thue Bjørndal,  
Norwegian School of Sport Sciences, Norway

## REVIEWED BY

Anette Skilbred,  
Norwegian School of Sport Sciences, Norway  
Robert Book,  
University of South-Eastern Norway (USN),  
Norway

## \*CORRESPONDENCE

Jan Bursik

✉ [Jlbursik@gmail.com](mailto:Jlbursik@gmail.com)

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# "Anyone who weighs up risks doesn't belong here": how do elite handball players manage physical health risk throughout their professional careers?

Jan Bursik<sup>1\*</sup> , Jochen Mayer<sup>2</sup>, Ansgar Thiel<sup>3</sup>, Felix Kühnle<sup>4</sup> and Jannika M. John<sup>1</sup>

<sup>1</sup>Institute of Sports Science, Eberhard Karls Universität Tübingen, Tübingen, Germany, <sup>2</sup>Institute of Health Sciences, University of Education Schwäbisch Gmünd, Schwäbisch Gmünd, Germany, <sup>3</sup>President's Office, German Sport University, Cologne, Germany, <sup>4</sup>Institute of Sport Science, Technical University of Darmstadt, Darmstadt, Germany

**Objectives:** Elite athletes frequently encounter physical health risks, such as an injury, illness or pain, which are accompanied by sociocultural norms, individual perceptions, and situational pressures. While research has explored risk management in sports, limited attention has been given to the subjective experiences of athletes managing these risks across their careers. This study addresses this gap by examining how elite handball players manage physical health risks, focusing on the role of risk perception, evaluation, and coping.

**Methods:** Using a constructivist lens, 11 handball players from the German national teams (5 females, 6 males) participated in biographical mapping interviews, providing insights into their career-long management of physical health risks.

**Results:** Using reflexive thematic analysis, we generated four themes: (1) Externalizing risks and refraining from proactivity, (2) Relinquishing control under medical uncertainty, (3) Fluctuating prioritization of health or success, and (4) Calculated health-risk taking to achieve success. The findings illustrate that athletes' risk management strategies vary based on career stage, injury experiences, situational priorities, and social pressures. The insights contribute to a deeper understanding of the dynamics of physical health risk management in high-performance sports and their sociocultural underpinnings. The study highlights the need for interventions that foster proactive risk management, emphasize personal agency, and balance performance with long-term health.

## KEYWORDS

health risk, risk management, qualitative, elite athlete, elite handball, reflexive thematic analysis, pain, injury

## Introduction

In the realm of elite sports, athletes regularly face situations containing varying degrees of physical health risks, which are often viewed as inherent to the competitive environment (1, 2). Physical health risks arise in situations where athletes' decisions and behaviors have the potential to impact their physical well-being. These situations are typically characterized by an injury, illness or related symptoms such as pain, which may disrupt the athletic pathway (3) and require adapted behaviors (4). In response to a health-

event, athletes often rely on quick fixes (cf. 5) instead of engaging in preventive measures, conducting rational risk assessments, or consulting with medical professionals. As a result, they participate in health-risk behaviors to maintain their social functioning in sport (6). These behaviors include playing hurt (7–9), using painkillers (5, 10), or shortening recovery times, which increases the likelihood of further injury (11), and potentially results in more severe or overuse injuries (cf. 12). These immediate behavioral solutions seem to be shaped by a variety of individual psychological, social, and environmental factors (5, 9, 13) such as the heterogeneous attitudes and expectations of athletes, coaches, and medical staff, but also cultural norms and values with regard to health risk management within the elite sports environment. These cultural norms have been shown to be embedded in a broader performance-driven framework, where success and competition often take priority over long-term well-being (14). Studies indicate that the performance narrative inherent to elite sports frequently overshadows considerations of health, recovery, or personal development, reinforcing an expectation that pain and injury are acceptable sacrifices for success (15–17).

A well-established body of sociologically informed research within elite sports has contributed to our understanding of how athletes manage physical health risks (1, 18–21). Using the heuristic of a “culture of risk”, these studies illustrated that athletes feel pressured to tolerate health risks, minimize or hide injuries, and engage in potentially harmful behaviors to align with performance expectations. Based on this line of research, risk management in athletic contexts can be conceptualized by four interrelated facets: risk perception, risk evaluation, risky behaviors, and coping strategies. In this context, Schnell, Mayer (22) have examined how athletes perceive and evaluate long-term physiological and psychological risks, often leading to the acceptance of these risks in their pursuit of success. This acceptance frequently manifests in risky behaviors in which athletes normalize or conceal their pain such as performing hurt or taking analgesics (e.g., 23, 24). Further, classic studies by Nixon (1) and Roderick, Waddington (7) into pain, injury, and risk provide critical insights into the sociocultural factors that reinforce such risky behaviors, often framing them as a symptom of the sport-specific culture of risk (1) and as a result of a decision-making process (13). Moreover, Schubring and Thiel (25) explored the coping strategies elite adolescent athletes use to navigate specific health risks (i.e., growth-related injuries), identifying both behavioral approaches (i.e., active agency) and cognitive strategies (i.e., distancing or rationalization).

Despite these advancements, a critical gap remains in understanding how athletes subjectively experience and navigate physical health risks over the course of their careers. While prior research has largely assumed that athletes assess risk and predominantly prioritize performance over well-being (e.g., 5, 13, 20), less attention has been given to how athletes individually perceive and interpret risk, and how these perceptions evolve throughout their careers and shape risky behaviors and coping strategies. In this regard, recent studies highlight that athletes’ individual experiences of risk, health, and performance are highly

contextual and shaped by personal and structural influences (e.g., 3, 17, 26), necessitating a more nuanced exploration of individual physical health risk management.

Given this gap, this study aims to advance the understanding of how elite handball players manage physical health risks throughout their professional careers. By examining the experiences of elite handball players from the German National Team, this research moves beyond static models of risk-taking to explore how risk management is shaped by evolving personal, social, and institutional factors over time. In doing so, this study contributes to a more comprehensive understanding of individual risk management in elite sport across different stages of athletes’ professional careers.

## Theoretical framing of physical health risk management

In this article, we define physical health risk management as an individual process that involves risk perception, risk evaluation, risky behaviors and coping strategies aimed at reducing uncertainties and supporting the achievement of objectives (27). Physical health risks are conceptualized as emerging from the interplay between the objective assessments of an adverse event—such as medical evaluations of injury severity, which are often regarded as “objective” in professional practice—and subjective evaluations of the event’s desirability (28). Thus, we conceptualize risk to be inherently situational and dynamic, shaped by individuals’ perceptions, priorities, and the socio-cultural environment in which athletes find themselves.

When examining how athletes manage physical health risks, it is essential to engage with established risk management theories. Risk theories encompass diverse approaches, with increasing recognition of the role of subjective interpretations. Scholars increasingly acknowledge that risk management is deeply shaped by the subjective perceptions of “objective” risk assessments (e.g., 28). In elite sports, athletes’ subjective perceptions are particularly consequential, as they directly influence subsequent behaviors, such as rehabilitating physical injuries or potentially exacerbating them by continuing to perform hurt.

## A constructivist approach to risk perception and risk evaluation

A constructivist perspective on risk management suggests that athletes continuously reinterpret and redefine risks based on career stage, external pressures, and personal priorities. Thus, it conceptualizes risk management in elite sport as a dynamic and evolving process, challenging previous research that treats risk perception and management as separate, stable constructs. This perspective further extends prior research on the culture of risk by highlighting that risk is actively constructed and reshaped over time, rather than merely accepted or rejected. Thus, by adopting a constructivist lens, this research positions risk perception and management as an ongoing, recursive process,

offering a novel perspective on how athletes manage shifting perceptions of health risks in response to changing social and professional contexts.

In this context, Boholm and Corvellec (29) postulate a Relational Theory of Risk for understanding how individuals perceive and evaluate risk. According to their theory, risk perception is rooted in *situated cognition*, where individuals establish a relationship between a risk object (e.g., physical pain) and an object at risk (e.g., physical health or career progression). For a risk to be perceived, this relationship must be seen as causal, contingent, and the outcome for the object at risk must be undesirable. In the context of elite sports, risk objects like pain and injury are not inherently perceived as risks by athletes. They become tangible risks to athletes only when athletes associate them with threats to valued outcomes, such as career progression or physical health. Thus, according to Boholm and Corvellec (29), athletes would only consider playing with an injury as risky if they believe that playing hurt could potentially harm something they value. More specifically, for athletes to perceive a physical risk when playing with an injury, two things must happen: first, they need to recognize a causal and contingent relationship between playing with the injury and potential long-term health issues; second, they must view those long-term health problems as a significant and undesirable outcome in that given moment (cf. 30). However, if athletes believe that not playing with an injury would lead to losing their position on the team or missing out on key career opportunities (9, 31), they might see greater risk in not playing hurt. Thus, athletes juggle multiple objects at risk—health vs. career progression—and their perception of risk is shaped by which outcome feels more immediate or important at the time.

Relatedly, Corvellec (32) argues that risk perception is neither static nor purely culturally imposed, it is actively constructed and reconstructed. Consequently, athletes' perceptions of risk may shift throughout their athletic careers as they define and redefine what they value most—be it health, career progression, or social status (cf. 33). An object is considered “at risk” only when it is explicitly or implicitly ascribed value, which in turn influences athletes' behavior. This valuation highlights that athletes' perceptions of risk are shaped by what they, or their environment, deem important at a given moment (cf. 32). In elite sport, the environment's social expectations and internalized norms particularly shape the athletes' attitudes toward performance and well-being (1, 6, 34) and, consequently, their approach to risk. The use of the Relational Theory of Risk as the theoretical framework of this work allows to address the underlying individual cognitive processes involved in risk perception and evaluation, which supplements studies informed by the “culture of risk” heuristic. Instead of viewing risk solely as a cultural phenomenon, the principles of the Relational Theory of Risk suggest that athletes actively shape their understanding of risk. They constantly reassess what is “at risk”, such as immediate performance or long-term health, based on their career stage, personal values, and changing situational pressures.

## Individual dynamics of risk management in decision-making situations

Once individuals have perceived risks, the subsequent risk management strategies are strongly informed by the specific decision-making situation. General research on risk management strategies (e.g., 35–37) commonly presumes that individuals engage in risky behaviors when “an activity [is] carried out by people with a frequency or intensity that increases the risk of disease or injury” (36). While this conceptualization of risk behaviors is mainly objective, the research also investigates how people subjectively compare risk consequences and why they engage in subsequent coping patterns (e.g., 35, 38). Referring to Huber's (35) Theory of Active Risk Management, athletes seem to manage risky situations by employing risk-defusing operators (RDOs; 31). These operators involve additional actions or cognitions which reduce the perceived risk and thereby enable athletes to choose the subjectively most promising alternative. Such individual risk management strategies, as researched in a quasi-naturalistic scenario study by Mayer, Burgess (31), are used by athletes to minimize the perceived risk by defusing either the probability of potential sporting consequences (e.g., losing a game) or medical consequences (e.g., worsening the injury).

For example, an athlete with a ligament rupture might identify two RDOs to reduce sporting consequences. One involves playing hurt; the other entails assessing the opponent as weak enough for the team to win without them. While both strategies attempt to reduce the perceived competitive risk, they conflict in terms of behavioral management (i.e., playing hurt vs. sitting out). To make a decision, the athlete must also consider the medical risks—such as worsening the injury—and may adopt an additional RDO, such as stabilizing the ligament with tape. This creates a subjective sense of control, allowing the athlete to justify competing hurt. However, this perceived control does not necessarily reduce the actual risk (32); even if the athlete feels protected, the danger of aggravating the injury remains. Overall, the process of identifying RDOs, weighing different consequences and choosing the most promising alternative as described in the Theory of Active Risk Management (31, 35) highlights the need for investigating subjective risk management.

A constructivist perspective on risk perception and evaluation, combined with active behavioral risk management, offers a novel contribution to the research of athletes' physical health risk management. Following the assumptions delineated within our theoretical approach, risk perception, risk evaluation, and behavioral coping with physical health risks are interwoven, fluid, and highly contextual. The use of RDOs illustrates how athletes subjectively construct and negotiate multiple competing risks (e.g., performance vs. health) rather than making binary decisions about how to behaviorally cope with physical health risks. This perspective on the individual dynamics of risk management moves beyond existing discussions and scholarship by highlighting that risk management is not solely a socialized behavior but also an evolving, self-regulated process in which athletes construct risk perceptions and evaluations and strategically modulate their behavioral responses over time.

## Purpose of the study

Despite the established body of sociological research surrounding risk acceptance and normalization in the culture of risk (1, 18–21) and a growing body of research examining the dynamics of “risk-behaviors” in elite sport (9, 10, 12), a notable gap remains in our understanding of how athletes actively construct, evaluate, and behaviorally cope with physical health risks over the course of their careers. While theories such as the Relational Theory of Risk (29) emphasize the subjective and context-dependent nature of risk perception and evaluation, it has not been applied to the elite sport context and thus, does not fully account for how athletes have to evaluate competing priorities, such as health, career progression, or status. Similarly, frameworks like the Theory of Active Risk Management (35) focus on risk management strategies but pay less attention to athlete’s subjective risk perception. Consequently, while both frameworks provide valuable theoretical foundations into sub-aspects of risk management, they have yet to be fully integrated to capture the dynamic and interwoven nature of physical health risk management in elite sport.

To address this gap, this study adopts a constructivist lens to examine how elite handball players adapt their risk perceptions, reinterpret their risk evaluations, and actively shape their behavioral coping strategies with risks throughout their careers. Unlike prior research, which has primarily examined sub-facets of risk management or considered risk-taking primarily as a product of socialization (1, 6, 31), this study primarily focuses on the agency of athletes in constructing and modifying their physical health risk management in response to shifting personal and contextual factors.

This study employs a qualitative biographical study design to provide an in-depth and longitudinal perspective on how athletes individually construct and adapt their cognitive and behavioral strategies for managing physical health risks across different career stages. By capturing the experiences of elite handball players, this research examines how risk perception, evaluation and coping strategies evolve as athletes navigate shifting career demands, personal priorities, and contextual pressures.

## Methodology

Constructivist theory posits that individuals do not passively absorb information from their environment; instead, they actively engage with and interpret their experiences to construct personal meaning and knowledge (39). Thus, we assume that elite athletes subjectively perceive and evaluate risks, which in turn shapes how they subsequently behaviorally manage physical health risks.

## Participants and data collection

We utilized a purposive sampling approach aimed at deepening the understanding of the phenomenon (40) in a

highly elite sample which is “most likely to yield appropriate useful information (41). To increase feasibility and comparability, we limited the sample to the sport of handball while aiming for a variation in age and gender. Handball was selected because it offers an ideal platform for research on health-related risk behaviors due to its high injury incidences and risk-taking behaviors (9, 10, 42). At the time of the interview, the participants were part of the German handball national team (male or female). On the club level, all participants played in the *German Handball Bundesliga* (1st division). The mean age was 27.6 (range 22–34 years).

The interviews with eleven handball players (5 females, 6 males) were conducted by the first author and AR in 2022. Quiet locations that were easily accessible for the athletes were chosen for the interviews (such as their training facility). The average interview lasted 86.1 minutes (ranging from 50 minutes to 128 minutes). The study received ethical approval by the ethics committee of the Faculty of Economic and Social Sciences ethics committee at the University of Tübingen (AZ: A2.5.4-176\_ns). Before the interviews, all participants signed informed consent forms.

For our interviews, we used the biographical mapping method to capture temporal dynamics of managing physical risks throughout careers (see 43 for further details). First, participants were asked to their professional career journeys, reflecting on significant life events, relevant developmental stages, and critical health-related events (see also: 44). Participants then engaged in a drawing activity coupled with a think-aloud protocol (43). Comparable to a therapeutic lifeline tool, this approach helps to “facilitate a structured recall of a sequence of previous events, particularly within the context of qualitative interviews” (cf. 45, p. 11). Athletes were asked to visually depict the intensity of health and performance-related experiences throughout their careers, as such nuances are often difficult to convey verbally due to their temporal and sensitive nature (cf. 46). The dimensions they were asked to draw over the course of their professional careers included pain intensity, the extent of painkiller use, health-related willingness to take risks, and perceived performance capacity. As they drew, participants were encouraged to verbally reflect on the curve courses (cf. 47). Relevant reflections about their behaviors surrounding health-related risks were verbalized and chronologically situated by the athletes throughout their professional careers. In addition, we also asked participants specific questions about the curves they drew. For example, athletes were asked to explain sharp increases in painkiller use or fluctuations in their perceived performance capacity, which provided further context and understanding of how they navigated critical moments in their careers. This verbal data was incorporated into our analysis. To guarantee anonymity to the participants, we used pseudonyms and deleted all identification information in the interviews. The biographical mapping method allowed us to capture how the athletes perceived and interpreted their past experiences regarding physical health risks, offering deeper insights into their subjective reality (48). The interviews were transcribed verbatim by a professional company.

## Reflexive thematic analysis

The transcripts and the audio tapes served as the raw data. The lead author corrected the transcripts through listening to the audio while reading the transcripts and familiarized himself with the data. To explore how the elite handball players managed physical health risks, the data analysis was conducted using an inductive reflexive thematic analysis (49). The adaptability of reflexive thematic analysis enabled us to develop our analysis inductively and identify underlying patterns of perceptions and described behaviors within the interviews. This proved to be a considerable methodological advantage, as the handball players seldom directly addressed how they managed physical health risks throughout their professional careers.

The data was analyzed in coherence with the six phases of reflexive thematic analysis (Braun & Clarke, 2021) and carried out using MaxQDA (Verbi Software, 2024). While becoming familiar with the data, the lead author marked sections of the interviews that seemed related to the management of physical health risks. This included instances where athletes described how they navigated injury risks during critical phases of their careers, such as deciding whether to compete in an important championship despite an ongoing or anticipated injury. The lead author also noted down his first analytical insights, such as recognizing patterns in how athletes assessed risks and balanced long-term health considerations and immediate performance goals.

After data familiarization, the first author mainly coded at the semantic level, staying close to the text (exemplary code: “Without a diagnosis I basically HAVE to play”). Throughout the process of coding (i.e., all interviews were coded three times), the codes became more latent (“Lack of Diagnosis pressures continued participation”). During the coding process, the research question was revised to better align with the data (49). Initially, the research question focused on how elite athletes retrospectively reflected on their physical health risks, it became clear that the data provided more insights into how handball players described their thoughts and perspectives on physical health risks in specific situations, as well as how they managed these risks. The lead author re-examined the codes to ensure they fitted with this new research focus. After the third round of coding, within MaxQDA, the first author grouped the codes into categories of codes focusing on overlaps in meaning (exemplary category: “Lack of Diagnosis as a relevant criterion for risk taking”). Then, he printed out the code categories and generated initial candidate themes with similar underlying meanings. Some categories (exemplary category: “Health risks must be taken for success”) were used as candidate themes whereas other categories (exemplary categories: “Lack of Diagnosis as a relevant criterion for risk taking” and “With clear diagnosis, a risk assessment becomes possible”) were merged to a new candidate theme (exemplary candidate theme: “The influence of diagnosis on risk management”). These themes were continuously discussed with the last author who acted as a critical friend (50). In this process, the themes were renamed and reorganized. In research meetings with all authors, the themes were presented and discussed. In this process, the first and last author defined the core ideas of

each theme as well as its boundaries. The first author then went back to the related interview passages to ensure that the generated themes were supported by the original data. During this last stage, the themes were refined, and the analytic narrative was developed. The stages of generating initial themes and refining and reviewing potential themes overlapped, highlighting the iterative process inherent to reflective thematic analysis (51).

## Reflexivity and quality criteria

Aligned with our paradigmatic stance, we adopted a relativist approach to quality (52, 53) and selected quality criteria that reflect our paradigmatic position and study objectives: transparency, sincerity, resonance, worthy topic, and credibility. The lead author worked as a soccer coach in his free time and has also gathered experience as a soccer player himself experiencing various minor and overuse injuries. During the research process, he reflected on his behavior concerning injury-related risk-taking from his coach and athlete perspective. Additionally, his experience as an applied sport psychologist in handball helped him establish an emotional and empathetic connection with the participants. To challenge any interpretations and assumptions influenced by his own experiences with sports-related injury risks, he regularly consulted with critical peers and maintained a reflexive journal where he systematically recorded his emotional reactions to the interviews, reflections on how the interviews affected his perspective on risk-taking in sport, and evolving thoughts on the data and analysis process (50). These strategies ensured the transparency and sincerity of our study by emphasizing the impact of personal experiences on the research process and findings.

## Findings and discussion

We constructed four themes which illustrate how athletes manage physical health risks: (1) Externalizing risks and refraining from proactivity; (2) Relinquishing control under medical uncertainty; (3) Fluctuating prioritization of health or success; (4) Calculated health-risk taking to achieve success.

### Externalizing risks and refraining from proactivity

This theme highlights how athletes externalize risks by attributing injuries to factors such as chance or fate. As a result, athletes fail to recognize the relationship between the risk objects (e.g., pain) and the object at risk (e.g., injury) and do not engage in proactive behaviors to minimize “objective” risks, such as seeking medical care or modifying their load: “Something can always happen. (...) That’s why. I don’t really think about the risk I’m taking (...). For example, with the patella tendon (...) I also thought to myself, well then it just ruptures” (Maya).

In this quote, Maya described her belief that injuries can “always happen” and are outside of her personal control, discouraging her from actively thinking about and managing risks. This aligns with findings demonstrating that athletes who perceive less control over injury risk tend to engage in higher levels of risk-taking behaviors (54). This pattern of externalization was particularly evident early in athletes’ careers, when athletes did not interpret objective health risks (i.e., pain or physical strain) as warnings that would require action.

Accordingly, athletes tended to perceive injuries as sudden events, as exemplified by Jack: “Actually, it wasn’t that my performance was slowly declining day by day. No, my performance was still there, and then boom—one day you twist your ankle, and suddenly your performance is gone, just like that.” Adding to Jack’s perspective, Tom emphasized the uncontrollable nature of injuries reinforcing the idea that injuries can occur randomly, regardless of an athlete’s physical preparedness or prior physical stress:

It can happen without any prior strain—you can twist your ankle, or you could tear up your knee because you’re already worn out. In this sport, that’s just how it is. If someone bumps into your knee, it doesn’t matter how trained or pre-injured you are, nothing can help you in that moment.

Tom’s perception reflected a broader tendency among handball players to view impaired health, such as pain or illness, as no more likely to lead to an injury than a state of good health. This belief led athletes to overlook the significance of impaired health as a risk object and to neglect the need for proactive risk management to prevent potential physical consequences such as an injury (i.e., object at risk).

Moreover, athletes frequently recounted their behavior in objectively risky situations with a sense of fatalism, emphasizing how they “were lucky” to have avoided more severe consequences while disregarding the risk associated with the present health event. This can be seen in the following quote by Lisa: “I had patella problems for a long time. I don’t know how clever it was to keep playing with it all that time (...) but I was lucky that nothing worse happened.” Similarly, Tom attributed a favorable outcome after neglecting an objective physical health risk (i.e., playing with a shoulder injury) to luck: “I was really lucky that nothing worse happened, even though I had previous injuries.” Both athletes externalized risk by attributing their injury outcomes to luck. By framing injuries as unpredictable and beyond their control, they distanced themselves from acknowledging how their decisions and behaviors might have contributed to their physical condition. This perspective reinforced a passive approach to risk management, discouraging proactive behaviors such as medical intervention or load modification. By attributing injuries to external factors like chance or fate, athletes neglected the relationship between potential risk objects and the objects at risk. This externalization, in line with the Relational Theory of Risk, shaped their subjective perception to the extent that they sometimes did not perceive physical health risks at all (cf. 29).

Underpinned by a general normalization of pain and injury, as described in various sociological studies (1, 7, 21), athletes seemed limited in their ability to proactively manage physical health risks, which in turn reinforced and sustained this normalization. This can be seen in the following quote by Tom in which he described how he typically reacted to pain:

Yeah, because I’m the kind of person who really pushes himself to the limit, I don’t go to doctors very often when I’m in pain. I always try to avoid going to doctors (...). Doctors are not important to me. I only go to the doctor when nothing works anymore in my body.

Since he viewed injuries as events beyond his control, he did not consider it necessary to seek medical care when he was in pain. Without seeing a clear need for intervention, Tom’s approach reflected the wider normalization of pain and injury (1, 21), expanding it to an individual tendency to disregard the relationship between proactive care and long-term consequences.

## Relinquishing control under medical uncertainty

Throughout their careers, athletes frequently relinquished control over their health decisions, downplaying symptoms and postponing action until a formal diagnosis validated the necessity for risk management. This reliance on external validation reflects compliance with cultural norms in elite sports, where enduring pain is expected (55), and symptoms are frequently dismissed as manageable without a clear medical diagnosis. Emily exemplified this phenomenon by reflecting on her experience with unaddressed pain symptoms: “Those are all things that, if I had been diagnosed earlier, I might have been able to react more quickly and simply shorten the period of pain—and maybe even the rehab phase.” This reliance on diagnosis is consistent with aspects of the Relational Theory of Risk proposed by Boholm and Corvellec (29), suggesting that an individual may not perceive a poor health state as a potential risk object unless it has been externally validated through a diagnosis. In the absence of a formal diagnosis, athletes engaged in selective risk assessment, often failing to recognize the connection between symptoms and potential long-term consequences. This dependency on diagnosis was further illustrated by Lisa’s differentiation between injuries where something was “inflamed but not broken” vs. those where something was “really damaged,” requiring time to heal:

That’s different for me because I wasn’t injured to the point where something was actually damaged. It’s more like something was inflamed but not broken. With my other diagnosed injuries, something was really damaged, something that needed time to heal properly.

This mindset suggested that symptoms only became a recognized risk when labeled as such by medical professionals.

Medical uncertainty in the absence of a formal diagnosis often resulted in ambiguity for athletes, which in turn led to a blurred perception of injury risks. This was because the subjective categorization of symptoms as a serious health event (i.e., injury or illness) was limited by the lack of a clear objective diagnosis. Lisa exemplified this challenge as she articulated her perplexity over symptoms (i.e., pain in the Achilles tendon) that were not formally recognized as an injury, which in turn impeded her ability to take action: “It wasn’t a type of injury where you could say, “okay, this is an injury, and I need to take a break” (...). I didn’t even realize I was injured”. Lisa’s excerpt demonstrated how diagnostic ambiguity can impair an athlete’s perception of risk, leading them to underestimate symptoms and avoid proactive management. Consequently, athletes reported a lack of information to make independent health decisions. Olivia highlighted the challenge of self-assessment when faced with ambiguous symptoms. She illustrated a situation in which her coach noticed her pain and enquired as to her ability to continue playing:

“What do you think, can you or can’t you play?” This question is easy to ask, because you can’t expect the player to approach it objectively and say: “I can’t do it.” Everyone of us would say: “I can do it somehow.”

The inability to correctly assess their state of health often prompted athletes to defer responsibility for health decisions to coaches or medical professionals, thereby reducing their personal agency in managing physical health risks. As Paul, Jones (56) describe, athletes find themselves in a “position of vulnerability” (p. 3) when they are expected to correctly assess their potentially complex health status. Within our interviews, such a position of vulnerability often occurred when athletes had transitioned to senior levels of elite handball or had recently been nominated to a new team. Hanna’s reflections on her first club in elite senior handball illustrate this issue: “Nobody knew what the current status was or what was on the doctor’s report. And then the coach expects me as a player to tell her the medical point of view which I sometimes didn’t really understand myself”. As a result, athletes relied heavily on external authorities for guidance, which can also be seen in the quote by Maya: “Then the doctor says: “Yes, she has to take a week off.” (...) So, for me, it was always the case that I didn’t have much to say in the matter.” In this context, cultural expectations and diagnostic uncertainty fostered a coping strategy of relinquishing control, where athletes increasingly deferred to medical or coaching staff for decisions in risky situations.

Furthermore, the internalization of social and cultural pressures within elite sports often compelled athletes to relinquish control over their health by aligning with the norm to perform hurt, particularly when pain was not acknowledged as a severe injury. Lisa reported: “It [Tibial Periostitis] wasn’t really THAT kind of injury where you could say, “Okay, I have to sit out for this””. As a consequence, she performed while in pain. Similarly, Maya indicated her reluctance to take rest periods, despite experiencing pain: “I just always want to be there to play. And I wouldn’t sit out because I’m in a bit of pain. Yes, I couldn’t reconcile that with myself.” These statements

emphasized how athletes internalized a cultural narrative that viewed enduring pain as an inherent aspect of their role and identity (9, 33), thereby limiting active risk management by downplaying the severity of the symptoms, particularly under conditions of medical uncertainty.

For many athletes, a formal diagnosis constituted a defining point that legitimized symptoms and validated the need for proactive risk management. Olivia described how receiving a diagnosis for a patellar injury changed her approach to her condition: “In general, I find it hard to cancel a training session, and almost impossible to miss a game—unless there’s a real diagnosis.” In this context, Olivia underscored how a diagnosis enabled her to reframe her pain as a legitimate injury, thereby allowing her to adopt a more careful approach to her recovery and thereby to actively manage risk. Steve echoed this stating, “It’s definitely easier when it’s clear [the diagnosis]—when you know, “I can’t play today, it’s just not possible.”” Thus, while athletes often dismissed pain, an official diagnosis reframed pain as a legitimate health risk, prompting athletes to reassess their risk management strategies. This findings highlights how athletes often undergo cognitive reappraisals after receiving a diagnosis (55), where the severity of an injury and the subsequent evaluation significantly alter their response to the injury (55). The phenomenon of diagnosis serving as a catalyst for behavior change has been scarcely researched in the elite sports context. However, it has been documented in medical fields as a critical turning point in managing symptoms and promoting self-care (e.g., 57, 58). This notable reliance on diagnosis illustrated how athletes were constrained within a system where both they and their support networks acknowledged symptoms as legitimate health risks only after they had been validated by medical authorities. Prior to such classification, athletes appeared to lack an understanding of the relationship between their symptoms (risk object) and potential health consequences (object as risk), which may have led them to continue risky behaviors despite the potential for deterioration in their physical condition.

## Fluctuating prioritization of health or success

This theme describes how athletes frequently fluctuated between prioritizing either health or success (cf. 17) when perceiving, evaluating, and managing risks. These shifts were influenced by social pressures, situational factors, and internal conflicts. Lisa demonstrated how her approach to physical health risks (i.e., pain or injuries) varied according to specific situational and contextual factors throughout her career:

It was quite different for each injury (...). For my shoulder, I had a very skilled physiotherapist, who would just say “yes” or “no”, and that took a lot of pressure off me. The coach didn’t really put any pressure on me either, so it was pretty relaxed. (...) But with the small muscle tear, things were a bit more complicated because I had a more important role in the team at that point, being one of the older players. By

then, I knew my body better and could say, “I don’t feel ready yet.” I’d tell the physiotherapist, and she would pass that on. But with my Achilles tendon issues, I didn’t handle it very well. I think if I’d had a coach who told me, “Take it easy for a couple of weeks,” that would have been good. But I didn’t speak up because I was unsure if I was just complaining too much or if it was something real.

Lisa’s approach illustrated how her focus moved back and forth between prioritizing self-care or performance (while suppressing injury concerns), contingent upon her role within a team and the external guidance or pressures exerted by coaches or management. This dynamic aligns with theoretical assumptions that posit that risk perception is a dynamic process which evolves according to context-specific values (29, 32).

External stakeholders, including coaches and medical staff, played a pivotal role in shaping athletes’ management of physical health risks, particularly with regard to their engagement in risky behaviors, a pattern that recurs in research on performing hurt (eg., 9). The handball players frequently followed the advice from these stakeholders when navigating health and performance. Emily recounted an instance when she obeyed to both her coach and her medical team, who persuaded her to compete despite a knee injury. However, she contrasted this with an incident where she prioritized her health due to good medical care, further underscoring how athletes’ risk management strategies are not fixed but shift based on situational factors such as evolving support systems:

Then, with the knee, it was shortly before the German Youth Championship Final. With tape, painkillers, and everything you can always manage another two games. The persuasion of the doctor and coach at the same time. That’s why I didn’t think much about any health risk (...). Because that was the Final Four of the German championship. And according to the coach and staff, they couldn’t have played it without me. So, I listened to them, because I was still young, and I played that game. (...) In contrast, I received good medical care for the fracture. That’s why it felt safe for me [not to play].

Emily’s health risk assessment was continuously shaped by the attitudes of her coaches and the medical team, which emphasized either performance or health risks depending on the situation. For example, during the Championship final, she downplayed health risks due to her team’s focus on performance and a strong sense of responsibility for her team, while with her fracture, the concern for health by her medical team led her to prioritize recovery. Similarly, Hanna noted that unlike previous coaches, her current coach aimed to create a balance between performance and health that was recognized and followed by the players:

He [the coach] demands a lot from us. Also, that we push ourselves to our limits which is good. But he clearly says: “It’s better to take a break from training than to be injured for three weeks afterwards.” I like that.

Hanna’s statement illustrated that external perspectives and social pressures influenced how she weighed health against performance, shaping whether she adopted a performance-focused or health-centered approach in a given situation which in turn impacted how she handled health risks (e.g., 56, 59).

Furthermore, athletes highlighted how situational factors were crucial in their consideration of the potential consequences of taking physical health risks (i.e., performing hurt). Emily, for instance, reported that she had engaged in performing hurt, particularly during important games at the end of the season: “Then came my knee injury. I had to play one more game. I did everything I could to play this game or, I had to do everything I could to play this [last] game.” Similarly, athletes felt pressured to step in when teammates were unavailable, even if it meant playing with pain and/or analgesics. Jack recalled a situation where he felt compelled to play with severe pain due to his teammate’s injury: “Yes, actually, because I was alone in my position at the time. Because my partner [on the same position] had a cruciate ligament rupture at the time. That’s why I had to play.” The repeated phrase “had to play” indicated a focus of both players on sporting and social consequences rather than health consequences (cf. 31).

The internal ambivalence between prioritizing health and achieving success also emerged as athletes reflected on health and risk, with the tension often intensifying during key career milestones, like becoming a starting player on their team. When asked to reflect on his risk-behavior throughout his career, Tom explained: “I always had in mind that I had to help the team, and I had to do my best for the squad. And accordingly, the team’s success was always more important than my own health.” Conversely, he later emphasized the significance of physical wellbeing when questioned about his conceptualization of health: “Health is simply the greatest good. And you simply have to take care of yourself, of your body.” Tom’s accounts demonstrated the fluctuating salience of health or success that often shifted throughout an athlete’s career. Athletes may perceive physical pain (i.e., risk object) as a threat to their health (i.e., object at risk), particularly after having experienced severe injuries themselves or within their team. However, this focus was often deprioritized when it competed with other valued outcomes, such as contributing to team success or a feeling of collective responsibility and commitment to their team (cf. 9, 29)

While athletes often neglected objective risks in favor of performance, severe explicit health risks prompted a shift in risk evaluation, making health and career continuity more salient than short-term success. Emily recounted an experience where medical advice prompted her to withdraw from playing with a hand fracture: “Because it was a fracture, they told me that especially in defense, if I took too many hits, it could shift. That’s when I knew I had to stop.” Emily highlighted that the clear warning from medical professionals marked a turning point, making the specific health risks in her situation more tangible and prompting her to adjust her risk management approach. The explicit risk of a more severe fracture shifted Emily’s priorities, showing how some risks can bring health considerations to the forefront for athletes (cf. 9, 13).

## Calculated health-risk taking to achieve success

In this theme, we draw attention to how handball players demonstrated a belief that risk-taking was necessary to achieve success. From early in their careers, athletes acknowledged the physical risks (i.e., potential for injury) inherent in handball, showing a calculated willingness to accept any consequences. Hanna noted sarcastically: “We all know that handball is not exactly the gentlest sport on the body.” This characterization of handball was echoed by Lisa who similarly characterized the physical risks of handball: “In handball, you [meaning herself] always take a certain amount of risk because it’s a very physical sport. That’s why I’d say you [meaning herself] always have a fundamentally high willingness to take risks.” These remarks reflected the players’ perception that potential risks were an inherent aspect of professional handball.

Building on this awareness of the general physical health risks associated with handball, players also recognized the specific health risks involved in playing through particular injuries or pain. Consequently, they knew that injuries could deteriorate and have long-term consequences. Emily described how she continued to play with various injuries (e.g., hairline fracture or a partially torn labrum) despite being aware of how each injury could have led to more serious injuries:

I took risks playing with the hairline fracture. I definitely risked getting a bone fracture. I know that now. I knew that I could take one wrong step, and the bone would just break. With the knee injury, it already felt fatigued. I knew that even with tape and so on, you can still get a more severe injury than just a bit of fluid in the knee, like an ACL. With the hip, only the labrum was damaged. But playing with it could have also caused more damage than it did.

Emily’s reflection, along with Hanna’s general statement that “I think we are aware of specific risks” underscored a recognition of the risks that accompanied their decisions to play through pain and injury (c.f. 22).

Furthermore, it appeared that athletes’ awareness of these risks increased throughout their professional careers, especially after experiencing their first serious injuries. Lucas highlighted the progression of risk awareness throughout his career, noting: “Now you [meaning himself] pay more attention to your body (...). Now you understand your body more. At that earlier time (...) you thought that nothing could hurt you.” In this passage, he contrasted his perception as an older athlete with his earlier sense of invulnerability commonly seen among younger athletes (17).

However, the awareness of risks did not necessarily reduce risky behavior. Instead, with accumulated experience, players perceived that they had developed a stronger ability to manage their bodies when confronted with physical health risks, which in turn seemed to lead to increased calculated risk-taking. Olivia remarked how knowing the limits of her body emboldened her to push her boundaries even further: “I think I know my body

well enough now to understand how much I can push it.” Lucas echoed this sentiment, acknowledging his increased confidence in managing physical risks: “I would take even more risks now. Because now I understand it better.” These statements suggest that, rather than promoting caution, experiences of risk management may have led athletes to feel more competent in handling future risks, reinforcing their awareness of risks and engagement in risky behaviors at the same time (cf. 22, 26).

Relatedly, athletes perceived physical risk taking (i.e., playing with an injury) as critical for success, which was clearly articulated by Tom:

And now for us, it’s all about winning, it’s all about being the best. And I think it’s automatic that you simply increase the risk because it’s all about everything. And we, for example, also knew that in the season if we all stay healthy or mostly healthy, the chances are very, very high that we will be successful. And that’s why the risk just increased.

Tom’s statement reflected a commitment to risk-taking in games in pursuit of success. Similarly, for Maya, tolerating pain was not only important during games, but she also perceived maintaining a rigorous training regime as necessary to achieve her goals: “When I’m in pain, I prefer to train because, well, you have goals, and you can only achieve them if you train.” Thus, the athletes not only acknowledged the physical health risks and willingly accepted the consequences (8, 22), but seemed convinced that the risks were necessary for achieving success at the elite level of sports.

Lastly, in order to maintain performance despite injury, players actively managed risks by using strategies like taping and taking painkillers (cf. 5). These tools were acknowledged as essential, particularly in later stages of their careers as a result of accumulated injuries (cf. 10). Hanna described her use of painkillers during tournaments as a legitimate risk management strategy: “Especially in a tournament like a World Championship, there’s just such constant strain that pain is present. And to dampen it, especially for the important players or the game, I think it’s actually okay.” Hanna’s perspective illustrated the normalization of calculated risk-taking within elite handball (e.g., 5), where accepting and taking health risks was seen as an intrinsic part of success. However, the employed risk management strategies often revealed a paradox in that athletes managed immediate risks with tools like analgesics, which carry their own risks such as severe side effects (5). Nevertheless, the normalization of risk-taking, cultivated over years of competitive sport, shows how deeply ingrained the willingness to take physical risks was among athletes (e.g., 60, 61).

## General discussion

In this study, we adopted a constructivist lens to explore how elite handball players’ individually managed physical health risks and how this management evolved throughout their careers. This approach allowed us to interpret players’ experiences in the

context of their career stages and personal development. Utilizing foundational theories of risk perception and risk management (29, 35), we investigated how athletes approached risk over time. Thereby, our study makes a novel contribution to the field by integrating frameworks on risk perception (28, 29) with the subsequent behavioral risk management strategies employed by elite athletes (22, 31, 60). While previous studies have often treated risk perception and evaluation separately from coping mechanisms or risky behaviors, the present study brings them together to provide a more comprehensive understanding of how athletes manage physical health risks over the course of their careers.

Furthermore, our focus on the athletes' perspectives adds a critical layer to the understanding of risk management. By capturing the experiences of athletes, this study expands the knowledge on sociocultural mechanisms that were identified in previous research (e.g., 1, 7, 21). Our findings highlight that risk management is not merely a product of socialization or a response to external pressures but an active, self-regulated process in which athletes continuously reassess and refine their strategies over time. While building on sociological research on the culture of risk, which examines how institutional and social norms shape the normalization of risk-taking, this study extends the discussion by emphasizing the individual cognitive processes and strategic behavioral adaptations athletes develop throughout their careers. Thereby, the present study offers a nuanced view of how subjective risk perception shapes decision-making and health management in elite sports from the athlete's perspective.

Within our analysis, we constructed four patterns of physical health risk management among elite handball players: (1) *Externalizing risks and refraining from proactivity*; (2) *Relinquishing control under medical uncertainty*; (3) *Fluctuating prioritization of health or success*; (4) *Calculated health-risk taking to achieve success*. Overall, our four themes illustrate the fluid nature of risk management strategies throughout elite handball players' careers. While these patterns were evident among athletes at specific points in their careers, not all athletes exhibited every pattern or went through them in the same order. However, employing a career-stage perspective enabled us to discern that certain risk management patterns were more prevalent at specific career stages.

Elite handball players' strategies for managing physical health risks throughout their careers can be understood as existing on a spectrum, reflecting varying levels of awareness, control, and proactivity across the facets of risk management. On a passive dimension of the spectrum, athletes adopted a fatalistic approach, frequently *externalizing risks and refraining from proactivity*. Injuries were externally attributed to luck or fate. Consequently, particularly younger athletes did not perceive risks. Instead, they viewed injuries as arbitrary and unavoidable events that required no particular behavioral adjustments, reflecting cognitive elements that have been attributed to risk normalization and risk acceptance in previous studies (cf. 21, 22). A novel finding of this study is that, according to the Relational Theory of Risk (29), the causal relationship between risk objects (e.g., pain or physical strain) and objects at risk (e.g., injury) was not

recognized by athletes. This lack of recognition further reinforced their passive approach to managing health risks.

In the second theme *complying with the norms by relinquishing control*, athletes were still passive in agency as they referred control over risk management to external authorities, such as coaches and medical professionals. The athletes demonstrated a limited awareness of the potential physical health risks, only acknowledging the existence of health threats when such concerns were validated by a formal diagnosis. This reliance on external judgement rather than self-monitoring extends findings in sports injury studies indicating that athletes frequently fail to perceive injury-related symptoms as serious unless validated by professionals (62).

At other times, athletes demonstrated a *fluctuating prioritization of health or success* based on situational pressures, such as the relevance of upcoming games or social and organizational factors (7, 9, 13, 34). These diverse influencing factors shaped which risks became most salient to the athlete at a given time and how athletes evaluated risks. When specific factors, such as the severity of injuries, heightened athletes' awareness of the risk for potential sporting or medical consequences, athletes frequently re-evaluated their priorities and values. This ultimately shaped how athletes managed risks (31). This dynamic process aligns with the Relational Theory of Risk, showing that risk perception and evaluation evolve based on personal and contextual factors. This finding extends the culture of risk heuristics beyond a static, socialized response by highlighting the situational and temporal variability of athletes' engagement with risk.

At the most active dimension of the spectrum, players perceived physical risks as an essential part of elite performance and exhibited *calculated health-risk taking to achieve success*. This strategy was characterized by a calculated risk-taking mindset; here, athletes acknowledged the potential for long-term consequences (21, 63) but willingly took risks by performing hurt or using analgesics to sustain peak performance. Particularly athletes at more advanced stages of their careers emphasized that their previous experiences with risk management allowed them to make informed choices about risk-taking, leading to increased risk-taking.

## Limitations and avenues for future research

Our career-perspective approach offered rich, longitudinal insights into individual risk management strategies. However, the study also has limitations in generalizing findings across sports or cultural contexts, as risk perceptions and management strategies are often shaped by sport-specific norms and changing organizational expectations (62). Future research could explore how these dynamics vary across different sports and cultural settings to identify broader patterns in risk perception and management. Comparative studies on sport-specific norms and organizational expectations may provide deeper insights into how athletes navigate physical health risks. Additionally, examining how evolving policies or medical advancements influence risk behaviors could further illuminate the adaptability of athletes' strategies over time.

Furthermore, the utilized method of retrospective interviews could be supplemented with real-time data collection during or immediately following health events to capture more precise, contextually grounded insights. This approach could also reveal relevant discrepancies between immediate and long-term interpretations of physical health risks. Further research could also specifically integrate the perspectives of coaches and medical staff to facilitate a multi-dimensional view of the influence of team dynamics and medical protocols on athletes' risk-related behavior.

## Practical implications

The results of this study indicate potential courses of action for organizations and stakeholders in elite sport, including coaches, sports psychologists and team doctors or external physicians. One key implication is the need for athlete-centered education programs that foster proactive physical health risk management. Programs should promote an internal locus of control, resilience, and awareness of long-term health risks (e.g., 64), empowering athletes to take an active role in injury prevention and recovery. Sport clubs and unions should facilitate access to independent health advisors, including general physicians and mental health professionals, fostering open dialogue about injury risks (20). Encouraging athletes to articulate their subjective perceptions to specialists outside of the sport network can enhance their awareness of the social and psychological factors shaping their risk evaluations and coping strategies. Integrating routine risk assessments and regular medical check-ins could further enhance athletes' awareness of their physical limits. In this context, health monitoring software and periodic consultations could provide athletes with structured opportunities to assess concerns and refine health risk management strategies, which in turn could also encourage more proactive health management (cf. 26).

By showing that athletes' risk perceptions often hinge on external validation, such as diagnoses, our study suggests that elite sports organizations must establish clear, transparent injury protocols that could give medical staff greater authority to make and communicate diagnoses that provide athletes with justification for rest periods when experiencing pain or illness (cf. 9, 57, 58). Regular health evaluations by independent medical professionals, alongside non-punitive injury reporting mechanisms, can help mitigate the fear of disclosing pain and injuries (34, 61). To prevent conflicts of interest for both athletes and medical professionals, organizations should implement policies ensuring medical staff's independence, such as mandating financial disclosure and removing performance-related incentives (9). These measures promote unbiased medical care, prioritizing athlete well-being over competitive demands (65).

## Data availability statement

The datasets presented in this article are not readily available because restrictions apply to their availability, as they were used under ethical permission for the current study. Due to the

sensitivity of health data, access is restricted to ensure compliance with data protection regulations and to safeguard participants' privacy. Requests to access the datasets should be directed to Jlbursik@gmail.com.

## Ethics statement

The studies involving humans were approved by Faculty of Economic and Social Sciences ethics committee at the University of Tübingen (AZ.: A2.5.4-176\_ns). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

JB: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. JM: Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – review & editing. AT: Conceptualization, Funding acquisition, Methodology, Resources, Supervision, Validation, Writing – review & editing. FK: Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – review & editing. JJ: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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## References

- Nixon HL. Accepting the risks of pain and injury in sport: mediated cultural influences on playing hurt. *Sociol Sport J.* (1993) 10(2):183–96. doi: 10.1123/ssj.10.2.183
- Bolling C, Barboza SD, Van Mechelen W, Pasman HR. Letting the cat out of the bag: athletes, coaches and physiotherapists share their perspectives on injury prevention in elite sports. *Br J Sports Med.* (2020) 54(14):871–7. doi: 10.1136/bjsports-2019-100773
- Reussner AK, Bursik J, Kuehnle F, Thiel A, John JM. The meaning of injury to the elite athlete: a systematic review. *Psychol Sport Exerc.* (2023) 71:102571. doi: 10.1016/j.psychsport.2023.102571
- Wiese-Bjornstal DM, Smith AM, Shaffer SM, Morrey MA. An integrated model of response to sport injury: psychological and sociological dynamics. *J Appl Sport Psychol.* (1998) 10(1):46–69. doi: 10.1080/10413209808406377
- Bursik J, John JM, Mayer J, Thiel A, Kühnle F. Risk profiles for self-medication with analgesics among elite German handball players. *Int Rev Sociol Sport.* (2024). doi: 10.1177/10126902241280156
- Thiel A, Schubring A, Schneider S, Zipfel S, Mayer J. Health in elite sports—a “bio-psycho-social” perspective. *German Journal of Sports Medicine/Deutsche Zeitschrift Fur Sportmedizin.* (2015) 66(9):241–7. doi: 10.5960/dzsm.2015.194
- Roderick M, Waddington I, Parker G. Playing hurt: managing injuries in English professional football. *Int Rev Sociol Sport.* (2000) 35(2):165–80. doi: 10.1177/10126900035002003
- Mayer J, Thiel A. Presenteeism in the elite sports workplace: the willingness to compete hurt among German elite handball and track and field athletes. *Int Rev Sociol Sport.* (2018) 53(1):49–68. doi: 10.1177/1012690216640525
- Bursik J, Thiel A, Mayer J, John JM. The role of psychosocial factors in performing hurt: a systematic review covering the high-performance domains of sport, music, and dance. *Int Rev Sport Exerc Psychol.* (2025):1–25. doi: 10.1080/1750984X.2025.2450791
- John JM, Bursik J, Burgstahler C, Büsch D, Luig P, Kühnle F, et al. Prevalence of sport-related analgesic use in German elite handball players: prävalenz des sportbezogenen schmerzmittelkonsums bei deutschen spitzen-handballern. *Deutsche Zeitschrift für Sportmedizin-Cuxhaven: Dynamic Media Sales Verlag.* (2023) 74(5):168–74. doi: 10.5960/dzsm.2023.568
- Berg EC, Migliaccio TA, Anzini-Varesio R. Female football players, the sport ethic and the masculinity-sport nexus. *Sport Soc.* (2014) 17(2):176–89. doi: 10.1080/17430437.2013.828699
- Tranaeus U, Martin S, Ivarsson A. Psychosocial risk factors for overuse injuries in competitive athletes: a mixed-studies systematic review. *Sports Med.* (2022) 52:1–16. doi: 10.1007/s40279-021-01597-5
- Mayer J, Kühnle F, Thiel A. Presenteeism in elite sport organisations: a framework for understanding athletes' decisions to practise sport despite health concerns. In: Lang M, editor. *Routledge Handbook of Athlete Welfare.* London: Routledge (2020). p. 81–93.
- Douglas K, Carless D. Performance, discovery, and relational narratives among women professional tournament golfers. *Women Sport Phys Act J.* (2006) 15(2):14–27. doi: 10.1123/wspaj.15.2.14
- Carless D, Douglas K. Stories of success: cultural narratives and personal stories of elite and professional athletes. In: Lee S, Dixon M, Ghaye T, editors. *Coaching for Performance: Realising the Olympic Dream.* London: Routledge (2016). p. 61–72.
- Everard C, Wade R, Howells K. Storying sports injury experiences of elite track athletes: a narrative analysis. *Psychol Sport Exerc.* (2021) 56:102007. doi: 10.1016/j.psychsport.2021.102007
- John JM, Wachsmuth S, Thiel A. “Either or” or “as well as”: exploring the relation between health and performance throughout the career pathways of high-performing athletes, musicians, and mathematicians. *Sport Exerc Perform Psychol.* Advance online publication 2024. doi: 10.1037/spy0000370
- Howe D. *Sport, Professionalism and Pain: Ethnographies of Injury and Risk.* London and New York, NY: Routledge (2003).
- Curry TJ. A little pain never hurt anyone: athletic career socialization and the normalization of sports injury. *Symb Interact.* (1993) 16(3):273–90. doi: 10.1525/si.1993.16.3.273
- Hughes R, Coakley J. Positive deviance among athletes: the implications of overconformity to the sport ethic. *Sociol Sport J.* (1991) 8(4):307–25. doi: 10.1123/ssj.8.4.307
- Theberge N. Just a normal bad part of what I do”: elite athletes' accounts of the relationship between health and sport. *Sociol Sport J.* (2008) 25(2):206–22. doi: 10.1123/ssj.25.2.206
- Schnell A, Mayer J, Diehl K, Zipfel S, Thiel A. Giving everything for athletic success!—sports-specific risk acceptance of elite adolescent athletes. *Psychol Sport Exerc.* (2014) 15(2):165–72. doi: 10.1016/j.psychsport.2013.10.012
- Allen-Collinson J, Hockey J. *Runners' Tales: Autoethnography, Injury and Narrative.* Los Angeles, CA: SAGE Publications (2001).
- Pike EC, Maguire JA. Injury in women's sport: classifying key elements of “risk encounters”. *Sociol Sport J.* (2003) 20(3):232–51. doi: 10.1123/ssj.20.3.232
- Schubring A, Thiel A. Coping with growth in adolescent elite sport. *Sociol Sport J.* (2014) 31(3):304–26. doi: 10.1123/ssj.2013-0071
- Schubring A, Halltén M, Barker-Ruchti N, Post A. Balancing risk-taking and self-care: the ecology of athlete health behaviour during the olympic qualification phase. *Int Rev Sociol Sport.* (2023) 58(8):1326–48. doi: 10.1177/10126902231168098
- Hubbard DW. *The Failure of Risk Management: Why It's Broken and how to fix it.* Hoboken, NJ: John Wiley & Sons (2020).
- Hansson SO. Risk: objective or subjective, facts or values. *J Risk Res.* (2010) 13(2):231–8. doi: 10.1080/13669870903126226
- Boholm Å, Corvellec H. A relational theory of risk. *J Risk Res.* (2011) 14(2):175–90. doi: 10.1080/13669877.2010.515313
- Chrétien A, D'arripe-Longueville F, Haffner K, Hayotte M, Bernier M, Vuillemin A. Using a socioecological approach to explore healthy lifestyle in elite sport: a qualitative study of French athletes', coaches', and managers' perspectives. *Int J Qual Stud Health Well-being.* (2023) 18(1):2251235. doi: 10.1080/17482631.2023.2251235
- Mayer J, Burgess S, Thiel A. Return-to-play decision making in team sports athletes. A quasi-naturalistic scenario study. *Front Psychol.* (2020) 11:1020. doi: 10.3389/fpsyg.2020.01020
- Corvellec H. Organizational risk as it derives from what managers value: a practice-based approach to risk assessment. *J Contingencies Crisis Manag.* (2010) 18(3):145–54. doi: 10.1111/j.1468-5973.2010.00611.x
- Coker-Cranney A, Watson JC, Bernstein M, Voelker DK, Coakley J. How far is too far? Understanding identity and overconformity in collegiate wrestlers. *Qual Res Sport Exerc Health.* (2018) 10(1):92–116. doi: 10.1080/2159676X.2017.1372798
- Roderick M. Adding insult to injury: workplace injury in English professional football. *Sociol Health Illn.* (2006) 28(1):76–97. doi: 10.1111/j.1467-9566.2006.00483.x
- Huber O. Risky decisions: active risk management. *Curr Dir Psychol Sci.* (2012) 21(1):26–30. doi: 10.1177/0963721411422055
- Steptoe A. Health behavior and stress. In: Fink G, editor. *The Encyclopedia of Stress.* New York: Academic Press (2007). p. 323–6.
- Kvillemo P, Nilsson A, Strandberg AK, Björk K, Elgán TH, Gripenberg J. Mental health problems, health risk behaviors, and prevention: a qualitative interview study on perceptions and attitudes among elite male soccer players. *Front Public Health.* (2023). doi: 10.3389/fpubh.2022.1044601
- Tyszka T, Zaleskiewicz T. When does information about probability count in choices under risk? *Risk Anal.* (2006) 26(6):1623–36. doi: 10.1111/j.1539-6924.2006.00847.x
- Schwandt T. *Constructivist, Interpretivist Approaches to Human Inquiry. Handbook of Qualitative Research.* Thousand Oaks, CA: Sage (1994).
- Palinkas LA, Horwitz SM, Green CA, Wisdom JP, Duan N, Hoagwood K. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Adm Policy Ment Health.* (2015) 42:533–44. doi: 10.1007/s10488-013-0528-y
- Kelly SE, Bourgeault I, Dingwall R. Qualitative interviewing techniques and styles. In: Bourgeault I, de Vries R, Dingwall R, editors. *The SAGE Handbook of Qualitative Methods in Health Research.* London: Sage (2010). p. 307–26.
- Moller M, Attermann J, Myklebust G, Wedderkopp N. Injury risk in Danish youth and senior elite handball using a new SMS text messages approach. *Br J Sports Med.* (2012) 46(7):531–7. doi: 10.1136/bjsports-2012-091022
- Thiel A, Gropper H, John JM, Keppler V, Mayer J. *bioMAP-Development of a Software for the Retrospective Analysis of Biopsychosocial Health Trajectories in Elite Sport.* Tübingen: Tübingen University Press (2020). doi: 10.15496/publikation-38957

44. John JM, Thiel A. All roads lead to Rome? Talent narratives of elite athletes, musicians, and mathematicians. *Qual Res Sport Exerc Health*. (2022) 14(7):1174–95. doi: 10.1080/2159676X.2022.2074078
45. Rodgers B, Elliott R. Qualitative methods in psychotherapy outcome research. In: Gelo O, Pritz A, Rieken B, editors. *Psychotherapy Research: Foundations, Process, and Outcome*. Vienna: Springer (2014). p. 559–78.
46. Schubring A. Biographical mapping interviews. In: Smith R, Rich KA, Giles AR, editors. *Participatory Research in Sport and Physical Activity*. London: Routledge (2024). p. 126–40.
47. Guenette F, Marshall A. Time line drawings: enhancing participant voice in narrative interviews on sensitive topics. *Int J Qual Methods*. (2009) 8(1):85–92. doi: 10.1177/160940690900800108
48. Sheridan J, Chamberlain K, Dupuis A. Timelining: visualizing experience. *Qual Res*. (2011) 11(5):552–69. doi: 10.1177/1468794111413235
49. Braun V, Clarke V. *Thematic Analysis: A Practical Guide*. London: SAGE Publications (2021).
50. Smith B, McGannon KR. Developing rigor in qualitative research: problems and opportunities within sport and exercise psychology. *Int Rev Sport Exerc Psychol*. (2018) 11(1):101–21. doi: 10.1080/1750984X.2017.1317357
51. Terry G, Hayfield N. *Essentials of Thematic Analysis*. American Psychological Association (2021).
52. Smith B, Sparkes AC, Caddick N. Judging qualitative research. In: Nelson L, Groom R, Potrac P, editors. *Research Methods in Sports Coaching*. London: Routledge (2014). p. 192–201.
53. Sparkes AC, Smith B. Judging the quality of qualitative inquiry: criteriology and relativism in action. *Psychol Sport Exerc*. (2009) 10(5):491–7. doi: 10.1016/j.psychsport.2009.02.006
54. Kontos AP. Perceived risk, risk taking, estimation of ability and injury among adolescent sport participants. *J Pediatr Psychol*. (2004) 29(6):447–55. doi: 10.1093/jpepsy/jsh048
55. Clement D, Arvinen-Barrow M, Fetty T. Psychosocial responses during different phases of sport-injury rehabilitation: a qualitative study. *J Athl Train*. (2015) 50(1):95–104. doi: 10.4085/1062-6050-49.3.52
56. Paul DJ, Jones L, Read P. Shared decision-making: some cautionary observations in the context of elite sport. *Sports Medicine-Open*. (2022) 8(1):44. doi: 10.1186/s40798-022-00413-2
57. Ledford CJ, Fisher CL, Cafferty LA, Jackson JT, Seehusen DA, Crawford PF. Turning points as opportunities to partner with patients living with type 2 diabetes or prediabetes. *J Am Board Fam Med*. (2020) 33(2):211–9. doi: 10.3122/jabfm.2020.02.190136
58. Humpel N, Magee C, Jones SC. The impact of a cancer diagnosis on the health behaviors of cancer survivors and their family and friends. *Support Care Cancer*. (2007) 15:621–30. doi: 10.1007/s00520-006-0207-6
59. Waddington I, Roderick M. Management of medical confidentiality in English professional football clubs: some ethical problems and issues. *Br J Sports Med*. (2002) 36(2):118–23. doi: 10.1136/bjbm.36.2.118
60. Mayer J, Giel KE, Malcolm D, Schneider S, Diehl K, Zipfel S, et al. Compete or rest? Willingness to compete hurt among adolescent elite athletes. *Psychol Sport Exerc*. (2018) 35:143–50. doi: 10.1016/j.psychsport.2017.12.004
61. Overbye M. Walking the line? An investigation into elite athletes' sport-related use of painkillers and their willingness to use analgesics to train or compete when injured. *Int Rev Sociol Sport*. (2021) 56(8):1091–115. doi: 10.1177/1012690220973552
62. Bolling C, Barboza D, van Mechelen S, Pasman W, R H. How elite athletes, coaches, and physiotherapists perceive a sports injury. *Translational Sports Medicine*. (2019) 2(1):17–23. doi: 10.1002/tsm2.53
63. Hammond LE, Lilley JM, Pope GD, Ribbans WJ, Walker NC. We've just learnt to put up with it': an exploration of attitudes and decision-making surrounding playing with injury in English professional football. *Qual Res Sport Exerc Health*. (2014) 6(2):161–81. doi: 10.1080/2159676X.2013.796488
64. Chandler GE, Kalmakis KA, Chiodo L, Helling J. The efficacy of a resilience intervention among diverse, at-risk, college athletes: a mixed-methods study. *J Am Psychiatr Nurses Assoc*. (2020) 26(3):269–81. doi: 10.1177/1078390319886923
65. Calandrillo SP. Sports medicine conflicts: team physicians vs. Athlete-patients. *Saint Louis University Journal*. (2005):185–210.

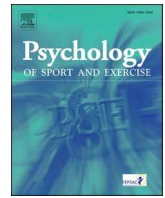
### **5.3 Paper 2: “The meaning of injury to the elite athlete”**

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## The meaning of injury to the elite athlete: A systematic review

Anna K. Reussner<sup>a,\*</sup>, Jan Bursik<sup>a</sup>, Felix Kühnle<sup>b</sup>, Ansgar Thiel<sup>a</sup>, Jannika M. John<sup>a</sup>

<sup>a</sup> Institute of Sports Science, University of Tübingen, Wilhelmstraße 124, 72074, Tübingen, Germany

<sup>b</sup> Institute of Sport Science, Technical University Darmstadt, Magdalenenstraße 27, 64289, Darmstadt, Germany

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### ABSTRACT

In the pursuit of a successful career in elite sports, athletes mostly rely on their physical abilities. An injury can threaten such a career, thereby representing a potentially critical life event that carries considerable meaning to the affected athlete. Qualitative literature exploring injury experiences in elite athletes is therefore seeking to frame injury through the athlete's own voice. With this systematic review, we aimed to answer the research question *What is the meaning of injuries to the elite athlete?* by reviewing existing qualitative research exploring the meaning of injury as told from the athlete's perspective. We constructed five overarching themes of meaning through thematic synthesis of 29 original studies: (1) *unwelcome disruption* – Injury as potential career threat; (2) *destruction* – My life (as an athlete) is over; (3) *reinforcement* – Relighting the fire; (4) *going through the motions* – Injury as an inherent part of elite sport; and (5) *time-out* – Respite and perspective. These meanings were neither exclusive nor static but constructed according to the situation at the moment of injury and could later be adapted depending on social context and specific circumstances. To better support injured athletes, practitioners need to be aware of the importance of the subjective meaning that athletes construct for individual injuries. Understanding these meanings enables practitioners to aid athletes in changing previously negative meanings into more positive ones. Our findings therefore call for improvements in the individualized support of elite athletes that leaves space for open communication about the meanings that athletes attach to their injury experiences.

### 1. Introduction

The world of elite sports is dominated by those athletes who continuously prove and build upon their own physical abilities. However, maintaining long-term health in an industry so focused on constant performance optimization is a difficult, if not contradictory condition (Everard, Wadey, & Howells, 2021; Theberge, 2008). Within this setting, injuries pose an omnipresent threat to a successful career. They can be small or life-altering, quick fixes or chronic. Their origin can range from overuse to one false move in training or competition. For injuries sustained in competition, López-Valenciano et al. (2020) found the prevalence rate in male professional football players during matches to be 36 injuries per 1000 hours of exposure, while in volleyball it was found to be “3.1 injuries per player per 1000 match hours” (Bele, Östenberg, Sjöström, & Alricsson, 2015, p. 204). A comparable prevalence of injuries in elite athletes has been observed in similar studies in other sports (Da Costa, King, Lewis, Vicenzino, & Watson, 2021; Joncheray, Chavinier-Réla, Burlot, Dalgalarondo, & Fukazawa-Couckuyt,

2022); for instance, Jacobsson et al. (2013) report that two-thirds of track and field athletes incur at least one injury per year (p. 1). These prevalences illustrate the high likelihood with which elite athletes experience injury sooner or later throughout their career. Injuries may also play a significant role in the retirement from sports: Arvinen-Barrow, DeGrave, Pack, and Hemmings (2019) report that “injuries are the main reason why Finnish elite athletes retire from sport” and “the second highest reason of career termination for Danish elite athletes” (p. 4).

Besides focusing on their prevalence, previous research concerning injuries in elite athletes has explored their causes, prevention, rehabilitation, psychological influences, and resulting responses. The established body of literature is mainly rooted in the sport medical field where injury has commonly been defined as “any physical complaint sustained”, the “need for medical attention”, or the time lost in training or competition (Fuller et al., 2006, p. 84). These medically-oriented injury definitions illustrate a rather functionalized perspective on athlete health in which the significance of injuries is constructed in

\* Corresponding author. Institute of Sports Science University of Tübingen, Wilhelmstraße 124, 72074, Tübingen, Germany.

E-mail addresses: [anna.reussner@uni-tuebingen.de](mailto:anna.reussner@uni-tuebingen.de) (A.K. Reussner), [jan.bursik@uni-tuebingen.de](mailto:jan.bursik@uni-tuebingen.de) (J. Bursik), [felix.kuehnle@tu-darmstadt.de](mailto:felix.kuehnle@tu-darmstadt.de) (F. Kühnle), [ansgar.thiel@uni-tuebingen.de](mailto:ansgar.thiel@uni-tuebingen.de) (A. Thiel), [jannika.john@uni-tuebingen.de](mailto:jannika.john@uni-tuebingen.de) (J.M. John).

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terms of physical complaints and time missed from sport (cf. Coyle, Gorczyński, & Gibson, 2017; Overbye, 2021; Schubring, Halltén, Barker-Ruchti, & Post, 2023). The athlete's own perspective on the injury experience is often left out from such scholarship, even though previous research has shown that injuries often represent critical life events to the elite athlete and carry significant meaning in the context of their athletic career (cf. Howells, Sarkar, & Fletcher, 2017; John, Gropper, & Thiel, 2019).

To capture the perspective of injury as a critical life event, a smaller, but continuously growing body of qualitative sociological and psychological literature is seeking to frame injury experiences through the athlete's own voice (see e.g., Bianco, 2001; Bolling, Delfino Barboza, van Mechelen, & Pasma, 2019; Podlog & Eklund, 2010; Wadey, Evans, Evans, & Mitchell, 2011). Such examination of the meaning of injury to the elite athlete is imperative, given that humans are meaning-makers who continuously try to make sense of their own experiences (Smith, 2016). As Sparkes and Smith (2009) point out, the meanings humans attach to their experiences inform and generate future behavior. Thus, focusing on the meaning of injury might further improve our understanding of the significance of injuries within athletic careers.

While several such studies on the subjective meaning of injuries for elite athletes have been conducted in the past, the findings have yet to be reviewed systematically and synthesized on a meta level. The results of such synthesis can provide significant insights for effective injury management as one aspect of athlete health protection, with the other being injury prevention (cf. Bekker et al., 2020). As Bekker et al. (2020) explain, "if we truly believe that the athlete is in fact the main focus of athlete health protection, it stands to reason that their experiences and perceptions should shape and inform the way we develop our athlete health protection strategies" (p. 898).

With this systematic review, we therefore aimed to answer the research question *What is the meaning of injuries to the elite athlete?*. For this purpose, *meaning* refers to the cognitive appraisal of a life event (i.e., injury) by the affected person (i.e. athlete). The meaning that the affected individual constructs is impacted by their own immediate emotional and behavioral response, social context, and the consequences for their own life or career (cf. Filipp & Aymanns, 2010). Further, *injury* refers to any physical harm experienced by the elite athlete that impacted their ability to train for or compete in their respective sport. We sought to meet our research aim by reviewing the existing body of qualitative research that explores the meaning of injury as told from the athlete's perspective.

## 2. Methods

As we aimed to identify and synthesize all relevant qualitative literature on the meaning that elite athletes attach to injury, we deemed a systematic review to be the most appropriate form of literature review. Our review follows the PRISMA Guidelines for Systematic Reviews (Page et al., 2021) and was prospectively registered on the Open Science Framework in November 2022 (registration doi: <https://doi.org/10.17605/OSF.IO/5SK9Z>). Our final systematic review differs from the preregistration in two aspects: Firstly, we removed "observation" from our search string, as it resulted in a high number of quantitative studies that were irrelevant to the purpose of our systematic review. It also appeared not to add further relevant qualitative studies, as the search terms "phenomenolog\*" and "ethnograph\*" likely covered qualitative observational studies. Secondly, we chose to use the CASP tool instead of the NICE guidelines for assessing the methodological quality of the included studies (Critical Appraisal Skills Programme, 2022). This decision is based partly on the fact that we found the CASP tool rather than the NICE guidelines to be used in similar projects to our own (cf. Bernard et al., 2023; Shorey & Baladram, 2023; Yao, Wu, Toland, & Li, 2023). In addition, the NICE guidelines were originally based in part on the CASP checklist for qualitative research (National Institute for Health and Care Excellence, 2012), but have been revised since the start of our research

project.

### 2.1. Retrieval of research papers

To retrieve the most relevant studies for our search, we constructed a search term consisting of four categories; (1) injury, (2) qualitative, (3) elite, and (4) athlete (the full search term is shown in Supplementary Table 1). We selected four databases (PubMed, SPORTDiscus, APA PsycInfo, and Web of Science Core Collection) that were searched on November 12th, 2022. We set no restriction for the date of publication of included studies. In all databases, the search protocol was set to select studies that had been peer-reviewed and written in English.

### 2.2. Screening and selection of research papers

The first (AR) and second (JB) author conducted the title and abstract screening independently. Any discord was solved in discussion with the last author (JJ). Full texts were screened by the first author. The records remaining after the full text screening were discussed for inclusion by the first and last author. The screening process is depicted in Figure 1. All records were required to fulfill the following four criteria for selection: (1) original research (no meta-syntheses or reviews), (2) qualitative research methods or mixed-method designs, and (3) aiming to explore the meaning of injuries (not prevention or recovery) with a focus on the (4) elite athlete's perspective. Analogous to the most commonly employed definition of the term (cf. Swann, Moran, & Piggett, 2015), we defined *elite athlete* as any athlete competing at least at a national level. However, in line with findings by McKay et al. (2022) and Swann et al. (2015), most retrieved and screened studies did not present clear definitions and descriptions of their samples, but rather used wordings such as "professional athlete" or "top-level" athlete. Only some of the included studies (n = 8) provided details on the level and type of competitions, such as "Olympic athletes" (Howells & Fletcher, 2016) or "NCAA Division I athletes" (Grindstaff, Wrisberg, & Ross, 2010). In cases of ambiguity, we included studies based on the respective wording within the manuscripts (i.e., "professional athlete" or "elite athlete"), potentially resulting in some distortion of our sample.

As the lived experience of injury and the meaning athletes attach to this experience is likely highly dependent on the context (cf. John et al., 2019; Sparkes & Smith, 2009), we chose to exclude studies focusing on the injury experiences of master athletes and Para athletes. Previous research has indicated that the causes of injuries for master athletes often lie in age-related declines of physical functions (Maharam, Bauman, Kalman, Skolnik, & Perle, 1999), therefore resulting in other potential meanings of the injury experience compared to elite athletes at peak performance age. Para athletes represent an extremely heterogeneous population with different impairment classifications and complex health needs (McKay et al., 2022; Swartz, Hunt, Bantjes, Hainline, & Reardon, 2019), potentially also impacting the construction of the meaning of injury. In terms of injury type, we chose to exclude cases of concussion, because it is a particular form of head injury that directly impacts brain function as opposed to other injuries.

### 2.3. Quality appraisal

The included studies – although concerning one area of interest and presenting similar research aims – were difficult to compare on a strict scoring system, such as is used commonly for the quality appraisal of quantitative research. We nevertheless agree that a form of critical appraisal is required in the review of qualitative research (cf. Garside, 2014, p. 68) and chose the CASP Tool to evaluate our identified reports (Critical Appraisal Skills Programme, 2022). The CASP Checklist for qualitative research is comprised of 10 individual questions designed to assess "research transparency and methodological appropriateness" (Rabitti, Cavuto, Díaz Crescitelli, Bassi, & Ghirrotto, 2023, p. 3) of each study, reflecting current debates on quality in qualitative research (cf.

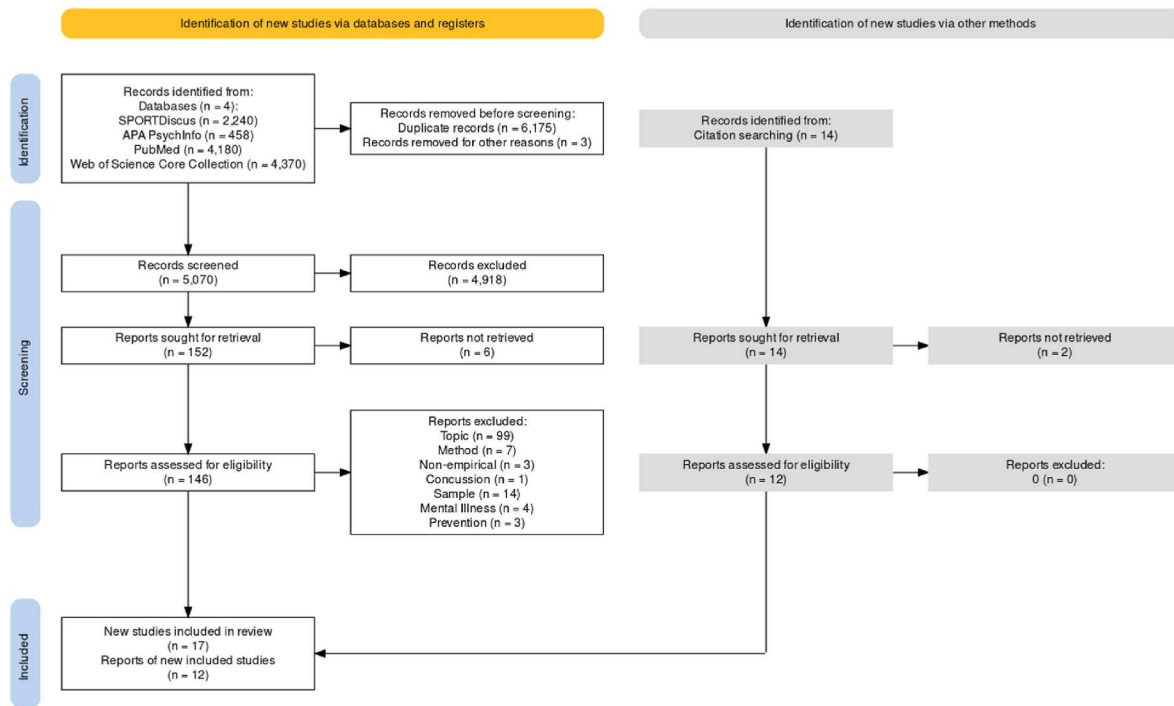


Figure 1. PRISMA flow diagram.

Sparkes & Smith, 2009). The first author conducted the assessment in consultation with the last author. The first nine questions in the CASP Checklist were answered “Yes,” “No,” or “Can’t Tell” for each individual report (question 10 being an open-ended question). The results of the appraisal are depicted in [Supplementary Table 2](#).

#### 2.4. Positioning and synthesis of results

Epistemologically, our systematic review is informed by a constructivist paradigm. On the one hand, this perspective assumes that knowledge emerges in social interactions and cultural contexts (cf. Lincoln, Lynham, & Guba, 2018). In this sense, the context in which the data was collected must be taken into account in the synthesis process (Horton, 2020). On the other hand, the constructivist perspective also implies reflexivity on the part of the researchers, in that their own assumptions and pre-understandings of the subject matter need to be continuously reflected upon and contextualized during the process of analysis (cf. Clarke & Braun, 2021; Smith & McGannon, 2018). Hence, particular attention should be placed on researchers’ own backgrounds. The first author (AR) has no personal experience within elite sports or with athletic injuries; thereby, she had an outsider perspective on the review topic. The second author (JB) is a sport psychologist who focuses on *playing hurt* within his academic research. Both, FK and JJ are former elite athletes who suffered from serious injuries during their athletic careers. Now, like AT, they are academic researchers focusing on health in elite sports from a sport sociological perspective.

Overall, we acknowledge that conducting a synthesis of qualitative research is still contested and hotly debated terrain (cf. Horton, 2020; Thomas & Harden, 2008), as qualitative research is often conceptualized as not generalizable and tied to a specific context, time, and group of people, with such synthesis risking to decontextualize the findings of original studies. However, some questions can only be answered through qualitative research, particularly those focusing on meaning-making. Therewith, we decided to conduct a thematic synthesis to summarize and interpret the findings of the existing original studies (Thomas & Harden, 2008). As Williams and Shaw (2016) have highlighted, thematic synthesis constitutes an interpretative method

with the aim to develop analytical themes that go beyond the findings of original studies. However, to preserve the context of the original findings, the first author extracted the setting, participants, methodology (i. e., philosophical assumptions, theoretical framework, data collection and analysis methods), and main findings of each study. The results of our data extraction are depicted in [Supplementary Table 3](#). Further, in an attempt to avoid de-contextualization of the findings in the original studies, we carefully checked whether the emerging findings of our synthesis were applicable to different contexts in the synthesis process (Horton, 2020). Whenever we noticed differences in the meaning of injury (for example due to contextual factors such as timing or severity of the injury), we highlighted these observations in the findings of the thematic synthesis. However, we realized that the original papers often provided only limited contextual information. With this in mind, our thematic synthesis encompassed different steps, moving from a descriptive to a more analytical orientation in an attempt to go beyond the findings of the original studies (cf. Thomas & Harden, 2008).

In a first step, the first author coded the findings of original studies line by line, focusing on those passages of text and direct participant quotes related to the meaning of injury (e.g., “It’s who I am. I am an athlete, it’s the first thing I say. If that is not the case, then what?” was coded as *injury threatens the athlete’s entire identity*). Secondly, the codes and associated passages of text were printed out on individual pieces of paper. The first, second, and last author then read and discussed all codes and related quotations and began to group codes with similar meaning together to derive more latent-level aspects. From these clusters of codes, we developed analytical themes that each summarized one type of meaning of injury for the elite athlete (e.g., *destruction – My life (as an athlete) is over*). These themes were then discussed and refined with all authors. Lastly, the first author cross-referenced the developed themes with the individual findings of each study to ensure that the developed themes were grounded in the original studies. In line with our constructivist perspective, we do not view the themes which we present in this paper as reflecting an objective “reality” but as our interpretative understanding of the meaning of injury to the elite athlete. The meaning we derive is grounded in the interpretations of the original studies’ authors, similar to the concept of “third order interpretations” described

for meta-ethnographies (Campbell et al., 2003; Soundy & Heneghan, 2022).

### 3. Results

#### 3.1. Literature identification

Of the initial 11,248 literature results, 6,175 were sorted out as duplicates, 4,918 were excluded after the title screening and a further 103 were excluded after the abstract screening. 17 studies were included after the full-text screening. Lastly, an additional 12 studies were identified for inclusion through citation searching, resulting in a total of 29 included full texts. The screening process is depicted in Figure 1. The most common reason for exclusion of studies was topical. Most ( $n = 3,499$ ) of the originally retrieved studies focused on topics such as biomechanics of different injuries, psychological impairment from concussion, prevalence of a certain type of injury, prevention of future injuries, or return to sport. A large number of studies ( $n = 638$ ) was excluded because the participants did not meet our specified criteria (e. g., participants were leisure athletes, see for example Badenhorst, Verhagen, Lambert, Van Mechelen, & Brown, 2019).

#### 3.2. Quality appraisal

The CASP quality appraisal we conducted showed definite discrepancies in the quality of included articles (see Supplementary Table 2). These discrepancies may in part be attributed to the varying norms and traditions of research processes within the various disciplines that are presented in our sample of original studies, including sport sociology, anthropology, sport psychology, and sports medicine (cf. Horton, 2020). Overall, we deemed qualitative research to be the appropriately selected approach for all 29 studies (Q2). We found the most severe differences in quality regarding chosen research methodology, recruiting strategy, and data collection (Q3, Q4, Q5), as these points were not always clearly addressed or justified by the respective authors. Relationship between researcher and participant(s), ethical considerations, and rigor of data analysis (Q6, Q7, Q8) were the points we found to be lacking most commonly. They were often poorly addressed in the work or completely left out of consideration. One study lacked a clearly stated aim of research (Q1). Two studies failed to present clear findings related to their research questions (Q9). However, we decided to include these three studies for review, as their findings nevertheless provided insights into the meaning of injury.

#### 3.3. Demographic characteristics of study participants

Over 327 elite athletes (one study did not specify the number of participants; see Howe, 2001) aged between 17 and 70 years participated in the included studies. The broad range in participant age stems from eight studies that included former elite athletes, who had experienced injuries during their competitive careers. The mean age of participants (based on those 11 studies that reported specific ages or average ages) was 28 years. Athletes from a total of 11 countries (as reported) were recruited, with most studies concerning athletes from the United States, Australia, and the UK. The athletes' level of experience (when reported) ranged from three months to 17 years at the elite level. The overall sample of athletes came from an even number of individual ( $n = 13$ ) and team ( $n = 13$ ) sports.

#### 3.4. Methodology of included studies

An overview of the methodological characteristics of all 29 studies is depicted in Supplementary Table 3.

##### 3.4.1. Philosophical assumptions

Most articles ( $n = 22$ ) did not specify philosophical assumptions,

which must be viewed critically since rigorous qualitative research is characterized by an alignment between philosophical assumptions, data collection, data analysis and interpretation of findings (Smith & McGannon, 2018). Of the seven articles in which the authors (clearly) reported their own philosophical assumptions, six were based on an interpretative paradigm with a constructivist (or constructionist) epistemology and relativist ontology – even though these positions were described in various terms (such as *critical constructivism*, *social constructivism*, *relativist subjectivism*). The remaining study described its positioning as post-positivist.

From the 22 studies that did not explicitly state their philosophical assumptions, we deemed 15 studies to be based on an interpretative paradigm and seven to be based on a positivist paradigm, based on the described theoretical frameworks, research questions, analytical procedures, and presentation of findings.

##### 3.4.2. Theoretical frameworks

The studies we analyzed were based on a multitude of theoretical frameworks; the four most common of which are discussed in the following paragraphs: (1) Integrated Model of Sport Injury (Wiese-Bjornstal, Smith, & LaMott, 1995; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998); (2) Typology of Illness Narratives (Frank, 2005, 2008); (3) Posttraumatic Growth (PTG) (Tedeschi & Calhoun, 1995; Tedeschi & Calhoun, 2004); (4) Conceptual Model of Adaptation to Retirement (Taylor & Ogilvie, 1994). The variations we saw in these frameworks illustrate the difference in approach that qualitative research on the meaning of injuries to elite athletes may take.

The theoretical framework that was used most frequently in the studies reviewed ( $n = 5$ ) is the *Integrated Model of Sport Injury*, developed by the working group around Wiese-Bjornstal (1995; 1998). This holistic psychological model of athletic injury depicts “how the appraisal of an injury subsequently affects both the emotional response to the injury and the behavioral response to the injury” (Ruddock-Hudson, O'Halloran, & Murphy, 2012, p. 378). Injury, according to the Integrated Model of Sport Injury, is regarded not in isolation of other variables, but in interaction with a “combination of personal and situational factors” (Bianco, Malo, & Orlick, 1999, p. 158). The importance that this model places on the individuality of each injured athlete makes it well-suited for assessing the meaning of injury.

While the Integrated Model of Sport injury was developed specifically for injuries, the *Typology of Illness Narratives* as developed by Frank (2005, 2008) was originally designed for a situation of illness rather than injury. However, as Bianco et al. (1999) state, “[i]t may be reasoned that athletes with debilitating illnesses are likely to confront many of the same stressors that seriously injured athletes encounter,” (p. 158) therefore making Frank's illness narratives a potentially appropriate framework for the qualitative study of injury. Foundational to Frank's framework is the assumption that, “when encountering a boundary situation of illness, we draw from culturally available storylines in order to impose meaning on our experiences” (Ronkainen & Ryba, 2017, p. 924). In this regard, Frank identified three major illness narratives that might also be applied to injury. Particularly his quest narrative is noteworthy in the context of elite athlete injury experience (Frank, 2013). Rather than focusing on the restoration of good health, this narrative is centralized around “finding new meaning and insight from the illness experience” (Ronkainen & Ryba, 2017, p. 924).

As opposed to the frameworks by Wiese-Bjornstal et. al and Frank, the concept of *Posttraumatic Growth (PTG)* and the *Conceptual Model of Adaptation to Retirement* assume a certain predetermined meaning of injury to the athlete (i.e. injury as trauma, injury as transition). The concept of PTG assumes that out of traumatic life events, individuals can “gain development beyond their pre-trauma functioning” (Howells & Fletcher, 2016, p. 173). This development is conceptualized as Posttraumatic Growth, which, much like the cognitive appraisal in the Wiese-Bjornstal model, “involves interaction among a variety of person and situational variables” (Howells & Fletcher, 2016, p. 173). The

included studies based on this framework examined the experience of adversity that the participating athletes needed to overcome to reach a potentially positive stadium of growth, sharing some parallels with Frank's quest narrative (Frank, 2005, 2008).

The Conceptual Model of Adaptation to Retirement by Taylor and Ogilvie (1994) was developed for the specific case of career transition. Kaul (2017) describes the model by Taylor and Ogilvie as useful for understanding the transition between an elite athlete's career and the life after elite sports, as it "includes the causes, the factors that may affect adaptation to a new life and the available resources leading to the outcomes or consequences of athletic termination" (p. 316). Accordingly, the two studies that applied this framework selected only participants that had transitioned (retired) from elite sports because of an injury. There was therefore a pre-assigned meaning of "injury as transition" to the research that was elaborated in the individual experiences.

### 3.4.3. Data collection and analysis

In most (n = 24) of the analyzed studies, the foundation of data collection was at least one semi-structured interview with each participant. One record (Gilbourne, 2002) presented the author's "own subjective tale" of his "past sporting experiences" (p. 72), while four studies did not specify the employed data collection method. Four of the studies that conducted interviews used at least one supplementary data collection method, such as focus groups, training surveys or timelining (see Barker-Ruchti, Schubring, Post, & Pettersson, 2019; Everard et al., 2021; Howells & Fletcher, 2016; Von Rosen, Kottorp, Fridén, Frohm, & Heijne, 2018).

### 3.5. Descriptive summary of findings

Overall, the included studies came from a range of scientific disciplines, including (sport) sociology (n = 5), (sport) psychology (n = 16), anthropology (n = 2), and sports medicine/sports science (n = 6). The included studies mainly focused on the experience of injury, particularly on the immediately resulting responses, worded for example as "cognitive appraisals" (Roy, Mokhtar, Karim, & Mohanan, 2015), "psychological reactions" (Udry, Gould, Bridges, & Beck, 1997) or "psychological responses" (Ruddock-Hudson, O'Halloran, & Murphy, 2014), rather than the meaning of injury to the elite athlete. Even when the original papers claimed to investigate the meaning of injury, their findings often focused solely on emotional responses and impacts or implications of the injury experience (e.g., Grindstaff et al., 2010). Beside studying the immediate responses to injury, the temporal experience of the injury process was often investigated, with a focus on the recovery and rehabilitation process and re-entry to sports. Several studies highlighted the importance of external influences, such as financial pressures and social support during the injury experience of elite athletes (e.g. Brock & Kleiber, 1994; Ronkainen & Ryba, 2017; San Jose, 2003).

### 3.6. Thematic synthesis of findings

Within our thematic synthesis, we construed the meaning of injury to the elite athlete from the findings of included studies. During the synthesis process, those studies that had more developed interpretative analyses contributed most to our thematic synthesis, while those studies presenting their findings mainly descriptively and with general or broad categories (such as "social support" or "consequences") contributed comparatively little. Resulting from our thematic synthesis, we constructed five overarching themes related to the meaning of injury: (1) *unwelcome disruption* – Injury as potential career threat; (2) *destruction* – My life (as an athlete) is over; (3) *reinforcement* – Relighting the fire; (4) *going through the motions* – Injury as an inherent part of elite sport and (5) *time-out* – Respite and perspective. These meanings of injury are neither exclusive nor static. Instead, athletes construct a meaning according to their individual situation at the moment of injury (e.g., degree of athletic

identity, point in career) and can later adapt to the new situation depending on the social context and specific circumstances of the injury (i.e., type and severity of injury, time or opportunities missed, quality of medical and social support, etc.). With more time passed since the incident of injury, its meaning can continuously change over an unlimited amount of time.

The following paragraphs describe each theme in more depth. We use participant quotes from the analyzed studies to support our interpretations. For an overview of the contributions made by each article to our thematic synthesis, please refer to Table 1.

#### 3.6.1. Unwelcome disruption – injury as potential career threat

According to our analysis, injuries signified a *disruption* in at least one, but likely multiple, areas of the athletes' lives; training and competition schedules needed to be modified (e.g., rehabilitation schedule), athletes needed to adapt mentally to the new situation, and injuries often resulted in a strain on personal relationships (i.e., with teammates or partners).

The *disruption* of injury impacted the athletes' positive future outlook, particularly regarding the ambiguity of rehabilitation, a timely return to pre-injury performance levels, and the possibility of re-injury after a return to sport. A potential inability to draw on others' experiences with similar injuries intensified the *unwelcome disruption*: "It was so hard process [sic], mentally. I wasn't sure about anything ... I think the worst thing was that nobody was ... couldn't tell me for sure if I will

**Table 1**

Overview of themes and contributions made by each article.

Theme	Papers	Exemplary Athlete Quote
<i>unwelcome disruption</i>	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 20, 22, 25, 26, 29	'It was so hard process [sic], mentally. I wasn't sure about anything ... I think the worst thing was that nobody was ... couldn't tell me for sure if I will be able to play hockey or not.' (7)
<i>destruction</i>	2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29	'... it was almost like a loss of identity, now I'm just ... just this battler ... just a small guy who can pass ... but, [names another player] already does that so what am I gonna be good for? ... well, nothing ... yeah ... like a little loss of identity ...' (8)
<i>reinforcement</i>	3, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 24, 25, 28,	'The fire inside of me was burning hotter than ever because something was taken away from me that had never been taken away before.' (3)
<i>going through the motions</i>	4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 17, 18, 19, 22, 24, 25, 26, 29	'Because I'm in a high risk sport where injuries happen, I'm ready for it. I expect it. So I just calmly go through the motions.' (10)
<i>time-out</i>	2, 3, 4, 5, 7, 8, 10, 11, 12, 14, 15, 16, 22, 24, 27, 29	'Ultimately the injuries were a blessing in disguise [...] They gave me respite in the middle of a ten-year career and that break I got has fueled and equipped me for longer.' (12)

1- Roy et al. (2015); 2- Grindstaff et al. (2010); 3- Udry et al. (1997); 4- Ruddock-Hudson et al. (2012); 5- Ivarsson, Stambulova, and Johnson (2018); 6- San Jose (2003); 7- Ronkainen and Ryba (2017); 8- Murray, Vuoskoski, Wellman, and Hebron (2022); 9- Borg, Falzon, and Muscat (2021); 10- Bianco et al. (1999); 11- Gilbourne (2002); 12- Everard et al. (2021); 13- Ruddock-Hudson et al. (2014); 14- Arvinen-Barrow et al. (2019); 15- Von Rosen et al. (2018); 16- Howells and Fletcher (2016); 17- Barker-Ruchti et al. (2019); 18- Howe (2001); 19- Joncheray et al. (2022); 20- Bele et al. (2015); 21- Fortunato and Marchant (1999); 22- Kaul (2017); 23- Pereira et al. (2016); 24- Brock and Kleiber (1994); 25- Roderick, Waddington, and Parker (2000); 26- Da Costa et al. (2021); 27- Stoltenburg, Kamphoff, and Bremer (2011); 28- Sarkar, Fletcher, and Brown (2015); 29- Lotysz and Short (2004).

be able to play hockey or not” (Ronkainen & Ryba, 2017, p. 925). Especially athletes experiencing continued disruption (e.g., from repeated injury) were often frustrated, anxious, fatigued, and sad: “The more games I missed, the more anxious and moody I became” (Ruddock-Hudson et al., 2012, p. 381).

The *disruption* of injury and adaptation to rehabilitation oftentimes meant having to train even harder than usual, adding to preexisting pressures. Many athletes perceived particularly internal pressure to return to sports and considered their own absence a negative impact on their own career: “I have missed several opportunities to play for Wales in the past because I was concealing an injury, so I don’t want to miss my next crack” (Howe, 2001, p. 298).

Lastly, injury as *disruption* carried a meaning of social separation, tension, and loneliness: “You don’t feel a part of it as much. You’re not in the match-day things, and that’s probably what you miss” (Ruddock-Hudson et al., 2012, p. 382). For relationships with those people closest to them, one athlete stated that injury “sort of affects you, your family and friends, just like the people who are with you all the time cause they know how much you put in” (Ruddock-Hudson et al., 2012, p. 381).

### 3.6.2. Destruction – my life (as an athlete) is over

For a large group of elite athletes, experiencing an injury was perceived as a threat, not only to their career, but to their entire person; for them, injury carried the meaning of *destruction* as they feared an end of their lives as athletes:

... it was ... scary to think that it could be all taken away from me in an instant ... it’s not necessarily in my control as well which ... I guess it’s quite scary to think that it could get taken ... could just get taken away ... this great life that I have could be gone in an instant. (Murray et al., 2022, p. 1225)

Existential fears went hand in hand with the notion of losing one’s identity due to a career interruption or potential career termination because of injury.

I started thinking about if I cannot run what would I do instead? What would I have done with all my time? For it defines me, I identify myself as a runner, that is who I am. I am the runner, I am running. (Von Rosen et al., 2018, p. 735)

In some cases, injuries carried the meaning of *destruction* not only for the athletic career, but also for everyday life, chronically limiting the former athletes in their physical abilities long after their sports career had ended:

Not being able to go up the stairs, or play with my son, or go for walks with my wife, or ride my motorcycle or things like that. Right now, it’s just such a negative impact on my life; it’s just immeasurable. (Lotysz & Short, 2004, p. 53)

The ongoing relationship to teammates, coaches, and clubs played an important part in the athletes’ realization that they were replaceable in the world of elite sports, exemplifying what has been described as social death by Taylor and Ogilvie (1994): “When the club decides they no longer need you, they just don’t want to know you; in fact, no one wants to know you” (Fortunato & Marchant, 1999, p. 276).

Athletes who constructed the meaning of *destruction* generally experienced negative emotions such as anger, intense sadness (depression), bitterness, and shock, much stronger than those who constructed the meaning of *disruption*.

These emotional reactions emphasize the devastating meaning of injuries to the affected athletes: “I would think about not being able to play and break down completely; I would just be sobbing. I couldn’t help myself, and I am not a crier ... I took it really, really hard” (Stoltenburg et al., 2011, p. 7).

### 3.6.3. Reinforcement - relighting the fire

In some cases, the *unwelcome disruption* of an injury caused a reinforcement of athletic goals rather than their abandonment. Injuries were perceived as opportunities to improve physical, but also mental capabilities: “When you come back you’re much stronger mentally. I’m going to go back into competition with a mental force that will allow me to make a real hit” (San Jose, 2003, p. 453).

Similarly, injury re-intensified the significance some athletes attributed to their respective sport, thereby fanning the flames of their existing desire to compete (again):

I think an underlying factor in all this is that I suppose it’s getting my hunger back to play footy; it’s making me think about it more. When I was playing I suppose I didn’t realise what I had until I lost it, and now that I can’t play, I just sit there and think ... I just want to play. (Ruddock-Hudson et al., 2014, p. 382)

Even though this *reinforcement* of athletic ambitions initiated by the injury experience carried positive meaning for most athletes, it could also result in negative consequences, as the following athlete described: “Players are so desperately keen to get back that 90 percent of them come back to play long before they have made a full recovery” (Roderick et al., 2000, p. 172). When injuries carried the meaning of *reinforcement*, the drive to return to sports appeared so strong that many athletes were willing to *play hurt* (cf. Roderick et al., 2000) rather than waiting for full recovery. Bianco et al. (1999) describe a similar willingness to compete while injured in their research:

Although they realized that the chances of doing well were slim and the possibility of further injury was high, the athletes felt compelled to take the risk. They had to give it a try and find out, because for them not knowing was intolerable. (p. 163)

We acknowledge that the drive to return to sport prematurely could also result from certain external pressures (i.e., financial or social) existing in the elite sports environment – at least in part. However, most athlete statements associated with this theme showed a clear tendency of intrinsic motivation over external factors, such as in the following quote: “I am more motivated due to my injury. I want to run again and perform at maximum effort at the next training session. I cannot wait” (Von Rosen et al., 2018, p. 735).

### 3.6.4. Going through the motions – injury as an inherent part of elite sports

A small number of athletes in the included studies constructed a meaning of normalcy around existing and future injuries. This group of athletes held realistic expectations on incurring an injury, as they had thoroughly considered the toll elite sports was taking on their bodies. They calmly *went through the motions* of recovery until a return to sport was safe (or no longer strongly contested), as the following athlete described: “Because I’m in a high risk sport where injuries happen, I’m ready for it. I expect it. So I just calmly go through the motions” (Bianco et al., 1999, p. 162). Often, these athletes were also able to draw on previous experiences with injury and took comfort in the knowledge that a return to pre-injury performance levels was possible: “I know since my [serious injury 1,5 years earlier] that I don’t lose my technique over that short time” (Barker-Ruchti et al., 2019, p. 694).

In some cases, the competitiveness of the elite sports industry and feelings of loyalty toward the team (and coaches) elicited the feeling that there was no time to be injured and sit out any competitions. Analogous to athletes who constructed the meaning of *reinforcement*, those who constructed the meaning of *going through the motions* were likely to play hurt, rather than giving themselves the time to heal:

Interviewer: Can you describe what it was like playing through these injuries?

Player: You get familiar with it, any pain ... if you don’t step back and ... get out of the scenario, you kind of get used to the sh\*\*t, I’m afraid. (Roderick et al., 2000, p. 174)

Oftentimes, a premature return to sport was rooted in a normalization or even glorification of the injury, as illustrated in the following quote:

In that culture and that set-up, injuries were seen as absolutely normal and going to happen, and if you wanted to be an elite athlete then you had to accept that that could happen ... They were almost seen as a badge of honour in some cases because they just meant you were working hard. (Everard et al., 2021, p. 7)

### 3.6.5. Time-out – respite and perspective

For those athletes who had the time and willingness to reflect, injury meant *time-out*, allowing athletes to gain a new perspective on life goals and priorities for the future:

In some ways emphasizing the notion that I could not really play allowed me to re-focus pretty quickly and to establish some kind of new pathway (I went to college to finally confront examinations). (Gilbourne, 2002, p. 83)

This shift in thinking about priorities was more prominent in some athletes than in others. Those who had been aware of and preparing for the eventual ending of their sports career for most of their athletic careers, experienced a less dramatic shift in priorities than those who had not yet considered their inevitable retirement, as evident in this athlete's description: "Hockey and sports are terminal; I have been told this from my mother ever since I was a little kid. School, education, and the work you do as a human being last forever ... sports will end" (Stoltenburg et al., 2011, p. 7).

Athletes who constructed the meaning of their injury as *time-out*, often perceived the recovery time spent with friends and family to be very valuable in offering a perspective on their sports career and life:

A major change which has given me a boost and gotten me back to my normal self is my son, he's three years old now and I want to see him do well in sports and for that, I want to get back to the best I can. (Kaul, 2017, p. 321, )

While not all athletes were able to adopt a positive meaning of injury through *respite and perspective* (particularly in the immediate aftermath of their diagnosis), some were able to find new meaning in their lives or even recognize injury as a blessing in disguise over time: "If I try to reflect back now, and look at the whole situation I ... it's almost in a kind a roundabout way ... it was a blessing in disguise" (Arvinen-Barrow et al., 2019, p. 16). A few athletes even explained how injury resulted in becoming a better person. This is illustrated in the following quote by one athlete who was not able to compete for two consecutive seasons due to injury, before returning to sports: "I think this all was good for me because I'm much a better person and a better husband, a better father to my children after all what happened" (Ronkainen & Ryba, 2017, p. 926).

The perspective gained throughout their individual journeys also led several athletes toward an appreciation of those things they still had and enjoyed:

I'm lucky to be able to play softball and be a Division I athlete; to have the opportunities that I have. People have a lot worse problems. I should be thankful for what I still have even though my teeth are wired shut and I have two plates in my chin. (Grindstaff et al., 2010, pp. 129–130)

## 4. Discussion

With this systematic review, we aimed to synthesize current qualitative literature exploring the meaning of injury to the elite athlete. In the following paragraphs, we discuss our findings, suggest practical implications, acknowledge challenges and limitations, and give recommendations for future research.

### 4.1. Discussion of key findings

We believe we were able to synthesize the results of the included studies in a way that provides a meaningful answer to the question *What is the meaning of injury to the elite athlete?* that goes beyond the findings of the original studies. Whereas the original studies tended to describe the experience of injury in terms of its impact on identity, emotions, and relationships, our review extended these findings by focusing on the actual meaning of injury to the elite athlete. Therewith, our thematic synthesis offers an interpretative account of the meaning of injury that was rarely described explicitly in the original papers. While we aimed to extend the findings of the included studies, our interpretations of injury meanings also share certain parallels with the findings of the original studies. There is a coherent understanding present in the original findings that injury experiences are a process influenced by contextual factors such as severity, timing, and career situation. These aspects also shape the constructed meaning of injury, which we will highlight in the following discussion of our themes.

Through thematic synthesis, we identified the five overarching constructed meanings of injury as presented in the Results section – (1) *unwelcome disruption* – Injury as potential career threat; (2) *destruction* – My life (as an athlete) is over; (3) *reinforcement* – Relighting the fire; (4) *going through the motions* – Injury as an inherent part of elite sport and (5) *time-out* – Respite and perspective. From our analysis, we deduce that elite athletes generally perceive the meaning of injury as either *unwelcome disruption* or *destruction*. For most athletes, *disruption* was the initial meaning of injury, while they awaited a further diagnosis or first results from rehabilitation. The athletes realized they were potentially restricted in their physical ability, at least for a brief time. Over the long term, the meaning of *disruption* commonly corresponded with less severe injuries, while for more severe prognoses (e.g., those of non-recovery or a serious future impediment of athletic activity), other meanings of injury, such as *destruction*, could be constructed.

The meaning of *destruction* commonly elicited a strong emotional reaction in athletes, particularly when important opportunities, the rest of the season or the entire career were threatened. Faced with such imminent, drastic changes to their lives, athletes deliberated the significance that they attributed to *being an athlete*, with their identities often being fully centered around their respective sport. The meaning of *destruction* thereby highlights critiqued hazards of an exclusive athletic identity and the prevalent performance narrative within elite sports (Carless & Douglas, 2013a, 2013b; Douglas & Carless, 2014; Everard et al., 2021; John & Thiel, 2022).

As opposed to the athletes constructing the meaning of *destruction*, those constructing the meaning of injury as *reinforcement*, described a strong determination to overcome the injury and return to their sport as soon as possible. This meaning of *reinforcement* coincided with any severity of diagnosis and was likely to occur when the injured athlete had previously recovered quickly from an identical injury or injuries in general. Those athletes with previous experiences of successful recovery from a specific injury may have even been inclined to see their own situation in a relatively positive light (i.e., *last time I came back even stronger*). The meaning of injury as *reinforcement* shows distinct parallels to the concept of adversarial growth (John et al., 2019; Sarkar et al., 2015) on the one hand (i.e., adversity as an opportunity to grow), but a higher willingness to return to sports without proper recovery (i.e., playing hurt) on the other. Fearing *disruption* or *destruction* of their athletic self, some athletes were determined to keep competing through injury. This pattern exemplifies the relationship between and interaction among the constructed meanings.

Similar to *destruction* and *reinforcement*, the meaning of *going through the motions* was commonly constructed by athletes with a particularly strong athletic identity and a particularly high acceptance of the elite sport culture of risk (Atkinson, 2019; Nixon, 1992, 1993; Roderick, 1998; Schnell, Mayer, Diehl, Zipfel, & Thiel, 2014). Athletes tended to construct the meaning of their injuries as *going through the motions* when

sustaining manageable injuries. They expected that injuries would be a part of their journey at some point in their lives and consequently accepted them as a part of their profession.

Despite being less common than the other constructed meanings, the meaning of injury as *time-out* is nevertheless important. In certain sports (e.g., those with particularly demanding competition schedules), athletes welcomed the short break in vigorous training and performance. This does not mean that they did not identify with their role, nor that they did not want to perform; it rather points to the intensity of most (but particularly of a select few, e.g., rugby or football) elite sports that are adding more and more playing time with less and less breaks between competitions (FIFPRO World Players' Union, 2021; Rugby Europe, 2023; Schwellnus et al., 2016; Soligard et al., 2016). For most athletes, *time-out* was constructed in retrospect rather than in the moment or period of injury, as common with the other meanings of injury.

During our thematic synthesis of included studies, we found varying aspects of elite sports culture to play an important role in the constructed meaning of injury to the elite athlete. The culture of elite sports expects its members to place sports above all else in life and to not show any weakness on the road to perfection (Atkinson, 2019; Nixon, 1992, 1993; Roderick, 1998; Schnell et al., 2014). As we have seen from our analysis, the degree of socialization into the elite sports culture has a stark effect on the constructed meaning of injury (e.g., *destruction* or *reinforcement*). Relatedly, the meaning of injuries constructed by the individual athletes appears to be shaped by narratives circulating within the respective elite sports environment (cf. John & Thiel, 2022; McGannon & Smith, 2015), such as when athletes construct the meaning of *injury as an inherent part of elite sports*. Such narratives are also often supported and reproduced by other stakeholders within the sportsnet work such as coaches and physicians.

#### 4.2. Implications

The culture of elite sports emphasizes performance over other aspects such as health (cf. Douglas & Carless, 2006). Critical sociological work has previously highlighted this problematic context of elite sports in which injuries are commonly normalized and sometimes even glorified (cf. Atkinson, 2019; Nixon, 1992). These critical aspects of elite sports culture are also underlined by our finding that for some athletes injuries simply carried the meaning of *going through the motions*, as they perceived injuries as an inherent part of elite sports. It is imperative that we acknowledge and challenge these problematic assumptions present in elite sports to improve existing structures and reduce or avoid high prevalences of injury in the future. As such high-level change in the structure of elite sports will likely be an arduous process, we also need to create avenues to help athletes cope when injuries do occur. To do so, we need to be aware of the importance of the subjective meaning that athletes construct for each individual injury, particularly as these meanings are often tied to experienced emotions. As our findings underline, some meanings of injury can coincide with more negative emotions than others. By understanding the differently constructed meanings of injury, practitioners in elite sports can aid athletes in changing previously negative meanings into more positive ones. In this context, we identify three possible starting points for athlete support personnel based on our findings: (1) emphasizing the importance of a social support network, (2) acknowledging the transience of elite sports careers, and (3) offering perspective grounded in previous experiences.

A strong social network outside of elite sports can counteract the experience of seemingly devastating setbacks such as injuries. A network outside of sports could aid athletes in constructing a meaning of *disruption* rather than *destruction* when injured, as at least a part of their identity would not be defined by their athletic self. In this case, the injury could appear analogous to an employee taking sick days rather than carrying the notion that *my life is over*.

Ensuring that the athlete's identity is not fixated solely on athletic

performance is equally important to reminding them that sports careers are not forever. Similarly to those athletes who had a social network outside of the elite sports world, those who had a plan for life after sports did not perceive the imminent threat of complete (financial) *destruction* from injury. This highlights the significance of future and retirement planning for the construction of an injury's meaning.

In addition to these implications, we have found that athletes can benefit from previous experiences (their own and others') when injured. Sharing those experiences is thereby not only helpful to the (formerly) injured athlete, but also to athletes incurring similar injuries in the future. Those sharing their own experiences with injury thereby have a chance to *respite and reflect*, while simultaneously helping others avoid experiencing injury as *destruction*. Through sharing previous experiences (that might have felt like *destruction* at the time), injured athletes can understand that their constructed meaning of injury is open to changes and can take on more favorable tones.

Our findings therefore call for improvements in the individualized support of elite athletes that leaves space for open communication about the meanings that athletes attach to their injury experiences. Medical personnel should work with sport psychologists who understand the importance of personal and situational factors in the treatment of injuries to help athletes cope with their situation. Particularly for those athletes who constructed the meaning of *reinforcement* this support system appeared crucial. While the meaning of injury as reinforcement was positively associated with a strong determination to return successfully to competition after injury, it could also result in a higher willingness to prematurely return to competition and play hurt, which should be considered critically by athlete support personnel.

#### 4.3. Challenges and limitations

When conducting our synthesis, we encountered two noteworthy challenges: (1) an often lacking definition of terms (e.g., *meaning*, *elite athlete*) and (2) a stark variability in scientific disciplines and related methodology.

The variance we encountered in the definition of the terms *meaning* and *elite athlete* increased the difficulty of comparing individual findings. While we defined *meaning* as the individual cognitive appraisal of the injury, the delineation from "results of injury" or "impact of injury" was often unclear in the work we analyzed. Thus, we acknowledge that a clear-cut line between meaning, experience, and impact is difficult to define and that the meaning of an injury is (at least partly) shaped by its result or impact on the athlete, as well as their social context. A similar point must be made for the participants selected and defined as *elite athletes*. As with the term *meaning*, we acknowledge that defining the term *elite* in particular is challenging, as it could be based on metrics such as experience (number of high-level matches played), competition level (national or international) or salary range (i.e., *professional athlete*) (cf. Swann et al., 2015). We found that most included studies did not include the authors' understanding of *elite athlete*. As we decided to select studies based on the terminology used in original studies, it is possible that some researchers employed underlying definitions of *elite athlete* that differed from our own. This might have led to some degree of distortion of our results.

A second challenge we encountered was the vast range of disciplines and related methodology represented in the 29 original studies. The differing norms and traditions of qualitative research present in these disciplines complicated the process of quality assessment and synthesis, as different studies reported a varying degree of metrics and details. The most significant deviances were noted in participant demographics reported, type of sport, type of injury, levels of competition, and age. The availability of such details could help contextualize the findings of the original studies substantially (i.e., knowing the length of time passed since the injury at the time of the interview). While this presented a challenge for our synthesis, we recognize the value of synthesizing the findings from such a multitude of disciplines, as it adds different nuances

to the meaning of injury that might not be recognizable when synthesizing research from just one scientific discipline.

#### 4.4. Recommendations for future research

Our analysis has contributed to the field of elite athlete injury experience, while also yielding two clear recommendations for future projects. Firstly, researchers should aim for a clear definition of terms. Particularly, the definition of *meaning* was a challenge we encountered in our analysis that should be further explored in the future, specifically on a theoretical level. Secondly, further qualitative research concerning the elite athlete injury experience should be conducted. Our analysis suggests that meanings of injury might change over time; hence, longitudinal, qualitative studies on the athlete's injury experience could further illuminate these temporal changes. Another avenue for future research would be to not only conduct research with athletes about their experiences but also with their social and professional networks to identify similarities and differences in their understandings of the meaning of injury.

## 5. Conclusion

We have conducted this systematic review to gain a deeper understanding of current research into the meaning of injury to the elite athlete. Analogous to the findings by Grindstaff et al. (2010), we have found the injury process “to be a dynamic one that changes in magnitude and direction over time” (p. 127). Particularly surrounding factors such as prognosis, athletic identity, and elite sports culture influence this process and the construction of meaning continuously, making the elite athlete injury experience an incredibly individual one. Simple injuries can be a mere *disruption* of the athletic path, but the meaning of injuries could also change and adapt over time, taking on a more intense, positive or negative dimension.

### CRedit authorship contribution statement

**Anna K. Reussner:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Jan Bursik:** Formal analysis, Investigation, Validation, Writing – review & editing. **Felix Kühnle:** Conceptualization, Methodology, Validation, Writing – review & editing. **Ansgar Thiel:** Conceptualization, Methodology, Resources, Supervision, Validation, Writing – review & editing. **Jannika M. John:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

All data included in the manuscript are publicly available as published research articles.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.psychsport.2023.102571>.

## References

- References marked with an asterisk indicate studies included in the systematic review.
- \* Arvinen-Barrow, M., DeGrave, K., Pack, S., & Hemmings, B. (2019). Transitioning out of professional sport: The psychosocial impact of career-ending non-musculoskeletal injuries among male cricketers from England and Wales. *Journal of Clinical Sport Psychology*, 13(4), 629–644.
  - Atkinson, M. (2019). Sport and risk culture. In *The suffering body in sport: Shifting thresholds of pain, risk and injury* (pp. 5–21). Emerald Publishing Limited.
  - Badenhorst, M., Verhagen, E., Lambert, M. I., Van Mechelen, W., & Brown, J. C. (2019). ‘In a blink of an eye your life can change’: Experiences of players sustaining a rugby-related acute spinal cord injury. *Injury Prevention*, 25(4), 313–320.
  - \* Barker-Ruchti, N., Schubring, A., Post, A., & Pettersson, S. (2019). An elite athlete's storying of injuries and non-qualification for an olympic games: A socio-narratological case study. *Qualitative Research in Sport, Exercise and Health*, 11(5), 687–703.
  - Bekker, S., Bolling, C., Ahmed, O. H., Badenhorst, M., Carmichael, J., Fagher, K., Häggglund, M., Jacobsson, J., John, J. M., & Litzky, K. (2020). Athlete health protection: Why qualitative research matters. *Journal of Science and Medicine in Sport*, 23(10), 898–901.
  - \* Bele, S., Östenberg, A. H., Sjöström, R., & Alricsson, M. (2015). Experiences of returning to elite beach volleyball after shoulder injury. *Journal of exercise rehabilitation*, 11(4), 204.
  - Bernard, K., Wildman, J. M., Tanner, L. M., Stoniute, A., Still, M., Green, R., Eastaugh, C., Sowden, S., & Thomson, K. H. (2023). Experiences of non-pharmaceutical primary care interventions for common mental health disorders in socioeconomically disadvantaged groups: A systematic review of qualitative studies. *International Journal of Environmental Research and Public Health*, 20(7), 5237. <https://www.mdpi.com/1660-4601/20/7/5237>.
  - Bianco, T. (2001). Social support and recovery from sport injury: Elite skiers share their experiences. *Research Quarterly for Exercise & Sport*, 72(4), 376–388.
  - \* Bianco, T., Malo, S., & Orlick, T. (1999). Sport injury and illness: Elite skiers describe their experiences. *Research Quarterly for Exercise & Sport*, 70(2), 157–169.
  - Bolling, C., Delfino Barboza, S., van Mechelen, W., & Pasman, H. R. (2019). How elite athletes, coaches, and physiotherapists perceive a sports injury. *Translational Sports Medicine*, 2(1), 17–23.
  - \* Borg, A. F., Falzon, R., & Muscat, A. (2021). Psychological implications and rehabilitation programmes due to football-related injuries. *Counselling and Psychotherapy Research*, 21(4), 882–898.
  - \* Brock, S. C., & Kleiber, D. A. (1994). Narrative in medicine: The stories of elite college athletes' career-ending injuries. *Qualitative Health Research*, 4(4), 411–430.
  - Campbell, R., Pound, P., Pope, C., Britten, N., Pill, R., Morgan, M., & Donovan, J. (2003). Evaluating meta-ethnography: A synthesis of qualitative research on lay experiences of diabetes and diabetes care. *Social Science & Medicine*, 56(4), 671–684. [https://doi.org/10.1016/S0277-9536\(02\)00064-3](https://doi.org/10.1016/S0277-9536(02)00064-3)
  - Carless, D., & Douglas, K. (2013a). “In the boat” but “selling myself short”: Stories, narratives, and identity development in elite sport. *The Sport Psychologist*, 27(1), 27–39.
  - Carless, D., & Douglas, K. (2013b). Living, resisting, and playing the part of athlete: Narrative tensions in elite sport. *Psychology of Sport and Exercise*, 14(5), 701–708.
  - Clarke, V., & Braun, V. (2021). Thematic analysis: A practical guide. *Thematic Analysis*, 1–100.
  - Coyle, M., Gorczynski, P., & Gibson, K. (2017). “You have to be mental to jump off a board any way”: Elite divers' conceptualizations and perceptions of mental health. *Psychology of Sport and Exercise*, 29, 10–18.
  - Critical Appraisal Skills Programme. (2022). CASP (qualitative studies checklist). <https://casp-uk.net/casp-tools-checklists/>.
  - Da Costa, N., King, M., Lewis, A., Vicenzino, B., & Watson, K. (2021). Throwing in the deep end, upper limb injuries and training load in elite women's water polo: Experiences, perceptions and beliefs of athletes, coaches and staff. *Journal of Science and Medicine in Sport*, 24, S25–\*.
  - Douglas, K., & Carless, D. (2006). Performance, discovery, and relational narratives among women professional tournament golfers. *Women in Sport & Physical Activity Journal*, 15, 14–27. <https://doi.org/10.1123/wspaj.15.2.14>
  - Douglas, K., & Carless, D. (2014). *Life story research in sport: Understanding the experiences of elite and professional athletes through narrative*. Routledge.
  - \* Everard, C., Wadey, R., & Howells, K. (2021). Storying sports injury experiences of elite track athletes: A narrative analysis. *Psychology of Sport and Exercise*, 56, Article 102007.
  - FIFPRO World Players' Union. (2021). <https://fifpro.org/en/supporting-players/health-and-performance/player-workload/rise-in-excessive-back-to-back-matches-in-men-s-football-fifpro-research-shows>.
  - Filipp, S., & Aymanns, P. (2010). *Kritische Lebensereignisse und Lebenskrisen [Critical Life Events and Life Crises]*. Stuttgart: Kohlhammer.
  - \* Fortunato, V., & Marchant, D. (1999). Forced retirement from elite football in Australia. *Journal of Personal and Interpersonal Loss*, 4(3), 269–280.
  - Frank, A. W. (2005). What is dialogical research, and why should we do it? *Qualitative Health Research*, 15(7), 964–974.
  - Frank, A. W. (2008). Narrative research from inside and outside. *Canadian Journal of Sociology/Cahiers canadiens de sociologie*, 33(3), 689–692.
  - Frank, A. W. (2013). *The wounded storyteller: Body, illness & ethics*. University of Chicago Press.

- 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. *Scandinavian Journal of Medicine & Science in Sports*, *16*(2), 83–92.
- Garside, R. (2014). Should we appraise the quality of qualitative research reports for systematic reviews, and if so, how? *Innovation: The European Journal of Social Science Research*, *27*(1), 67–79.
- \* Gilbourne, D. (2002). Sports participation, sports injury and altered images of self: An autobiographical narrative of a lifelong legacy. *Reflective Practice*, *3*(1), 71–88.
- \* Grindstaff, J. S., Wrisberg, C. A., & Ross, J. R. (2010). Collegiate athletes' experience of the meaning of sport injury: A phenomenological investigation. *Perspectives in Public Health*, *130*(3), 127–135.
- Horton, L. (2020). Making qualitative data more visible in policy: A critical appraisal of meta-synthesis. *Qualitative Research*, *20*(5), 534–548.
- \* Howe, P. D. (2001). An ethnography of pain and injury in professional rugby union: The case of Pontypridd RFC. *International Review for the Sociology of Sport*, *36*(3), 289–303.
- \* Howells, K., & Fletcher, D. (2016). Adversarial growth in Olympic swimmers: Constructive reality or illusory self-deception? *Journal of Sport & Exercise Psychology*, *38*(2), 173–186.
- Howells, K., Sarkar, M., & Fletcher, D. (2017). Can athletes benefit from difficulty? A systematic review of growth following adversity in competitive sport. *Progress in Brain Research*, *234*, 117–159.
- \* 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.
- Jacobsson, J., Timpka, T., Kowalski, J., Nilsson, S., Ekberg, J., Dahlström, Ö., & Renström, P. A. (2013). Injury patterns in Swedish elite athletics: Annual incidence, injury types and risk factors. *British Journal of Sports Medicine*, *47*(15), 941–952.
- John, J. M., Gropper, H., & Thiel, A. (2019). The role of critical life events in the talent development pathways of athletes and musicians: A systematic review. *Psychology of Sport and Exercise*, *45*, Article 101565.
- John, J. M., & Thiel, A. (2022). Talent as a social construction: Proposing a constructivist conceptualization of athletic talent. *Zeitschrift für Erziehungswissenschaft*, *25*(5), 1199–1220.
- \* Joncheray, H., Chavinier-Réla, S., Burlot, F., Dagalarrondo, S., & Fukazawa-Couckuyt, S. (2022). Experiences of normalization of pain and injury in elite adolescent basketball. *Sociology of Sport Journal*, *1*(aop), 1–9.
- \* Kaul, N. (2017). Involuntary retirement due to injury in elite athletes from competitive sport: A qualitative approach. *Journal of the Indian Academy of Applied Psychology*, *43*(2), 305–315.
- Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2018). Paradigmatic controversies, contradictions, and emerging confluences, revisited. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative* (5th ed. ed, pp. 108–150). SAGE.
- López-Valenciano, A., Ruiz-Pérez, I., García-Gómez, A., Vera-García, F. J., Croix, M. D. S., Myer, G. D., & Ayala, F. (2020). Epidemiology of injuries in professional football: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *54*(12), 711–718.
- \* Lotysz, G. J., & Short, S. E. (2004). What ever happened to...?: The effects of career termination from the national football league. *Athletic Insight*, *6*(3), 47–66.
- Maharam, L., Bauman, P., Kalman, D., Skolnik, H., & Perle, S. (1999). Masters athletes: Factors affecting performance. *Sports Medicine*, *28*, 273–285.
- McGannon, K. R., & Smith, B. (2015). Centralizing culture in cultural sport psychology research: The potential of narrative inquiry and discursive psychology. *Psychology of Sport and Exercise*, *17*, 79–87.
- McKay, A. K. A., Stellingwerff, T., Smith, E. S., Martin, D. T., Mujika, I., Goosey-Tolrey, V. L., Sheppard, J., & Burke, L. M. (2022). Defining training and performance caliber: A participant classification framework. *International Journal of Sports Physiology and Performance*, *17*(2), 317–331. <https://doi.org/10.1123/ijspp.2021-0451>
- \* Murray, L., Vuoskoski, P., Wellman, J., & Hebron, C. (2022). "It was the end of the world"—The lifeworld of elite male rugby union players living with injury. An interpretative phenomenological analysis. *Physiotherapy: Theory and Practice*, *38*(9), 1219–1232.
- National Institute for Health and Care Excellence. (2012). *The guidelines manual: Appendices B-1*.
- Nixon, H. L. (1992). A social network analysis of influences on athletes to play with pain and injuries. *Journal of Sport & Social Issues*, *16*(2), 127–135.
- Nixon, H. L. (1993). Accepting the risks of pain and injury in sport: Mediated cultural influences on playing hurt. *Sociology of Sport Journal*, *10*(2), 183–196.
- Overbye, M. (2021). Walking the line? An investigation into elite athletes' sport-related use of painkillers and their willingness to use analgesics to train or compete when injured. *International Review for the Sociology of Sport*, *56*(8), 1091–1115.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamsler, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. <https://doi.org/10.1136/bmj.n71>
- \* Pereira, A., Pinheiro, M., Carvalhinho, L., Sequeira, P., Resende, R., & Liston, K. (2016). Journeys of Portuguese athletes to sporting success: The peaks and troughs. *Journal of Physical Education and Sport*, *16*, 397–406.
- Podlog, L., & Eklund, R. C. (2010). Returning to competition after a serious injury: The role of self-determination. *Journal of Sports Sciences*, *28*(8), 819–831.
- Rabitti, E., Cavuto, S., Díaz Crescitelli, M. E., Bassi, M. C., & Ghirrotto, L. (2023). Hospice patients' end-of-life dreams and visions: A systematic review of qualitative studies. *American Journal of Hospice and Palliative Medicine*, Article 10499091231163571.
- Roderick, M. (1998). The sociology of risk, pain, and injury: A comment on the work of howard L. Nixon II. *Sociology of Sport Journal*, *15*(1), 64–79.
- \* Roderick, M., Waddington, I., & Parker, G. (2000). Playing hurt: Managing injuries in English professional football. *International Review for the Sociology of Sport*, *35*(2), 165–180.
- \* Ronkainen, N. J., & Ryba, T. V. (2017). Is hockey just a game? Contesting meanings of the ice hockey life projects through a career-threatening injury. *Journal of Sports Sciences*, *35*(10), 923–928.
- Roy, J., Mokhtar, A. H., Karim, S. A., & Mohanan, S. A. (2015). Cognitive appraisals and lived experiences during injury rehabilitation: A narrative account within personal and situational backdrop. *Asian Journal of Sports Medicine*, *6*(3), \*.
- \* Ruddock-Hudson, M., O'Halloran, P., & Murphy, G. (2012). Exploring psychological reactions to injury in the Australian Football League (AFL). *Journal of Applied Sport Psychology*, *24*(4), 375–390.
- \* Ruddock-Hudson, M., O'Halloran, P., & Murphy, G. (2014). The psychological impact of long-term injury on Australian football league players. *Journal of Applied Sport Psychology*, *26*(4), 377–394.
- Rugby Europe. (2023). <https://www.rugbyeurope.eu/news/world-rugby-launches-new-global-competition-and-aligned-calendar/>.
- \* San Jose, A. (2003). Injury of elite athletes: Sport-and gender-related representations. *International Journal of Sport and Exercise Psychology*, *1*(4), 434–459.
- \* Sarkar, M., Fletcher, D., & Brown, D. J. (2015). What doesn't kill me...: Adversity-related experiences are vital in the development of superior Olympic performance. *Journal of Science and Medicine in Sport*, *18*(4), 475–479.
- Schnell, A., Mayer, J., Diehl, K., Zipfel, S., & Thiel, A. (2014). Giving everything for athletic success!—Sports-specific risk acceptance of elite adolescent athletes. *Psychology of Sport and Exercise*, *15*(2), 165–172.
- Schubring, A., Halltén, M., Barker-Ruchti, N., & Post, A. (2023). Balancing risk-taking and self-care: The ecology of athlete health behaviour during the Olympic qualification phase. *International Review for the Sociology of Sport*, Article 10126902231168098.
- Schwellnus, M., Soligard, T., Alonso, J.-M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T. J., Gleeson, M., Hägglund, M., & Hutchinson, M. R. (2016). How much is too much?(Part 2) International Olympic Committee consensus statement on load in sport and risk of illness. *British Journal of Sports Medicine*, *50*(17), 1043–1052.
- Shorey, S., & Baladram, S. (2023). "Does it really get better after dad leaves?" Children's experiences with domestic violence: A qualitative systematic review. *Trauma, Violence, & Abuse*, *0*(0), Article 15248380231156197. <https://doi.org/10.1177/15248380231156197>
- Smith, J. A. (2016). Interpretative phenomenological analysis in sport and exercise: Getting at experience. In *Routledge handbook of qualitative research in sport and exercise* (pp. 241–251). Routledge.
- Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology*, *11*(1), 101–121.
- Soligard, T., Schwellnus, M., Alonso, J.-M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T., Gleeson, M., Hägglund, M., & Hutchinson, M. R. (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.
- Soundy, A., & Heneghan, N. R. (2022). Meta-ethnography. *International Review of Sport and Exercise Psychology*, *15*(1), 266–286.
- Sparkes, A. C., & Smith, B. (2009). Judging the quality of qualitative inquiry: Criteriology and relativism in action. *Psychology of Sport and Exercise*, *10*(5), 491–497.
- Stoltenburg, A. L., Kamphoff, C. S., & Bremer, K. L. (2011). Transitioning out of sport: The psychosocial effects of collegiate athletes' career-ending injuries. *Athletic Insight: Online Journal of Sport Psychology*, *13*(2), \*.
- Swann, C., Moran, A., & Piggott, D. (2015). Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise*, *16*, 3–14. <https://doi.org/10.1016/j.psychsport.2014.07.004>
- Swartz, L., Hunt, X., Bantjes, J., Hairline, B., & Reardon, C. L. (2019). Mental health symptoms and disorders in paralympic athletes: A narrative review. *British Journal of Sports Medicine*, *53*(12), 737–740. <https://doi.org/10.1136/bjsports-2019-100731>
- Taylor, J., & Ogilvie, B. C. (1994). A conceptual model of adaptation to retirement among athletes. *Journal of Applied Sport Psychology*, *6*(1), 1–20.
- Tedeschi, R. G., & Calhoun, L. G. (1995). *Trauma and transformation*. Sage.
- Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: A new perspective on psychotraumatology. *Psychiatric Times*, *21*(4), 58–60.
- Theberge, N. (2008). "Just a normal bad part of what I do": Elite athletes' accounts of the relationship between health and sport. *Sociology of Sport Journal*, *25*(2), 206–222.
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, *8*(1), 1–10.
- \* Udry, E., Gould, D., Bridges, D., & Beck, L. (1997). Down but not out: Athlete responses to season-ending injuries. *Journal of Sport & Exercise Psychology*, *19*(3), 229–248.
- \* 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.
- Wadey, R., Evans, L., Evans, K., & Mitchell, I. (2011). Perceived benefits following sport injury: A qualitative examination of their antecedents and underlying mechanisms. *Journal of Applied Sport Psychology*, *23*(2), 142–158.
- Wiese-Bjornstal, D. M., Smith, A., & LaMott, E. (1995). A model of psychologic response to athletic injury and rehabilitation. *Athletic Training: sports health care perspectives*, *1*, 16–30.

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.

Williams, T. L., & Shaw, R. L. (2016). Synthesizing qualitative research: Meta-synthesis in sport and exercise. In *Routledge handbook of qualitative research in sport and exercise* (pp. 296–310). Routledge.

Yao, Y., Wu, L., Toland, S., & Li, N. (2023). An exploration of the psychological impact and support needs of nurses during a pandemic: A qualitative systematic review. *Nursing Open*, *10*(7), 4244–4273. <https://doi.org/10.1002/nop2.1716>

**5.4 Paper 3: “The role of psychosocial factors in performing hurt: A systematic review covering the high-performance domains of sport, music, and dance”**

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**The role of psychosocial factors in performing hurt: A systematic review covering the high-performance domains of sport, music, and dance**

Jan Bursik<sup>a,b,\*</sup>, Ansgar Thiel<sup>c</sup>, Jochen Mayer<sup>d</sup>, Jannika M. John<sup>a,b</sup>

*<sup>a</sup>Institute of Sports Science, Eberhard Karls Universität Tübingen, 72074 Tübingen, Germany; <sup>b</sup>Interfaculty Research Institute for Sport and Physical Activity, Eberhard Karls Universität Tübingen, Germany; <sup>c</sup>German Sport University Cologne, 50933 Köln, Germany; <sup>d</sup>Institute of Health Sciences, University of Education Schwäbisch Gmünd, 73525 Schwäbisch Gmünd, Germany*

\*Corresponding author. Institute of Sports Science, Eberhard Karls Universität Tübingen, Wilhelmstraße 124, 72074 Tübingen, Germany. E-mail address: [Jan.Bursik@uni-tuebingen.de](mailto:Jan.Bursik@uni-tuebingen.de), ORCID: <https://orcid.org/0000-0003-0457-918X>

## Abstract

Performing hurt is a complex but common phenomenon among high-performing athletes, musicians, and dancers. Previous research has analyzed this health risk behavior from different perspectives, predominantly focusing on psychological aspects and the influence of the social and cultural context. The diversity of current research underscores the need for a synthesis informed by a psychosocial approach. With this systematic review, we aimed to synthesize research on the role of psychosocial factors in performing hurt. Forty studies from three high-performance domains, namely sports, music, and dancing, were included. Our convergent thematic analysis identified two overarching psychosocial factors that contributed to performing hurt from the current research: 1) *Personal characteristics of the high-performer* such as performance identity or fearing the consequences of not performing hurt, and 2) *Characteristics of the high-performance setting* such as the sociocultural trivialization of pain and injuries or intensive practice and competition schedules. Whereas most included studies examined the role of psychological and social factors in performing hurt separately, we highlight the potential interplay between characteristics of the high-performer and the high-performance setting. Future performing hurt research should focus particularly on these interconnections, as such knowledge might help to identify both, high-performers at risk and organizational factors that contribute to performing hurt.

Keywords: playing hurt, injury, psychosocial, elite sports, music, dance

## Introduction

Remarkable numbers of athletes report a high willingness to participate in competitions despite being injured, experiencing joint pain at rest, taking painkillers, or having general health problems (Diehl et al., 2019; Mayer et al., 2018; Overbye, 2021). In sport sociological research, this heterogeneous spectrum of phenomena (ranging from actual behaviors to intentions) is mostly referred to as ‘playing hurt’ (Nixon, 1992; Roderick et al., 2000). From a conceptual standpoint, a key characteristic of playing hurt is that the experience of a health-related event (such as an acute, chronic, or overuse injury, an illness, or subjective complaints) does not result in any time loss from sport as the athlete continues participation in practice or competition (Mayer & Thiel, 2018). Due to its association with serious acute and chronic injuries and prolonged recovery time, playing hurt represents a health risk behavior (Asken et al., 2016; DiFiori et al., 2014). Thus, the relevant question of why athletes play hurt has occupied sports science research and practice for quite some time (Hughes & Coakley, 1991; Nixon, 1992).

Psychologically oriented research on playing hurt has primarily focused on how specific personal and psychological characteristics, such as personality traits or emotions, contribute to playing hurt (e.g., Kabiri, Choi, Shadmanfaat, & Lee, 2021; Madrigal et al., 2016). This approach places the athlete and their individual characteristics at the center of this behavioral phenomenon. In contrast, sport sociological approaches have examined social and cultural factors, using theory-driven heuristics to explain the decision to play hurt (e.g., Hughes & Coakley, 1991; Mayer & Thiel, 2018; Roderick et al., 2000). While these approaches also consider personal characteristics and individual behavior, they frame them as products of a prevailing culture or the social environment. In sport sociology, the ‘culture of risk’ (Nixon, 1993) is the most prominent explanatory heuristic for health-related risk behavior within elite sports settings. It is proposed that pain and injuries are normalized and

trivialized within this culture, and that risk-taking is necessary for athletic success (Hughes & Coakley, 1991). Athletes are assumed to adapt to the values of the ‘culture of risk’ as part of their sport specific socialization processes (Frey, 1991; Nixon, 1992; Thiel et al., 2015) in which their identities are increasingly shaped by the particular requirements of their sport, their success, and their sport-specific social networks (Coakley, 1992; Schnell et al., 2014).

However, several researchers have found similar values, norms, and beliefs concerning pain and injuries in other high-performance domains, such as the performing arts or music (e.g. Davies & Mangion, 2002; McEwen & Young, 2011), suggesting that the ‘culture of risk’ is not sport-specific but can also be observed in other high-performance domains (e.g., John et al., 2019). Relatedly, the phenomenon of playing or rather performing hurt has also been described in the domains of professional music and dance (e.g., McEwen & Young, 2011; Waters, 2019), with dancers and musicians, similar to high-performing athletes, showing the tendency to prioritize their performance goals over their health and well-being (John & Thiel, 2022; Molan et al., 2019).

Analogous to research on health behaviors and sports injuries (Forsdyke et al., 2016; Ivarsson et al., 2017; Newman & Newman, 2020; Tranaeus et al., 2022), several calls have been issued to specifically focus on psychological and social factors and particularly their interplay when studying performing hurt (Mayer et al., 2020; Roderick et al., 2000), which is also reflected in several theoretical models in the wider context of performing hurt (e.g., Creighton et al., 2010; Mayer et al., 2020; Mayer & Thiel, 2018). Particularly the ‘process-structure model of competing hurt decision-making’ (Mayer et al., 2020) argues that presenteeism (i.e., performing hurt) is the result of a complex decision-making process, which is shaped by the underlying nature of the health event and is influenced by the interplay of personal and behavioral expectations of significant others in specific scenarios.

Thus, a comprehensive psychosocial approach that presents the current state of research on individual psychological characteristics, social influences, and their interrelation with regard to performing hurt appears necessary and relevant (cf. Gledhill et al., 2017; Mayer et al., 2020; Roderick et al., 2000). With this review, we therefore aim to systematically synthesize the literature on the role of psychosocial factors in performing hurt among high-performing athletes, musicians, and dancers. More specifically, we aim to (a) systematically review qualitative and quantitative research on psychosocial factors that contribute to performing hurt in high-performance sports, music, and dancing, (b) compare the phenomenon of performing hurt across the three different high-performance contexts to identify cross-domain patterns of psychosocial factors that affect performing hurt, and (c) identify avenues for future transdisciplinary research on performing hurt in high-performance domains. We decided to include the high-performance domains of sports, music, and dancing due to their commonalities concerning cultural norms and values related to the culture of risk (cf. Nixon, 1993; John et al., 2019) as well as health-risk behaviors displayed to achieve high-performance (John et al., 2019; McEwen & Young, 2011; Park et al., 2007).

### **Approach**

Due to our focused research question, we decided to conduct a systematic review. The methodology for this systematic review was informed by the PRISMA (Page et al., 2021) and PERSiST guidelines (Ardern et al., 2022; Moher et al., 2009; Moher et al., 2015). Therewith, we aimed to synthesize international research evidence on the role of psychosocial factors in performing hurt, identify and inform avenues of future research, and guide health-related organizational policies (Munn et al., 2018). We prospectively registered our review with the Open Science Framework in February 2022 (registration DOI:

<https://doi.org/10.17605/OSF.IO/RTBQ3>)

### **Search Strategy**

The search terms were agreed on a priori and were intentionally broad to reduce the risk of missing relevant studies (see Table 1). Due to the incoherent naming of performing hurt within existent literature, it was necessary to search for a wide range of possible synonyms (such as playing with pain, playing through pain). We restricted the records to a publication date starting in 1990 as this was the year when the phenomenon of playing hurt was first scientifically discussed (Hughes & Coakley, 1991). We used three processes to identify relevant studies for this review: (1) We conducted the initial search in seven databases (Medline, SPORTDiscus, CINAHL, Academic Search Premier, Web of Science, APA PsycInfo, RILM Abstracts of Music Literature) on 3 March 2022 and updated the search on 15 November 2023. (2) Further searches were conducted using GoogleScholar to identify potential studies published in journals not indexed in the respective databases. (3) We screened the reference sections of eligible studies.

[Table 1 near here]

### **Inclusion and Exclusion of Studies**

We applied the following inclusion criteria: Papers a) were published in English or German due to the language skills of the researchers; b) represent original, peer-reviewed studies; c) were either of qualitative, quantitative, or mixed-method design; d) present data on psychosocial factors in the context of performing hurt; e) report on a study with athletes, musicians, or dancers on a high-performance level. In line with other authors (e.g., Swann et al., 2015), it was difficult to define clear boundaries concerning the performance level of the respective study population, particularly in music and dancing samples. Therefore, we decided to define ‘high-performing’ in terms of performance level (highest senior/college

level, potential of competing in Olympics), professionalism (economic dependence or compensation), or high potential for a professional career based on an enrollment in a specialized program in music or dance (cf. McKay et al., 2021; Swann et al., 2015). We also included qualitative studies that reported not only on the experiences of high-performers, but also those of surrounding stakeholders (e.g., coaches, staff, management). For these studies, however, the data extraction and synthesis of the study results focused on the experiences of the high-performers themselves.

### **Sifting Articles and Study Eligibility**

Studies were identified in a three-step screening process based on (1) title, (2) abstract, and (3) full text. The first and last author independently assessed the title of each study against the pre-determined inclusion and exclusion criteria. In case of disagreement, both authors discussed the respective studies until reaching consensus. The abstract screening proceeded in the same manner. The first author conducted the full-text screening and, in case of uncertainty, consulted with the last author to reach the final decision of inclusion in the review.

### **Quality appraisal**

We utilized the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018) to evaluate the methodological quality of studies included in our review. The MMAT is based on two general screening questions and five criteria for evaluating qualitative, quantitative, or mixed-method studies. The updated 2018 version of the MMAT tool provides a detailed and informative presentation of the quality of included studies (Hong et al., 2018). For this review, the first author appraised all studies, while the last author acted as a critical friend.

We chose to use the MMAT for several reasons. First, the MMAT is a reliable and widely-used tool successfully applied in systematic reviews in sport and exercise psychology

(e.g., Boudreau et al., 2020; Gröpel & Mesagno, 2019). Second, the MMAT was designed to assess the quality of various types of studies, including qualitative, quantitative, and mixed methods. Given the diverse range of research methods and designs found in the literature on performing hurt, we determined that the MMAT was a suitable tool to account for this variation. However, ongoing discussions about the concept of risk of bias (Malterud, 2001) and the use of criterion-based approaches to assess the methodological quality of qualitative research (Sparkes & Smith, 2009) should be acknowledged. Nonetheless, the MMAT represents a useful tool for evaluating the extent to which studies report their philosophical assumptions and discuss elements of reflexivity, which are all considered indicators of good practice in qualitative research (Sparkes & Smith, 2009).

### **Data Extraction and Synthesis of Study Results**

In the first step of the data analysis, we read each study several times to familiarize ourselves with the research context, findings, and inferences. The first author extracted initial data on the sample, methodology, and main findings (see Supplementary Material A).

We used a convergent thematic analysis to synthesize the findings of included studies (CTA; Hong et al., 2017). With a CTA, it becomes possible to identify main and recurring themes from a diverse body of literature including findings from both qualitative and quantitative studies (Pluye & Hong, 2014; Thomas & Harden, 2008). As Creswell and Clark (2017) highlight, CTA can also be used for systematic reviews aiming to synthesize qualitative and quantitative research.

In the first step of CTA, JB inductively coded each psychosocial factor that was reported to affect, guide, or shape performing hurt. In line with the definition of psychosocial factors by Gledhill et al. (2017), we sought to identify psychological characteristics (such as individual emotions, attitudes and behaviors) and social influences (such as attitudes or

behaviors of relevant stakeholders, and structural aspects). We also focused on described or hypothesized interactions between psychological and social factors in the studies. In qualitative studies, we coded the findings and discussion sections including direct participant quotes. In quantitative studies, we interpretatively ‘qualified’ quantitative results (cf. Babones, 2016). In this regard, we first assessed which psychosocial factors were significantly related to performing hurt within the results section of the included papers. Next, particularly when unvalidated instruments were used, we also checked the items within the utilized instruments to get a better impression of the operationalization of the reported psychosocial factors in the original studies. For instance, Diehl et al. (2019) reported that a “high over-conformity to sports ethics” (p.47) significantly influenced the willingness to compete hurt. However, this factor was operationalized through five items, including, for example, the high-performer’s perception of the importance of competitions. Consequently, in such cases, we coded each of these items individually. This initial coding phase resulted in an exhaustive list of 396 codes, such as “personal fulfilment through athletic role”, “pressure from coaches to perform hurt”, “no access to health care”, or “importance of practice”. Next, JB and JJ grouped codes with similar meaning together (the codes “Coaches describe pain as a sign of improvement” and “Teammates depict pain as a normal part of playing” were grouped together to “Trivialization of pain”). In a last step, all authors categorized and refined these code clusters into two overarching areas of psychosocial factors: personal characteristics of the high-performer, and characteristics of the high-performance setting. Although the potential interaction between these two areas of psychosocial factors was partially addressed in the discussion section of the included studies, it was not enough to warrant a separate theme based on the results of included studies. However, the interactions hypothesized in the included studies and the interdependencies inferred from our synthesis are described in detail in the discussion section of the current

paper.

## Findings

### Literature Identification

The electronic database search produced 891 results after removing duplicates (see Figure 1). Eleven additional records were retrieved from bibliographic searching. During the title and abstract screening, 829 records were excluded, and 9 reports were not retrieved. We screened 64 full texts and considered 40 eligible for inclusion. The eligible records include qualitative (n = 19), quantitative (n = 18), mixed-method (n = 1), and multiple-method (n = 2) studies. Amongst these, 24 studies reported research on athletes, ten on musicians, five on dancers, and one on athletes and musicians.

[Figure 1 near here]

### Quality Appraisal

Utilizing the MMAT quality criteria (see Supplementary Material B), we observed that the researchers' pre-existing beliefs and knowledge about the participants and the setting were only reported in a few papers. Only five qualitative studies adequately addressed their reasons for choosing specific data sources, collection methods, and data analysis strategies. Further, most qualitative studies did not critically address the methodological coherence between the research question, sampling strategies, data collection, and analysis. As methodological coherence can be considered a key characteristic of rigorous qualitative research (Smith & McGannon, 2018), the lack thereof is noteworthy and deserves consideration. Most quantitative studies appropriately described their sample but often lacked specific explanations or validity assessments for the measurements used.

## Demographic Characteristics

The studies reported on a total of 7588 high-performers with a mean age of 20.96 years. Overall, 6457 athletes (mean age 19.56 years; 2887 females and 3570 males), 318 dancers (22.43 years; 216 females and 102 males), and 813 musicians (30.77 years; 364 females and 449 males) were studied. Twelve studies did not report participants' age, and seven only reported an age range. Supplementary Material A contains further relevant study details, sample characteristics, and main findings of each included study.

## Convergent Thematic Analysis

Most psychosocial factors we identified as contributing to performing hurt were described in at least two of the three high-performance domains, which illustrates the similarity of the performing hurt phenomenon within high-performance sports, music, and dance. The identified psychosocial factors appearing to play a role in performing hurt among high-performing athletes, musicians, and dancers were clustered into two overarching categories: *Personal characteristics of the high-performer* included those factors in the context of performing hurt that were related to the high-performing athletes, musicians, and dancers themselves. Here, we subsumed those factors in which high-performers played an active role such as when they experienced emotions, expressed personality characteristics and attitudes, or showed behaviors associated with performing hurt. *Characteristics of the high-performance setting* included the aspects of the high-performance setting that high-performers perceived as directly affecting performing hurt or indirectly influencing their emotions, attitudes, or performing-hurt behavior. Since the included studies rarely examined the interplay between the personal characteristics of the high-performer and the characteristics of the high-performance setting explicitly, we present the overarching categories separately in our report on the current state of research. However, the suggested

relationships and interdependencies between these factors are discussed in detail in the discussion section.

Within Figure 2, we graphically display the findings of our thematic synthesis. Here, we depict both overarching categories of psychosocial factors that played a role in performing hurt along with their sub-aspects and indexed the respective studies reporting on these aspects. We also hint at the interplay between specific sub-aspects of the personal characteristics of the high-performer and the high-performance setting through dashed lines in Figure 2. In line with the approach of Gledhill et al. (2017), we derived these interactions mostly from the discussion sections of the included studies in which the authors described a potential interplay with regard to performing hurt or argued for a potential interplay between personal and social factors.

[Figure 2 near here]

### **Personal characteristics of the high-performer**

A total of 34 studies reported on how personal characteristics of the high-performers themselves contributed to performing hurt. Here, we identified six sub-aspects in the included studies: a) Performance identity, b) Fearing the consequences of not performing hurt, c) Feeling responsible for the team, d) Psychological characteristics, e) Attitudes towards pain and performing hurt, and f) Imitating role models.

- a) ‘Performance identity’ appeared as one important contributing factor to performing hurt (Andersen et al., 2013; Bourne et al., 2019; Bragge et al., 2006; Guptill, 2011; Madrigal et al., 2015; McEwen & Young, 2011). We understand ‘Performance identity’ as the interplay of three aspects closely related to the defining characteristics of athletic identity as described by Brewer et al. (1993): (1) the extent to which high-performers identify with their performance domain (i.e., sports, music, or dance) alongside the extent to which goals and social relations are tied to the domain; (2) high enjoyment and self-esteem resulting from

(successful) participation in the respective domain; and (3) negative emotional consequences when high-performers cannot participate (successfully) in their domain. In addition, when high-performers designated their team, dancing company, or orchestra as ‘family’ (Berg et al., 2014), they tended to confirm strongly to the values of the team regarding performing hurt (Aalten, 2007; Andersen et al., 2013; Berg et al., 2014; Bourne et al., 2019; Bragge et al., 2006; Curry, 1993; Hammond et al., 2013; Ioannou & Altenmüller, 2015; Jasny, 2021; Madrigal et al., 2015; McEwen & Young, 2011; Overbye, 2021; Theberge, 2008; Tibbert et al., 2015; Waters, 2020). Further, high-performers described experiencing pride and satisfaction when performing hurt (e.g., Madrigal et al., 2015; McEwen & Young, 2011). Simultaneously, they often emphasized that the inability to compete could cause severe negative emotional consequences, such as depressed mood or loneliness, which they aimed to avoid by performing hurt (Bragge et al., 2006; Guptill, 2011; Hammond et al., 2013; Madrigal et al., 2015; McEwen & Young, 2011; Theberge, 2008).

- b) High-performers reported that ‘Fearing the consequences of not performing hurt’ was another relevant factor for performing hurt. They feared being labeled as injury-prone or weak (Coker-Cranney et al., 2018; Guptill, 2011; Hammond et al., 2013; Joncheray et al., 2022; Madrigal et al., 2015; McEwen & Young, 2011; Roderick, 2006; Roderick et al., 2000; Ryou & Lee, 2023; Waters, 2019, 2020) and worried about losing their spot on the (first) team or orchestra when they did not perform hurt (Aalten, 2007; Bragge et al., 2006; Curry, 1993; Guptill, 2011; Hammond et al., 2013; Kabiri, Choi, Shadmanfaat, & Lee, 2021; Madrigal et al., 2015; McEwen & Young, 2011; Roderick, 2006; Roderick et al., 2000; Ryou & Lee, 2023). However, the nature and temporality of these fears seemed to differ between performance domains. When athletes’ performances dropped due to pain or injury, they tended to experience such fears ahead of each team selection (e.g., Aalten, 2007; Guptill, 2011; Roderick et al., 2000). Musicians and dancers frequently mentioned that they experienced these fears mainly ahead of those auditions and events that were decisive for securing future appearances (e.g., Andersen et al., 2013; McEwen & Young, 2011).

Consequently, high-performers tried to hide their injuries and performed hurt to avoid being blamed by their teachers or coaches (McEwen & Young, 2011; Roderick, 2006).

- c) High-performers mentioned that ‘Feeling responsible for the team’ such as their teammates or their team’s success was also a reason for performing hurt (Aalten, 2007; Berg et al., 2014; Hammond et al., 2013; Roderick, 2006). The belief that their team(mates) depended on their participation led to a self-expectation not to let others down and therefore to perform hurt (Andersen et al., 2013; Berg et al., 2014; Hammond et al., 2013; Kabiri, Choi, Shadmanfaat, & Lee, 2021; Roderick, 2006; Wanke et al., 2020).
- d) The sub-factor ‘Psychological Characteristics’ encompasses personality traits and values that facilitated performing hurt. Perfectionism, characterized by striving for flawlessness and setting excessively high performance standards (Barrette & Harman, 2020; Bragge et al., 2006; Coker-Cranney et al., 2018; Mayer & Thiel, 2018; McEwen & Young, 2011; Roderick, 2006; Theberge, 2008; Wanke et al., 2020) was identified as a relevant personality trait contributing to performing hurt. In addition, mental toughness, operationalized as the ability to persevere through physical challenges and remain focused under pain and pressure (Kabiri, Choi, Shadmanfaat, & Lee, 2021; Madrigal et al., 2016; Rickert et al., 2013; Theberge, 2008), was found to be a key factor in performing hurt. At the same time, these traits often represented desirable characteristics for high-performers to strive for (McEwen & Young, 2011; Theberge, 2008; Vassallo et al., 2019).
- e) The sub-factor ‘Attitudes towards pain and performing hurt’ encompassed high-performers’ own perspectives on pain and performing hurt. Included studies reported on how high-performers often struggled to assess pain correctly (e.g., difficulty differentiating between being sore and being in pain) and appeared to develop positive attitudes towards pain (e.g., pain as an indicator of good practice), which facilitated performing hurt (Aalten, 2007; Andersen et al., 2013; Anderson & Hanrahan, 2008; Coker-Cranney et al., 2018; Curry, 1993; Hammond et al., 2013; Joncheray et al., 2022; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021; Kabiri, Choi, Shadmanfaat, & Lee, 2021; Kristensen et al., 2023; McEwen & Young, 2011; Tibbert et al., 2015). Some studies even reported that high-performers viewed

performing hurt itself as a desirable behavior (Berg et al., 2014; Jasny, 2021; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021; Nixon, 1994; Schneider et al., 2019).

- f) A few studies also reported on how the desire to ‘imitate role models’ contributed to performing hurt. In this regard, high-performers described that aiming to imitate media representations of their role models involved performing hurt (Hammond et al., 2013; Jasny, 2021; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021). Some high-performers also reported that witnessing the celebration of family members performing hurt reinforced their own performing-hurt behavior (Curry, 1993; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021; Kristensen et al., 2023).

### **Characteristics of the high-performance setting**

Thirty-eight papers reported on how characteristics of the high-performance setting affected performing hurt among high-performing athletes, musicians, and dancers. As this review included studies that primarily focused on the experiences and reports of high-performers, it is important to note that the characteristics of the high-performance setting were described from the perspective of the high-performers. That is to say, within the included studies, high-performers reported on aspects of the high-performance setting that impacted performing hurt. Thus, the implicit interplay between the social influences and the high-performers’ perceptions thereof constitutes the basis of the identified characteristics of the high-performance setting.

Through a culture that valued risk-taking and sacrificing the body, high-performance settings seemed to facilitate performing hurt. In this regard, we identified five relevant aspects: a) Sociocultural trivialization of pain and injury, b) Attitudes and pressures from relevant stakeholders, c) Intensive practice and competition schedules, d) Contractual conditions, and e) Organizational integration of the health care system.

- a) Within the high-performance domains of sports, music, and dancing, high-performers experienced a ‘Sociocultural trivialization of pain and injury’. Stakeholders (e.g., coaches, managers, or the head of a company) within the high-performance setting normalized pain through explicit statements in which they characterized pain as no reason to rest (e.g., Aalten, 2007; Joncheray et al., 2022; Overbye, 2021; Tibbert et al., 2015) and through implicit expressions that embraced pain and injuries as part of the journey to success (e.g., Andersen et al., 2013; Berg et al., 2014; Bourne et al., 2019; Bragge et al., 2006; Curry, 1993; Hammond et al., 2013; Ioannou & Altenmüller, 2015; Jasny, 2021; Madrigal et al., 2015; McEwen & Young, 2011; Theberge, 2008; Tibbert et al., 2015; Waters, 2020). Vague definitions of injury within the high-performance setting (e.g., injuries being defined as inhibiting performance vs. preventing participation) and the invisible nature of many injuries further blurred the boundaries for when high-performers felt that it was appropriate to withdraw from participation. Consequently, they often opted to perform hurt (Aalten, 2007; Andersen et al., 2013; Coker-Cranney et al., 2018; Curry, 1993; Hammond et al., 2013; Joncheray et al., 2022; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021; Kabiri, Choi, Shadmanfaat, & Lee, 2021; McEwen & Young, 2011; Ryou & Lee, 2023; Tibbert et al., 2015).
- b) Alongside unclear boundaries for when it was legitimate to stop participating, high-performers were confronted with ‘Attitudes and pressures from relevant stakeholders’ related to performing hurt. High-performers believed that stakeholders expected them to perform hurt (Barrette & Harman, 2020; Coker-Cranney et al., 2018; Curry, 1993; Druckman & Rothschild, 2018; Hammond et al., 2013; Kabiri, Choi, Shadmanfaat, & Lee, 2021; Kristensen et al., 2023; Ryou & Lee, 2023; Waters, 2020). The pressure to perform hurt was directly imposed on high-performers when coaches or teachers emphasized their importance to the team or orchestra and their status as role models (Aalten, 2007; Hammond et al., 2013; Kristensen et al., 2023; Mayer et al., 2018; Mayer & Thiel, 2018; Nixon, 1994; Overbye, 2021; Roderick, 2006; Tibbert et al., 2015; Waters, 2019). Pressure was created indirectly when coaches or teachers did not provide opportunities to discuss health-related decisions

and set unrealistic expectations or goals that could only be achieved when performing hurt (Andersen et al., 2013; Mayer et al., 2018; McEwen & Young, 2011; Rickert et al., 2015; Roderick et al., 2000; Ryou & Lee, 2023; Waters, 2019). Particularly, in high-performance settings that were characterized by masculine norms (e.g., highly valuing physical and mental toughness), high-performers described how they received encouragement (e.g., being motivated to prove their physical toughness by performing hurt) prior to performing-hurt and acknowledgment (e.g., being praised and awarded more playing-time) after performing-hurt (Barrette & Harman, 2020; Coker-Cranney et al., 2018; Curry, 1993; Hammond et al., 2013; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021; Kabiri, Choi, Shadmanfaat, & Lee, 2021; McEwen & Young, 2011; Nixon, 1994; Roderick et al., 2000).

- c) High-performers regularly described how the ‘Intensive practice and competition schedules’ within their respective high-performance setting contributed to a lack of recovery and left no time for medical diagnoses when high-performers experienced pain. Consequently, they felt they had no other choice but to perform hurt. In this regard, high-performers described that the perceived obligation to perform hurt increased with higher competition levels (Bourne et al., 2019; Diehl et al., 2019; Guptill, 2011; Hammond et al., 2013; Ioannou & Altenmüller, 2015; Mayer & Thiel, 2018; Waters, 2019). Relatedly, they had the impression that the intensive working and practicing hours (Andersen et al., 2013; Bragge et al., 2006; Davies & Mangion, 2002; Hammond et al., 2013; Ioannou & Altenmüller, 2015; Kaneko et al., 2005; Rickert et al., 2013), the lack of control over practice schedules (Hammond et al., 2013; Madrigal et al., 2016; Rickert et al., 2013; Waters, 2019), and intensive competition schedules (Bragge et al., 2006; Ioannou & Altenmüller, 2015; Kaneko et al., 2005; Rickert et al., 2013) all contributed to pain through not leaving time for adequate recovery, and consequently also to performing hurt. Particularly, specific competitions or performances (e.g., deciding games or auditions; Andersen et al.,

2013; Barrette & Harman, 2020; Diehl et al., 2019; Hammond et al., 2013; Kristensen et al., 2023; Madrigal et al., 2015; McEwen & Young, 2011; Overbye, 2021; Roderick et al., 2000) or competitions or performances at certain crucial times within a season (e.g., towards the end of the season; Barrette & Harman, 2020; Hammond et al., 2013; Madrigal et al., 2015; Tibbert et al., 2015) seemed to increase the probability of performing hurt. Analogously, high-performers felt obliged to perform hurt when they perceived the competition or performance as particularly important for their employers (Aalten, 2007; Andersen et al., 2013; Bourne et al., 2019; Hammond et al., 2013; McEwen & Young, 2011).

- d) In a similar vein, performing hurt also appeared to be shaped by ‘Contractual conditions’. When competitions or performances took place at crucial times within a contract situation (for example, when the competition or performance was perceived as decisive for their future contract situation), high-performers tended to perform hurt (Hammond et al., 2013; Ryou & Lee, 2023; Tibbert et al., 2015). Since musicians and dancers were frequently existentially dependent on their job, they were afraid of having their contract terminated when withdrawing due to pain, injury, or illness, which in turn increased their willingness to perform hurt (Guptill, 2011; Vassallo et al., 2019). In sport, contract clauses such as bonuses for participating in a certain number of competitions were mentioned as contributing to performing hurt (Hammond et al., 2013; Roderick et al., 2000).
- e) The way of the ‘Organizational integration of the health care system’ into the high-performance setting also appeared to contribute to performing hurt. While findings from all three high-performance domains highlighted that the high-performers’ dissatisfaction with the medical system played a role in performing hurt (Curry, 1993; Jasny, 2021; Mayer & Thiel, 2018; McEwen & Young, 2011; Roderick, 2006; Roderick et al., 2000; Ryou & Lee, 2023; Schneider et al., 2019), the specific reasons for this dissatisfaction varied across performance domains. Dancers were dissatisfied mostly because they perceived healthcare professionals as not being specialists for their specific needs (e.g., McEwen & Young, 2011).

Among athletes, the dissatisfaction arose from the medical system being part of the high-performance sports setting and rather representing the elite sports logic rather than medical values (e.g., Curry, 1993). Studies from music, in contrast, showed that musicians often reported a lack of accessible health care, as medical professionals were usually not part of the music setting (Andersen et al., 2013; Guptill, 2011), causing musicians to spend additional time and financial resources on treatments (e.g., Guptill, 2011) .

## **Discussion**

This systematic review provides a comprehensive and thorough overview of the diverse psychosocial factors influencing performing hurt among high-performing athletes, musicians, and dancers by thematically synthesizing 40 qualitative and quantitative studies. The included quantitative studies primarily examined the influence of psychological predictor variables, such as the athletic identity, on performing hurt (e.g., Coker-Cranney et al., 2018; Druckman & Rothschild, 2018). In contrast, qualitative studies focused on subjective perceptions and experiences of high-performers with regard to performing hurt and mainly highlighted how high-performers had internalized the underlying sociocultural values of the respective high-performance setting with regard to pain, injuries, and performing hurt (e.g., Berg et al., 2014; Tibbert et al., 2015).

### **Discussion of Main Findings and Hypothesized Interplays**

Our findings illustrate that current research on performing hurt within sport, music, and dancing has primarily examined the characteristics of the high-performers (dark grey area in Figure 2) as well as characteristics of the high-performance setting (light grey area in Figure 2) that contribute to performing hurt. While 32 out of the 40 included studies reported on aspects of both categories (i.e., individual characteristics of the high-performer and

characteristics of the high-performance setting), their interaction (dashed lines in Figure 2) was rarely explicitly measured or analyzed. The lack of studies examining this interplay stands in contrast to recurring calls for this interplay to be a primary focus of research and applied discussions on performing hurt (e.g., Mayer et al., 2020; Roderick et al., 2000). Therefore, we discuss the main findings of our systematic review and specifically highlight hypothesized interactions between the psychosocial factors.

‘Performance identity’ was a frequently researched concept, with our synthesis of the included studies suggesting that a more pronounced performance identity, particularly the exclusiveness regarding the high-performer’s life interest, was associated with performing hurt. This finding aligns with previous research showing that a more pronounced athletic identity increases risk-taking and health-risk behaviors (Steinfeldt & Steinfeldt, 2012) and decreases health promotion behaviors (Mahalik et al., 2007). Moreover, based on our synthesis, we assume an interplay between ‘performance identity’ and the ‘sociocultural trivialization of pain and injury’. High-performers with a pronounced performance identity appeared to have internalized values associated with the culture of risk more deeply. Consequently, they often showed a higher willingness to perform hurt (e.g., Madrigal et al., 2015; McEwen & Young, 2011). We further assume an effect of the ‘attitudes and pressures of relevant stakeholder’ on ‘performance identity’ and the high-performers’ own ‘attitudes towards pain and performing hurt’, particularly under certain situational aspects. When competitions or performances were highly important to high-performers (e.g., Barrette & Harman, 2020; Madrigal et al., 2015; Roderick et al., 2000) or were presented as such by their social environment (e.g., Aalten, 2007; Hammond et al., 2013; McEwen & Young, 2011), high-performers were more likely to perform hurt. Thus, under certain situational conditions, high-performers appeared to be even more susceptible to pressures from relevant stakeholders (e.g., coaches, teachers, colleagues) and adopt their attitudes towards

performing hurt. In their process-structure model of competing hurt decision making, Mayer et al. (2020) similarly emphasize the significance of situational factors in moderating how high-performers' identity and attitudes interact with aspects of the organizational culture in performing hurt decision-making.

Alongside a pronounced performance identity, the personality traits of perfectionism and mental toughness seemed to facilitate performing hurt. Perfectionism was identified as crucial in this regard, with the included studies suggesting that perfectionistic high-performers often attempted to exceed goals and overfulfil what they perceived as cultural expectations derived from the 'attitudes and pressures of relevant stakeholders' through performing hurt (e.g., Bragge et al., 2006; Coker-Cranney et al., 2018; McEwen & Young, 2011). As another 'Psychological characteristic', mental toughness was also associated with performing hurt. Within the included studies, mental toughness was commonly understood as hardiness in response to adverse health events, rather than as optimism, effective coping skills, or resilience, which are also conceptualized as facets of mental toughness in the broader discussion of mental toughness (Liew et al., 2019). Since high-performers within the included studies had the impression that mental toughness represents a desirable characteristic of high-performers (e.g., McEwen & Young, 2011; Theberge, 2008; Vassallo et al., 2019), they may be inclined to engage in behaviors, such as performing hurt, that could be interpreted as an indication of mental toughness by their high-performance network (e.g., Madrigal et al., 2016; Rickert et al., 2015). Some included studies even suggest that high-performers expected that performing hurt would result in receiving praise and acknowledgment by teammates, colleagues, teachers or coaches (e.g., Barrette & Harman, 2020; Coker-Cranney et al., 2018; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021). Consequently, we advocate for further research on the environmental and cultural dimensions of mental toughness with regard to health-risk behaviors through qualitative

approaches, as suggested by Eubank et al. (2017).

Within the included qualitative studies, high-performers explicitly discussed how performing hurt was socially expected and intrinsic to their roles as athletes, musicians, or dancers (e.g., Coker-Cranney et al., 2018). Resulting from inherent cultural expectations to consistently demonstrate the highest possible performance and to sacrifice health for the team's success (Hughes & Coakley, 1991), performing hurt often appeared to represent the most socially acceptable alternative when in pain, ill, or injured. High-performers exhibited a heightened willingness to perform hurt, particularly when their efforts in performing hurt were encouraged and acknowledged. Consequently, performing hurt helped high-performers to build a positive reputation and gain recognition as role models among colleagues or teammates (e.g., Tibbert et al., 2015). High-performers also reported to perform hurt due to a fear of recrimination if they disclosed their injuries and chose not to perform hurt. For instance, they worried about being blamed for their injuries (e.g., due to incorrect training or lack of fitness) and being accused of letting the team down if they refused to perform hurt (e.g., Aalten, 2007). These fears were intensified by uncertain and temporary 'contractual conditions' (Vassallo et al., 2019). Based on the synthesis of included studies, we hypothesize that the anticipation of these social consequences – whether for performing hurt or for not performing hurt – reinforces feelings of responsibility and obligation towards the team, which in turn may facilitate future performing hurt.

The fear of recrimination and stigmatization was further exacerbated when high-performers found themselves in settings where pain and injuries were trivialized. While only a few of the included studies reported that high-performers were directly coerced into performing hurt, our synthesis suggests that the social environment significantly contributed to performing hurt through structural dependencies (e.g., contractual conditions), physical demands (e.g., intensive practice and competition schedules), and implicit pressure. Some

studies indicate that the ‘sociocultural trivialization of pain and injuries’ even shaped high-performers’ own attitudes, making them more likely to view pain positively and trivialize minor injuries (e.g., Curry, 1993; Kabiri, Choi, Shadmanfaat, Ponnet, et al., 2021). Oftentimes, high-performers appeared to perceive their attitudes towards pain and performing hurt as essential to their performance identity. This perception contributed to a reluctance to withdraw from competition or practice when feeling ill, being injured, or in pain (Diehl et al., 2019; Mayer et al., 2018; Overbye, 2021; Schneider et al., 2019). If pain arises solely from physical exertion and not structural damage, such a positive reinterpretation of pain could be beneficial at the level of highest performance (McNarry et al., 2020). However, a positive framing of pain that leads to performing hurt could also result in the development of overuse injuries (Heil, 2012). Consistent with research in other areas that explores situations where pain is perceived as helpful, rewarding, or even pleasurable (Bastian et al., 2014; Leknes et al., 2013), further research in high-performance settings should examine when and why high-performers interpret pain positively, even when it signals an injury.

The positive framing of pain was often compounded by vague definitions of injury within the respective high-performance setting, which blurred the lines of when it was appropriate for high-performers to withdraw from practice and competition (e.g., Berg et al., 2014). As a result of these unclear definitions of injury, high-performers seemed to adjust their ‘attitudes toward pain and performing hurt’. They no longer viewed pain as a legitimate reason to stop performing; instead, enduring pain became a symbol of dedication and resilience. Since high-performers implicitly defined injuries as an inability to participate in training or competition, they often did not consider their symptoms as injuries if they could still perform despite pain (e.g., Coker-Cranney et al., 2018). At the same time, the findings of

the included studies also illustrate that high-performers would consider injuries a legitimate reason to take a break and refrain from performing hurt (e.g., Madrigal et al., 2015).

Our findings further suggest that the medical system and its integration within high-performance settings often played a role in performing hurt. The included studies reveal that different approaches to (not) integrating medical staff into the high-performance setting came with benefits and costs for high-performers, frequently leading to dissatisfaction with the medical system and, as a result, performing hurt (e.g., Ioannou & Altenmüller, 2015). High-performance sports organizations typically integrated medical professionals within their structures (e.g., Roderick, 2006), often putting medical staff in challenging positions, as they had to balance their professional ethics and the organization's expectations (Malcolm, 2011; Safai, 2003). This close connection between the sports systems and the medical system led to dissatisfaction among athletes who felt that their medical needs were compromised (e.g., Roderick et al., 2000). Conversely, in high-performing music and dance, where the medical system was not integrated, performers often felt that healthcare professionals failed to address their specific needs (e.g., Ioannou & Altenmüller, 2015). Negative experiences with the medical system often caused high-performers to avoid medical interventions, opting instead to self-diagnose and manage pain and injury symptoms independently, which further contributed to performing hurt (Ioannou & Altenmüller, 2015; Overbye, 2021; Waters, 2020).

Lastly, the influence of other systems, such as the family and the media, on performing hurt was evident. The media frequently celebrated and heroicized high-performers who performed hurt (see also; Read & Burch, 2023), portraying them as role models. This glorification may lead other high-performers to view enduring pain as admirable and even necessary for success, thereby reinforcing performing hurt (e.g., Hammond et al., 2013; Jasny, 2021). Additionally, some high-performers sought to imitate

family members who had also performed hurt during their professional careers and valued this behavior as a sign of dedication (e.g., Curry, 1993; Kristensen et al., 2023). This finding suggests that family values and experiences play a critical role in shaping attitudes towards pain and injury. Analyses of athletes' careers have shown that family structures and dynamics can significantly impact athletes' development, including their approach to managing injuries and setbacks (cf., Côté, 1999; Wylleman & Lavallee, 2004), which underscores the importance of considering the broader biographical and familial context when addressing health-risk behaviors like performing hurt.

### **Applied Implications**

Our findings provide practical recommendations at the individual, organizational, and cultural levels. Applied sport psychologists can assist high-performers in developing a more balanced and multidimensional identity by encouraging them to explore interests and skills beyond their high-performance roles. Programs focused on life skills development (Hardcastle et al., 2015) and the promotion of continuous professional development both within and outside of their domain (e.g., Champ et al., 2020) could be beneficial in this regard. Moreover, it appears crucial to educate high-performers, along with their coaches or teachers, on setting realistic and flexible goals, while stressing the importance of prioritizing long-term health over short-term success. Such strategies could help mitigate the exclusive focus on performance outcomes, which has been shown to contribute to risk-taking behavior (Schnell et al., 2014).

High-performance organizations also have a critical role in fostering environments that prioritize the health and well-being of high-performers. Much like established concussion protocols (Davis et al., 2020; Jacobi et al., 2023), the implementation and enforcement of clear protocols specifying when withdrawal from practice and competitions due to health concerns is recommended or required could significantly reduce the health

risks associated with performing hurt. Such protocols should be integrated into mandatory education programs for all stakeholders, particularly medical professionals, coaches, or teachers. Furthermore, carefully considering the optimal integration of medical services within organizations can help minimize conflicts of interest, ensuring that healthcare professionals provide independent and unbiased care. To maintain transparency, organizations should implement policies that require the disclosure of potential conflicts of interest by medical staff, such as financial ties to the organization or mutual concessions. Establishing contracts that guarantee physicians' independence by granting decision-making authority and removing performance-related incentives can support both the integrity of the high-performance environment and the health of high-performers (for a detailed explanation, see Calandrillo, 2005).

Beyond individual organizational protocols and contractual regulations, federations and unions should take action by reviewing and adjusting practice and competition schedules to prevent over-scheduling and ensure sufficient time for medical diagnoses and recovery (Luke et al., 2011). Involving athlete (or high-performers) advocacy groups in these efforts could be beneficial. By focusing on the welfare of high-performers, these groups could advocate for necessary changes and help enhance the effectiveness of the implemented measures.

Culturally, there needs to be a shift in how pain and injury are perceived within high-performance settings. In this regard, it is essential to recognize the normalization of performing hurt as a form of interpersonal violence. Literature classifies the pressure to perform hurt as physical violence (Ohlert et al., 2021) and views the trivialization of such behaviors as institutional violence (Parent & Fortier, 2017). Thus, emerging safe sport initiatives should explicitly address the often overlooked issue of performing hurt.

Organizations, federations and unions should commit to implementing educational programs

for coaches, teachers and other relevant stakeholders to raise awareness of the dangers of normalizing pain and valuing performance at the expense of health. Medical professionals, in particular, can play a pivotal role in these educational efforts.

In this context, media professionals could also contribute to driving the cultural transformation by providing a more critical perspective on performing hurt. Based on McGannon and McMahon's (2020) review on media and sport injury, we recommend targeted education for journalists on how to report and frame performing hurt behavior. In this regard, journalists need to be informed about the potential long-term health risks associated with performing hurt and should highlight these issues to the public, rather than merely glorifying potential short-term success. By incorporating the physical and psychological toll on high-performers into their narratives, journalists can support a high-performance culture that prioritizes health alongside performance.

### **Limitations of Current Research and Avenues for Future Research**

Overall, we observed inconsistencies in the definition of performing hurt and its assessment. Particularly, research with high-performing athletes not only investigated their actual performing hurt behavior but also their willingness to perform hurt (i.e., in hypothetical scenarios). Further, some included studies were inconsistent as to whether performing hurt in practice was also categorized as performing hurt. Research in music often used the term playing-related pain but did not clarify whether this pain occurred before, during, or after performing, which sometimes made it difficult to judge whether the research actually described the phenomenon of performing hurt (i.e., performing while experiencing pain). Overall, the inconsistent terminology used for the phenomenon of performing hurt represents a particular difficulty in this area of research as it makes comparison across studies challenging. Thus, we call for a consistent use of terminology as well as a clear definition of the (respective) term(s).

Further, most included studies did not work with theoretical frameworks. Only ten studies from sport exemplified their theoretical framework and used it as guidance for their research questions or discussion of results. The lack of theoretical frameworks to explain the associations between psychosocial factors and performing hurt must be viewed critically as theories should be used as a starting and reference point in research, especially when aiming to describe or explain such a complex phenomenon as performing hurt (cf. Thiel et al., 2018). This limitation also aligns with the findings of the MMAT showing that included studies often lacked a thorough explanation of their methods or approaches to collect and analyze data, which might tie back to their lack of a theoretical framework. Thus, there is a clear need for more theoretically informed performing hurt research, specifically in order to capture the complex interplay of personal, organizational and sociocultural factors that shape individual or shared decision-making processes leading to performing hurt (Mayer et al., 2020).

Methodologically, research on performing hurt would particularly benefit from longitudinal studies to investigate causal relations between the identified psychosocial factors and performing hurt behavior. Longitudinal studies could further highlight the dynamic nature of performing hurt decision-making (cf. Mayer et al., 2020), delineating how high-performers navigate changing performing hurt situations over time (cf. Everard et al., 2021). The lack of such approaches within the included studies, combined with methodological shortcomings, particularly in the qualitative studies, needs to be addressed to enhance the validity and generalizability of research findings. Future studies should adopt rigorous methodological designs and clearly defined theoretical frameworks to develop a more robust understanding of the phenomenon and strengthen the evidence base. Specifically, the current state of performing hurt research limits the ability to present and

discuss the interplay between characteristics of the high-performers and the high-performance setting since it lacks data that explicitly examines this interaction.

Drawing upon the theoretical work of Mayer et al. (2020) on performing hurt decision-making, we noticed that the existing and synthesized research also lacks consideration of the specific types of health-related events that preceded performing hurt. Thus, a promising avenue for future research would involve analyzing how the nature of a health-related event (e.g., acute vs. chronic) impacts performing hurt decision-making (cf. Mayer & Thiel, 2018; Mayer, Thiel, & Burgess, 2020). In this regard, it appears particularly important to focus on the interrelation between overuse injuries and performing hurt behavior. Given that over 50% of overuse injuries do not result in time loss from sport, performing hurt and overuse injuries appear to go hand in hand for most athletes (Yang et al., 2012). Tranaeus et al. (2022) identified similar psychosocial risk factors for overuse injuries among athletes as our review did for performing hurt among high-performers. Thus, future research should further investigate the relation between performing hurt behavior and types of overuse injuries in different high-performance settings. This is particularly important as overuse injuries are health-related events which might repeatedly lead to performing hurt behaviors. Moreover, recurrent performing hurt behavior can also contribute to the (further) development of overuse injuries.

Although the phenomenon of performing hurt has been studied since the early 1990s (Hughes & Coakley, 1991), it remains unclear how high-performers' experiences of performing hurt have evolved over time. The 40 studies included in this review span 34 years and cover three high performance domains, which shows that the phenomenon of performing hurt has not gained substantial prominence within the scientific community. Methodological weaknesses, inconsistent definitions, and the lack of an established, validated scale for assessing performing hurt contribute to the difficulty of identifying time

trends. However, certain sub-aspects of performing hurt, such as overuse injuries or the use of analgesics as a strategy to manage pain and allow participation, are receiving increasing attention in both academic research and practical applications (e.g. John et al., 2023; Leyk et al., 2023; Tranaeus et al., 2022). Therefore, we propose that future research should aim to develop a cohesive discourse on performing hurt by integrating existing concepts and findings to create a unified research field that enhances understanding and informs practice.

### **Conclusion**

With this review, we aimed to systematically examine and synthesize literature on the role of psychosocial factors and their interrelations in performing hurt among high-performers. The inclusion of qualitative, quantitative, and mixed-method studies allowed us to offer a holistic perspective on the phenomenon of performing hurt in high-performance sports, music, and dance. Methodologically, the findings of our review emphasize the need for a consistent definition of performing hurt and the use of theoretical frameworks to guide research. Through a convergent thematic analysis, we were able to synthesize and categorize the researched psychosocial aspects into personal characteristics of the high-performer and characteristics of the high-performance settings and elucidate their role in performing hurt behavior. Overall, our findings illustrate the complexity of the performing hurt phenomenon, with psychological and social factors interacting when it comes to performing hurt. Understanding which psychosocial factors are critical not only helps to identify high-performers at risk but also to reflect on organizational aspects that may contribute to performing hurt. Practical recommendations include fostering a balanced identity among high-performers, educating all stakeholders on the potential long-term health consequences of performing hurt, implementing clear health protocols, and minimizing conflicts of interest in medical care. Our practical recommendations could be crucial in shifting the focus from

solely valuing performance to equally prioritizing the health and well-being of high-performers. By cultivating a culture that balances performance with long-term health, high-performance settings can become safer environments where individuals are supported in making decisions that safeguard their physical well-being.

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**Data availability**

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

## References

References marked with an asterisk indicate studies included in the systematic review.

- \*Aalten, A. (2007). Listening to the dancer's body. *The Sociological Review*, 55, 109-125. <https://doi.org/10.1111/j.1467-954X.2007.0069>
- Andersen, N. L., Roessler, K. K., & Eichberg, H. (2013). Pain among professional orchestral musicians: a case study in body culture and health psychology. *Medical Problems of Performing Artists*, 28(3), 124-130. <https://doi.org/10.21091/mppa.2013.3026>
- Anderson, R., & Hanrahan, S. J. (2008). Dancing in pain: pain appraisal and coping in dancers. *Journal of Dance Medicine & Science*, 12(1), 9-16. <https://doi.org/10.1177/1089313X0801200102>
- Arden, C. L., Büttner, F., Andrade, R., Weir, A., Ashe, M. C., Holden, S., Impellizzeri, F. M., Delahunt, E., Dijkstra, H. P., & Mathieson, S. (2022). Implementing the 27 PRISMA 2020 Statement items for systematic reviews in the sport and exercise medicine, musculoskeletal rehabilitation and sports science fields: the PERSiST (implementing Prisma in Exercise, Rehabilitation, Sport medicine and SporTs science) guidance. *British journal of sports medicine*, 56(4), 175-195. <https://doi.org/10.1136/bjsports-2021-103987>
- Asken, B. M., McCrea, M. A., Clugston, J. R., Snyder, A. R., Houck, Z. M., & Bauer, R. M. (2016). "Playing through it": delayed reporting and removal from athletic activity after concussion predicts prolonged recovery. *Journal of athletic training*, 51(4), 329-335. <https://doi.org/10.4085/1062-6050-51.5.02>
- Babones, S. (2016). Interpretive quantitative methods for the social sciences. *Sociology*, 50(3), 453-469. <https://doi.org/10.1177/0038038515583637>
- Barrette, A., & Harman, K. (2020). Athletes Play Through Pain-What Does That Mean for Rehabilitation Specialists? *J Sport Rehabil*, 29(5), 640-649. <https://doi.org/10.1123/jsr.2018-0426>
- Bastian, B., Jetten, J., Hornsey, M. J., & Leknes, S. (2014). The positive consequences of pain: A biopsychosocial approach. *Personality and Social Psychology Review*, 18(3), 256-279. <https://doi.org/10.1177/1088868314527831>
- Berg, E. C., Migliaccio, T. A., & Anzini-Varesio, R. (2014). Female football players, the sport ethic and the masculinity-sport nexus. *Sport in Society*, 17(2), 176-189. <https://doi.org/10.1080/17430437.2013.828699>
- Boudreau, P., Mackenzie, S. H., & Hodge, K. (2020). Flow states in adventure recreation: A systematic review and thematic synthesis. *Psychology of Sport and Exercise*, 46, 101611. <https://doi.org/10.1016/j.psychsport.2019.101611>
- Bourne, D., Hallaran, A., & Mackie, J. (2019). The Lived Experience of Orchestral String Musicians with Playing Related Pain. *Med Probl Perform Art*, 34(4), 198-204. <https://doi.org/10.21091/mppa.2019.4031>
- Bragge, P., Bialocerkowski, A., & McMeeken, J. (2006). Understanding playing-related musculoskeletal disorders in elite pianists: a grounded theory study. *Medical*

- Problems of Performing Artists*, 21(2), 71-79.  
<https://doi.org/10.21091/mppa.2006.2014>
- Brewer, B. W., Van Raalte, J. L., & Linder, D. E. (1993). Athletic identity: Hercules' muscles or Achilles heel? *International journal of sport psychology*.
- Calandrillo, S. P. (2005). Sports medicine conflicts: Team physicians vs. athlete-patients. . *Louis ULJ*, 50, 185.
- Champ, F. M., Ronkainen, N. J., Littlewood, M. A., & Eubank, M. (2020). Supporting identity development in talented youth athletes: Insights from existential and cultural psychological approaches. *Journal of Sport Psychology in Action*, 11(4), 219-232.
- Coakley, J. (1992). Burnout among Adolescent Athletes: A Personal Failure or Social Problem? *Sociology of Sport Journal*, 9(3), 271–285.  
<https://doi.org/10.1123/ssj.9.3.271>
- Coker-Cranney, A., Watson, J. C., 2nd, Bernstein, M., Voelker, D. K., & Coakley, J. (2018). How far is too far? Understanding identity and overconformity in collegiate wrestlers. *Qual Res Sport Exerc Health*, 10(1), 92-116.  
<https://doi.org/10.1080/2159676X.2017.1372798>
- Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, 13(4), 395-417.
- Creighton, D. W., Shrier, I., Shultz, R., Meeuwisse, W. H., & Matheson, G. O. (2010). Return-to-play in sport: a decision-based model. *Clinical Journal of Sport Medicine*, 20(5), 379-385. <https://doi.org/10.1097/JSM.0b013e3181f3c0fe>
- Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.
- Curry, T. J. (1993). A little pain never hurt anyone: Athletic career socialization and the normalization of sports injury. *Symbolic interaction*, 16(3), 273-290.  
<https://doi.org/10.1525/si.1993.16.3.273>
- Davies, J., & Mangion, S. (2002). Predictors of pain and other musculoskeletal symptoms among professional instrumental musicians: elucidating specific effects. *Medical Problems of Performing Artists*, 17(4), 155-168.  
<https://doi.org/10.21091/mppa.2002.4025>
- Davis, G. A., Makdissi, M., Bloomfield, P., Clifton, P., Cowie, C., Echemendia, R., Falvey, E. C., Fuller, G. W., Green, G. A., & Harcourt, P. (2020). Concussion guidelines in national and international professional and elite sports. *Neurosurgery*, 87(2), 418-425. <https://doi.org/10.1093/neuros/nyaa057>
- Diehl, K., Mayer, J., Thiel, A., Zipfel, S., & Schneider, S. (2019). „Playing hurt“: der Umgang jugendlicher Leistungssportler mit Gelenkschmerzen. *Der Schmerz*, 33(1), 49–56. <https://doi.org/10.1007/s00482-017-0263-5>
- DiFiori, J. P., Benjamin, H. J., Brenner, J. S., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014). Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *British journal of sports medicine*, 48(4), 287-288. <http://dx.doi.org/10.1136/bjsports-2013-093299>

- Druckman, J. N., & Rothschild, J. E. (2018). Playing with pain: social class and pain reporting among college student-athletes. *Sport J*, *21*.  
<https://doi.org/10.1097/01.jsm.0000186681.13416.0c>
- Eubank, M., Nesti, M., & Littlewood, M. (2017). A culturally informed approach to mental toughness development in high performance sport. *International journal of sport psychology*, *48*(3), 206-222.
- Everard, C., Wadey, R., & Howells, K. (2021). Storying sports injury experiences of elite track athletes: A narrative analysis. *Psychology of Sport and Exercise*, *56*, 102007.  
<https://doi.org/10.1016/j.psychsport.2021.102007>
- Forsdyke, D., Smith, A., Jones, M., & Gledhill, A. (2016). Psychosocial factors associated with outcomes of sports injury rehabilitation in competitive athletes: a mixed studies systematic review. *British journal of sports medicine*, *50*(9), 537–544.  
<https://doi.org/10.1136/bjsports-2015-094850>
- Frey, J. H. (1991). Social Risk and the Meaning of Sport. *Sociology of Sport Journal*, *8*(2), 136–145. <https://doi.org/10.1123/ssj.8.2.136>
- Gledhill, A., Harwood, C., & Forsdyke, D. (2017). Psychosocial factors associated with talent development in football: A systematic review. *Psychology of Sport and Exercise*, *31*, 93-112. <https://doi.org/10.1016/j.psychsport.2017.04.002>
- Gröpel, P., & Mesagno, C. (2019). Choking interventions in sports: A systematic review. *International Review of sport and exercise psychology*, *12*(1), 176-201.  
<https://doi.org/10.1080/1750984X.2017.1408134>
- Guptill, C. A. (2011). The lived experience of professional musicians with playing-related injuries: a phenomenological inquiry. *Medical Problems of Performing Artists*, *26*(2), 84-95. <https://doi.org/10.21091/mppa.2011.2013>
- Hammond, L. E., Lilley, J. M., Pope, G. D., Ribbans, W. J., & Walker, N. C. (2013). ‘We’ve just learnt to put up with it’: an exploration of attitudes and decision-making surrounding playing with injury in English professional football. *Qualitative Research in Sport, Exercise and Health*, *6*(2), 161-181.  
<https://doi.org/10.1080/2159676x.2013.796488>
- Hardcastle, S. J., Tye, M., Glassey, R., & Hagger, M. S. (2015). Exploring the perceived effectiveness of a life skills development program for high-performance athletes. *Psychology of Sport and Exercise*, *16*, 139-149.
- Heil, J. (2012). Pain on the run: Injury, pain and performance in a distance runner. *The Sport Psychologist*, *26*(4), 540-550. <https://doi.org/10.1123/tsp.26.4.540>
- Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., & O’Cathain, A. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for information*, *34*(4), 285-291. <https://doi.org/10.3233/EFI-180221>
- Hong, Q. N., Pluye, P., Bujold, M., & Wassef, M. (2017). Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Systematic Reviews*, *6*(1), 1-14.  
<https://doi.org/10.1186/s13643-017-0454-2>

- Hughes, R., & Coakley, J. (1991). Positive deviance among athletes: The implications of overconformity to the sport ethic. *Sociology of Sport Journal*, 8(4), 307-325. <https://doi.org/10.1123/ssj.8.4.307>
- Ioannou, C. I., & Altenmüller, E. (2015). Approaches to and treatment strategies for playing-related pain problems among Czech instrumental music students: an epidemiological study. *Medical Problems of Performing Artists*, 30(3), 135-142. <https://doi.org/10.21091/mppa.2015.3027>
- 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*, 47(2), 353–365. <https://doi.org/10.1007/s40279-016-0578-x>
- Jacobi, J., Wasserman, E. B., D. Mack, C., Heinzelmann, M., Cárdenas, J., Rehberg, R., Solomon, G., Sills, A., & Vargas, B. (2023). The National Football League Concussion Protocol: A Review. *HSS Journal*®, 15563316231177207. <https://doi.org/10.1177/15563316231177207>
- Jasny, M. (2021). “Playing with injury”: the health-related aspects of a career in women’s handball. *Physical Culture and Sport. Studies and Research*, 93(1), 62-71. <https://doi.org/10.2478/pcssr-2021-0031>
- John, J. M., Gropper, H., & Thiel, A. (2019). The role of critical life events in the talent development pathways of athletes and musicians: A systematic review. *Psychology of Sport and Exercise*, 45, 101565. <https://doi.org/10.1016/j.psychsport.2019.101565>
- John, J. M., & Thiel, A. (2022). All roads lead to Rome? Talent narratives of elite athletes, musicians, and mathematicians. *Qualitative Research in Sport, Exercise and Health*, 1-22. <https://doi.org/10.1080/2159676X.2022.2074078>
- Joncheray, H., Chavinier-Réla, S., Burlot, F., Dalgalarondo, S., & Fukazawa-Couckuyt, S. (2022). Experiences of Normalization of Pain and Injury in Elite Adolescent Basketball. *Sociology of Sport Journal*, 1(aop), 1-9. <https://doi.org/10.1123/ssj.2021-0143>
- Kabiri, S., Choi, J., Shadmanfaat, S., Ponnet, K., Lee, J., Lee, S., & Donner, C. (2021). Learning to play through pain and injury: An examination of social learning theory among Iranian athletes. *Social Science Quarterly*, 102(1), 343-361. <https://doi.org/10.1111/ssqu.12878>
- Kabiri, S., Choi, J., Shadmanfaat, S. M., & Lee, J. (2021). Control Deficits, Conditioning Factors, and Playing through Pain and Injury among Iranian Professional Soccer Players. *Int J Environ Res Public Health*, 18(7). <https://doi.org/10.3390/ijerph18073387>
- Kaneko, Y., Lianza, S., & Dawson, W. J. (2005). Pain as an incapacitating factor in symphony orchestra musicians in Sao Paulo, Brazil. *Medical Problems of Performing Artists*, 20(4), 168-174. <https://doi.org/10.21091/mppa.2005.4033>
- Kristensen, J. Å., Haugen, T., & Ommundsen, Y. (2023). Perceived social pressure and intention to play through injuries in junior ice hockey: The sporting environment matters. *Journal of sports sciences*, 1-9. <https://doi.org/10.1080/02640414.2023.2273084>

- Leknes, S., Berna, C., Lee, M. C., Snyder, G. D., Biele, G., & Tracey, I. (2013). The importance of context: when relative relief renders pain pleasant. *PAIN®*, *154*(3), 402-410. <https://doi.org/10.1016/j.pain.2012.11.018>
- Leyk, D., R  ther, T., Hartmann, N., Vits, E., Staudt, M., & Hoffmann, M. A. (2023). Analgesic use in sports: Results of a systematic literature review. *Deutsches   rzteblatt International*, *120*(10), 155.
- Liew, G. C., Kuan, G., Chin, N. S., & Hashim, H. A. (2019). Mental toughness in sport: Systematic review and future. *German Journal of Exercise and Sport Research*, *49*(4), 381-394.
- Luke, A., Lazaro, R. M., Bergeron, M. F., Keyser, L., Benjamin, H., Brenner, J., d'Hemecourt, P., Grady, M., Philpott, J., & Smith, A. (2011). Sports-related injuries in youth athletes: is overscheduling a risk factor? *Clinical Journal of Sport Medicine*, *21*(4), 307-314.
- Madrigal, L., Robbins, J., Gill, D. L., & Wurst, K. (2015). A Pilot Study Investigating the Reasons for Playing Through Pain and Injury: Emerging Themes in Men's and Women's Collegiate Rugby. *The Sport Psychologist*, *29*(4), 310-318. <https://doi.org/10.1123/tsp.2014-0139>
- Madrigal, L., Wurst, K., & Gill, D. L. (2016). The role of mental toughness in coping and injury response in female roller derby and rugby athletes. *Journal of Clinical Sport Psychology*, *10*(2), 137-154. <https://doi.org/10.1123/JCSP.2015-0021>
- Mahalik, J. R., Levi-Minzi, M., & Walker, G. (2007). Masculinity and health behaviors in Australian men. *Psychology of Men & Masculinity*, *8*(4), 240. <https://doi.org/10.1037/1524-9220.8.4.240>
- Malcolm, D. (2011). Sport medicine, injured athletes and Norbert Elias's sociology of knowledge. *Sociology of Sport Journal*, *28*(3), 284-302. <https://doi.org/10.1123/ssj.28.3.284>
- Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, *358*(9280), 483-488. [https://doi.org/10.1016/S0140-6736\(01\)05627-6](https://doi.org/10.1016/S0140-6736(01)05627-6)
- Mayer, J., Giel, K. E., Malcolm, D., Schneider, S., Diehl, K., Zipfel, S., & Thiel, A. (2018). Compete or rest? Willingness to compete hurt among adolescent elite athletes. *Psychology of Sport and Exercise*, *35*, 143-150. <https://doi.org/10.1016/j.psychsport.2017.12.004>
- Mayer, J., K  hnle, F., & Thiel, A. (2020). Presenteeism in elite sport organisations: A framework for understanding athletes' decisions to practise sport despite health concerns (*Routledge Handbook of Athlete Welfare* (pp. 81-93). Routledge.
- Mayer, J., & Thiel, A. (2018). Presenteeism in the elite sports workplace: The willingness to compete hurt among German elite handball and track and field athletes. *International Review for the Sociology of Sport*, *53*(1), 49-68. <https://doi.org/10.1177/1012690216640525>
- McEwen, K., & Young, K. (2011). Ballet and pain: reflections on a risk-dance culture. *Qualitative Research in Sport, Exercise and Health*, *3*(2), 152-173. <https://doi.org/10.1080/2159676x.2011.572181>

- McGannon, K. R., & McMahon, J. (2020). Sport media research: Examining the benefits for sport injury psychology and beyond (*Sport Injury Psychology* (pp. 25-35). Routledge.
- McKay, A. K., Stellingwerff, T., Smith, E. S., Martin, D. T., Mujika, I., Goosey-Tolfrey, V. L., Sheppard, J., & Burke, L. M. (2021). Defining training and performance caliber: a participant classification framework. *International journal of sports physiology and performance*, *17*(2), 317-331. <https://doi.org/10.1123/ijsp.2021-0451>
- McNarry, G., Allen-Collinson, J., & Evans, A. B. (2020). “You always wanna be sore, because then you are seeing results”: Exploring positive pain in competitive swimming. *Sociology of Sport Journal*, *37*(4), 301-309. <https://doi.org/10.1123/ssj.2019-0133>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The, P. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine*, *6*(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L. A., & Group, P.-P. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, *4*(1), 1. <https://doi.org/10.1186/2046-4053-4-1>
- Molan, C., Kelly, S., Arnold, R., & Matthews, J. (2019). Performance management: A systematic review of processes in elite sport and other performance domains. *Journal of Applied Sport Psychology*, *31*(1), 87-104. <https://doi.org/10.1080/10413200.2018.1440659>
- Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC medical research methodology*, *18*, 1-7. <https://doi.org/10.1186/s12874-018-0611-x>
- Newman, B. M., & Newman, P. R. (Eds.). (2020). *Theories of Adolescent Development*. Academic Press.
- Nixon, H. (1992). A Social Network Analysis of Influences On Athletes To Play With Pain and Injuries. *Journal of Sport and Social Issues*, *16*(2), 127–135. <https://doi.org/10.1177/019372359201600208>
- Nixon, H. (1993). Accepting the Risks of Pain and Injury in Sport: Mediated Cultural Influences on Playing Hurt. *Sociology of Sport Journal*, *10*(2), 183–196. <https://doi.org/10.1123/ssj.10.2.183>
- Nixon, H. (1994). Social pressure, social support, and help seeking for pain and injuries in college sports networks. *Journal of Sport and Social Issues*, *18*(4), 340-355. <https://doi.org/10.1177/019372394018004004>
- Ohlert, J., Vertommen, T., Rulofs, B., Rau, T., & Allroggen, M. (2021). Elite athletes’ experiences of interpersonal violence in organized sport in Germany, the Netherlands, and Belgium. *European journal of sport science*, *21*(4), 604-613.
- Overbye, M. (2021). Walking the line? An investigation into elite athletes’ sport-related use of painkillers and their willingness to use analgesics to train or compete when

- injured. *International Review for the Sociology of Sport*, 56(8), 1091–1115. <https://doi.org/10.1177/1012690220973552>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, 88, 105906. <https://doi.org/10.1136/bmj.n71>
- Parent, S., & Fortier, K. (2017). Prevalence of interpersonal violence against athletes in the sport context. *Current Opinion in Psychology*, 16, 165-169.
- Park, A., Guptill, C., & Sumsion, T. (2007). Why Music Majors Pursue Music Despite the Risk of Playing-related Injuries. *Medical Problems of Performing Artists*, 22(3), 89–96. <https://doi.org/10.21091/mppa.2007.3021>
- Pluye, P., & Hong, Q. N. (2014). Combining the power of stories and the power of numbers: mixed methods research and mixed studies reviews. *Annual review of public health*, 35, 29-45. <https://doi.org/10.1146/annurev-publhealth-032013-182440>
- Read, D., & Burch, L. M. (2023). The Framing of ‘Playing Through the Pain’ in the Media: An Investigation of Rafael Nadal During the 2022 French Open. *Communication & Sport*, 21674795231199037.
- Rickert, D. L., Barrett, M. S., & Ackermann, B. J. (2013). Injury and the orchestral environment: Part I. *Med Probl Perform Art*, 28(4), 219-229. <https://doi.org/10.21091/mppa.2013.4043>
- Rickert, D. L., Barrett, M. S., & Ackermann, B. J. (2015). Are music students fit to play? A case study of health awareness and injury attitudes amongst tertiary student cellists. *International Journal of Music Education*, 33(4), 426-441. <https://doi.org/10.1177/0255761415582343>
- Roderick, M. (2006). Adding insult to injury: workplace injury in English professional football. *Sociology of Health & Illness*, 28(1), 76-97. <https://doi.org/10.1111/j.1467-9566.2006.00483.x>
- Roderick, M., Waddington, I., & Parker, G. (2000). Playing hurt: Managing injuries in English professional football. *International Review for the Sociology of Sport*, 35(2), 165-180. <https://doi.org/10.1177/101269000035002003>
- Ryou, J., & Lee, E. (2023). Capital game: male athletes’ rationalisation of playing hurt and reproduction of the risk, pain, and injury custom in professional combat sports. *Qualitative Research in Sport, Exercise and Health*, 1-18. <https://doi.org/10.1080/2159676X.2023.2243953>
- Safai, P. (2003). Healing the body in the “culture of risk”: Examining the negotiation of treatment between sport medicine clinicians and injured athletes in Canadian intercollegiate sport. *Sociology of Sport Journal*, 20(2), 127-146. <https://doi.org/10.1123/ssj.20.2.127>
- Schneider, S., Sauer, J., Berrsche, G., Löbel, C., & Schmitt, H. (2019). “Playing hurt”—competitive sport despite being injured or in pain. *Deutsche Zeitschrift für Sportmedizin*, 2019(2), 43-52. <https://doi.org/10.5960/dzsm.2019.365>
- Schnell, A., Mayer, J., Diehl, K., Zipfel, S., & Thiel, A. (2014). Giving everything for athletic success!—Sports-specific risk acceptance of elite adolescent athletes.

- Psychology of Sport and Exercise*, 15(2), 165-172.  
<https://doi.org/10.1016/j.psychsport.2013.10.012>
- Smith, B., & McGannon, K. R. (2018). Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of sport and exercise psychology*, 11(1), 101-121.  
<https://doi.org/10.1080/1750984X.2017.1317357>
- Sparkes, A. C., & Smith, B. (2009). Judging the quality of qualitative inquiry: Criteriology and relativism in action. *Psychology of Sport and Exercise*, 10(5), 491-497.  
<https://doi.org/10.1016/j.psychsport.2009.02.006>
- Steinfeldt, M., & Steinfeldt, J. A. (2012). Athletic identity and conformity to masculine norms among college football players. *Journal of Applied Sport Psychology*, 24(2), 115-128. <https://doi.org/10.1080/10413200.2011.603405>
- Swann, C., Moran, A., & Piggott, D. (2015). Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise*, 16, 3-14.  
<https://doi.org/10.1016/j.psychsport.2014.07.004>
- Theberge, N. (2008). "Just a normal bad part of what I do": Elite athletes' accounts of the relationship between health and sport. *Sociology of Sport Journal*, 25(2), 206-222.  
<https://doi.org/10.1123/ssj.25.2.206>
- Thiel, A., Schubring, A., Schneider, S., Zipfel, S., & Mayer, J. (2015). Health in Elite Sports-a "Bio-Psycho-Social" Perspective. *German Journal of Sports Medicine/Deutsche Zeitschrift Fur Sportmedizin*, 66(9). <https://doi.org/10.5960/dzsm.2015.194>
- Thiel, A., Seiberth, K., & Mayer, J. (2018). Why does theory matter? Reflections on an apparently self-evident question in sport sociology. *European Journal for Sport and Society*, 15(1), 1-4. <https://doi.org/10.1080/16138171.2018.1437689>
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC medical research methodology*, 8(1), 1-10.  
<https://doi.org/10.1186/1471-2288-8-45>
- Tibbert, S. J., Andersen, M. B., & Morris, T. (2015). What a difference a "Mentally Toughening" year makes: The acculturation of a rookie. *Psychology of Sport and Exercise*, 17, 68-78. <https://doi.org/10.1016/j.psychsport.2014.10.007>
- Tranaeus, U., Martin, S., & Ivarsson, A. (2022). Psychosocial risk factors for overuse injuries in competitive athletes: a mixed-studies systematic review. *Sports Medicine*, 1-16. <https://doi.org/10.1007/s40279-021-01597-5>
- Vassallo, A. J., Pappas, E., Stamatakis, E., & Hiller, C. E. (2019). Injury Fear, Stigma, and Reporting in Professional Dancers. *Saf Health Work*, 10(3), 260-264.  
<https://doi.org/10.1016/j.shaw.2019.03.001>
- Wanke, E. M., Haenel, J., & Groneberg, D. A. (2020). Musculoskeletal Pain in Latin American Formation Dance: Localization, Assessment, and Related Behavior. *J Dance Med Sci*, 24(1), 24-32. <https://doi.org/10.12678/1089-313X.24.1.24>
- Waters, M. (2019). Perceptions of playing-related discomfort/pain among tertiary string students: A general overview of contributing factors. *International Journal of Music Education*, 37(2), 226-242. <https://doi.org/10.1177/0255761419833078>

- Waters, M. (2020). The perceived influence of the one-on-one instrumental learning environment on tertiary string students' perceptions of their own playing-related discomfort/pain. *British Journal of Music Education*, 37(3), 221-233. <https://doi.org/10.1017/s0265051720000236>
- Wylleman, P., & Lavallee, D. (2004). A developmental perspective on transitions faced by athletes. *Developmental sport and exercise psychology: A lifespan perspective*, 507-527.
- Yang, J., Tibbetts, A. S., Covassin, T., Cheng, G., Nayar, S., & Heiden, E. (2012). Epidemiology of overuse and acute injuries among competitive collegiate athletes. *Journal of athletic training*, 47(2), 198-204. <https://doi.org/10.4085/1062-6050-47.2.198>

## Tables

**Table 1**

## Search terms for literature search

Set	Search Terms
#1	sport OR music OR dance OR athlet* OR player* OR musician* OR instrumentalist* OR dancer* OR dancing OR ballet
#2	'Play* hurt' OR 'Play*-hurt' OR 'Play* injured' OR 'Play* with injury' OR 'Play* with pain' OR 'Play* despite pain' OR 'Play* through pain' OR 'Willingness to compete hurt' OR 'Willingness to play hurt' OR 'Willingness to compete injured' OR 'Compet* hurt' OR 'Compet* Injured' OR 'Compet* with injury' OR 'Compet* with pain' OR 'Compet* despite pain' OR 'Compet* through pain' OR 'Sport presenteeism' OR 'Presenteeism in Sport' OR 'Presenteeism in athletes' OR 'Athlete presenteeism' OR 'Presenteeism in music' OR 'Musician Presenteeism' OR 'Participate* hurt' OR 'Participate* injured' OR 'Participate* with injury' OR 'Participate* with pain' OR 'Participate* despite pain' OR 'Participate* through pain' OR 'Continue to play injured' OR 'Continue to train injured' OR 'Continue to play when injured' OR 'Continue to train when injured' OR 'Danc* hurt' OR 'Danc* injured' OR 'Danc* with injury' OR 'Danc* with pain' OR 'Danc* despite pain' OR 'Danc* through pain' OR 'Willingness to dance injured' OR 'Willingness to dance hurt'
#3	#1 AND #2

### Figures

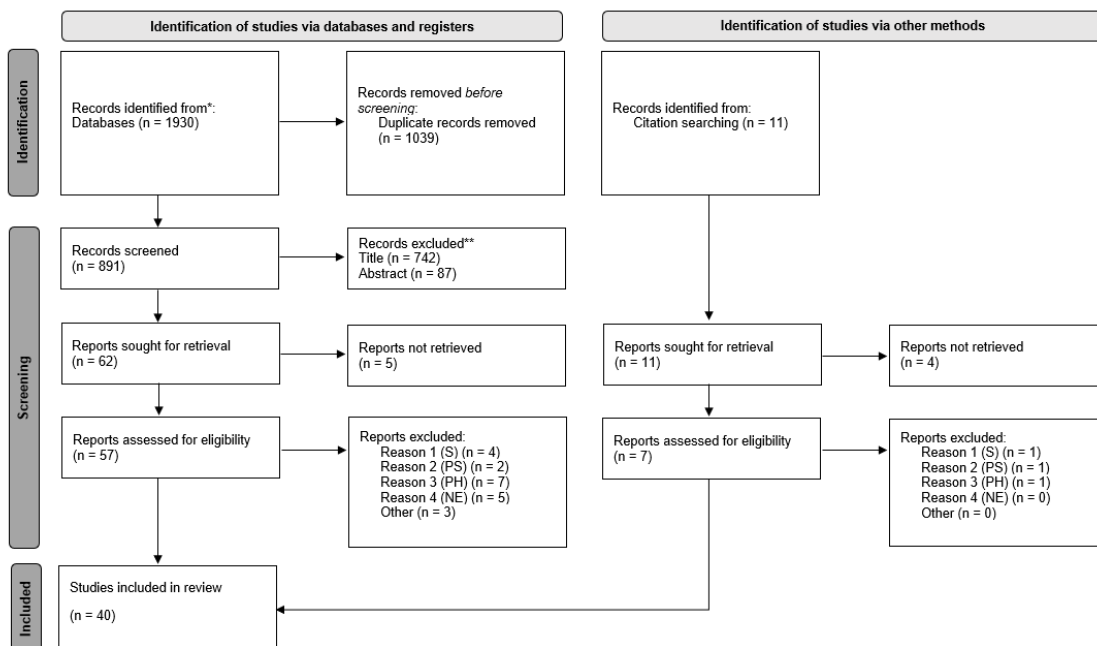


Figure 1

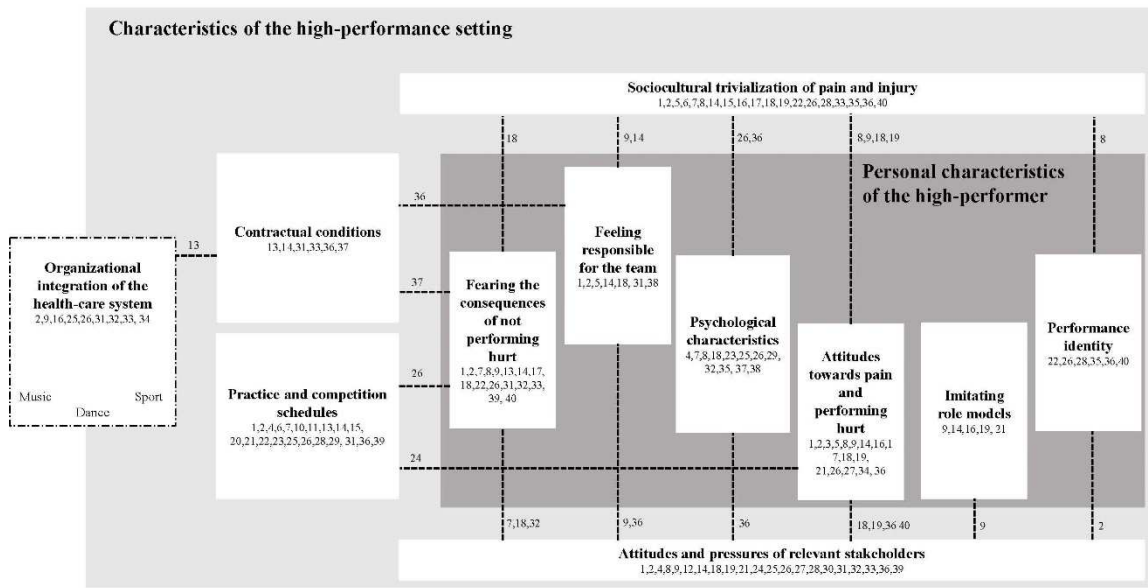


Figure 2

## Figure Captions

Figure 1: PRISMA flow diagram (Reasons for exclusion: S = Not elite Sample; PS = No psychosocial factors reported; PH = Not related to performing hurt; NE = Not empirical)

Figure 2: Psychosocial factors and their interplay in performing hurt

1: Aalten (2007); 2: Andersen et al. (2013); 3: Anderson and Hanrahan (2008); 4: Barrette and Harman (2020); 5: Berg et al. (2014); 6: Bourne et al. (2019); 7: Bragge et al. (2006); 8: Coker-Cranney et al. (2018); 9: Curry (1993); 10: Davies and Mangion (2002); 11: Diehl et al. (2019); 12: Druckman and Rothschild (2018); 13: Guptill (2011); 14: Hammond et al. (2013); 15: Ioannou and Altenmüller (2015); 16: Jasny (2021); 17: Joncheray et al. (2022); 18: Kabiri, Choi, Shadmanfaat, and Lee (2021); 19: Kabiri, Choi, Shadmanfaat, Ponnet, et al. (2021); 20: Kaneko et al. (2005); 21: Kristensen et al. (2023); 22: Madrigal et al. (2015); 23: Madrigal et al. (2016); 24: Mayer et al. (2018); 25: Mayer and Thiel (2018); 26: McEwen and Young (2011); 27: Nixon (1994); 28: Overbye (2021); 29: Rickert et al. (2013); 30: Rickert et al. (2015); 31: Roderick et al. (2000); 32: Roderick (2006); 33: Ryou and Lee (2023); 34: Schneider et al. (2019); 35: Theberge (2008); 36: Tibbert et al. (2015); 37: Vassallo et al. (2019); 38: Wanke et al. (2020); 39: Waters (2019); 40: Waters (2020)

### **5.5 Paper 4: “Prevalence of Sport-Related Analgesic Use in German Elite Handball Players”**

John, J. M.\*, Bursik, J. \*, Burgstahler, C., Büsch, D., Luig, P., Kühnle, F., Mayer, J., Reussner, A. & Thiel, A. (2023). Prevalence of Sport-Related Analgesic Use in German Elite Handball Players. *German Journal of Sports Medicine/Deutsche Zeitschrift für Sportmedizin*, 74(5). <https://doi.org/10.5960/dzsm.2023.568>

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# Prevalence of Sport-Related Analgesic Use in German Elite Handball Players

## Prävalenz des sportbezogenen Schmerzmittelkonsums bei deutschen Spitzen-Handballern

1. UNIVERSITY OF TÜBINGEN, *Institute of Sports Science, Tübingen, Germany;*
2. UNIVERSITY OF TÜBINGEN, *Interfaculty Research Institute for Sport and Physical Activity, Tübingen Germany*
3. UNIVERSITY OF TÜBINGEN, *Department of Sports Medicine, Internal Medicine V, Tübingen, Germany*
4. UNIVERSITY OF OLDENBURG, *Institute of Sport Science, Oldenburg, Germany*
5. GERMAN HANDBALL FEDERATION E.V., *Dortmund, Germany*
6. INSTITUTE OF SPORT SCIENCE, *Technical University of Darmstadt, Darmstadt, Germany*
7. UNIVERSITY OF EDUCATION SCHWÄBISCH GMÜND, *Institute of Health Sciences, Schwäbisch Gmünd, Germany*

\* equal first authors

### Summary

- ▶ **With its high physical demands** on players' bodies and high rates of injury, elite-level handball constitutes an ideal environment for studying analgesic use. We aimed to investigate the career and season prevalence of sport-related analgesics use among elite youth and elite senior handball players. We explored the frequency of analgesic use on practice and competition days within one season.
- ▶ **The sample** consisted of 459 elite handball players (233 female, 226 male). Sport-related analgesic use was assessed with two replicable measures of prevalence complemented by two frequency measures.  $\chi^2$  analyses were performed to determine group differences in prevalences for gender, age group, contract situation, and role within the team. We conducted hierarchical binomial linear regression analyses for the analgesic prevalences to evaluate the prediction of the prevalences from the independent variables.
- ▶ **The sport-related career prevalence** of analgesic use was 70.7% (95% CI[66.6, 74.9]). Throughout one season, 55.6% (95% CI[51.0-60.1]) of handball players used analgesics. Gender, age, contract status, and role within the team seemed to impact the use of analgesics. Further, analgesics were used significantly more often on competition than on practice days.
- ▶ **Our findings indicate** that the sport-related use of analgesics is relatively common among elite handball players, with female players, senior players, players with a contract, and perceived rotation players reporting significantly higher career and season prevalences. Therewith, our findings offer a starting point for targeted prevention strategies.

### Zusammenfassung

- ▶ **Handball auf hohem Leistungsniveau ist** angesichts der hohen körperlichen Anforderungen und Verletzungsraten ein geradezu idealtypisches Exempel für eine Studie über Schmerzmittelgebrauch. Ziel dieser Studie war es, die Karriere- und Saisonprävalenz des sportbezogenen Schmerzmittelgebrauchs bei jugendlichen und erwachsenen Spitzenhandballspielern zu untersuchen. Dabei wurde auch die Häufigkeit des Schmerzmittelgebrauchs an Trainings- und Wettkampftagen innerhalb einer Saison untersucht.
- ▶ **Die Stichprobe** umfasste 459 Spitzenhandballspieler (233 weiblich, 226 männlich). Der sportbezogene Schmerzmittelgebrauch wurde mit zwei replizierbaren Prävalenzmaßen und zwei Häufigkeitsmaßen erfasst. Chi-Quadrat-Analysen ( $\chi^2$ ) wurden durchgeführt, um Gruppenunterschiede in der Prävalenz nach Geschlecht, Altersgruppe, Vertragsstatus und Rolle im Team zu identifizieren. Zusätzlich wurden hierarchische binomiale lineare Regressionsanalysen durchgeführt, um die Vorhersage der Prävalenzen aus den unabhängigen Variablen zu bewerten.
- ▶ **Die sportbezogene Karriereprävalenz** des Schmerzmittelgebrauchs betrug 70,7% (95% CI[66,6, 74,9]). Im Verlauf einer Saison verwendeten 55,6% (95% CI[51,0-60,1]) der Handballspieler Schmerzmittel. Geschlecht, Alter, Vertragsstatus und Rolle im Team schienen den Schmerzmittelgebrauch zu beeinflussen. Darüber hinaus wurden Schmerzmittel signifikant häufiger an Wettkampftagen als an Trainingstagen eingesetzt.
- ▶ **Unsere Ergebnisse zeigen**, dass der sportbezogene Gebrauch von Schmerzmitteln bei Spitzenhandballspielern relativ verbreitet ist, wobei weibliche Spieler, ältere Spieler, Spieler mit Vertrag und Spieler, die nicht Stammspieler sind, signifikant höhere Karriere- und Saisonprävalenzen berichten. Damit bieten unsere Ergebnisse einen Ausgangspunkt für gezielte Präventionsstrategien.

### KEY WORDS:

Elite Athlete, Pain, Sport, Medication

### SCHLÜSSELWÖRTER:

Spitzenathlet, Schmerz, Sport, Medikamente

### Introduction

Within competitive sports, pain and injuries constitute inevitable health risks for elite athletes who must continually push their bodies to the limit to increase performance capability (6, 23). In contact sports like handball or football, pain is often linked to sport-typical physical contact with opponents (8, 14). Both youth and senior athletes report a high willingness to participate in competitions despite

health complaints such as injuries, pain, or illness (18); in fact, research indicates that the concealment of pain by athletes to allow ongoing participation in training and competition (12, 16, 17, 28) is almost the norm within elite sports (18, 22).

One way to suppress pain to tolerable levels is the use of analgesics. A high prevalence of sport-related analgesic use has been reported across a range of



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### CORRESPONDING ADDRESS:

Jan Bursik  
 University of Tübingen  
 Institute of Sports Science  
 Wilhelmstraße 124  
 72074 Tübingen, Germany  
 ✉: Jan.Bursik@uni-tuebingen.de

Table 1

Career-time prevalence of sport-related analgesic use with Chi-Square Analyses.

VARIABLE	N	%	CHI <sup>2</sup>	P	CRAMER'S V
<b>Gender</b>			9.98	.002	0.15
Male	226	63.7			
Female	232	77.6			
<b>Age group</b>			69.91	<.001	0.40
Senior	205	90.7			
Youth	253	54.5			
<b>Contract</b>			39.33	<.001	0.26
Yes	131	89.3			
No	327	63.3			
<b>Perceived Role</b>			9.60	0.002	0.15
Starting	227	63.9			
Rotation	231	77.5			

sports, with non-steroidal anti-inflammatory drugs (NSAIDs) being the most common (4, 38). The reported prevalence of NSAID use among athletes varies depending on the survey method and sample, ranging from 12% to 93% (10, 33, 36, 39). Based on these findings, pain medication use appears more common among competitive athletes than the general population (3, 10).

Consumption of pain medication has been linked to several negative health consequences ranging from kidney and liver damage to lesions in the gastrointestinal tract or gastric bleeding. With continuous use, damage to the central nervous system has also been reported (3, 4, 37, 39). Further, the use of NSAIDs was found to be associated with positive attitudes toward risk behaviors in terms of health and doping (20).

Several factors appear to be associated with a higher risk of analgesic use in sports. Higher pain medication use is reported in female compared to male athletes (30, 38). Concerning age, few studies have directly compared youth and senior athletes. A recent meta-analysis, however, suggests that the prevalence of analgesic use is not significantly associated with age (24). Previous research involving elite football players instead indicates that those players with precarious employment conditions (i.e., short-term contracts or no contracts) face high pressure to make the most of every opportunity (2, 26, 27). Such conditions might increase the likelihood of playing hurt and, consequently, of using analgesics. Similar pressures have also been reported for players who are not considered starters but have to fight for a spot on the roster (27).

With its high physical demands on players' bodies and high rates of injury, elite-level handball constitutes an ideal environment for studying pain medication use (1, 21). Previous qualitative studies exploring the health and injury management of elite senior handball players have indicated the complexity of pain causes and the difficulty of prevention in handball (17); however, research on the actual extent of pain medication use within elite-level handball is lacking. Thus, with the current study, we first aimed to examine the career and season prevalence of sport-related analgesics use among elite youth and elite senior handball players. Secondly, we explored the relative frequency of analgesic use on practice and competition days within one season. Thirdly, we tested for sociodemographic differences in prevalence and frequency of analgesic use, taking age, gender, contract situation, and role within the team (starters vs. non-starters) into account.

## Methods

The data was collected between October 2021 and April 2022 through an online survey on Unipark ([www.unipark.com](http://www.unipark.com)). The survey was distributed directly to the athletes and clubs via channels of the German Handball Federation. The study has been approved by the Faculty of Economic and Social Sciences ethics committee at the University of Tübingen (AZ.: A2.5.4-176\_ns). All participants completed an online informed consent, a demographic questionnaire, and an extensive questionnaire on painkiller use and their understanding of pain and injuries. Further, item batteries regarding psychosocial characteristics and the handling of pain and injuries were also assessed but are not included in this analysis. In total, the questionnaire took approximately 30 minutes to complete. Participants of the study were not involved in the design, conduct, reporting, or dissemination plans of our research.

## Participants

The sample includes 459 handball players (233 females, 226 males) from the first division 9.6% (n=44), the second division 6.5% (n=30), the third division 28.5% (n=131), and the German Youth Handball Bundesliga 55.3% (n=254). According to Unipark, the link to the online survey reached 1404 participants; hence, the survey was distributed to 1404 out of approximately 4000 handball players competing within the respective German leagues. The mean age of participants was 22.8 years (SD=4.8 years). As one of the most popular sports in Europe (28), Handball has comparable revenues and spectators per game to ice hockey and basketball (11), tying for the second most popular sport behind football. Thus, the sample of this study can be considered as (nationally) elite (see 34). On average, the athletes physically participated in their sport for 13.51h per week (SD=5.57h).

## Outcome Measures

Two specific prevalences of sport-related analgesic use and two frequencies of sport-related analgesic use function as the primary outcomes in this study. The career prevalence of sport-related analgesic use was assessed with the question: "Have you ever taken painkillers in connection with sports (before/during/after practice/game)?" For the assessment of the season prevalence, we used a similar wording ("Did you take any painkillers in connection with sports (before/during/ >

after practice/game) last season?”). Last season referred to the 2020/21 season. The frequencies of painkiller use were assessed for practice sessions and competitions. In order to obtain comparable data, participants reported their use of painkillers per 100 hypothetical practice days per season (“Suppose you had 100 practice days last season: On how many of these 100 practice days did you consume painkillers?”) and per 30 hypothetical competitions per season (“Suppose you had 30 game days last season: On how many of these 30 game days did you use painkillers?”). Data resulted in binary form for the two prevalences and as percentage values (per 100 practice days; per 30 competitions) for the two frequencies. Further, athletes were asked to indicate (multiple selections) which types of analgesics they had taken throughout their careers and during the last season.

### Data Analysis

R Software (25) was used to perform the statistical analyses.  $\chi^2$  analyses were performed to determine group differences in prevalences for gender, age group, contract situation, and role within the team. The role within the team variable was assessed through the extent to which the athletes subjectively perceived themselves as starting players (0-100%). We binary-coded this variable into “starters” and “rotation players” through a median split. Further, we conducted hierarchical binomial linear regression analyses for the analgesic prevalences to evaluate the prediction of the prevalences from the independent variables. Group differences in frequencies of sport-related analgesic use were analyzed using t-tests. The level of significance was set at  $\alpha=0.05$ . Cramer’s V was calculated as an effect size statistic for the  $\chi^2$  analyses and Cohen’s d as the effect size statistic for the t-test analyses. Due to a lack of reported effect sizes for similar assessments or samples (32, 35), the traditional benchmarks for effect sizes (7) were used as first orientation (Cramer’s V: small=.10, medium=.30, large=.50; Cohen’s d: small<0.50, medium=0.50 - 0.80, large>0.80).

## Results

### Sport-Related Career Prevalence

Overall, 70.7% (95% CI[66.6, 74.9]) of the athletes (n=324) reported having used analgesics in temporal or causal relation to their sport participation at some point in their career. Among these athletes, Ibuprofen was the most frequently reported type of analgesic used (96.0%), followed by Diclofenac (57.1%). Fewer athletes had used paracetamol (38.3%) and acetylsalicylic Acid (23.8%). Just 4.6% of the athletes reported to have used other pain medications (e.g. Etoricoxib, Metamizole). The career prevalence of sport-related analgesics use was significantly higher among female vs. male athletes, senior vs. youth athletes, athletes with a contract vs. no contract, and perceived rotation players vs. starting players (table 1). The block hierarchical binomial regression analysis revealed the model including the predictor variable of age to be statistically significant. A main effect of age ( $z=-7.72$ ,  $p<.001$ ) was identified. Senior athletes had a higher chance (OR=8.16, 95% CI[4.89, 14.27]) of having used analgesics in their careers than youth athletes.

### Sport-Related Season Prevalence

The use of analgesics in temporal or causal relation to sport participation during the last season was reported by 55.6% (95% CI[51.0, 60.1]) of the athletes (n=254). Ibuprofen was also the type of analgesic (98.8%) that most athletes used over the last season. The use of Diclofenac (48.6%), Paracetamol (31.6%),

and Acetylsalicylic acid (15.4%) was reported by fewer athletes. Other types of pain medications (e.g., Etoricoxib, Metamizole) were used by 5.9% of the athletes. Analogous to the career prevalence, the season prevalence of sport-related analgesics use was significantly higher among female vs. male athletes, senior vs. youth athletes, athletes with a contract vs. no contract, and perceived rotation players vs. starting players (table 2). The block hierarchical binomial regression analysis revealed a model which includes the predictor variables of gender and age to be statistically significant. A main effect of gender ( $z=2.97$ ,  $p<.003$ ) and age ( $z=-6.01$ ,  $p<.001$ ) was identified. Female athletes had a higher chance (OR: 1.87, 95% CI[1.23, 2.81]) of having used analgesics last season than male athletes. Similarly, senior athletes had a higher chance (OR: 3.63, 95% CI[2.40, 5.57]) than youth athletes.

### Sports Event-Related Frequencies

For the frequencies of analgesic use on practice days and competitions over the previous season, we only considered those athletes that had used analgesics at least once in temporal or causal relation to their sport participation. Athletes reported using analgesics relatively more frequently on competition days (M=19.4%) compared to practice days (M=10.8%,  $t(381.08)=5.12$ ,  $p<.001$ ,  $d=0.46$ , 95% CI[5.28, 11.89]).

### Frequencies of Analgesic Use in Practice

Most athletes (81.9%) reported using analgesics on less than 20 practice days during a hypothetical season with 100 practice days (see table 3). However, 19% of athletes used analgesics on more than every fifth practice day. Regarding group differences, there was no significant difference between the frequencies of analgesic use on practice days for gender, age group, contract situation, or role within the team.

### Frequencies of Analgesic Use in Competition

Most athletes (69.6%) reported using painkillers on less than six competition days (during a hypothetical season with 30 games). In contrast to the practice days, some athletes used analgesics rather regularly on competition days (see table 3). Regarding group differences, there was no significant difference between the frequencies of analgesic use on competition days for gender, age group, contract situation, or role within the team.

## Discussion

This study is the first to specifically assess four key measures that characterize sport-related analgesic use in a sample of elite German handball players, with equally distributed gender and age groups. Whereas previous studies have assessed the consumption of painkillers through a wide variety of prevalence estimates (10, 33, 36, 39), we employed specific and replicable prevalence and frequency measures of sport-related analgesic use. Two measures of prevalence (career, season) were complemented by two frequency measures in which we assessed the number of days players practiced or competed with analgesics in the previous season (per 100 practice days, per 30 competition days).

Concerning the types of analgesics handball players used, our results are consistent with studies in the German general population and German professional football reporting that Ibuprofen was the most widely used analgesic (29, 36). Whereas our study shows that Diclofenac is the second most widely used analgesic among elite German handball players, in the general population Acetylsalicylic acid and paracetamol are used more frequently (29).

Table 2

Season prevalence of sport-related analgesic use with Chi-Square Analyses.

VARIABLE	N	%	CHI <sup>2</sup>	P	CRAMER'S V
<b>Gender</b>			26.06	<.001	0.24
Male	226	43.4			
Female	231	67.5			
<b>Age group</b>			53.28	<.001	0.35
Senior	205	74.6			
Youth	252	40.0			
<b>Contract</b>			20.39	<.001	0.22
Yes	131	72.3			
No	326	48.8			
<b>Perceived Role</b>			5.69	.017	0.12
Starting	227	49.8			
Rotation	230	61.3			

Table 3

Frequency of analgesic use on practice and competition days among athletes who ever used analgesics in connection with their sport participation. Table shows the percentage and total number of athletes who reported using pain medication on 30 hypothetical competition days and 100 practice days in a season. The number of competition and practice days were divided into quintiles for clarity and comparability.

	PERCENTAGE OF COMPETITION/PRACTICE DAYS WITH ANALGESIC USE				
	< 20%	20%-40%	40%-60%	60%-80%	80%-100%
<b>Athletes in % (n) – on practice days</b>	81.9% (204)	13.3% (33)	3.2% (8)	1.6% (4)	-
<b>Athletes in % (n) – on competition days</b>	69.6% (158)	16.3% (37)	4.4% (10)	4.9% (11)	4.0% (9)

The assessed career prevalence for sport-related analgesic use of 70.7% and the season prevalence of 55.6% align with findings from other sports, samples, and prevalence measures (24). According to our results, athletes used pain medication on average every 10<sup>th</sup> practice and every 5<sup>th</sup> competition day, with small high-risk groups of athletes reporting an alarming number of days with analgesic use, especially on competition days. Overall, our findings indicate that the sport-related use of analgesics is relatively common among elite handball players to allow ongoing participation in training and competition. These findings are in line with previous research in elite sports (12, 16, 17, 18, 28).

The results of our study suggest an underlying constellation of variables for a higher risk of analgesic use. Group differences were found in the sport-related career and season prevalence for gender, age group, contract situation, and perceived role. Previous research has also reported higher analgesic use among female athletes (30, 38). Menstrual symptoms, which are reported to be one of the leading causes of analgesic use in women (13), might account for these gender differences. With regard to the contract situation and perceived role, our results underline that pressures related to employment conditions and uncertainty could result in a higher chance of using analgesics (2, 26, 27). More specifically, athletes with contracts had a significantly higher chance of taking analgesics throughout a season and their careers. Future research could investigate whether further employment-related details such as the duration of the contract (e.g., number of seasons) or the degree of financial dependence on handball further impacts the risk of analgesic use (cf. 28). The significant difference between age groups in our study does not align with the findings of a recent meta-analysis that did not find an influence of age on

analgesic use (24). However, whereas the meta-analysis only considered athletes aged 15-24, the present study also included older athletes.

Further, within our study, the variable age group (youth vs. senior athletes) appeared to have the most predictive value for the career and season prevalence of sport-related analgesic use. Older athletes might have accumulated more injuries during their careers that might cause ongoing pain (31). Further, senior athletes might be more socialized into the sport-specific culture of risk (22) in which athletes are expected to play despite pain or injuries (18, 28). Both aspects might explain why senior athletes had a higher chance of having used analgesics within their careers and over the previous season. However, given that recent studies suggest that a significant amount of analgesic medication among youth athletes is not supervised by a medical professional (6), the lower prevalences of analgesic use among youth handball players should not be neglected.

Interestingly, neither the career nor the season prevalence showed significant interactions between the predictor variables. Further, when accounting for all variables in the regression models, only age group for the career prevalence and gender and age group for the season prevalence remained significant. Additionally, our analyses did not reveal any group differences for the frequency measures. However, situational aspects seem to impact the frequency of analgesic use; athletes reported using analgesics relatively more frequently on competition days compared to practice days. This finding is consistent with qualitative and quantitative studies highlighting a higher willingness of athletes to participate in important competitions despite injury or illness compared to practice sessions (9, 23). >

### Limitations of the Study

Two important limitations of the study warrant discussion. First, our study uses novel prevalence and frequency measures. Despite offering replicable measures, their comparability with earlier studies has been proven difficult. Second, a recurrent limitation of studies investigating analgesic use in athletes is the unknown response bias due to the topic's sensitivity. However, there is no possibility of assessing a potential non-response bias in the sample. We tried to address this issue a priori by actively emphasizing the anonymity of participants within the informed consent forms.

### Avenues for Future Research

We identified several critical areas for future research. Methodologically, future research should precisely analyze how analgesic use is measured. Similar measures of analgesic use should be adopted across studies to improve the comparability of results. Within our paper, we have proposed four easily replicable measures of analgesic use, targeting both the prevalence and frequency of analgesic use among elite athletes.

Further, our results indicate that, particularly for the frequency of analgesic use on competition and practice days, other variables (than the ones we assessed in our study) should be given additional consideration. Based on research within the area of playing hurt and presenteeism in elite sport (19), we suggest that future research focuses on psychosocial (such as perfectionism and athletic identity) and sociocultural variables (such as handling of pain and injuries and values related to the culture of risk) to identify athletes with an elevated risk of analgesic use. Situational aspects (i.e., time in the season, underlying reasons for analgesic use) should also be considered. In addition, our analyses highlighted that a higher number of senior handball players compared to youth athletes had consumed analgesics at least once during the last season. To better understand the development of analgesic consumption over an athlete's career, qualitative research designs might also be promising (5).

### Perspectives

Our study demonstrated widespread use of analgesics among elite handball players, particularly on competition days. Regarding career and season prevalence, especially female handball players and senior players seem more vulnerable to using analgesics and thus might be the target point for specific prevention and education campaigns. In this regard, coaches, medical staff, or science support staff in elite sports settings should aim to sensitize athletes to the appropriate and inappropriate uses of analgesics, highlighting the potential, negative effects on training adaptations (15) and negative side effects (such as kidney and liver damage, and bleeding in the stomach and gastrointestinal tract). Overall, it is imperative that athletes, coaches, medical staff, and other support staff critically assess the risks and benefits before using analgesics in connection with elite sports participation. ■

### Conflict of Interest

*The authors have no conflict of interest.*

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## References

- (1) AASHEIM C, STAVENES H, ANDERSSON SH, ENGBRETSEN L, CLARSEN B. Prevalence and burden of overuse injuries in elite junior handball. *BMJ Open Sport Exerc Med*. 2018; 4: e000391. doi:10.1136/bmjsem-2018-000391
- (2) ADAMS R, DARBY P. Precarious pursuits, broken 'dreams' and immobility among Northern Irish soccer migrants. *Sport Soc*. 2020; 23: 920-937. doi:10.1080/17430437.2019.1593376
- (3) ALARANTA A, ALARANTA H, HELENIUS I. Use of prescription drugs in athletes. *Sports Med*. 2008; 38: 449-463. doi:10.2165/00007256-200838060-00002
- (4) ALARANTA A, ALARANTA H, HELIÖVAARA M, AIRAKSINEN M, HELENIUS I. Ample use of physician-prescribed medications in Finnish elite athletes. *Int J Sports Med*. 2006; 27: 919-925. doi:10.1055/s-2006-923811
- (5) BEKKER S, BOLLING C, H AHMED O, BADENHORST M, CARMICHAEL J, FAGHER K, HÄGGLUND M, JACOBSSON J, JOHN JM, LITZY K, H MANN R, D MCKAY C, MUMFORD S, TABBEN M, THIEL A, TIMPKA T, THURSTON J, TRUONG LK, SPÖRRI J, VAN NASSAU F, VERHAGEN EA. Athlete health protection: why qualitative research matters. *J Sci Med Sport*. 2020; 23: 898-901. doi:10.1016/j.jsams.2020.06.020
- (6) BERRSCHE G, SCHMITT H. Pain prevalences and analgesic use in junior athletes—a recent narrative review. *Pain*. 2022; 73: 93-97.
- (7) COHEN J. *Statistical power analysis for the behavioral sciences*: Routledge; 1988.
- (8) GIROTO N, HESPANHOL JUNIOR LC, GOMES MR, LOPES AD. Incidence and risk factors of injuries in Brazilian elite handball players: A prospective cohort study. *Scand J Med Sci Sports*. 2017; 27: 195-202. doi:10.1111/sms.12636
- (9) HAMMOND LE, LILLEY JM, POPE GD, RIBBANS WJ, WALKER N. 'We've just learnt to put up with it': an exploration of attitudes and decision-making surrounding playing with injury in English professional football. *Qual Res Sport Exerc Health*. 2014; 6: 161-181. doi:10.1080/2159676X.2013.796488
- (10) HARLE CA, DANIELSON EC, DERMAN W, STUART M, DVORAK J, SMITH L, HAINLINE B. Analgesic Management of Pain in Elite Athletes: A Systematic Review. *Clin J Sport Med*. 2018; 28: 417-426. doi:10.1097/JSM.0000000000000604
- (11) HORKY T. No sports, no spectators—no media, no money? The importance of spectators and broadcasting for professional sports during COVID-19. *Soccer Soc*. 2021; 22: 96-102. doi:10.1080/14660970.2020.1790358

- (12) **HOWE D.** Sport, professionalism and pain: Ethnographies of injury and risk: Routledge; 2003.
- (13) **ISACSON D, BINGEFORS K, EDS.** Epidemiology of analgesic use: a gender perspective. *European Journal of Anaesthesiology* [EJA]; 2002; LWW.
- (14) **LANGEVOORT G, MYKLEBUST G, DVORAK J, JUNGE A.** Handball injuries during major international tournaments. *Scand J Med Sci Sports*. 2007; 17: 400-407.
- (15) **LUNDBERG TR, HOWATSON G.** Analgesic and anti-inflammatory drugs in sports: Implications for exercise performance and training adaptations. *Scand J Med Sci Sports*. 2018; 28: 2252-2262. doi:10.1111/sms.13275
- (16) **MALCOLM D, SHEARD K.** Pain in the Assets<sup>™</sup>: The Effects of Commercialization and Professionalization on the Management of Injury in English Rugby Union. *Sociol Sport J*. 2002; 19. doi:10.1123/ssj.19.2.149
- (17) **MAYER J.** Verletzungsmanagement im Spitzensport: eine systemtheoretisch-konstruktivistische Analyse mit Fallstudien aus den Sportarten Leichtathletik und Handball [Pain and injury management in elite sports. A systems-theoretical and constructivist analysis with case studies in professional athletics and handball]. Hamburg: Feldhaus; 2010.
- (18) **MAYER J, GIEL KE, MALCOLM D, SCHNEIDER S, DIEHL K, ZIPFEL S, THIEL A.** Compete or rest? Willingness to compete hurt among adolescent elite athletes. *Psychol Sport Exerc*. 2018; 35: 143-150. doi:10.1016/j.psychsport.2017.12.004
- (19) **MAYER J, KÜHNLE F, THIEL A.** Presenteeism in elite sport organisations: A framework for understanding athletes' decisions to practise sport despite health concerns. *Routledge Handbook of Athlete Welfare*: Routledge; 2020: 81-93.
- (20) **MELZER M, ELBE A-M, STRAHLER K.** Athletes' use of analgesics is related to doping attitudes, competitive anxiety, and situational opportunity. *Frontiers in Sports and Active Living*. 2022; 4.
- (21) **MOLLER M, ATTERMANN J, MYKLEBUST G, WEDDERKOPP N.** Injury risk in Danish youth and senior elite handball using a new SMS text messages approach. *Br J Sports Med*. 2012; 46: 531-537. doi:10.1136/bjsports-2012-091022
- (22) **NIXON HL.** Accepting the risks of pain and injury in sport: Mediated cultural influences on playing hurt. *Sociol Sport J*. 1993; 10: 183-196. doi:10.1123/ssj.10.2.183
- (23) **OVERBYE M.** Walking the line? An investigation into elite athletes' sport-related use of painkillers and their willingness to use analgesics to train or compete when injured. *Int Rev Sociol Sport*. 2021; 56: 1091-1115. doi:10.1177/1012690220973552
- (24) **PEDERSEN JR, ANDREUCCI A, THORLUND JB, KOES B, MØLLER M, STORM LK, BRICCA A.** Prevalence, frequency, adverse events, and reasons for analgesic use in youth athletes: A systematic review and meta-analysis of 44,381 athletes. *J Sci Med Sport*. 2022; 25: 810-819. doi:10.1016/j.jsams.2022.08.018
- (25) **R CORE TEAM.** R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing; 2022.
- (26) **RODERICK M.** Adding insult to injury: workplace injury in English professional football. *Sociol Health Illn*. 2006; 28: 76-97. doi:10.1111/j.1467-9566.2006.00483.x
- (27) **RODERICK M, SCHUMACKER J.** 'The whole week comes down to the team sheet': a footballer's view of insecure work. *Work Employ Soc*. 2017; 31: 166-174. doi:10.1177/0950017016672792
- (28) **RODERICK M, WADDINGTON I, PARKER G.** Playing hurt: Managing injuries in English professional football. *Int Rev Sociol Sport*. 2000; 35: 165-180. doi:10.1177/10126900035002003
- (29) **SARGANAS G, BUTTERY AK, ZHUANG W, WOLF IK, GRAMS D, ROSARIO AS, SCHEIDT-NAVE C, KNOPF H.** Prevalence, trends, patterns and associations of analgesic use in Germany. *BMC Pharmacol Toxicol*. 2015; 16: 1-13. doi:10.1186/s40360-015-0028-7
- (30) **SARI DM, RØNNE PEDERSEN J, BLOCH THORLUND J, MIKKELSEN UR, MØLLER, M.** Pain medication use in youth athletes: A cross-sectional study of 466 youth handball players. *Translational Sports Medicine*. 2021; 4: 914-920. doi:10.1002/tsm2.295
- (31) **STEVENSON MR, HAMER P, FINCH CF, ELLIOT B, KRESNOW M.** Sport, age, and sex specific incidence of sports injuries in Western Australia. *Br J Sports Med*. 2000; 34: 188-194. doi:10.1136/bjsm.34.3.188
- (32) **SUN S, PAN W, WANG LL.** A comprehensive review of effect size reporting and interpreting practices in academic journals in education and psychology. *J Educ Psychol*. 2010; 102: 989. doi:10.1037/a0019507
- (33) **SUZIC LAZIC J, DIKIC N, RADIVOJEVIC N, MAZIC S, RADOVANOVIC D, MITROVIC N, LAZIC M, ZIVANIC S, SUZIC S.** Dietary supplements and medications in elite sport – polypharmacy or real need? *Scand J Med Sci Sports*. 2011; 21: 260-267. doi:10.1111/j.1600-0838.2009.01026.x
- (34) **SWANN C, MORAN A, PIGGOTT D.** Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychol Sport Exerc*. 2015; 16: 3-14. doi:10.1016/j.psychsport.2014.07.004
- (35) **THOMPSON B, OSBORNE J.** Computing and interpreting effect sizes, confidence intervals, and confidence intervals for effect sizes. *Best practices in quantitative methods*. 2008: 246-62.
- (36) **TRINKS S, SCHEIFF AB, KNIPP M, GOTZMANN A.** Declaration of analgesics on Doping Control Forms in German football leagues during five seasons. *Dtsch Z Sportmed*. 2021; 72: 68-74. doi:10.5960/dzsm.2020.474
- (37) **TSCHOLL P, FEDDERMANN N, JUNGE A, DVORAK J.** The use and abuse of painkillers in international soccer: data from 6 FIFA tournaments for female and youth players. *Am J Sports Med*. 2009; 37: 260-265. doi:10.1177/0363546508324307
- (38) **TSCHOLL PM, VASO M, WEBER A, DVORAK J.** High prevalence of medication use in professional football tournaments including the World Cups between 2002 and 2014: a narrative review with a focus on NSAIDs. *Br J Sports Med*. 2015; 49: 580-582. doi:10.1136/bjsports-2015-094784
- (39) **WARNER DC, SCHNEPF G, BARRETT MS, DIAN D, SWIGONSKI NL.** Prevalence, attitudes, and behaviors related to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) in student athletes. *J Adolesc Health*. 2002; 30: 150-153. doi:10.1016/S1054-139X(01)00325-1

### **5.6 Paper 5: “Risk profiles for self-medication with analgesics among elite German handball players”**

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# Risk profiles for self-medication with analgesics among elite German handball players

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**Jan Bursik** 

Eberhard Karls Universität Tübingen, Germany

**Jannika M John**

Eberhard Karls Universität Tübingen, Germany

**Jochen Mayer**

University of Education Schwäbisch Gmünd, Germany

**Ansgar Thiel**

German Sport University Cologne, Germany

**Felix Kühnle**

Technical University of Darmstadt, Germany

## Abstract

This study presents empirical evidence on self-medication with analgesics among elite German handball players. The aim is to elucidate the intentions behind therapeutic and preventive analgesic use and identify high-risk profiles for this complex health-risk behavior based on psychosocial factors. Data were collected from 459 handball players (233 female, 226 male athletes) across the highest German divisions (1<sup>st</sup> – 3<sup>rd</sup> and German Youth Handball Bundesliga) through a quantitative online survey conducted between October 2021 and April 2022. The survey requested demographic information and details on analgesic use patterns, intentions behind analgesic use, and psychosocial variables. The study shows that athletes use self-medication with painkillers as a coping strategy to manage distractions from acute injuries and pain as well as to prevent expected distractions. Engaging in self-medication allows athletes to navigate

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## Corresponding author:

Jan Bursik, Institute of Sports Science, Eberhard Karls Universität Tübingen, Wilhelmstraße 124, 72074 Tübingen, Germany.

Email: [Jan.Bursik@uni-tuebingen.de](mailto:Jan.Bursik@uni-tuebingen.de)

the pressures of elite sport. Classification tree analysis revealed distinct risk profiles for therapeutic and preventive analgesic use. Key factors of self-medication include age, athletic identity, willingness to compete hurt, and perceived performance state. The high-risk group for therapeutic self-medication with analgesics consists of senior athletes. The high-risk group for using analgesics preventively, in contrast, is composed of athletes over the age of 17 with strong negative affectivity, a heightened willingness to take risks, and good perceived performance. Our findings highlight the necessity for specific interventions to address the multifaceted motivations behind self-medication and promote safer practices in elite sports. Future research should concentrate on longitudinal studies and diverse athlete populations and use qualitative studies to gain a deeper understanding of the determinants of analgesic use and to develop effective intervention strategies.

### **Keywords**

self-medication, analgesics, handball, coping, risk profiles

Elite sport poses physical, emotional, and social challenges for athletes. The intensity of competitions, the pressure to perform, and the high expectations placed on elite athletes often create a highly demanding environment. Together with the precarious nature of contracts and the constant chance of failure, the working environment of athletes is characterized by high degrees of uncertainty (Roderick, 2006b). Athletes are thus challenged to balance their individual desire to play, the social pressure to perform, and their goal of staying “healthy” (or fit to play) (Malcolm and Sheard, 2002). Oftentimes, elite athletes are expected to push their bodies to the limit in training and competition, constantly managing and risking their health in the process (Theberge, 2008). According to Hughes and Coakley (1991), a central shared belief among athletes and coaches characterizing what it means to be an athlete “involves accepting risks and playing through pain” (p. 309). Playing through pain is even recognized as “positive deviance” (Hughes and Coakley, 1991: 307), as it represents over conformity to the norms and values of elite sport shared by various stakeholders within the sports network such as medical specialists, coaches and managers (cf. Nixon, 1992). By engaging in health-related risk behaviors such as performing hurt (i.e. playing despite being injured, ill or in pain), athletes further avoid being “inconvenienced” by the club staff or stigmatized by other players as “poofers” (Roderick et al., 2000). Building on this idea, the use of analgesics has been discussed as a strategy to enable performing hurt and thereby meet sport-specific expectations (Mayer et al., 2018). Throughout their careers, athletes are thus socialized into a veritable “culture of risk” (Nixon, 1992), in which they learn that sacrificing their bodies for the game and taking health risks is necessary for success (Atkinson, 2019).

With its high level of physical contact (Luig et al., 2020) and high incidences of injuries (Engebretsen et al., 2013; Raya-González et al., 2020), handball is considered a particularly tough and risky sport and thus offers an ideal platform for research on health-related risk behaviors such as the use of analgesics<sup>1</sup>. The prevalence of analgesic use is generally high in elite sports (e.g. Harle et al., 2018; Pedersen et al., 2022; Trinks et al., 2021) and especially high in handball (John et al., 2023; Sari et al., 2021), with

many athletes relying on analgesics regularly. In a recent sociological mixed-method study with Danish elite athletes, Overbye (2021) found that analgesic use was widespread and significantly influenced by interactions within the sport network. The identified reasons for taking analgesics were extensive, but primarily aimed at participating in competitions and training without distraction, both with and without injury. These findings echo previous research that distinguished between two common strategies for analgesic use in sports. Firstly, analgesics may be legitimately prescribed by physicians and used under medical supervision to treat a diagnosed medical short- and long-term condition or an acute sport injury (Mottram and Mottram, 2010). Despite the ambivalent role of sport clinicians and physicians which are “sometimes supporting the culture of risk, sometimes contributing to a culture of precaution” (Malcolm, 2006: 377), they are still trained to consider the medical side effects of analgesic use and influence the shared decision-making process with athletes and their coaches on this basis (Hainline et al., 2017a; Shrier, 2015). Safai’s (2003) work illustrates that while sports medicine professionals partially treat and advise coaches and athletes on the basis of a culture of risk, “the core process remains centred on the desire to heal” (p. 143).

Secondly, existing studies suggest that athletes commonly engage in self-medication with analgesics either to perform hurt or to prevent declines in performance due to potential pain and related distractions (André et al., 2020; Fernando et al., 2017; Warden, 2009). Whereas the first strategy (i.e. using analgesics to be able to perform hurt) is indicative of therapeutic self-medication, the second strategy (i.e. using analgesics to prevent declines in performance due to potential pain) can<sup>1</sup> be described as preventive self-medication. In this study, we define *therapeutic self-medication* as the use of analgesics without medical recommendation or guidance in the presence of pain or symptoms of illness (cf. Ruiz, 2010). Therapeutic self-medication carries the potential for *misuse* when analgesics are used in an inappropriate manner (e.g. higher doses than medically recommended or longer time frames of application than medically recommended; Smith et al., 2013). Conversely, we define *preventive self-medication* as the proactive use of analgesics prior to practice or a game when no pain is present. Due to the nontherapeutic nature of preventive self-medication, it could even be considered *abuse*, which is defined as “the intentional, nontherapeutic use of a drug or substance, even once, to obtain a desired psychological or physiological effect” (Smith et al., 2013: 2292).

We thus conceptualize self-medication as a health-risk behavior that is part of the culture of risk enabling athletes to play through pain and injury, thereby managing pressures and fulfilling both individual and social expectations. The unsupervised use of analgesics in the context of sport is associated with several risks. Firstly, analgesic use in sport increases the risk of acute and chronic injuries by numbing relevant pain signals and diminishing their informative value regarding overuse of the athlete’s body (Bersche and Schmitt, 2022; Mayer and Thiel, 2018). Secondly, analgesics have well-known side effects, ranging from gastrointestinal toxicity reported as the most common adverse drug reaction (Rich and Scheiman (2000) to renal, cardiovascular and cerebrovascular side effects (for an overview see: Harirforoosh et al., 2013), aspirin-induced asthma (Jenkins et al., 2004) and neurological side effects (Auriel et al., 2014). Self-medication can further heighten the risk of severe negative side effects through overdosing (amount or time period), drug interactions, or a lack of

accompanying medication and precautions (Khan et al., 2018; Pedersen et al., 2022). In addition to the adverse side effects of analgesics, Ziltener et al. (2010) suggest that while analgesics might be helpful for some sport-related issues, their use is not beneficial or even contraindicated for some typical sports injuries (e.g. overuse tendinopathy, acute muscle tears, bone fractures and stress fractures).

Given the high prevalence rates, well-known side effects of analgesics and other potential risks associated with self-medication, this study critically examines self-medication with analgesics in elite handball. This empirical investigation focuses on two central aspects of this practice among elite German handball players: 1) the intentions behind therapeutic and preventive self-medication and 2) risk profiles for therapeutic and preventive self-medication.

### **Self-medication as a coping strategy**

On the one hand, we consider self-medication in elite sport as a form of risk-taking behavior in the culture of risk through which athletes attempt to ensure continued participation in sport despite potential health risks and side effects of misuse (cf. Overbye, 2021). Indeed, previous research in elite sports has shown that the culture of risk significantly influences athletes' willingness to participate despite pain or injuries by using analgesics (Diehl et al., 2019; Mayer et al., 2018; Overbye, 2021).

On the other hand, in accordance with research on doping in sports (cf. Bette and Schimank, 1995, 2006) and on the use of prohibited and permitted substances in sport (Didymus and Backhouse, 2020), we regard self-medication as an individual coping strategy to deal with the challenges of the elite sport setting. As part of an elite sports career, athletes experience physical impairments (e.g. pain or injuries) that create emotional (Reussner et al., 2023), social, and organizational challenges and distractions (Roderick et al., 2000). The constant pressure to perform even when in pain is accompanied by the athletes' personal and social expectations (cf. Hammond et al., 2014; Roderick, 2006a). Meeting these expectations (e.g. by performing hurt) allows athletes to avoid conflicts or stigmatization. With their easy applicability and strong causal coupling with freedom from pain, the use of analgesics can constitute a particularly practical strategy for athletes in individually treating pain symptoms in temporal connection to their sport. Thus, self-medication with analgesics could represent a 'useful' strategy for coping with the elite sport system from the athletes' perspective. However, by relying on self-medication to maintain participation and performance, elite athletes jeopardize their health in two ways: directly, by using analgesics without supervision and risking misuse and overdosing, and indirectly, by exposing their (potentially weakened) numbed bodies to physical risks.

### ***Coping with injuries and pain through therapeutic self-medication***

Being regularly confronted with high levels of physical stress in elite sport, athletes inherently rely on their athletic performance to increase the chance of a successful career. Thus, injuries not only lead to physical pain but can also represent "a disruptive experience curtailing the mode of athletic expression within a milieu of uncertainty about return

to play” (Roy et al., 2015: 1). Consequently, pain and injuries can become critical life events (cf. John et al., 2019; Reussner et al., 2023) with the potential to question the athlete’s life trajectory, personal identity, and social functioning. For elite athletes, health events can further trigger biographical risks such as losing their spot on the team and their self-image as athletes (Roderick et al., 2000).

In this context, therapeutic self-medication can serve as a coping strategy. Striving to “make the ‘team sheet’” (Roderick and Schumacker, 2016: 166), athletes often opt to play hurt. In this regard, the use of analgesics could allow athletes to continue participation and maintain focus on performance despite pain and injury. Further, through the use of analgesics, athletes regain a sense of control by alleviating immediate pain and hiding accompanying distractions (Overbye, 2021). Consequently, therapeutic self-medication with analgesics even serves a dual coping purpose. First, it enables the immediate continuation of sports participation, preserving the athlete’s short-term engagement (Overbye, 2021). Secondly, athletes maintain their sport-related social functioning within the team (Thiel et al., 2015), discreetly managing health-related issues without any disclosure to their sports network.

### *Coping with potential pain and related distractions through preventive self-medication*

In correspondence with our conceptualization of therapeutic use, we consider preventive self-medication with analgesics to be aimed at coping with *potential* distractions triggered by anticipated pain or physical contact. With pain, injuries, and physical contact being inherent to handball participation (Giroto et al., 2017; Langevoort et al., 2007), athletes expect their occurrence. By using analgesics before competition or training, athletes increase the likelihood of maintaining participation regardless of external influences (Overbye, 2021) and, as a result, stabilize or potentially enhance their performance (André et al., 2020; Fernando et al., 2017; Warden, 2009). Thereby, similar to doping behavior, preventive self-medication with painkillers can be regarded as a control mechanism in elite sports careers.

However, the attempt to ensure performance through the use of certain substances represents a paradoxical strategy, wherein certain risks are reduced by increasing other risks (cf. Bette and Schimank, 2006). While self-medication with analgesics might manage current biographical risks associated with an athletic career (e.g. getting substituted or experiencing declines in performance), their use generates additional physical risks and postpones biographical risks to the future.

### *The role of psychosocial factors in therapeutic and preventive self-medication*

Based on theoretical considerations regarding health-risk behaviors (e.g. Mayer et al., 2020), we hypothesize that certain combinations of psychosocial factors increase the likelihood of athletes engaging in self-medication. As empirical studies on the psychosocial determinants of self-medication with analgesics in elite sports remain scarce, we also draw on existing scholarship regarding health-related risk-taking

more broadly. We assume that self-medication is impacted by similar structural, social, and personal determinants as other health-related risk behaviors. Demographic factors such as age and gender are discussed in the context of risk-taking in sports (Charlesworth and Young, 2006) and analgesics use in elite sports (John et al., 2023). Further, an athlete's performance level has also been linked to playing hurt (Hammond et al., 2014; Mayer and Thiel, 2018) and analgesic use (Leyk et al., 2023). Moreover, we assume that how athletes perceive their own health status may play a relevant role in self-medication as it has been found to influence the general use of analgesics in elite sports (Overbye, 2021). Similarly, risk behaviors could also be linked to the athlete's evaluation of his or her own performance. Since performance is crucial to future team selection, athletes may attempt to compensate for poor performance by taking health risks but may also validate positive performances through risk-taking behavior in order "to maintain membership in the athletic fraternity" (Hughes and Coakley, 1991: 322). Finally, athletic identity and perfectionism have also been shown to contribute to health-related risk behaviors (e.g. Coker-Cranney et al., 2020; Mayer et al., 2018; Schnell et al., 2014).

### *Purpose of the study*

Previous studies have examined the prevalence of therapeutic self-medication among amateur and competitive athletes (e.g. André et al., 2020; Fernando et al., 2017; Locquet et al., 2016), discussed preventive analgesic use in sports from a theoretical perspective (Warden, 2009, 2010) and investigated the potential performance-enhancing effects of analgesics (Holgado et al., 2018; Semark et al., 1999). Whereas most studies have been conducted from a sport medical perspective, a recent study analyzed analgesic use from a sociological perspective investigating the situations and routines in which Danish youth and senior elite athletes use analgesics (Overbye, 2021). However, there is a lack of studies focusing on and empirically investigating therapeutic and preventive self-medication, particularly with regard to exploring psychosocial determinants that characterize risk profiles for therapeutic and preventive self-medication among elite athletes.

In this study, we therefore aimed to answer the following two research questions: 1) Why do elite German handball players engage in therapeutic and preventive self-medication with analgesics? 2) What are the risk profiles for therapeutic and preventive self-medication among elite German handball players?

To answer these questions, we analyzed the intentions behind therapeutic and preventive self-medication with analgesics among German handball players, drawing on Overbye's (2021) research on the reasons for sports-related painkiller use among athletes. Additionally, we used classification tree analysis (CTA), a statistical method based on machine learning, to identify psychosocial risk profiles of handball players who are at high and low risk of engaging in therapeutic and preventive self-medication. Even though this is a quantitative methodological approach, it has the potential to explore the complexity of athletes' experiences and characteristics to a greater extent. By capturing not only the influence of isolated constructs on a dependent variable (i.e. therapeutic and preventive self-medication), but also examining the interaction of different

psychosocial factors on a group level, this method provides further insights into the phenomenon of therapeutic and preventive self-medication from a sociological perspective and can therewith inform interventions and future research.

## Methods

### *Study design and participants*

Data for this study was collected through an online survey platform between October 2021 and April 2022. Prior to data collection, ethical approval was obtained from the Faculty of Economic and Social Sciences ethics committee at the University of Tübingen (AZ.: A2.5.4-176\_ns). All participants provided their informed consent online before proceeding with the survey. On average, participants spent 30 min completing the survey.

The survey was directly disseminated to athletes and clubs via various channels facilitated by the German Handball Federation using anonymous web links. The final sample consists of 459 handball players (233 female, 226 male athletes) with a mean age of 22.8 years ( $SD = 4.8$  years). A total of 9.6% ( $n = 44$ ,  $n_{female} = 32$ ;  $n_{male} = 12$ ) of the athletes competed in the first division, 6.5% ( $n = 30$ ,  $n_{female} = 25$ ;  $n_{male} = 5$ ) in the second division, 28.5% ( $n = 131$ ,  $n_{female} = 86$ ;  $n_{male} = 45$ ) in the third division, and 55.3% ( $n = 254$ ,  $n_{female} = 90$ ;  $n_{male} = 164$ ) in the German Youth Handball Bundesliga (for more information about the sample, see also: John et al., 2023). Thus, the sample of our study can be considered elite on a national level (cf. Swann et al., 2015). On average, the athletes engaged in physical participation in their sport for 13.51 hours per week ( $SD = 5.57$  h).

### *Instruments*

The online survey comprised several components, including a demographic questionnaire, an extensive questionnaire on analgesic use including therapeutic and preventive self-medication, questions on intentions behind using analgesics in self-medication, and questions exploring the participants' understanding of pain and injuries. Additionally, we collected data on various psychosocial variables to gain a comprehensive understanding of the factors associated with self-medication in this population.

*Dependent variables: Therapeutic and preventive self-medication.* First, we inquired whether the participants had used painkillers in connection with handball in the previous season. If this was the case, we asked them about the specific situations of painkiller use. These situations included therapeutic self-medication and preventive self-medication with analgesics before practice and competition. If the participants indicated that they had used painkillers in these sport-related situations, we further asked them about the intentions behind their use.

*Questionnaire items regarding the intentions behind self-medication.* To identify the intentions behind therapeutic analgesic use, we used a self-designed questionnaire that listed potential intentions and asked participants to indicate how much they agreed

with each reason for therapeutic use on a five-point Likert scale. Possible intentions behind therapeutic use were derived from previous research (André et al., 2020; Overbye, 2021) and included items assessing the intentions and health-related issues behind self-medication among athletes such as “I took painkillers last season without a doctor’s recommendation due to practice-related pain” (Table 1). Similarly, we recorded the intentions behind preventive self-medication before practice or competition based on quantitative and qualitative studies (Hammond et al., 2014; Mayer et al., 2018; Theberge, 2008) and included items such as “Last season, I took painkillers before a game/practice so that I wouldn’t feel any pain that might occur” (Table 2).

*Independent variables: Psychosocial factors for classification tree analysis.* In order to examine risk profiles for therapeutic and preventive self-medication, we assessed several psychosocial variables that had been shown to be associated with analgesic use and health-related risk-taking (see above). The included demographic factors were age and gender. We assumed that the athlete’s age could characterize risk profiles as age impacts the access to pain medication, pressure to perform and experiences with injuries and pain management. Similarly, gender was included as a demographic variable, as gender differences in analgesic use patterns have been described in previous studies (e.g. John et al., 2023; Overbye, 2021). We also collected sport-specific variables such as the role within the team (differentiated between first-team players and rotation players), the amount of time the athletes participated in handball per week, the league in which they competed, and their perceived health status and performance state. Furthermore, we assessed the athletes’ personal characteristics. To capture the athletes’ athletic identity, we utilized the Athletic Identity Measurement Scale (AIMS; Brewer and Cornelius, 2001). This instrument assesses three dimensions of athletic identity, namely social identity, exclusivity, and negative affectivity dimensions. We further assessed the athletes’ willingness to take risks using a scale that was designed to assess the athletes’ risk perception and willingness to accept negative physical or psychosocial consequences of athletic activity (Schnell et al., 2014). Further, the various dimensions of perfectionism (self-oriented, other-oriented, socially prescribed) were assessed using the Multidimensional Perfectionism Scale (Hewitt and Flett, 2004). Lastly, the ‘willingness to compete hurt’ scale was used to assess the athletes’ perception of legitimate reasons for not competing hurt (Mayer et al., 2018). Here, the athletes had to indicate their agreement with statements that were related to refraining from competition for

**Table 1.** Intentions behind therapeutic self-medication.

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I took painkillers last season without a doctor’s recommendation...

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- ... due to menstrual pain. (menstrual pain)
  - ... due to headaches. (headache)
  - ... due to flu symptoms. (influenza)
  - ... due to playing-related pain. (playing-related pain)
  - ... due to practice-related pain. (practice-related pain)
-

**Table 2.** Intentions behind preventive self-medication.

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 I took painkillers last season before a practice session/competition...
 

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- ... because it is part of my routine. (routine)
  - ... to not be distracted by any pain that may occur. (not be distracted by pain)
  - ... to avoid feeling any pain that may occur. (not feel pain)
  - ... to increase performance during practice/competition. (increase performance)
- 

various reasons such as not feeling physically resilient, having a cold with fever, or experiencing joint pain at rest (e.g. “I refrain from competitions if I feel joint pain at rest”). Thus, high scores on this scale indicated a low willingness to compete hurt.

### *Statistical analyses*

We conducted two statistical analyses. First, we descriptively analyzed the intentions of elite handball players for therapeutic and preventive self-medication with analgesics. This descriptive data is presented with the mean and standard deviation for each intention. We also indicate the percentage of athletes who “fully” or “rather” agreed with the listed intentions for therapeutic and preventive use.

Second, we identified risk profiles of athletes with a higher (or lower) likelihood of engaging in preventive and therapeutic self-medication. To achieve this, we employed a CTA (Camp and Slattery, 2002). CTA constitutes an exploratory group-level approach that has been successfully used in previous elite sports research to investigate risk profiles of elite athletes with regard to burnout (Granz et al., 2019), willingness to compete hurt (Mayer et al., 2018) and risk acceptance (Schnell et al., 2014). The exploratory character of CTA makes it particularly useful for examining complex phenomena within large samples since it is a “highly flexible (approach that) does not require the stringent theoretical and distributional assumptions of more traditional methods” (Mayer et al., 2018: 145), thereby allowing to include various variable types (nominal, ordinal, or metric) in the exploratory analysis. The classification tree model was preferred over regression analysis to mitigate the risk of overfitting and produce an informative visual output, in which the high and low risk groups can be easily identified (Andrews et al., 2002).

Using principles of machine learning, we employed CTA to detect sub-groups of handball players that exhibited high (and low) probabilities of engaging in preventive or therapeutic self-medication based on the assessed psychosocial predictor variables. Therewith, CTA allows us to capture the complex interplay between psychosocial variables and self-medication. To achieve this, the exhaustive CHAID algorithm (Chi-squared Automatic Interaction Detector) within IBM SPSS 24 systematically detects relationships between the psychosocial factors (independent variables) and therapeutic or preventive self-medication (dependent variable) based on chi-square tests (Camp and Slattery, 2002). At each step of the analysis, the CHAID algorithm identifies the psychosocial predictor that exerts the most influence on the dependent variable, splitting the sample into various subgroups (i.e. when CTA identifies the athlete’s role in the

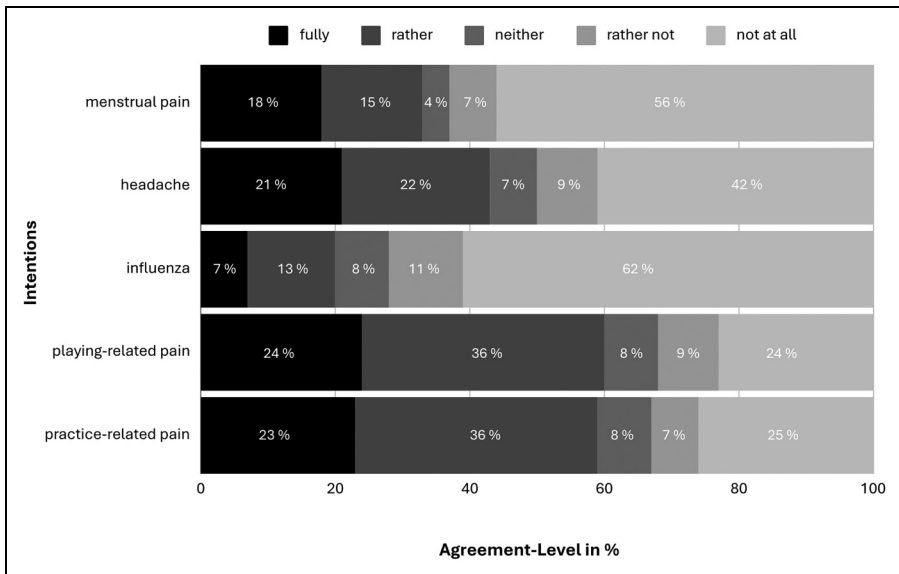
team as the first splitting variable, it means that the athlete's role in the team is the psychosocial predictor that exerted the most influence on self-medication. The same principle applies to all further splitting variables). When no further statistically significant splits can be made based on the available psychosocial predictor variables, CTA reaches its "final node" and thus, the high- or low-risk profile of athletes who are characterized by a specific combination of psychosocial factors.

To ensure the validity and reliability of our analyses, we set certain rule specifications for the calculations in line with previous research aimed at identifying risk profiles (cf. McCarty and Hastak, 2007). The significance level for node division and category merging was set at .05. Adjusted to the sample size in this study, the depth of the tree was set to three, and the minimum number of cases in superior or inferior nodes was established as 40 and 20, respectively.

## Results

### Intentions behind therapeutic self-medication

We asked the athletes who reported therapeutic self-medication with painkillers in the temporal context of handball participation ( $n=240$ ; 52.3%) about their intentions behind this use (Figure 1). The analysis revealed that the items "to treat practice-related pain" with 59.6% ( $M=3.3$ ,  $SD=1.5$ ) and "to treat competition-related pain" with 59.1% ( $M=3.3$ ,  $SD=1.5$ ) received the strongest agreement ("rather agree" or "fully agree")



**Figure 1.** Agreement with intentions behind therapeutic self-medication numbers for *menstrual pain* is only reported for female athletes ( $n_{female} = 139$ ).

from the handball players. Additionally, 43% of the athletes agreed that they used painkillers to alleviate headaches ( $M = 2.7, SD = 1.66$ ) and 33.3% to treat menstrual pain ( $M_{female} = 3.14, SD_{female} = 1.66$ ).

### Intentions behind preventive self-medication

Preventive use of analgesics before competition was reported by 84 athletes (18.3%). Among these athletes, we observed strong agreement regarding two specific intentions behind their preventive analgesic use (Figure 2): First, 89.3% of athletes agreed to the intention “in order not to feel any pain that may occur” ( $M = 4.2, SD = 1.0$ ), and second, 75% agreed to the intention “not to be distracted by any pain that may occur” ( $M = 3.8, SD = 1.3$ ). The item “to increase performance in competition” ( $M = 2.36, SD = 1.4$ ) received agreement from 26.2% of the athletes, while only 42% of these 84 athletes stated that they had never taken painkillers preventively with the intention of improving performance in competition. It is further noticeable that preventive self-medication with painkillers was hardly done routinely before competition, with only 2.4% of athletes agreeing to this intention.

Similarly, we examined the group of athletes who reported using analgesics preventively before practice sessions ( $n = 48, 10.5\%$ ). A comparable response structure emerged within this subsample, indicating similar intentions behind preventive analgesic use before practice and competition among the athletes (Figure 3). The two intentions – “in order not to feel any pain that may occur” ( $M = 4.0, SD = 1.2$ ) and “not to be distracted by any pain that may occur” ( $M = 3.5, SD = 1.4$ ) – received agreement from 78.7% and 63.9% of athletes respectively. Here, 17.1% of athletes agreed to the item “to increase performance in practice” ( $M = 2.0, SD = 1.3$ ).

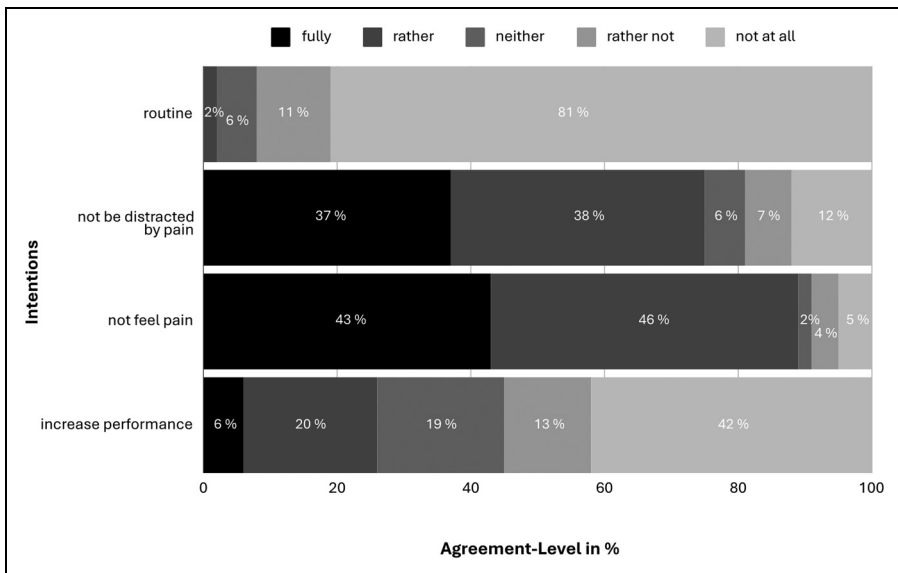
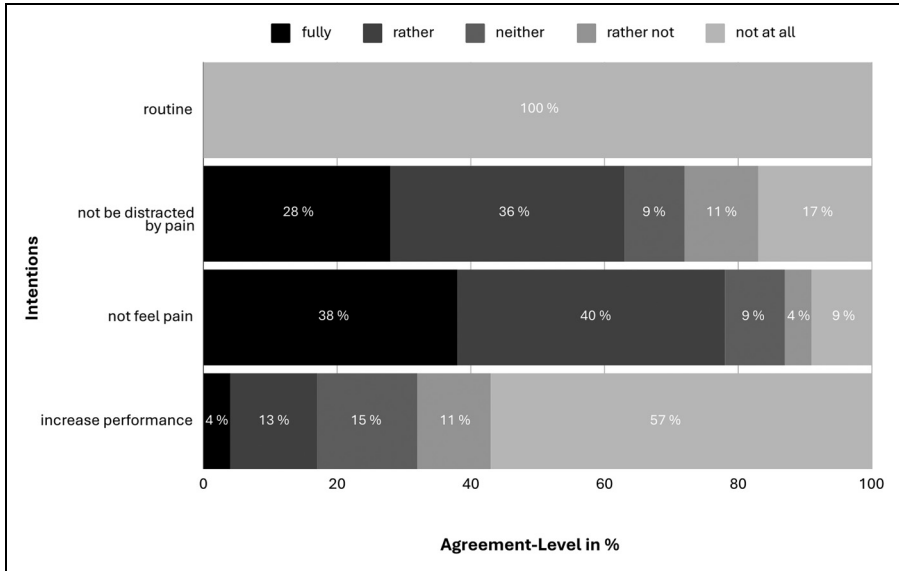


Figure 2. Agreement with intentions behind preventive analgesic use before competition.



**Figure 3.** Agreement with intentions behind preventive analgesic use before practice.

*Risk profiles for therapeutic self-medication*

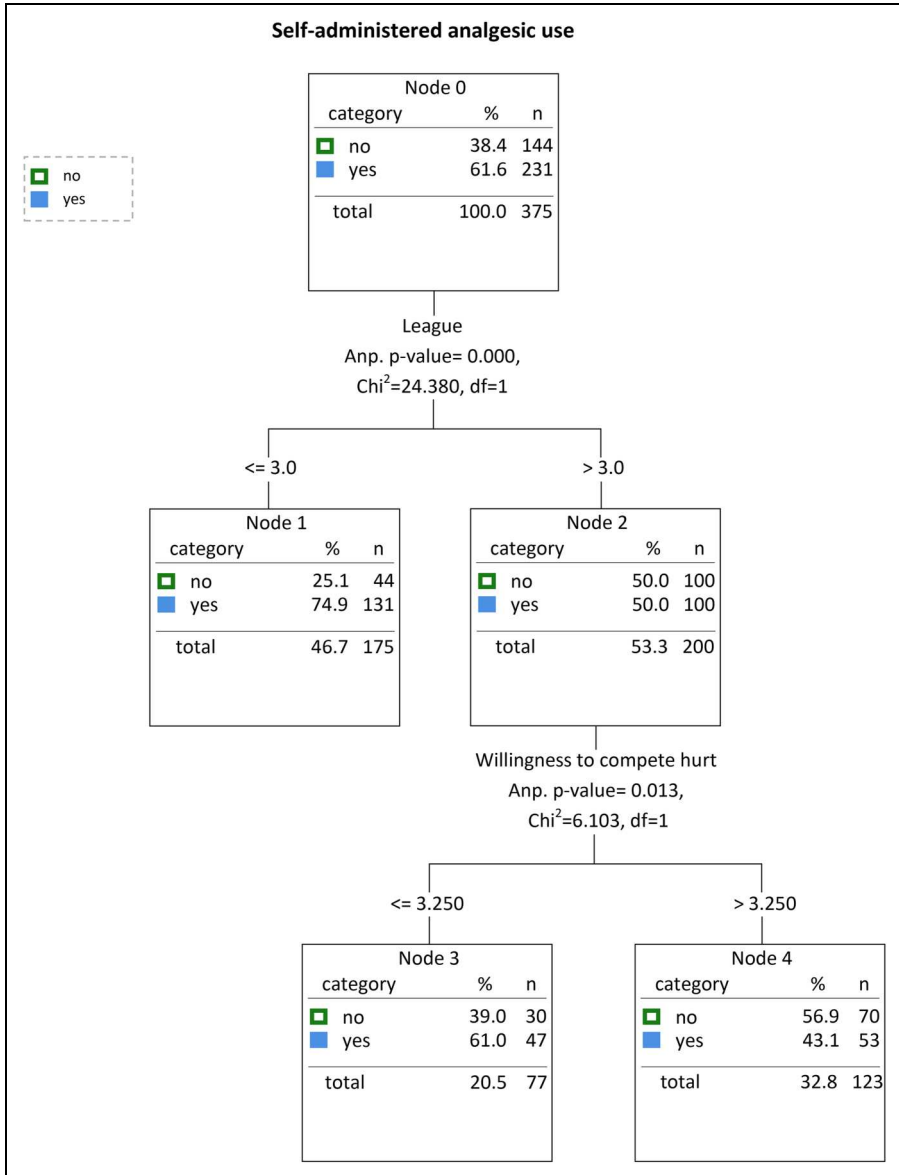
Among the 231 athletes who practiced therapeutic self-medication ( $M_{age} = 19.8$ ,  $n_{female} = 139$ ;  $n_{male} = 92$ ), the CTA revealed a high-risk profile for therapeutic self-medication consisting of senior handball players (node 1 in Figure 4). The low-risk profile consists of youth handball players who reported a low willingness to compete hurt (node 4 in Figure 4). The athletes’ *age level* (senior vs. youth) was identified at level 1 and the youth athletes’ *willingness to compete hurt* was identified at level 2.

*Root node – level 1: League.* At level 1, the classification tree differentiated between senior and youth leagues. While 74.9% of senior league players engaged in therapeutic self-medication (node 1 in Figure 4), 50.0% of youth athletes reported such practices (node 2 in Figure 4).

*Branch beneath node 2: Willingness to compete hurt.* Further subdividing the youth players subgroup, the *willingness to compete hurt* variable was identified on level 2. Youth athletes who were less willing to compete hurt (higher score on the scale) were least likely (43.1%) to therapeutically self-medicate with analgesics (node 4 in Figure 4), while those who were more willing to compete hurt were more likely (61.0%) to self-medicate (node 3 in Figure 4).

*Risk profiles for preventive self-medication*

Among the 91 athletes who practiced preventive self-medication in practice or competition ( $M_{age} = 20.1$ ,  $n_{female} = 42$ ;  $n_{male} = 49$ ), the CTA revealed a high-risk profile for



preventive analgesic use is characterized by athletes aged 17 or younger who perceived themselves as starters and practiced their sport twelve hours or less per week (node 7 in Figure 5). This profile had a prevalence of 6.6% for preventive self-medication.

At Level 1, the classification tree differentiated between athletes older than 17 years of age and athletes aged 17 or younger. *Role in the team* and the subfactor *negative affect* of athletic identity differentiated groups at Level 2. *Willingness to take risks*, *perceived performance state during the last season*, and *time practicing handball (h/week)* were identified on Level 3.

**Root node – level 1: Age.** The total sample was partitioned into two subgroups by the predictor *age*. Athletes above the age of 17 had a significantly higher probability of using analgesics preventively (30.6%; see node 2 in Figure 5) in comparison to athletes aged 17 or younger (18.8%; see node 1 in Figure 5).

**Branch beneath node 1: Role in the team and time in handball per week.** The subgroup of athletes aged 17 or younger was further statistically divided by the variable of their perceived *role in the team*. The athletes who perceived themselves less as starters had a higher probability of using analgesics preventively (26.7%; see node 3 in Figure 5) than those who perceived themselves more as starters (12.9%; see node 4 in Figure 5).

Among the athletes 17 and younger who perceived themselves more as starters, the variable of *time in handball (h/week)* significantly divided the groups. Athletes who spent more than 12 h per week in their sport had a higher probability of using analgesics preventively (20.0%; see node 8 in Figure 5) than those who spent 12 h or less in their sport (6.6%; see node 7 in Figure 5).

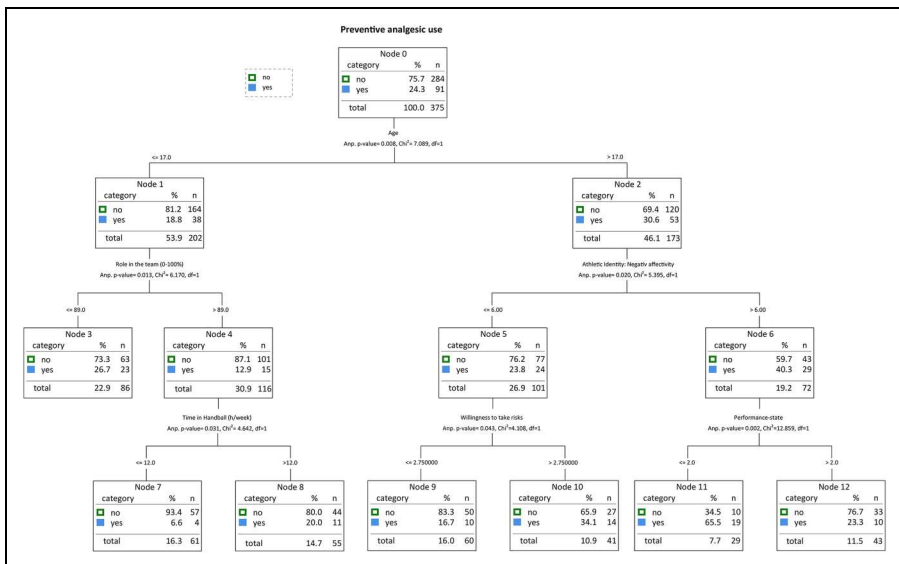


Figure 5. Classification tree analysis of preventive self-medication.

*Branch beneath node 2: Negative affect, willingness to take risks, and performance state.* The athletes older than 17 were further statistically subdivided by the subfactor *negative affect* of athletic identity. The athletes with a high score on this subfactor had a higher probability of using analgesics preventively (40.3%; see node 6 in Figure 5) than the athletes with a lower score on this subfactor (23.8%; see node 5 in Figure 5).

The *willingness to take risks* divided the group of athletes with a lower score on the athletic identity subfactor. Those athletes with a higher willingness to take risks showed a higher probability of using analgesics preventively (34.1%; see node 10 in Figure 5) than those with a lower willingness to take risks (16.7%; see node 9 in Figure 5). Lastly, the subgroup of athletes older than 17 with a pronounced negative affectivity of their athletic identity was separated by the variable of their *perceived performance state* during the last season. Those athletes who judged their performance state as weak were less prone to using analgesics preventively (23.3%; see node 12 in Figure 5) than those who perceived themselves as performing well (65.5%; see node 11 in Figure 5).

## Discussion

To our knowledge, our study represents the first study in elite sports investigating risk profiles for therapeutic and preventive self-medication with analgesics among a sample of elite German handball players and their intentions behind these health-related risk behaviours.

### *Intentions behind therapeutic and preventive self-medication*

Therapeutic self-medication with analgesics, which is practiced by every second elite German handball player, can be interpreted as a coping strategy for managing actual physiological symptoms (e.g. pain). However, in line with theoretical assumptions regarding performing hurt (e.g. Mayer and Thiel, 2018; Roderick, 2006a; Roderick et al., 2000), self-medication can also be considered a strategy for coping with psychosocial challenges within an athletic career (e.g. experiencing stigmatization when not performing hurt). In this regard, the athletes in this sample reported treating physical irritations including playing-related or competition-related pain through self-medication (Figure 1). By numbing or suppressing sensations of pain (Warner et al., 2002), players might aim to ensure that they are able to push their physical limits, focus solely on their performance and maintain their athletic identity. Therewith, through using analgesics to manage pain without consulting a doctor, athletes might attempt to navigate personal and social conflicts independently (cf. Theberge, 2008) and consistently achieve freedom from pain during sport participation (Overbye, 2021).

Almost one-fifth of the elite German handball players in this sample also reported self-medicating with analgesics preventively. These players reported using painkillers preventively to engage in handball unfazed by *potential* pain and, in some cases, to improve their performance (see Figures 2 and 3). Using analgesics preventively prior to practice and competition could be interpreted as an attempt to avoid anticipated

challenges. In this regard, by muting *potential* physiological distractions (such as injury, pain, or expected pain; e.g. Hainline et al., 2017b) with the help of painkillers, elite athletes may also aim to mitigate biographical risks (like substitution or losing their spot on the team; e.g. Hammond et al., 2014). The fact that few athletes also reported using painkillers to enhance performance further generates the idea that analgesics are occasionally used beyond their traditional role (i.e. as painkillers) to cope with performance pressures inherent to elite sports and keep up with teammates and opponents. Similar intentions are also assumed behind the use of performance-enhancing drugs (Pappa and Kennedy, 2013). It should be noted, however, that most athletes did not take analgesics preventively, and of those who did, only some athletes had the specific intention of improving performance.

The presented findings on the intentions behind therapeutic and preventive self-medication suggest that some elite athletes tend to minimize biographical risks by increasing risks in other aspects of life (cf. Bette and Schimank, 1995, 2006). Therewith, self-medication with analgesics represents a paradoxical strategy: to deal with expected distractions due to pain and potential decreases in performance, the athletes in this study took health risks by self-medicating with analgesics for preventive or therapeutic purposes.

### *Risk profiles for therapeutic and preventive self-medication*

The classification tree models identified distinct risk profiles for therapeutic and preventive self-medication characterized through specific sets of psychosocial determinants.

*High-risk profile for therapeutic self-medication.* Within the CTA for therapeutic self-medication, the athlete's age emerged as a central characteristic for risk profiles, with senior athletes (1<sup>st</sup>–3<sup>rd</sup> senior leagues) showing a higher likelihood of *therapeutic* self-medication with analgesics compared to their counterparts in youth leagues. These findings are consistent with the concept of a risk culture in elite sport. Senior athletes have to cope with even higher pressures to perform (Diehl et al., 2019; Mayer et al., 2018) and expectations to prioritize performance over health (Nixon, 1993; Roderick et al., 2000), which may contribute to a greater tendency to self-medicate with analgesics. In addition to coping with increased performance demands, senior athletes may have accumulated more injuries during their longer careers. As a result, they may have more experience in managing their pain and injuries through the use of analgesics in self-medication, which might be further facilitated by easier access to over-the-counter pain medication.

*Low-risk profile for therapeutic self-medication.* The low-risk profile for therapeutic self-medication comprised youth players with a lower willingness to compete hurt despite health-related concerns. This finding is consistent with the study of Mayer and Thiel (2018), which identified two clusters among youth elite handball and track and field cohorts, namely "Athletes conditionally willing to rest" and "rest-averse and pain-trivializing athletes". The latter group would be more likely to use therapeutic self-medication as a coping strategy to maintain their performance while injured or in pain.

*High-risk profile for preventive self-medication.* The classification tree for *preventive* self-medication with analgesics (Figure 5) highlights the chronological age as a pivotal factor. Older athletes, particularly those over the age of 17 years, were more likely to use analgesics preventively, suggesting that this risk behavior may be influenced by the transition to a competitive environment. However, the high-risk profile for preventive analgesic use (Figure 4) was further characterized by strong negative affectivity observed in athletes older than 17. Negative affectivity refers to how strongly a person feels negative emotions when experiencing unfavorable results in sports (Brewer and Cornelius, 2001). This finding suggests that athletes who react especially negatively to sporting failure or missing practice and competition may be particularly motivated to self-medicate preventatively to prevent distractions, manage potential discomfort, and maintain their performance. This finding is consistent with the concept of entering an “identity tunnel” (Curry, 1993: 287), which suggests that athletes with a strong athletic identity may actually overconform to the values of the sport because “they see it as confirming or reconfirming their identity as athletes and as members of select sport groups” (Hughes and Coakley, 1991: 311). The identification of the *perceived performance state during the last season* as the final splitting variable for the high-risk group of preventive analgesic use reinforces the idea of overconforming to the sport ethic through preventive self-medication. According to the assumptions of Coker-Cranney et al. (2020), athletes who “engage in actions aligning with the sport ethic, and receive favorable feedback [...] and performance outcomes [...] may begin to adopt those methods with increasing frequency” (p. 250). In this regard, the results of the present study suggest that sport performance and success do not necessarily minimize the health-related risk behavior of preventive self-medication. Instead, perceived good performances could also lead to an escalatory dynamic. Athletes may have learned to use analgesics preventively to maintain good performance, achieve success, and thereby also avoid the negative emotional reactions associated with failure or missing out. However, the expected increase in performance and pain resistance through analgesics promises a pseudo-safety, as analgesic use can lead to collateral damage and potential long-term consequences in the form of side effects and acute or chronic injuries (DiFiori et al., 2014; Pedersen et al., 2022).

*Low-risk profile for preventive self-medication.* The low-risk profile for preventive analgesic use is characterized by age, role in the team, and the time spent playing handball per week. Specifically, young athletes (aged 17 or younger) who perceived themselves as starters and spent less than 12 hours per week playing handball showed the lowest risk of preventive self-medication. This finding suggests that not having to worry about missing out on playing time is a relevant aspect in preventive analgesic use. When athletes perceived themselves as starters who rarely miss a game, they were less likely to use analgesics preventively. This finding corresponds with research suggesting that the pressure to compete for a spot on the team and perceived uncertainty about playing time increase performing hurt behavior (Berg et al., 2014; Roderick, 2006a). In turn, as the athletes perceive their career continuity as secured and the biographical risk associated with missing playing time as low, they appear to reduce potential health risks. Finally, the amount of time spent playing handball each week also constituted a relevant aspect in reducing the risk of preventive self-medication with analgesics. Manageable practice

and competition schedules with adequate time between practices and competitions may provide athletes with a “‘window of opportunity’ to recover” (Hammond et al., 2014: 173), which may reduce the perceived need for preventive analgesic use.

### *Implications for interventions and athletes’ well-being*

Addressing self-medication with analgesics is a significant challenge due to its complex and multifaceted nature. The results of our study emphasize that self-medication is not driven by a single factor or motivation; rather, athletes who self-medicated agreed with multiple intentions behind their use of analgesics. Combined with the results of the high- and low-risk profiles, our findings call for a comprehensive, multifaceted, and target-group-specific approach to prevent, control, or combat self-medication with analgesics in elite sports.

First, athletes transitioning to senior levels should be specifically targeted and provided with information on alternative strategies for coping with the increased personal (e.g. pressure to perform) and physical challenges (e.g. pain due to increased intensity) often associated with high-performance sport. Further, athletes who exhibit high levels of *negative affects*, such as strong negative emotions when experiencing unfavorable results in sports, and who are going through a period of poor performance should be given special attention, as they may be at particular risk of self-medicating with analgesics preventively to regain their athletic role. Since the coaching staff (e.g. coach and athletic trainer) usually has the most contact with the athletes in handball, it stands to reason that they could, if adequately trained, serve as a conduit of knowledge about pain medication or refer athletes to relevant persons. However, research indicates that the coaching staff often perpetuates norms and values related to the culture of risk, such as performing hurt (e.g. Nixon, 1992). Therefore, we suggest that athletes should rather consult trained medical specialists (e.g. general practitioners) from outside of the athletic context (Hughes and Coakley, 1991).

In addition, given the frequent unsupervised use of analgesics, trained practitioners independent of the association and club (such as physicians or sport psychologists) should initiate informed discussions with elite athletes about health as a preventive measure. These discussions could center around the question of how to balance short-term team and individual performance with long-term athlete health and team success in a competitive environment (John et al., 2023; Schubring and Thiel, 2014).

Finally, health-related risk behaviours, such as self-medication with analgesics, should be addressed organizationally in terms of their negative impact on long-term individual and team performance. Accordingly, heightened willingness to take risks and to perform hurt should not be heroized by the team culture and the coaching staff but should be addressed critically.

### *Limitations and future directions*

While the study’s results provide valuable insights, it is essential to acknowledge its limitations. The data collected through self-report questionnaires might be subject to biases (e.g. social desirability, recall bias), and the cross-sectional design prevents causal

conclusions. Furthermore, the quantitative approach with predefined intentions behind therapeutic and preventive self-medication constrains the scope for the perceptions and attitudes of the athletes themselves, confining them to the options provided in the questionnaire. As the study focuses solely on German handball players, its generalizability to other sports and populations is limited. However, it characterizes the risk profiles of preventive and therapeutic analgesics use among elite handball players and provides valuable insights into the interplay of psychosocial factors. Future research could include longitudinal mixed-method studies to track and qualitatively assess self-medication over time and explore the effectiveness of interventions aimed at altering the culture of risk-taking and painkiller use in elite sports. Qualitative studies could also provide a very useful approach to identifying the underlying assumptions and perceptions that are particularly conducive to preventive self-medication.

## Conclusion

The study provides empirical evidence that deepens the understanding of analgesic use in elite sport by providing valuable insights into two critical aspects of self-medication: first, the intentions behind therapeutic and preventive self-medication with analgesics among elite German handball players and, second, the risk profiles associated with the therapeutic and preventive use of analgesics. The results show that athletes use analgesics in self-medication – sometimes beyond their traditional role as painkillers – to manage anticipated pain and enhance performance. While therapeutic use appears to be aimed at coping with physiological challenges, preventive use is aimed at reducing anticipated distractions (such as pain), maintaining performance, and thereby conforming to the athletic role.

The high-risk profile for therapeutic self-medication with analgesics, with a prevalence of 64.9%, was observed in senior athletes, potentially due to increased performance pressures and accumulated injuries. With regard to preventive analgesic use, the high-risk group with a prevalence of 65.5% comprised athletes aged above 17 years who exhibited strong negative affectivity and had achieved good performances in the last season. Overall, these findings contribute to a better understanding of the complex intentions behind and risk factors associated with self-medication among elite handball players. The knowledge gained from this study can inform targeted interventions aimed at promoting the health and well-being of athletes.

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## ORCID iD

Jan Bursik  <https://orcid.org/0000-0003-0457-918X>

## Note

1. In this study, we particularly investigated Nonsteroidal Anti-inflammatory Drugs and Paracetamol, which can be acquired “over-the-counter”. To refer to these “over-the-counter” pain medication, we have used the term *analgesics* within the manuscript.

## References

- André C, Girard J, Gautier S, et al. (2020) Training modalities and self-medication behaviors in a sample of runners during an ultratrail. *Science & Sports* 35(1): 48.e1–48.e7.
- Andrews PJ, Sleeman DH, Statham PF, et al. (2002) Predicting recovery in patients suffering from traumatic brain injury by using admission variables and physiological data: A comparison between decision tree analysis and logistic regression. *Journal of Neurosurgery* 97(2): 326–336.
- Atkinson M (2019) Sport and risk culture. In: *The Suffering Body in Sport: Shifting Thresholds of Pain, Risk and Injury*. Bingley: Emerald Publishing Limited, 5–21.
- Auriel E, Regev K and Korczyn AD (2014) Nonsteroidal anti-inflammatory drugs exposure and the central nervous system. *Handbook of Clinical Neurology* 119: 577–584.
- Berg EC, Migliaccio TA and Anzini-Varesio R (2014) Female football players, the sport ethic and the masculinity-sport nexus. *Sport in Society* 17(2): 176–189.
- Bersche G and Schmitt H (2022) Pain prevalences and analgesic use in junior athletes – a recent narrative review. *Deutsche Zeitschrift für Sportmedizin/German Journal of Sports Medicine* 73(3): 93–97.
- Bette K-H and Schimank U (1995) *Doping im Hochleistungssport: Anpassung durch Abweichung*. Frankfurt a.M.: Suhrkamp Verlag.
- Bette K-H and Schimank U (2006) *Die Dopingfalle: Soziologische Betrachtungen*. Bielefeld: Transcript Verlag.
- Brewer BW and Cornelius AE (2001) Norms and factorial invariance of the Athletic Identity Measurement Scale (AIMS). *Academic athletic journal* 16: 103–113.
- Camp NJ and Slattery ML (2002) Classification tree analysis: A statistical tool to investigate risk factor interactions with an example for colon cancer (United States). *Cancer Causes and Control* 13: 813–823.
- Charlesworth H and Young K (2006) Injured female athletes: Experiential accounts from England and Canada. In: *Pain and Injury in Sport*. New York: Routledge, pp.89–105.
- Coker-Cranney AM, Huysmans Z and Swary S (2020) The only constant is change: Exploring shifting relationships in sport overconformity through a narrative identity lens. *Journal of Sport Psychology in Action* 11(4): 279–291.
- Curry TJ (1993) A little pain never hurt anyone: athletic career socialization and the normalization of sports injury. *Symbolic Interaction* 16(3): 273–290.

- Didymus FF and Backhouse SH (2020) Coping by doping? A qualitative inquiry into permitted and prohibited substance use in competitive rugby. *Psychology of Sport and Exercise* 49: 101680.
- Diehl K, Mayer J, Thiel A, et al. (2019) „Playing hurt “: Der Umgang jugendlicher Leistungssportler mit Gelenkschmerzen. *Der Schmerz* 33(1): 49–56.
- DiFiori JP, Benjamin HJ, Brenner J, et al. (2014) Overuse injuries and burnout in youth sports: A position statement from the American Medical Society for Sports Medicine. *Clinical Journal of Sport Medicine* 24(1): 3–20.
- Engebretsen L, Soligard T, Steffen K, et al. (2013) Sports injuries and illnesses during the London Summer Olympic Games 2012. *British Journal of Sports Medicine* 47(7): 407–414.
- Fernando ADA, Bandara LMH, Bandara H, et al. (2017) A descriptive study of self-medication practices among Sri Lankan national level athletes. *BMC Research Notes* 10(1): 257.
- Giroto N, Hespagnol Junior LC, Gomes MR, et al. (2017) Incidence and risk factors of injuries in Brazilian elite handball players: a prospective cohort study. *Scandinavian Journal of Medicine & Science in Sports* 27(2): 195–202.
- Granz HL, Schnell A, Mayer J, et al. (2019) Risk profiles for athlete burnout in adolescent elite athletes: a classification analysis. *Psychology of Sport and Exercise* 41: 130–141.
- Hainline B, Derman W, Verrec A, et al. (2017a) International Olympic Committee consensus statement on pain management in elite athletes. *British Journal of Sports Medicine* 51(17): 1245–1258.
- Hainline B, Turner J, Caneiro J, et al. (2017b) Pain in elite athletes—neurophysiological, biomechanical and psychosocial considerations: A narrative review. *British Journal of Sports Medicine* 51(17): 1259–1264.
- Hammond LE, Lilley JM, Pope GD, et al. (2014) ‘We’ve just learnt to put up with it’: An exploration of attitudes and decision-making surrounding playing with injury in English professional football. *Qualitative Research in Sport, Exercise and Health* 6(2): 161–181.
- Harirforoosh S, Asghar W and Jamali F (2013) Adverse effects of nonsteroidal antiinflammatory drugs: An update of gastrointestinal, cardiovascular and renal complications. *Journal of Pharmacy & Pharmaceutical Sciences* 16(5): 821–847.
- Harle CA, Danielson EC, Derman W, et al. (2018) Analgesic management of pain in elite athletes: A systematic review. *Clinical Journal of Sport Medicine* 28(5): 417–426.
- Hewitt PL and Flett GL (2004) *Multidimensional Perfectionism Scale: Technical Manual*. Toronto, ON: Multi-Health Systems Inc.
- Holgado D, Hopker J, Sanabria D, et al. (2018) Analgesics and sport performance: Beyond the pain-modulating effects. *PM&R* 10(1): 72–82.
- Hughes R and Coakley J (1991) Positive deviance among athletes: The implications of overconformity to the sport ethic. *Sociology of Sport Journal* 8(4): 307–325.
- Jenkins C, Costello J and Hodge L (2004) Systematic review of prevalence of aspirin induced asthma and its implications for clinical practice. *Bmj* 328(7437): 434.
- John J, Bursik J, Burgstahler C, et al. (2023) Prevalence of sport-related analgesic use in German elite handball players. *German Journal of Sports Medicine/Deutsche Zeitschrift Fur Sportmedizin* 74(5): 168–173.
- John JM, Gropper H and Thiel A (2019) The role of critical life events in the talent development pathways of athletes and musicians: A systematic review. *Psychology of Sport and Exercise* 45: 101565.
- Khan A, Khan S, Abbas SA, et al. (2018) Health complications associated with self-medication. *Journal of Physical Fitness, Medicine & Treatment in Sports* 1: 555566.
- Langevoort G, Myklebust G, Dvorak J, et al. (2007) Handball injuries during major international tournaments. *Scandinavian Journal of Medicine & Science in Sports* 17(4): 400–407.
- Leyk D, R  ther T, Hartmann N, et al. (2023) Analgesic use in sports: Results of a systematic literature review. *Deutsches   rzteblatt International* 120(10): 155.

- Locquet M, Beudart C, Larbuisson R, et al. (2016) Self-medication practice among amateur runners: Prevalence and associated factors. *Journal of Sports Science & Medicine* 15(2): 387.
- Luig P, Krutsch W, Henke T, et al. (2020) Contact—but not foul play—dominates injury mechanisms in men’s professional handball: A video match analysis of 580 injuries. *British Journal of Sports Medicine* 54(16): 984–990.
- Malcolm D (2006) Unprofessional practice? The status and power of sport physicians. *Sociology of Sport Journal* 23(4): 376–395.
- Malcolm D and Sheard K (2002) “Pain in the assets”: The effects of commercialization and professionalization on the management of injury in English rugby union. *Sociology of Sport Journal* 19(2): 149–169.
- Mayer J, Giel KE, Malcolm D, et al. (2018) Compete or rest? Willingness to compete hurt among adolescent elite athletes. *Psychology of Sport and Exercise* 35: 143–150.
- Mayer J, Kühnle F and Thiel A (2020) Presenteeism in elite sport organisations: a framework for understanding athletes’ decisions to practise sport despite health concerns. In: *Routledge Handbook of Athlete Welfare*. London, New York: Routledge, pp.81–93.
- Mayer J and Thiel A (2018) Presenteeism in the elite sports workplace: The willingness to compete hurt among German elite handball and track and field athletes. *International Review for the Sociology of Sport* 53(1): 49–68.
- McCarty JA and Hastak M (2007) Segmentation approaches in data-mining: A comparison of RFM, CHAID, and logistic regression. *Journal of Business Research* 60(6): 656–662.
- Mottram D and Mottram DR (2010) *Drugs in sport*. London: Routledge.
- Nixon HL (1992) A social network analysis of influences on athletes to play with pain and injuries. *Journal of Sport and Social Issues* 16(2): 127–135.
- Nixon HL (1993) Accepting the risks of pain and injury in sport: Mediated cultural influences on playing hurt. *Sociology of Sport Journal* 10(2): 183–196.
- Overbye M (2021) Walking the line? An investigation into elite athletes’ sport-related use of painkillers and their willingness to use analgesics to train or compete when injured. *International Review for the Sociology of Sport* 56(8): 1091–1115.
- Pappa E and Kennedy E (2013) ‘It was my thought... he made it a reality’: Normalization and responsibility in athletes’ accounts of performance-enhancing drug use. *International Review for the Sociology of Sport* 48(3): 277–294.
- Pedersen JR, Andreucci A, Thorlund JB, et al. (2022) Prevalence, frequency, adverse events, and reasons for analgesic use in youth athletes: A systematic review and meta-analysis of 44,381 athletes. *Journal of Science and Medicine in Sport* 25(10): 810–819.
- Raya-González J, Clemente FM, Beato M, et al. (2020) Injury profile of male and female senior and youth handball players: A systematic review. *International Journal of Environmental Research and Public Health* 17(11): 3925.
- Reussner AK, Bursik J, Kühnle F, et al. (2023) The meaning of injury to the elite athlete: A systematic review. *Psychology of Sport and Exercise* 72: 102571.
- Rich M and Scheiman JM (2000) Nonsteroidal anti-inflammatory drug gastropathy at the new millennium: Mechanisms and prevention. *Seminars in Arthritis and Rheumatism* 30: 167–179.
- Roderick M (2006a) Adding insult to injury: Workplace injury in English professional football. *Sociology of Health & Illness* 28(1): 76–97.
- Roderick M (2006b) A very precarious profession: Uncertainty in the working lives of professional footballers. *Work, Employment and Society* 20(2): 245–265.
- Roderick M and Schumacker J (2016) ‘The whole week comes down to the team sheet’: A footballer’s view of insecure work. *Work, Employment and Society* 31(1): 166–174.
- Roderick M, Waddington I and Parker G (2000) Playing hurt: Managing injuries in English professional football. *International Review for the Sociology of Sport* 35(2): 165–180.

- Roy J, Mokhtar AH, Abdul Karim S, et al. (2015) Cognitive appraisals and lived experiences during injury rehabilitation: A narrative account within personal and situational backdrop. *Asian Journal of Sports Medicine* 6(3): e24039.
- Ruiz ME (2010) Risks of self-medication practices. *Current Drug Safety* 5(4): 315–323.
- Safai P (2003) Healing the body in the “culture of risk”: Examining the negotiation of treatment between sport medicine clinicians and injured athletes in Canadian intercollegiate sport. *Sociology of Sport Journal* 20(2): 127–146.
- Sari DM, Rønne Pedersen J, Bloch Thorlund J, et al. (2021) Pain medication use in youth athletes: a cross-sectional study of 466 youth handball players. *Translational Sports Medicine* 4(6): 914–920.
- Schnell A, Mayer J, Diehl K, et al. (2014) Giving everything for athletic success!—Sports-specific risk acceptance of elite adolescent athletes. *Psychology of Sport and Exercise* 15(2): 165–172.
- Schubring A and Thiel A (2014) Coping with growth in adolescent elite sport. *Sociology of Sport Journal* 31(3): 304–326.
- Semark A, Noakes TD, St Clair Gibson A, et al. (1999) The effect of a prophylactic dose of flurbiprofen on muscle soreness and sprinting performance in trained subjects. *Journal of Sports Sciences* 17(3): 197–203.
- Shrier I (2015) Strategic Assessment of Risk and Risk Tolerance (StARRT) framework for return-to-play decision-making. *British Journal of Sports Medicine* 49(20): 1311–1315.
- Smith SM, Dart RC, Katz NP, et al. (2013) Classification and definition of misuse, abuse, and related events in clinical trials: ACTION systematic review and recommendations. *Pain®* 154(11): 2287–2296.
- Swann C, Moran A and Piggott D (2015) Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise* 16: 3–14.
- Theberge N (2008) “Just a normal bad part of what I do”: elite athletes’ accounts of the relationship between health and sport. *Sociology of Sport Journal* 25(2): 206–222.
- Thiel A, Schubring A, Schneider S, et al. (2015) Health in elite sports—a “bio-psycho-social” perspective. *German Journal of Sports Medicine/Deutsche Zeitschrift Fur Sportmedizin* 66(9): 241–247.
- Trinks S, Scheiff AB, Knipp M, et al. (2021) Declaration of analgesics on Doping Control Forms in German football leagues during five seasons. *Deutsche Zeitschrift für Sportmedizin/German Journal of Sports Medicine* 72(2): 67–74.
- Warden SJ (2009) Prophylactic misuse and recommended use of non-steroidal anti-inflammatory drugs by athletes. *British Journal of Sports Medicine* 43(8): 548–549.
- Warden SJ (2010) Prophylactic use of NSAIDs by athletes: A risk/benefit assessment. *The Physician and Sportsmedicine* 38(1): 132–138.
- Warner DC, Schnepf G, Barrett MS, et al. (2002) Prevalence, attitudes, and behaviors related to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) in student athletes. *Journal of Adolescent Health* 30(3): 150–153.
- Ziltener J-L, Leal S and Fournier P-E (2010) Non-steroidal anti-inflammatory drugs for athletes: An update. *Annals of Physical and Rehabilitation Medicine* 53(4): 278–288.

## 6 Final Discussion

This dissertation provides a comprehensive examination of individual physical health risk management in elite sports, drawing on insights from sports medicine, psychology, and sociology. Building on previous disciplinary studies and theoretical concepts (Chapter 2), I developed an interdisciplinary conceptualization of individual physical health risk management which acknowledges both the objective medical dimensions of risk and the subjective, sociocultural, and psychological factors influencing athletes' cognitions and behaviors. In particular, by integrating the relational theory of risk (Boholm & Corvellec, 2011) with the theory of active risk management (Huber, 2012; Mayer et al., 2020a), the conceptualization maps the entire process of individual physical risk management, encompassing risk perception, risk evaluation, and behavioral coping in response to physical health risks (Chapter 3).

Through five empirical studies (Chapter 5), the dissertation investigated how elite athletes perceive, evaluate, and respond to physical health risks. These studies employed qualitative, quantitative, and mixed-methods approaches to capture the complexity of risk-related cognitions and behaviors, and the interaction between individual experiences, cultural norms, medical measures, and institutional structures. The key findings across these studies highlight how subjective meaning-making, external social influences, and career priorities shape athletes' physical health risk management.

### 6.1 Overall Discussion of Key findings

This dissertation conceptualizes physical health risk management as a dynamic and interdisciplinary process, examining how elite athletes perceive, evaluate, and respond to physical health risks. By integrating perspectives from sports medicine, sports psychology,

and sports sociology, it proposes a holistic framework that captures the interplay between individual experiences and broader sociocultural and medical influences. Rather than a fixed or purely rational decision-making process, risk management emerges as an evolving negotiation, shaped by the subjective construction of social context, external pressures, and career priorities (Bursik et al., 2025a).

This dissertation demonstrates how research from sports medicine, psychology, and sociology each provide distinct but complementary perspectives that, when integrated, can create a comprehensive framework. While biopsychosocial models of (Engel, 1977) have traditionally emphasized physiological mechanisms, the findings of this dissertation highlight the central role of subjective experiences and sociocultural influence. Concluding that individual physical health risk management cannot be fully understood without acknowledging the social and psychological dimensions that shape athletes' engagement with health risks.

The methodological approaches within this dissertation further substantiate its interdisciplinary claim. Given the complexity of individual physical health risk management, a combination of quantitative and qualitative methods was employed to capture both generalizable patterns and context-dependent subjective nuances. Qualitative and mixed-method approaches allowed for a deep exploration of how athletes construct, rationalize, and negotiate their physical health risk management (Bursik et al., 2025a; Bursik et al., 2025b; Reussner et al., 2023), while quantitative analyses provided insights into the prevalence and psychosocial risk profiles associated with analgesic use, offering a broader understanding of self-medication behaviors in elite sports (Bursik et al., 2024; John et al., 2023). The integration of diverse methods, synthesizing both nomothetic and idiographic perspectives, is essential for capturing the evolving and socially embedded nature of athletes' management of physical health risks.

A central empirical finding of this dissertation is that physical health risk management is an individual process that is deeply embedded within a broader social and cultural framework (Bursik et al., 2024; Bursik et al., 2025a; Bursik et al., 2025b). Athletes do not manage physical health risks in isolation but rather construct their evaluations and coping strategies in response to external pressures, cultural norms, and social reinforcement (Hughes & Coakley, 1991; Overbye, 2021).

Beyond the social embeddedness of risk, this dissertation highlights the dynamic evolution of risk perception, evaluation, and behavioral coping throughout changing circumstances within an athlete's career (Bursik et al., 2025a). Risk management strategies are not static, but shift in response to changing social contexts, individual priorities, experiences, and career stages.

This dissertation further underscores that risk perception, evaluation, and behavioral coping are not isolated processes but interdependent mechanisms that shape and reinforce one another. Coping strategies such as playing hurt and using analgesics do not emerge in isolation but develop within the broader context of how athletes perceive and evaluate risks (Bursik et al., 2024; Bursik et al., 2025a; Bursik et al., 2025b). The following sections will delve deeper into the aspects of individual physical health risk management, beginning with an examination of physical health risk perception in elite athletes.

### **6.1.1 Elite athletes' perception of physical health risks**

Risk perception serves as the foundation of physical health risk management, determining whether athletes recognize potential health threats to subsequently interpret their significance. The findings from Paper 1 particularly illustrate that risk perception is highly subjective, dynamic, and shaped by individual experiences, career stage, and sociocultural influences. Rather than being a static cognitive process, risk perception evolves as athletes

encounter new situations, reinterpret past experiences, and adjust their priorities in response to external pressures (Bursik et al., 2025a).

#### *6.1.1.1 Empirical insights into athletes' perception of physical health risks*

Paper 1 highlights that risk perception is not merely a response to objective health threats but a process of selective attention and situational salience. Athletes do not perceive all risks equally. Instead, they focus on risks that are most relevant to their immediate priorities, often filtering out medical concerns that do not align with their performance goals. According to the Relational Theory of Risk (Boholm & Corvellec, 2011), this selectivity in risk perception seems to be shaped by the extent to which an athlete perceives a connection between a risk object (e.g., pain, injury) and a valued object at risk (e.g., career progression, team selection, financial security). If this connection is weak or non-existent, the risk may be ignored altogether.

For instance, Paper 1 identifies “neglecting risks and refraining from proactivity” as a prominent theme in the risk management of elite handball players, showing that athletes may disregard pain and minor injuries, perceiving them as an unavoidable part of elite competition rather than as warning signs requiring intervention (cf. Schnell et al., 2014). This mindset is further reinforced by the tendency to attribute injuries to external factors, such as bad luck or fate, rather than to an accumulation of ignored warning signs (Bursik et al., 2025a). As a result, athletes may fail to recognize the link between experiencing pain (risk object) and the potential for serious injury (object at risk), leading them to dismiss proactive health measures such as seeking medical attention or adjusting their training load (Bursik et al., 2025a). This is particularly evident in handball players, who assume that being in pain or feeling unwell is no more likely to lead to injury than feeling physically fit. Such

beliefs further weaken the perceived need for active risk management, allowing physical health risks to go unnoticed.

Paper 1 further reveals that risk perception is highly dynamic, changing as athletes progress through their careers. Early-career athletes are more likely to disregard objective warning signs (cf. Schnell et al., 2014), often due to the sociocultural environments they enter, where proving themselves becomes a priority (Curry, 1993). Within elite sports, pain and injury are frequently framed as challenges to be endured, reinforcing a culture of risk that discourages proactive health management (Joncheray et al., 2022; Theberge, 2008).

By contrast, senior athletes tend to demonstrate greater sensitivity in risk perception, often due to accumulated experience with injuries and an increased awareness of long-term health consequences (cf. Schnell et al., 2014). Paper 1 suggests that this shift occurs gradually as athletes experience the impact of previous injuries, witness the career-ending consequences faced by peers, and reassess their professional priorities. These findings align with research showing that adherence to risk reduction becomes more nuanced when individuals directly experience or observe the negative consequences of a given risk (Edouard et al., 2024).

The findings from Paper 1 further highlight the influence of social and cultural environments in shaping risk perception. Athletes often internalize dominant norms within their sport, which can either heighten or suppress their awareness of risks (Howe, 2001). For instance, within teams where playing through pain is strongly encouraged or rewarded, athletes may be less likely to interpret injuries as serious threats, whereas in environments where health and recovery are prioritized, they may be more attuned to medical risks (Madrigal et al., 2015).

This aligns with Nixon's (1993) concept of 'sportsnets', which describes how social networks within sport settings shape athletes' interpretations of health and injury. Paper 1

illustrates how stakeholders such as coaches, medical staff, and teammates contribute to athletes' selective attention toward certain risks. In some cases, external influences reinforce risk neglect, encouraging athletes to disregard symptoms or return to play prematurely.

#### *6.1.1.2 Methodological approaches to examining risk perception*

The qualitative methodology employed in paper 1 was essential in uncovering the complex, subjective nature of risk perception. Paper 1 used biographical mapping interviews, a participant-centered approach that allows athletes to reconstruct their risk experiences over the course of their careers (cf. Thiel et al., 2020). This method facilitated a nuanced exploration of how athletes' constructions of their risk perception evolved throughout their careers, highlighting how early experiences, external pressures, and cumulative injuries may have contributed to shifting attitudes toward health risks.

Biographical mapping is particularly effective in visualizing how situational dynamics influence certain behaviors and how they are interpreted in retrospect (cf. John et al., 2024; Sheridan et al., 2011). By prompting athletes to recall and plot key moments related to injuries and health decisions, this method provides a career-time perspective on risk perception, capturing not just what athletes perceived as risky, but how and why their perceptions change over time (Schubring, 2024).

### **6.1.2 Elite Athletes' evaluation of physical health risks**

Athletes' evaluations of physical health risks are complex, shaped by their subjective interpretations, career priorities, and the broader sociocultural environment in which they compete (Pike & Maguire, 2003; Schnell et al., 2014). Unlike objective medical classifications, risk evaluation in elite sport is a dynamic and individualized process, in

which athletes weigh the perceived significance of pain, injury, and illness against immediate performance demands and long-term career considerations (Bursik et al., 2025a; Bursik et al., 2025b). Papers 1, 2, and 3 collectively provide empirical insights into how athletes evaluate physical health risks, demonstrating how situational, psychological, and sociocultural factors shape their evaluations of severity and the likelihood of potential consequences. Rather than a straightforward calculation, risk evaluation is a dynamic process influenced by two key dimensions: the subjective undesirability of a given risk and the athletes' estimation of the likelihood that negative consequences will occur (cf. Boholm & Corvellec, 2011). These two dimensions seem to be strongly influenced by the communication of diagnoses within the sport's medical system, the prevailing cultural expectations surrounding injury management, social pressures, and individual characteristics (Bursik et al., 2025a; Bursik et al., 2025b; Reussner et al., 2023).

#### *6.1.2.1 Empirical insights into athletes' evaluation of physical health risks*

Across Papers 1, 2, and 3, a key finding emerges: Risk evaluation in elite athletes is not a fixed, purely rational process but rather a dynamic, context-dependent, and subjective construction which is shaped by personal experiences, external validation, and career priorities (cf. Nixon, 1993; Schubring et al., 2023). Athletes evaluate physical health risks through subjective meaning-making, which is shaped by their personal experiences (Reussner et al., 2023) and perceived control over consequences (Bursik et al., 2025a). At the same time, the subjective evaluations are influenced by sociocultural factors, such as medical communication, team norms, and external pressures to conform to high-performance expectations (Bursik et al., 2025b). Additionally, situational demands, such as the importance of competitions, intensive competition schedules, or contract security shape how athletes evaluate particular physical health risks (Bursik et al., 2025a; Bursik et al., 2025b).

A major factor influencing risk evaluation is reliance on external validation (Bursik et al., 2024; Bursik et al., 2025a). In line with research on the role of the medical staff and their peers (Roderick, 2006a; Waddington, 2006), Paper 1 demonstrates that athletes frequently defer to medical professionals, coaches, and teammates when determining whether a physical health risk warrants concern, often prioritizing external input over their own bodily sensations. Without a formal diagnosis, athletes often fail to recognize the connection between symptoms and performance or potential long-term consequences, leading to a negligent or even overly optimistic risk evaluation (Bursik et al., 2025a). This skewed risk evaluation substantiates previous studies, suggesting that athletes tend to minimize symptoms unless reinforced by medical opinions in high-performance sport environments, a phenomenon influenced by the culture of risk (Nixon, 1993; Safai, 2003). The reliance on external validation means that a health complaint is not classified as an injury or health risk based solely on an athlete's physical sensations but is strongly shaped by how their environment interprets and legitimizes their experience (Nixon, 1992). In the absence of a formal diagnosis, enduring pain is often normalized as a necessary part of success. However, once an injury is medically confirmed, athletes frequently reassess their evaluation, leading to adjustments in their risk management strategies (Bursik et al., 2025a). This underscores the fluid nature of risk evaluation, where the perception of risk severity can shift based on available medical feedback or the lack thereof.

Beyond external validation, career stage and accumulated experience play a crucial role in shaping subjective risk evaluation (Schubring et al., 2023). While early-career athletes may neglect warning signs due to an evaluation of risks as necessary for success, experienced athletes seem to develop calculated risk-taking strategies (cf. Schnell et al., 2014). Paper 1 suggests that increased awareness of risks does not necessarily lead to more conservative evaluations. Rather, experienced athletes perceive themselves as having greater

control over risk and therefore evaluate risks as manageable. This paradox, where risk awareness leads to a perceived ability to manage risks rather than avoid them, illustrates the complexity of risk evaluation in elite sport.

Paper 2 expands on this by illustrating that athletes assign different meanings to injuries, which significantly influence their risk evaluations. Some athletes perceive injuries as destructive, viewing them as threats to their careers, evoking strong negative emotions (e.g., Murray et al., 2022). Others, however, normalize injuries as part of the athletic experience, interpreting them as expected obstacles that must be endured. In some cases, injuries are even evaluated as chances for reinforcement, serving as motivation or validation of toughness (Ruddock-Hudson et al., 2014). This variation highlights that risk evaluation is not a uniform process, but it is shaped by individual histories, emotional responses, and social reinforcement (Reussner et al., 2023).

Paper 3 complements these findings by systematically reviewing the role of psychosocial influences on performing hurt. Athletes' evaluations of pain and injury severity are highly situational and psychologically mediated, influencing whether performing hurt seems desirable or not (Bursik et al., 2025b). Thus, risk evaluations in elite sports are often biased and performance-driven rather than health-focused, shaped by situational dynamics such as intensive competition schedules and high-stakes games, as well as psychological factors like perfectionism and fear of failure. Social pressures further reinforce these tendencies (Coker-Cranney et al., 2018; Hammond et al., 2014; Roderick et al., 2000). Paper 3 particularly highlights the interplay between individual characteristics of high-performing athletes and the sociocultural factors of their environment. One example of this interaction is how performance identity and the internalization of cultural values significantly shape athletes' risk evaluations, reinforcing the notion that risk evaluation is a continuous negotiation between personal ambition and structural expectations (Bursik et al., 2025b).

Synthesizing these insights, risk evaluation in elite athletes aligns with the Relational Theory of Risk (Boholm & Corvellec, 2011) and the Framework of Active Risk Management (Mayer et al., 2020a). Athletes do not evaluate risk in a vacuum, their assessments are shaped by external validation, social reinforcement, situational dynamics, and individual expectations. For the evaluation process, athletes identify Risk Diffusion Operators (RDOs) to rationalize certain risks, based on their perceived ability to control the consequences (Mayer et al., 2020a). These mechanisms allow athletes to reframe injuries or symptoms in ways that maintain their competitive participation, often without fundamentally altering the underlying health risk. For example, athletes may justify playing hurt by using medical interventions such as analgesics (compensatory RDOs) or by modifying training intensity to balance perceived risk (preventive RDOs). Additionally, RDOs such as seeking social validation from coaches, teammates, or medical staff help athletes manage uncertainty about whether an injury requires immediate attention or can be ignored (Bursik et al., 2025a).

Consequently, risk evaluation is not merely a response to objective health threats but an active, evolving process, where athletes continuously reinterpret risks within their social, psychological, and situational contexts. This dynamic nature of risk evaluation highlights the importance of both individual agency and cultural adaptation, as athletes internalize norms that influence their willingness to engage in risk-taking behaviors (cf. Mayer et al., 2018; Mayer & Thiel, 2018). While some athletes recalibrate their risk tolerance based on injury experiences, others remain embedded in environments that reinforce risk acceptance, further normalizing behaviors such as playing hurt or delaying medical intervention (cf. Nixon, 1993).

#### *6.1.2.2 Methodological approaches to examining risk evaluation*

This dissertation employs diverse methodological approaches to examine how athletes evaluate physical health risks. Paper 1 used biographical mapping interviews combined with reflexive thematic analysis (Braun & Clarke, 2021) to explore patterns in how athletes' retrospectively construct their risk management over the course of their careers. This approach proved particularly effective in capturing how risk evaluations develop and shift in response to changing career priorities, accumulated injury experiences, and exposure to medical guidance or social pressures (Bursik et al., 2025a).

Paper 2 employed thematic synthesis to analyze qualitative studies on athletes' experiences with injury. This method enabled the identification of overarching patterns in how athletes construct meaning around injuries, highlighting how subjective interpretations evolve through social interactions and cultural influences (Reussner et al., 2023). The ability to synthesize findings across multiple qualitative studies strengthens the depth of insights, providing a more detailed perspective on the individual and sociocultural dynamics underlying risk evaluation in elite sport.

Paper 3 utilized a systematic mixed-methods review to integrate qualitative and quantitative research on the role of psychosocial factors in performing hurt. In this context, patterns of risk evaluation, particularly of injuries and pain, become evident. The use of convergent thematic analysis (Creswell & Clark, 2017) facilitated the synthesis of findings from diverse methodological traditions, offering a more comprehensive understanding of the factors shaping risk evaluation. This approach aligns with Creswell's (2014) recommendation to reconcile qualitative and quantitative methodologies to deepen the interpretation of complex phenomena. By systematically analyzing both self-reported and externally observed influences on performing hurt, this paper provides a nuanced exploration of how athletes consider pain, injury severity, and performance consequences in their evaluation process (Bursik et al., 2025).

Collectively, these methodological approaches aim to address the interdisciplinary facets of individual risk evaluation. By integrating a qualitative study, a systematic review of qualitative studies and a systematic review of mixed-methods approaches, this dissertation aimed to capture the complexity of athletes' risk evaluation.

### **6.1.3 Elite athletes' behavioral coping in response to physical health risks**

Athletes employ a range of behavioral coping strategies to respond to manage physical health risks within elite sports (Overbye, 2021; Schneider et al., 2019; Schubring & Thiel, 2014). These behavioral strategies are shaped by individual experiences, sociocultural environments, and career-related demands, often balancing the tension between maintaining performance and long-term health preservation (Roderick et al., 2000). While some athletes adopt proactive risk management behaviors, such as modifying training loads or seeking medical consultation, others engage in risk behaviors, including playing hurt or self-medicating with analgesics (Mayer et al., 2020b). However, athletes do not adhere strictly to a single approach; rather, their strategies shift dynamically depending on career stage, experiences with physical health risks, and individual expectations or contextual pressures (Bursik et al., 2025a).

#### *6.1.3.1 Empirical Insights into athletes' behavioral coping in response to physical health risks*

This dissertation specifically examines two primary behavioral coping strategies in response to physical health risks: performing hurt (Bursik et al., 2025a; Bursik et al., 2025b) and self-administered analgesic use (Bursik et al., 2024; John et al., 2023). The studies of this dissertation collectively illustrate that behavioral coping in response to physical health risks is influenced by both individual and structural factors, with performing hurt and analgesic

use emerging as two dominant mechanisms. Across the studies conducted, these coping behaviors are shaped by a deeply embedded belief that enduring pain is an essential component of professionalism and athletic success. In line with other studies on performing hurt (e.g., Mayer et al., 2018; Roderick et al., 2000) and analgesic use (e.g., Overbye, 2021), athletes were found to internalize cultural norms that trivialize injury, reinforcing the expectation that pushing through physical discomfort is not only necessary but commendable (Bursik et al., 2024; Bursik et al., 2025a; Bursik et al., 2025b). These norms contribute to a cycle in which athletes view risk behaviors as rational and inevitable, rather than optional or problematic (cf. Curry, 1993; Theberge, 2008).

The decision to perform hurt is influenced by both personal characteristics and sociocultural aspects (Bursik et al., 2025b). By systematically reviewing studies across sport medicine, sociology, and psychology, paper 3 demonstrates that athletes who strongly identify with their performance ambitions are more likely to engage in risk-taking behaviors, as they perceive health sacrifices as necessary to maintain their competitive standing. This aligns with the conceptualization of athletic identity (Brewer & Cornelius, 2001), which emphasizes the centrality of sport and performance in an athletes' self-concept. The relation of athletic identity and engagement in performing hurt also relates to the broader concept of positive deviance, which explains why athletes overconform to sport-specific norms, viewing over-adherence to cultural expectations as a marker of success (Hughes & Coakley, 1991).

External reinforcement from coaches, teammates, and medical professionals plays a crucial role in shaping both the evaluation of physical health risks and the subsequent behavioral responses to injury (Bursik et al., 2025a). Paper 1 highlights that athletes frequently seek external orientation when determining whether an injury warrants concern, leading them to downplay pain or dismiss early warning signs in the absence of a formal

diagnosis. The dependency on social validation creates a feedback loop between risk evaluation and behavioral coping strategies. When athletes receive reinforcement, whether direct encouragement from coaches and teammates (e.g., Coker-Cranney et al., 2018; Hammond et al., 2014) or implicit messages from medical professionals (Curry, 1993; Malcolm, 2006), who minimize their concerns, they are more likely to normalize risk and interpret injuries as manageable obstacles rather than significant health threats (Bursik et al., 2025a; Bursik et al., 2025b). This evaluation of risk, in turn, influences behavioral responses such as playing hurt or engaging in self-medication, as athletes strive to align with the performance expectations embedded in elite sports culture (Bursik et al., 2025a; Bursik et al., 2025b).

Analgesic use further illustrates the complexity of behavioral coping, as athletes engage in both preventive and therapeutic self-medication to sustain performance. Paper 4 provides a demographic and contextual perspective, demonstrating that factors such as contract status and role within the team influence the likelihood of self-medication. These conditions correlate with athletes' engagement in self-administered analgesic use, highlighting that coping behaviors are not purely individual but are embedded within demographic, structural, and team dynamics (John et al., 2023). Building on this, Paper 5 identifies distinct patterns of analgesic use, demonstrating that preventive analgesic use is closely linked to the desire to maintain availability for competition, whereas therapeutic analgesic use is often perceived as a necessary tool for immediate symptom relief by athletes (Bursik et al., 2024).

Together, the findings on analgesic use highlight how athletes' risk evaluation, both of pain and injury, as well as the potential risks associated with analgesic use directly influences their behavioral coping strategies (Bursik et al., 2024; John et al., 2023). When athletes perceive sitting out or underperforming as a greater threat to their career than the

potential health risks of self-medication, analgesic use becomes a strategic tool to sustain performance (Bursik et al., 2024). The subjective evaluation of whether pain or injury requires medical intervention, as well as the perceived controllability of symptoms through medication, shapes whether athletes engage in preventive or therapeutic analgesic use (Bursik et al., 2025a). Consequently, risk-related coping behaviors are not merely responses to physical health risks but are actively constructed based on an athlete's evaluation of competing risks within their professional environment (Mayer et al., 2020a; Mayer et al., 2020b)

While playing hurt and analgesic use may appear as distinct coping mechanisms, they are deeply interconnected, reinforcing each other in a cycle of risk normalization (cf. Overbye, 2021; Pedersen et al., 2022). Paper 5 suggests that self-medication is not only a response to pain but also a strategic means to enable playing hurt, allowing athletes to meet performance expectations while suppressing physical discomfort (Bursik et al., 2024). Because performing hurt is widely glorified in elite sports and associated with resilience, dedication, and professionalism, athletes often feel compelled to continue competing despite injuries (cf. Hammond et al., 2014; Mayer et al., 2018). In turn, analgesic use becomes a necessary tool to sustain this expectation (cf. Overbye, 2021), ensuring that pain does not interfere with their ability to meet competitive demands (Bursik et al., 2024). This reciprocal relationship illustrates how external pressures and internalized coping strategies reinforce each other: Combining the results of Papers 1, 3, and 5 suggest that the glorification of performing hurt legitimizes analgesic use, while the availability and use of analgesics facilitate the very practice of playing hurt. Consequently, athletes may become trapped in a self-perpetuating cycle where pain suppression is not only normalized but required to maintain their status and fulfill the expectations embedded in the elite sporting environment.

### *6.1.3.2 Methodological approaches to examining risk perception*

A combination of qualitative and quantitative methodologies provides a comprehensive understanding of how athletes cope with physical health risks by engaging in risk behaviors. The studies in this dissertation employ diverse approaches to capture both subjective experiences and broader population-level patterns.

Qualitative methodologies, including biographical mapping interviews analyzed through reflexive thematic analysis in Paper 1, provide in-depth insights into how athletes construct their coping strategies across career stages (Bursik et al., 2025a). This approach allows for an exploration of patterns in how behavioral coping is experienced and evolves over time, revealing how shifting evaluations and justifications shape their behaviors. Paper 3 expands this perspective by conducting a systematic mixed-methods review, integrating qualitative and quantitative findings to identify psychosocial determinants of performing hurt (Bursik et al., 2025b). The use of convergent thematic analysis (Creswell & Clark, 2017) enables a structured synthesis of diverse research findings, allowing for hypotheses on the complex interactions between personal, social, and cultural influences on performing hurt.

Quantitative methodologies complement these qualitative insights by providing empirical evidence on the prevalence and predictors of self-administered analgesic use. Paper 4 employs survey-based statistical analysis to examine demographic and sport-specific factors influencing analgesic use (John et al., 2023). Paper 5 further advances this approach by applying classification tree analysis, a machine learning technique that uncovers multidimensional relationships between psychosocial factors and self-medication behaviors (Bursik et al., 2024). This method enables a more nuanced understanding of how various risk profiles contribute to athletes' engagement in preventive or therapeutic analgesic use.

By integrating qualitative and quantitative approaches, this dissertation bridges the gap between individual lived experiences and generalizable trends in behavioral coping in response to physical health risks. This interdisciplinary methodological approach ensures a more holistic exploration of how elite athletes develop and adapt their coping strategies in response to physical health risks

## **6.2 Avenues for Future Research**

The findings of this dissertation underscore the opportunities provided by an interdisciplinary approach to understanding physical health risk management in elite sports. The Interdisciplinary Framework for Physical Health Risk Management provides a foundation for future research to deepen insights into this complex phenomenon and advance interdisciplinary research.

Theoretically, this dissertation highlights the need to further refine the interdisciplinary conceptualization of physical health risk management as a multidimensional process. By integrating constructs from sports medicine, psychology, and sociology, the proposed framework situates the athlete as an active agent in shaping their physical health risk management. Emphasizing the central role of risk perception, risk evaluation, and behavioral coping strategies, highlights that subjective and context-dependent interpretations are fundamental to the process of physical health risk management (Bursik et al., 2025a). Future research should further refine the conceptualization of individual physical health risk management by examining more specifically how risk perception, risk evaluation, and behavioral coping strategies interact and whether they are shaped by overlapping or distinct psychological, social, and medical factors.

The findings of this dissertation underscore the significant influence of stakeholders such as coaches, medical staff, and team management on how athletes manage physical

health risks (Bursik et al., 2025a; Bursik et al., 2025b). Given this social influence, future research could benefit from exploring how these stakeholders perceive and evaluate physical health risks themselves and what they consider to be appropriate coping strategies. Such investigations could reveal how differing individual viewpoints shape and are shaped by the culture of risk in elite sports. Integrating these diverse perspectives would provide a more holistic understanding of the social and organizational dimensions that shape individual physical health risk management. It would also help to identify potential mismatches or conflicts between athletes' subjective experiences and the expectations or risk perceptions of these stakeholders (cf. Barrette & Harman, 2019; Bolling et al., 2019; Safai, 2003). Such insights could advance the theoretical conceptualization of physical health risk management by highlighting the role of power dynamics, communication processes, and collective decision-making in shaping how risks are managed at both individual and systemic levels.

Methodologically, this dissertation has demonstrated the value of integrating qualitative and quantitative approaches across disciplines to capture the complexity of physical health risk management in elite sport. Future research could extend the application of methodological approaches across disciplines by leveraging real-time data collection methods such as ecological momentary assessment (EMA), to capture athletes' perceptions, evaluations, and coping strategies immediately (Reifsteck et al., 2021; Shiffman et al., 2008). EMA could offer a granular view of how immediate factors, such as pain, stress, and situational pressures, influence risk-related cognitions and behaviors. Moreover, comparing EMA findings with retrospective interview or biographical mapping studies, could enrich the understanding of how retrospective construction surround risk management evolve over time. This methodological expansion aligns with the constructivist emphasis on context and subjectivity, complementing retrospective accounts with real-time insights into athletes' lived experiences.

Additionally, advances in machine learning and data analytics offer promising avenues for future research. These technologies can identify nuanced patterns and predictors of risk behaviors, contributing to both individual and organizational physical health risk management (cf. Schinke et al., 2022). Building on the hierarchical tree modeling employed in this dissertation (Bursik et al., 2024), future studies could analyze larger datasets incorporating variables such as social network metrics and environmental influences. These tools could uncover complex risk profiles, facilitating the development of tailored interventions on individual or organizational levels.

Empirically, this dissertation's focus on behaviors like playing hurt and analgesic use has opened pathways for further exploration of other risky behaviors, such as disordered eating, overtraining, and doping in the context of physical health risk management. These behaviors, shaped by the interplay of physical health, performance demands, and sociocultural norms (Theberge, 2008), warrant closer investigation through an interdisciplinary and constructivist lens. For instance, future research on disordered eating in elite sport could investigate how sociocultural pressures related to body image and performance intersect with individual psychological traits and medical metrics. Similarly, studies on overtraining could explore how athletes evaluate excessive workloads in response to organizational dynamics and performance expectations (cf. Schinke et al., 2022). Research into doping could investigate how athletes construct the meaning of these behaviors within their broader health and performance management strategies, exploring how risk perception, evaluation and management unfolds around doping behavior (cf. Bette et al., 2002).

Interdisciplinary collaboration will be critical for advancing research in physical health risk management. Future studies should prioritize the development of training programs and research networks that bring together scholars from diverse fields such as

sports medicine, sociology, and psychology. Such collaborations could foster innovative methodologies and theoretical frameworks that address the multifaceted nature of physical health risk management. Additionally, reconciling interdisciplinary tensions, such as the epistemological differences between qualitative and quantitative approaches, will be essential for developing integrative models (Hausken-Sutter et al., 2023) that balance idiographic and nomothetic perspectives (Barta & Tennen, 2008; Dunn, 1994).

In conclusion, future research should focus on expanding interdisciplinary frameworks to capture the complexity of physical health risk management in elite sport. Additionally, it should enhance the understanding of the interplay between risk perception, evaluation, and coping behaviors, adopt methodologies across disciplines, and exploring underexamined risk behaviors. By building on the contributions of this dissertation, these efforts can enhance the understanding of physical health risk management in elite sports and contribute to the development of athlete-centered strategies that prioritize long-term health and well-being.

### **6.3 Practical Implications**

The findings of this dissertation have broader implications for athletes, sport clubs, medical professionals, sport federations, and sport policy makers. First, in the context of athlete support systems, they underscore the critical importance of developing targeted interventions that address either athletes' perception, evaluation, or coping behaviors in response to physical health risks. Given that elite athletes operate in environments where sociocultural norms, individual traits, and medical realities converge to shape their physical health risk management, interventions must be context-sensitive and interdisciplinary. This includes educational programs to raise awareness of long-term health risks, psychological support to

counteract the normalization of pain and injury, and medical protocols that encourage early injury detection and treatment.

One key recommendation is the development of athlete-centered support systems designed to enhance physical health risk awareness, promote injury prevention, and provide guidance on managing pain and rehabilitation. Paper 1 demonstrated that athletes' experience of pain, injuries, and risks is deeply influenced by their career stage, personal history, and sociocultural contexts (Bursik et al., 2025a). The evolving nature of physical health risks highlights the need for support systems that recognize and address subjective dimensions and adapt to athletes' changing needs. Such support systems should be implemented by sport organizations, medical teams, and athlete unions and should include a multidisciplinary network of professionals such as sports physicians, physiotherapists, psychologists, and independent health advisors. Sport clubs and unions should facilitate access to expertise beyond the immediate sports environment, allowing athletes to engage with general physicians and mental health professional (Hughes & Coakley, 1991). These health professionals should foster open and empathetic conversations about injury risks, long-term health consequences, and performance limits. By encouraging athletes to articulate their perceptions and priorities rather than relying solely on objective performance metrics, such dialogue can enhance their awareness of the social and psychological factors influencing their risk evaluations and coping strategies, enabling them to navigate physical health risks with greater agency within the constraints of high-performance sport.

Support systems should also focus on promoting proactive risk management strategies. Paper 2 revealed that athletes often construct injuries as defining moments in their careers, which can either prompt reflection and growth or exacerbate risky behaviors (Bianco et al., 1999; Reussner et al., 2023). Coaches, medical staff, sport psychologists, and athlete mentors could play a crucial role in leveraging these moments by fostering dialogue

and providing guidance on healthier approaches to injury management. Encouraging athletes to adopt alternative pain management techniques, engage in structured recovery plans, and seek psychological support could help mitigate the normalization of risk-taking behaviors. By actively intervening during these critical points, support systems can reduce athletes' reliance on risky coping strategies such as analgesic use or playing hurt, promoting long-term physical and mental health.

The findings also emphasize the need for organizational policies and educational programs that address the systemic factors that athletes perceive to influence risk behaviors. Paper 3 and 5 highlighted how attitudes associated with a culture of risk in elite sport contexts, normalize playing hurt and analgesic use, often framing them as signs of professionalism and commitment (Bursik et al., 2024; Bursik et al., 2025b). To counteract these pressures, sports organizations must implement policies that prioritize athlete well-being over short-term performance.

First, organizations should establish clear protocols for injury reporting and management with external medical specialists, prioritizing transparency and medical oversight. Athletes often feel compelled to underreport injuries or self-medicate to avoid being sidelined (Overbye, 2021; Roderick, 2006a; Roderick et al., 2000). A system that mandates regular health evaluations by independent medical professionals and non-punitive injury reporting mechanisms could help to reduce the fears associated with disclosing health concerns.

Second, educational initiatives initiated by sport clubs and required by sport federations (licensing bodies for coaches, athletic trainers, and physiotherapists) should target both athletes and support staff, including coaches, medical teams, and administration (cf. Bursik et al., 2025b). These programs should emphasize the long-term consequences of risky behaviors, such as playing hurt and over-reliance on analgesics, while challenging the

normalization of these behaviors. Educational workshops could further highlight alternative pain management strategies, such as physiotherapy, mental health support, and recovery techniques, reducing reliance on pharmacological solutions (Hainline et al., 2017). Coaches, in particular, should be trained to recognize and discourage risk behaviors while fostering a team culture that values recovery and holistic health. However, given the competitive pressures and job insecurity often faced by coaches (Bentzen et al., 2020), they may struggle to prioritize athlete well-being if their continued employment is tied exclusively to sporting success (cf. Fletcher & Scott, 2010). To mitigate this, sport federations and clubs must ensure that health-conscious coaching practices are institutionally supported and incentivized, preventing coaches from having to choose between job security and responsible athlete management (cf. Bentzen et al., 2020; Graham & Smith, 2022).

Third, policy interventions should incorporate mandatory rest and recovery periods, particularly during intense competition schedules. These policies should account for the subjective experiences and needs of athletes, empowering them through autonomy-supportive approaches to load management. For instance, incorporating subjective training load monitoring methods can allow for personalized training and recovery plans (cf. Coyne et al., 2018). Limiting the number of consecutive games or establishing athlete-driven load monitoring systems could mitigate cumulative health risks while fostering a collaborative approach to training adjustments (Meeuwisse et al., 2007; Overbye, 2021). Additionally, clear guidelines on the permissible use of analgesics, developed in collaboration with medical experts, could ensure that painkillers are used responsibly and only under professional supervision (cf. Bursik et al., 2024).

Fourth, organizations should implement athlete-centered career development programs that emphasize long-term health and post-career well-being. Mentorship programs pairing younger athletes with educated retired athletes (athlete mentors) could provide

valuable guidance on managing the pressures of elite sports, including how to manage injuries (cf. Roderick, 2006a). Mentorship and career-development programs could also help athletes develop a broader sense of identity beyond their sport, reducing reliance on risky behaviors to maintain performance and status.

Finally, sport federations, professional leagues, and national governing bodies must actively monitor and evaluate the implementation of these policies. Regular audits, athlete surveys, interviews, and feedback mechanisms could ensure that organizational behaviors align with well-being objectives. Periodic reviews of injury rates, analgesic use patterns, and athlete satisfaction with the policies could guide iterative improvements in policy design while addressing unintended consequences, such as increased pressure on medical staff.

The practical implications of this dissertation highlight the need for systemic changes to support athletes in managing physical health risks. By addressing subjective perceptions and evaluations of physical health risks, tailoring interventions to individual needs and fostering a culture that values health, these recommendations offer a roadmap for reducing harmful behaviors in athletes and promoting sustainable health management in elite sports.

## References

- 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>
- Anderson, B. J. (2008). Paracetamol (Acetaminophen): mechanisms of action. *Pediatric Anesthesia, 18*(10), 915-921. <https://doi.org/10.1111/j.1460-9592.2008.02764.x>
- Armstrong, D. (1987). Theoretical tensions in biopsychosocial medicine. *Social Science & Medicine, 25*(11), 1213-1218. [https://doi.org/10.1016/0277-9536\(87\)90368-6](https://doi.org/10.1016/0277-9536(87)90368-6)
- Bahr, R., Clarsen, B., & Ekstrand, J. (2018). Why we should focus on the burden of injuries and illnesses, not just their incidence. *52*(16), 1018-1021.  
<https://doi.org/https://doi.org/10.1136/bjsports-2017-098160>
- Bahr, R., & Holme, I. (2003). Risk factors for sports injuries—a methodological approach. *British Journal of Sports Medicine, 37*(5), 384-392.  
<https://doi.org/10.1136/bjism.37.5.384>
- Barker-Ruchti, N., Schubring, A., Post, A., & Pettersson, S. (2019). An elite athlete's storying of injuries and non-qualification for an Olympic Games: A socio-narratological case study. *Qualitative research in sport, exercise and health, 11*(5), 687-703. <https://doi.org/10.1080/2159676X.2019.1605405>
- Barrette, A., & Harman, K. (2019). Athletes play through pain—what does that mean for rehabilitation specialists? *Journal of sport rehabilitation, 29*(5), 640-649.  
<https://doi.org/10.1123/jsr.2018-0426>
- Barta, W., & Tennen, H. (2008). An idiographic-nomothetic approach to personality and psychological influences on health risk behavior. In B. P. Reimann (Ed.), *Personality and social psychology research* (pp. 13-59). Nova Biomedical Books.
- Baxter Magolda, M. B. (2004). Evolution of a constructivist conceptualization of epistemological reflection. *Educational Psychologist, 39*(1), 31-42.  
[https://doi.org/10.1207/s15326985ep3901\\_4](https://doi.org/10.1207/s15326985ep3901_4)
- Bekker, S., Bolling, C., Ahmed, O. H., Badenhorst, M., Carmichael, J., Fagher, K., Hägglund, M., Jacobsson, J., John, J. M., & Litzy, K. (2020). Athlete health protection: why qualitative research matters. *Journal of Science and Medicine in Sport, 23*(10), 898-901. <https://doi.org/10.1016/j.jsams.2020.06.020>

- Bekker, S., & Clark, A. M. (2016). Bringing complexity to sports injury prevention research: from simplification to explanation. *50*(24), 1489-1490.  
<https://doi.org/10.1136/bjsports-2016-096457>
- Bentzen, M., Kenttä, G., Richter, A., & Lemyre, P.-N. (2020). Impact of job insecurity on psychological well-and ill-being among high performance coaches. *International journal of environmental research and public health*, *17*(19), 6939.  
<https://doi.org/10.3390/ijerph17196939>
- Bette, K.-H. (2008). Doping im Leistungssport—zwischen individueller Schuld und kollektiver Verantwortung. *Deutsche Zeitschrift für Sportmedizin*, *59*(1), 5-11.
- Bette, K.-H., Schimank, U., Wahlig, D., & Weber, U. (2002). *Biographische dynamiken im leistungssport: Möglichkeiten der dopingprävention im jugendalter*. Sport und Buch Strauß Köln.
- Bianco, T., Malo, S., & Orlick, T. (1999). Sport injury and illness: Elite skiers describe their experiences. *Research quarterly for exercise and sport*, *70*(2), 157-169.  
<https://doi.org/10.1080/02701367.1999.10608033>
- Bicalho, C. C. F., & Da Costa, V. T. (2018). Burnout in elite athletes: a systematic review. *Cuadernos de Psicología del Deporte*, *18*(1), 89-102.
- Bittencourt, N. F., Meeuwisse, W., Mendonça, L., Nettel-Aguirre, A., Ocarino, J., & Fonseca, S. (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>
- Boholm, Å., & Corvellec, H. (2011). A relational theory of risk. *Journal of risk research*, *14*(2), 175-190. <https://doi.org/10.1080/13669877.2010.515313>
- Bolling, C., Barboza, S. D., 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>
- Bolling, C., Delfino Barboza, S., van Mechelen, W., & Pasman, H. R. (2019). How elite athletes, coaches, and physiotherapists perceive a sports injury. *Translational Sports Medicine*, *2*(1), 17-23. <https://doi.org/10.1002/tsm2.53>
- Braun, V., & Clarke, V. (2021). *Thematic Analysis: A Practical Guide*. SAGE Publications Ltd.

- Brewer, B. W. (2020). Three decades later: Looking back to look forward. In *Sport Injury Psychology* (pp. 232-246). Routledge. <https://doi.org/10.4324/9780367854997-20>
- Brewer, B. W., & Cornelius, A. E. (2001). Norms and factorial invariance of the Athletic Identity Measurement Scale (AIMS).
- Brewer, B. W., & Petitpas, A. J. (2017). Athletic identity foreclosure. *Current opinion in psychology, 16*, 118-122. <https://doi.org/10.1016/j.copsyc.2017.05.004>
- Brewer, B. W., & Redmond, C. (2016). *Psychology of sport injury*. Human Kinetics.
- Bursik, J., John, J. M., Mayer, J., Thiel, A., & Kühnle, F. (2024). Risk profiles for self-medication with analgesics among elite German handball players. *International Review for the Sociology of Sport*, 10126902241280156. <https://doi.org/10.1177/101269022412801>
- Bursik, J., Mayer, J., Thiel, A., Kühnle, F., & John, J. M. (2025a). “Anyone who weighs up risks doesn’t belong here”: How do elite handball players manage physical health risk throughout their professional careers? *Frontiers in sports and active living, 7*. <https://doi.org/10.3389/fspor.2025.1553948>
- Bursik, J., Thiel, A., Mayer, J., & John, J. M. (2025b). The role of psychosocial factors in performing hurt: A systematic review covering the high-performance domains of sport, music, and dance. *International Review of Sport and Exercise Psychology, 1-25*. <https://doi.org/10.1080/1750984X.2025.2450791>
- Burwitz, L., Moore, P. M., & Wilkinson, D. M. (1994). Future directions for performance-related sports science research: An interdisciplinary approach. *Journal of sports sciences, 12*(1), 93-109. <https://doi.org/10.1080/02640419408732159>
- Cardoso-Marinho, B., Barbosa, A., Bolling, C., Marques, J. P., Figueiredo, P., & Brito, J. (2022). The perception of injury risk and prevention among football players: A systematic review. *Frontiers in sports and active living, 4*, 1018752. <https://doi.org/10.3389/fspor.2022.1018752>
- Chaari, F., Boyas, S., Sahli, S., Fendri, T., Harrabi, M. A., Rebai, H., & Rahmani, A. (2022). Postural balance asymmetry and subsequent noncontact lower extremity musculoskeletal injuries among Tunisian soccer players with groin pain: A prospective case control study. *Gait & Posture, 98*, 134-140. <https://doi.org/10.1016/j.gaitpost.2022.09.004>

- Chen, Y., Buggy, C., & Kelly, S. (2019). Winning at all costs: a review of risk-taking behaviour and sporting injury from an occupational safety and health perspective. *Sports medicine-open*, 5(1), 15. <https://doi.org/10.1186/s40798-019-0189-9>
- 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>
- Coddington, R. D., & Troxell, J. R. (1980). The effect of emotional factors on football injury rates—A pilot study. *Journal of human stress*, 6(4), 3-5. <https://doi.org/10.1080/0097840X.1980.9936100>
- Coker-Cranney, A., Watson, J. C., Bernstein, M., Voelker, D. K., & Coakley, J. (2018). How far is too far? Understanding identity and overconformity in collegiate wrestlers. *Qualitative research in sport, exercise and health*, 10(1), 92-116. <https://doi.org/10.1080/2159676X.2017.1372798>
- Coyne, J. O., Gregory Haff, G., Coutts, A. J., Newton, R. U., & Nimphius, S. (2018). The current state of subjective training load monitoring—a practical perspective and call to action. *Sports medicine-open*, 4, 1-10. <https://doi.org/10.1186/s40798-018-0172-x>
- Creighton, D. W., Shrier, I., Shultz, R., Meeuwisse, W. H., & Matheson, G. O. (2010). Return-to-play in sport: a decision-based model. *Clinical Journal of Sport Medicine*, 20(5), 379-385. <https://doi.org/10.1097/JSM.0b013e3181f3c0fe>
- Creswell, J. W. (2014). *Reserach Design: Qualitative, Quantitative and Mixed Methods Approaches* (4 ed.). Sage.
- Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.
- Curry, T. J. (1993). A little pain never hurt anyone: Athletic career socialization and the normalization of sports injury. *Symbolic interaction*, 16(3), 273-290. <https://doi.org/10.1525/si.1993.16.3.273>
- Dalen-Lorentsen, T., Ranvik, A., Bjørneboe, J., Clarsen, B., & Andersen, T. E. (2021). Facilitators and barriers for implementation of a load management intervention in football. *BMJ Open Sport & Exercise Medicine*, 7(2), e001046. <https://doi.org/10.1136/bmjsem-2021-001046>

- Deroche, T., Stephan, Y., Woodman, T., & Le Scanff, C. (2012). Psychological mediators of the sport injury—perceived risk relationship. *Risk Analysis: An International Journal*, 32(1), 113-121. <https://doi.org/10.1111/j.1539-6924.2011.01646.x>
- DiFiori, J. P., Benjamin, H. J., Brenner, J., Gregory, A., Jayanthi, N., Landry, G. L., & Luke, A. (2014). Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Clinical Journal of Sport Medicine*, 24(1), 3-20. <https://doi.org/10.1136/bjsports-2013-093299>
- Dunn, J. G. (1994). Toward the combined use of nomothetic and idiographic methodologies in sport psychology: An empirical example. *The Sport Psychologist*, 8(4), 376-392. <https://doi.org/10.1123/tsp.8.4.376>
- Edouard, P., Sorg, M., Martin, S., Verhagen, E., & Ruffault, A. (2024). Athletes who have already experienced an injury are more prone to adhere to an injury risk reduction approach than those who do not: an online survey of 7870 French athletics (track and field) athletes. *BMJ Open Sport & Exercise Medicine*, 10(1). <https://doi.org/10.1136/bmjsem-2023-001768>
- Elias, N. (1978). *The civilizing process: The History of Manners*. Blackwell. (1939)
- Elovainio, M., Hakulinen, C., Pulkki-Råback, L., Juonala, M., & Raitakari, O. T. (2020). A network approach to the analysis of psychosocial risk factors and their association with health. *Journal of Health Psychology*, 25(10-11), 1587-1600. <https://doi.org/10.1177/1359105318765624>
- Emrich, E., Frenger, M., & Pitsch, W. (2013). Doping im Sport. In A. Güllich & M. Krüger (Eds.), *Sport: Das Lehrbuch für das Sportstudium* (pp. 697-717). Springer Spektrum. [https://doi.org/10.1007/978-3-642-37546-0\\_19](https://doi.org/10.1007/978-3-642-37546-0_19)
- Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science*, 196(4286), 129-136. <https://doi.org/10.1126/science.847460>
- Everard, C., Wadey, R., & Howells, K. (2021). Storying sports injury experiences of elite track athletes: A narrative analysis. *Psychology of sport and exercise*, 56, 102007. <https://doi.org/10.1016/j.psychsport.2021.102007>
- Fagher, K., Forsberg, A., Jacobsson, J., Timpka, T., Dahlström, Ö., & Lexell, J. (2016). Paralympic athletes' perceptions of their experiences of sports-related injuries, risk factors and preventive possibilities. *European journal of sport science*, 16(8), 1240-1249. <https://doi.org/10.1080/17461391.2016.1192689>

- Fernando, A., Bandara, L., Bandara, H., Pilapitiya, S., & De Silva, A. (2017). A descriptive study of self-medication practices among Sri Lankan national level athletes. *BMC research notes*, *10*, 1-12. <https://doi.org/10.1186/s13104-017-2579-8>
- Finch, C. F., & Cook, J. (2014). Categorising sports injuries in epidemiological studies: the subsequent injury categorisation (SIC) model to address multiple, recurrent and exacerbation of injuries. *British Journal of Sports Medicine*, *48*(17), 1276-1280. <https://doi.org/10.1136/bjsports-2012-091729>
- Fisher, H., Gittoes, M. J., Evans, L., Bitchell, C. L., Mullen, R. J., & Scutari, M. (2020). An interdisciplinary examination of stress and injury occurrence in athletes. *Frontiers in sports and active living*, *2*, 595619. <https://doi.org/10.3389/fspor.2020.595619>
- Fletcher, D., & Scott, M. (2010). Psychological stress in sports coaches: A review of concepts, research, and practice. *Journal of sports sciences*, *28*(2), 127-137.
- Forsdyke, D., Smith, A., Jones, M., & Gledhill, A. (2016). Psychosocial factors associated with outcomes of sports injury rehabilitation in competitive athletes: a mixed studies systematic review. *British Journal of Sports Medicine*, *50*(9), 537-544. <https://doi.org/10.1136/bjsports-2015-094850>
- Fosnot, C. T. (2005). *Constructivism: Theory, perspectives, and practice*. Teachers College Press.
- Fredericson, M., Lawley, R., & Raiser, S. (2021). An Overview of Sports Medicine. *Essential Sports Medicine: A Clinical Guide for Students and Residents*, 3-11. <https://doi.org/10.1177/101269001036003003>
- Frey, J. H. (1991). Social risk and the meaning of sport. *Sociology of sport journal*, *8*(2), 136-145. <https://doi.org/10.1123/ssj.8.2.136>
- Fuller, C., & Drawer, S. (2004). The application of risk management in sport. *Sports Medicine*, *34*, 349-356. <https://doi.org/10.2165/00007256-200434060-00001>
- Fuller, C. W. (2007). Managing the risk of injury in sport. *Clinical Journal of Sport Medicine*, *17*(3), 182-187. <https://doi.org/10.1097/JSM.0b013e31805930b0>
- Fuller, C. W. (2018). Injury risk (burden), risk matrices and risk contours in team sports: a review of principles, practices and problems. *Sports Medicine*, *48*(7), 1597-1606. <https://doi.org/10.1007/s40279-018-0913-5>
- Fuller, C. W., Ekstrand, J., Junge, A., Andersen, T. E., Bahr, R., Dvorak, J., Häggglund, M., McCrory, P., & Meeuwisse, W. H. (2006). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Scandinavian*

- journal of medicine & science in sports*, 16(2), 83-92.  
<https://doi.org/10.1136/bjism.2005.025270>
- Galambos, S. A., Terry, P. C., Moyle, G. M., & Locke, S. A. (2005). Psychological predictors of injury among elite athletes. *British Journal of Sports Medicine*, 39(6), 351-354.  
<https://doi.org/10.1136/bjism.2005.018440>
- 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>
- Graham, J. A., & Smith, A. B. (2022). Work and life in the sport industry: A review of work-life interface experiences among athletic employees. *Journal of athletic training*, 57(3), 210-224. <https://doi.org/10.4085/1062-6050-0633.20>
- Hainline, B., Derman, W., Vernec, A., Budgett, R., Deie, M., Dvorak, J., Harle, C., Herring, S. A., McNamee, M., Meeuwisse, W., Lorimer Moseley, G., Omololu, B., Orchard, J., Pipe, A., Pluim, B. M., Raeder, J., Siebert, C., Stewart, M., Stuart, M., . . . Engebretsen, L. (2017). International Olympic Committee consensus statement on pain management in elite athletes. *British Journal of Sports Medicine*, 51(17), 1245-1258. <https://doi.org/10.1136/bjsports-2017-097884>
- Halson, S. L. (2014). Monitoring training load to understand fatigue in athletes. *Sports Medicine*, 44(Suppl 2), 139-147. <https://doi.org/10.1007/s40279-014-0253-z>
- Hammond, L. E., Lilley, J. M., Pope, G. D., Ribbans, W. J., & Walker, N. C. (2014). 'We've just learnt to put up with it': an exploration of attitudes and decision-making surrounding playing with injury in English professional football. *Qualitative research in sport, exercise and health*, 6(2), 161-181.  
<https://doi.org/10.1080/2159676X.2013.796488>
- Hanson, S. J., McCullagh, P., & Tonymon, P. (1992). The relationship of personality characteristics, life stress, and coping resources to athletic injury. *Journal of Sport and Exercise Psychology*, 14(3), 262-272. <https://doi.org/10.1123/jsep.14.3.262>
- Hansson, S. O. (2010). Risk: objective or subjective, facts or values. *Journal of risk research*, 13(2), 231-238. <https://doi.org/10.1080/13669870903126226>
- Harle, C. A., Danielson, E. C., Derman, W., Stuart, M., Dvorak, J., Smith, L., & Hainline, B. (2018). Analgesic management of pain in elite athletes: a systematic review. *Clinical Journal of Sport Medicine*, 28(5), 417-426.  
<https://doi.org/10.1097/JSM.0000000000000604>

- Hausken-Sutter, S. E., Boije af Gennäs, K., Schubring, A., Grau, S., Jungmalm, J., & Barker-Ruchti, N. (2023). Interdisciplinary sport injury research and the integration of qualitative and quantitative data. *BMC Medical Research Methodology*, 23(1), 110. <https://doi.org/10.1186/s12874-023-01929-1>
- 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>
- Hewett, T. E., Ford, K. R., Hoogenboom, B. J., & Myer, G. D. (2010). Understanding and preventing acl injuries: current biomechanical and epidemiologic considerations-update 2010. *North American journal of sports physical therapy: NAJSPT*, 5(4), 234.
- Hewitt, P. L., & Flett, G. L. (1996). The multidimensional perfectionism scale. *Toronto: Multi-Health Systems Inc.*
- Holgado, D., Hopker, J., Sanabria, D., & Zabala, M. (2018). Analgesics and sport performance: beyond the pain-modulating effects. *PM&R*, 10(1), 72-82. <https://doi.org/10.1016/j.pmrj.2017.07.068>
- Hopkins, W. G., Marshall, S. W., Quarrie, K. L., & Hume, P. A. (2007). Risk factors and risk statistics for sports injuries. *Clinical Journal of Sport Medicine*, 17(3), 208-210. <https://doi.org/10.1097/JSM.0b013e3180592a68>
- Howe, D. (2003). *Sport, professionalism and pain: Ethnographies of injury and risk*. Routledge.
- Howe, P. D. (2001). An ethnography of pain and injury in professional rugby union: The case of Pontypridd RFC. *International Review for the Sociology of Sport*, 36(3), 289-303. <https://doi.org/10.1177/101269001036003003>
- Howells, K., Sarkar, M., & Fletcher, D. (2017). Can athletes benefit from difficulty? A systematic review of growth following adversity in competitive sport. *Progress in brain research*, 234, 117-159. <https://doi.org/10.1016/bs.pbr.2017.06.002>
- Huber, O. (2007). Behavior in risky decisions: Focus on risk defusing. *Uncertainty and risk: Mental, formal, experimental representations*, 291-306. [https://doi.org/10.1007/978-3-540-48935-1\\_17](https://doi.org/10.1007/978-3-540-48935-1_17)
- Huber, O. (2012). Risky decisions: Active risk management. *Current Directions in Psychological Science*, 21(1), 26-30. <https://doi.org/10.1177/0963721411422205>

- Hughes, R., & Coakley, J. (1991). Positive deviance among athletes: The implications of overconformity to the sport ethic. *Sociology of sport journal*, 8(4), 307-325.  
<https://doi.org/10.1123/ssj.8.4.307>
- Igolnikov, I., Gallagher, R. M., & Hainline, B. (2018). Sport-related injury and pain classification. *Handbook of clinical neurology*, 158, 423-430.  
<https://doi.org/10.1016/B978-0-444-63954-7.00039-2>
- 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*, 47, 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., Johnson, U., & Podlog, L. (2013). Psychological predictors of injury occurrence: a prospective investigation of professional Swedish soccer players. *Journal of sport rehabilitation*, 22(1), 19-26. <https://doi.org/10.1123/jsr.22.1.19>
- John, J. M., Bursik, J., Burgstahler, C., Büsch, D., Luig, P., Kühnle, F., Mayer, J., Reußner, A., & Thiel, A. (2023). Prevalence of sport-related analgesic use in German elite handball players: Prävalenz des sportbezogenen Schmerzmittelkonsums bei deutschen Spitzen-Handballern. *Deutsche Zeitschrift für Sportmedizin/German Journal of Sports Medicine*, 74(5). <https://doi.org/10.5960/dzsm.2023.568>
- John, J. M., Gropper, H., & Thiel, A. (2019). The role of critical life events in the talent development pathways of athletes and musicians: A systematic review. *Psychology of sport and exercise*, 45, 101565. <https://doi.org/10.1016/j.psychsport.2019.101565>
- John, J. M., Wachsmuth, S., & Thiel, A. (2024). “Either or” or “as well as”: Exploring the relation between health and performance throughout the career pathways of high-performing athletes, musicians, and mathematicians. *Sport, Exercise, and Performance Psychology*. <https://doi.org/10.1037/spy0000370>
- Johnson, U. (2011). Athletes’ experiences of psychosocial risk factors preceding injury. *Qualitative research in sport, exercise and health*, 3(1), 99-115.  
<https://doi.org/10.1080/19398441.2011.547690>

- Johnson, U., & Ivarsson, A. (2011). Psychological predictors of sport injuries among junior soccer players. *Scandinavian journal of medicine & science in sports*, *21*(1), 129-136. <https://doi.org/10.1111/j.1600-0838.2009.01057.x>
- Joncheray, H., Chavinier-Réla, S., Burlot, F., Dalgalarondo, S., & Fukazawa-Couckuyt, S. (2022). Experiences of normalization of pain and injury in elite adolescent basketball. *Sociology of sport journal*, *40*(1), 69-77. <https://doi.org/10.1123/ssj.2021-0143>
- Jones, C. M., Griffiths, P. C., & Mellalieu, S. D. (2017). Training load and fatigue marker associations with injury and illness: a systematic review of longitudinal studies. *Sports Medicine*, *47*, 943-974. <https://doi.org/10.1007/s40279-016-0619-5>
- Junge, A., Cheung, K., Edwards, T., & Dvorak, J. (2004). Injuries in youth amateur soccer and rugby players—comparison of incidence and characteristics. *British Journal of Sports Medicine*, *38*(2), 168-172. <https://doi.org/10.1136/bjism.2002.003020>
- Kabiri, S., Choi, J., Shadmanfaat, S. M., & Lee, J. (2021a). Control deficits, conditioning factors, and playing through pain and injury among Iranian professional soccer players. *International journal of environmental research and public health*, *18*(7), 3387. <https://doi.org/10.3390/ijerph18073387>
- Kabiri, S., Choi, J., Shadmanfaat, S. M., Ponnet, K., Lee, J., Lee, S., & Donner, C. M. (2021b). Learning to play through pain and injury: An examination of social learning theory among Iranian athletes. *Social Science Quarterly*, *102*(1), 343-361. <https://doi.org/10.1111/ssqu.12878>
- Kerr, G., & Minden, H. (1988). Psychological factors related to the occurrence of athletic injuries. *Journal of Sport and Exercise Psychology*, *10*(2), 167-173. <https://doi.org/10.1123/jsep.10.2.167>
- Klein, J. T., & Newell, W. H. (1997). Advancing interdisciplinary studies. In *Handbook of the Undergraduate Curriculum: A Comprehensive Guide to Purposes, Structures, Practices, and Change* (pp. 393-415). Jossey-Bass Publishers.
- Kontos, A., Feltz, D., & Malina, R. (2000). The development of the Risk of Injury in Sports Scale (RISSc). *J Sport Exerc Psychol*, *22*, S10.
- Kontos, A. P. (2004). Perceived risk, risk taking, estimation of ability and injury among adolescent sport participants. *Journal of pediatric psychology*, *29*(6), 447-455. <https://doi.org/10.1093/jpepsy/jsh048>
- Lavallée, L., & Flint, F. (1996). The relationship of stress, competitive anxiety, mood state, and social support to athletic injury. *Journal of athletic training*, *31*(4), 296.

- Law, G., & Bloyce, D. (2019). 'Pressure to play?' A sociological analysis of professional football managers' behaviour towards injured players. *Soccer & Society*, 20(3), 387-407. <https://doi.org/10.1080/14660970.2017.1321540>
- Leckey, C., van Dyk, N., Doherty, C., Lawlor, A., & Delahunt, E. (2024). Machine learning approaches to injury risk prediction in sport: a scoping review with evidence synthesis. *British Journal of Sports Medicine*. <https://doi.org/10.1136/bjsports-2024-108576>
- Lemmens, S. M., Lopes van Balen, V. A., Röselaers, Y. C., Scheepers, H. C., & Spaanderman, M. E. (2022). The risk matrix approach: a helpful tool weighing probability and impact when deciding on preventive and diagnostic interventions. *BMC Health Services Research*, 22(1), 218. <https://doi.org/10.1186/s12913-022-07484-7>
- Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage handbook of qualitative research*, 4(2), 97-128.
- Liporaci, R. F., Yoshimura, S., & Baroni, B. M. (2022). Perceptions of professional football players on injury risk factors and prevention strategies. *Science and medicine in football*, 6(2), 148-152. <https://doi.org/10.1080/24733938.2021.1937689>
- Lundberg, T. R., & Howatson, G. (2018). Analgesic and anti-inflammatory drugs in sports: Implications for exercise performance and training adaptations. *Scandinavian journal of medicine & science in sports*, 28(11), 2252-2262. <https://doi.org/10.1111/sms.13275>
- Madigan, D. J., Stoeber, J., Forsdyke, D., Dayson, M., & Passfield, L. (2018). Perfectionism predicts injury in junior athletes: Preliminary evidence from a prospective study. *Journal of sports sciences*, 36(5), 545-550. <https://doi.org/10.1080/02640414.2017.1322709>
- Madrigal, L., Robbins, J., Gill, D. L., & Wurst, K. (2015). A pilot study investigating the reasons for playing through pain and injury: Emerging themes in men's and women's collegiate rugby. *The Sport Psychologist*, 29(4), 310-318. <https://doi.org/10.1123/tsp.2014-0139>
- Madrigal, L., Wurst, K., & Gill, D. L. (2016). The role of mental toughness in coping and injury response in female roller derby and rugby athletes. *Journal of Clinical Sport Psychology*, 10(2), 137-154. <https://doi.org/10.1123/JCSP.2015-0021>

- Malcolm, D. (2006). Unprofessional practice? The status and power of sport physicians. *Sociology of sport journal*, 23(4), 376-395. <https://doi.org/10.1123/ssj.23.4.376>
- Malcolm, D. (2016). *Sport, medicine and health: The medicalization of sport?* Routledge. <https://doi.org/10.4324/9781315739311>
- Malcom, N. L. (2006). “Shaking it off” and “toughing it out” socialization to pain and injury in girls’ softball. *Journal of contemporary ethnography*, 35(5), 495-525. <https://doi.org/10.1177/0891241605283571>
- Mann, K., & MacLeod, A. (2015). Constructivism: learning theories and approaches to research. *Researching medical education*, 49-66. <https://doi.org/10.1002/9781118838983.ch6>
- Mathisen, T. F., Ackland, T., Burke, L. M., Constantini, N., Haudum, J., Macnaughton, L. S., Meyer, N. L., Mountjoy, M., Slater, G., & Sundgot-Borgen, J. (2023). Best practice recommendations for body composition considerations in sport to reduce health and performance risks: a critical review, original survey and expert opinion by a subgroup of the IOC consensus on Relative Energy Deficiency in Sport (REDs). *British Journal of Sports Medicine*, 57(17), 1148-1158. <https://doi.org/10.1136/bjsports-2023-106812>
- Mayer, J., Burgess, S., & Thiel, A. (2020a). Return-to-play decision making in team sports athletes. A quasi-naturalistic scenario study. *Frontiers in Psychology*, 11, 1020. <https://doi.org/10.3389/fpsyg.2020.01020>
- Mayer, J., Giel, K. E., Malcolm, D., Schneider, S., Diehl, K., Zipfel, S., & Thiel, A. (2018). Compete or rest? Willingness to compete hurt among adolescent elite athletes. *Psychology of sport and exercise*, 35, 143-150. <https://doi.org/10.1016/j.psychsport.2017.12.004>
- Mayer, J., Kühnle, F., & Thiel, A. (2020b). Presenteeism in elite sport organisations: a framework for understanding athletes’ decisions to practise sport despite health concerns. In *Routledge Handbook of Athlete Welfare* (pp. 81-93). Routledge. <https://doi.org/10.4324/9780429201745>
- Mayer, J., & Thiel, A. (2018). Presenteeism in the elite sports workplace: The willingness to compete hurt among German elite handball and track and field athletes. *International Review for the Sociology of Sport*, 53(1), 49-68. <https://doi.org/10.1177/1012690216640525>
- McIntosh, A. S., & McCrory, P. (2005). Preventing head and neck injury. *British Journal of Sports Medicine*, 39(6), 314-318. <https://doi.org/10.1136/bjism.2005.018200>

- 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>
- McNarry, G., Allen-Collinson, J., & Evans, A. B. (2020). “You always wanna be sore, because then you are seeing results”: Exploring positive pain in competitive swimming. *Sociology of sport journal*, *37*(4), 301-309. <https://doi.org/10.1123/ssj.2019-0133>
- Meeuwisse, W. H. (1994). Assessing causation in sport injury: a multifactorial model. In (Vol. 4, pp. 166-170): LWW.
- 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*, *17*(3), 215-219. <https://doi.org/10.1097/JSM.0b013e3180592a48>
- Mottram, D., & Mottram, D. R. (2010). *Drugs in sport*. Routledge.
- Murphy, P., & Waddington, I. (2007). Are elite athletes exploited? *Sport in society*, *10*(2), 239-255. <https://doi.org/10.1080/17430430601147096>
- Murray, L., Vuoskoski, P., Wellman, J., & Hebron, C. (2022). “It was the end of the world”– The lifeworld of elite male rugby union players living with injury. An interpretative phenomenological analysis. *Physiotherapy theory and practice*, *38*(9), 1219-1232. <https://doi.org/10.1080/09593985.2020.1825578>
- Neil, E. R., Winkelmann, Z. K., & Edler, J. R. (2018). Defining the term “overuse”: an evidence-based review of sports epidemiology literature. *Journal of athletic training*, *53*(3), 279-281. <https://doi.org/10.4085/1062-6050-84-16>
- Nixon, H. L. (1992). A social network analysis of influences on athletes to play with pain and injuries. *Journal of sport and social issues*, *16*(2), 127-135. <https://doi.org/10.1177/019372359201600208>
- Nixon, H. L. (1993). Accepting the risks of pain and injury in sport: Mediated cultural influences on playing hurt. *Sociology of sport journal*, *10*(2), 183-196. <https://doi.org/10.1123/ssj.10.2.183>
- Oliveira, J., & Ribeiro, M. d. C. (2023). Risk Management. In S. O. Idowu, R. Schmidpeter, N. Capaldi, L. Zu, M. Del Baldo, & R. Abreu (Eds.), *Encyclopedia of Sustainable Management* (pp. 2818-2822). Springer International Publishing. [https://doi.org/10.1007/978-3-031-25984-5\\_574](https://doi.org/10.1007/978-3-031-25984-5_574)

- Overbye, M. (2021). Walking the line? An investigation into elite athletes' sport-related use of painkillers and their willingness to use analgesics to train or compete when injured. *International Review for the Sociology of Sport*, 56(8), 1091-1115.  
<https://doi.org/10.1177/101269022097355>
- Papathomas, A. (2018). Disordered eating in sport: Legitimized and stigmatized. In *Sport, mental illness, and sociology* (pp. 97-109). Emerald Publishing Limited.  
<https://doi.org/10.1108/S1476-285420180000011007>
- Pedersen, J. R., Andreucci, A., Thorlund, J. B., Koes, B., Møller, M., Storm, L. K., & Bricca, A. (2022). Prevalence, frequency, adverse events, and reasons for analgesic use in youth athletes: A systematic review and meta-analysis of 44,381 athletes. *Journal of Science and Medicine in Sport*, 25(10), 810-819.  
<https://doi.org/10.1016/j.jsams.2022.08.018>
- Pike, E. C., & Maguire, J. A. (2003). Injury in women's sport: Classifying key elements of "risk encounters". *Sociology of sport journal*, 20(3), 232-251.  
<https://doi.org/10.1123/ssj.20.3.232>
- Pitsch, W., Emrich, E., & Klein, M. (2007). Doping in elite sports in Germany: results of a www survey. *European Journal for Sport and Society*, 4(2), 89-102.  
<https://doi.org/10.1080/16138171.2007.11687797>
- Pouliot, V. (2004). The essence of constructivism. *Journal of International Relations and Development*, 7, 319-336. <https://doi.org/10.1057/palgrave.jird.1800022>
- Póvoas, S. C., Seabra, A. F., Ascensão, A. A., Magalhães, J., Soares, J. M., & Rebelo, A. N. (2012). Physical and physiological demands of elite team handball. *The Journal of Strength & Conditioning Research*, 26(12), 3365-3375.  
<https://doi.org/10.1519/JSC.0b013e318248aeec>
- 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>
- Ragin, D. F. (2024). *Health Psychology: An Interdisciplinary Approach*. Routledge.  
<https://doi.org/10.4324/9781003300670>
- Raja, S. N., Carr, D. B., Cohen, M., Finnerup, N. B., Flor, H., Gibson, S., Keefe, F. J., Mogil, J. S., Ringkamp, M., Sluka, K. A., Song, X. J., Stevens, B., Sullivan, M. D., Tutelman, P. R., Ushida, T., & Vader, K. (2020). The revised International Association for the Study of Pain definition of pain: concepts, challenges, and

- compromises. *Pain*, 161(9), 1976-1982.  
<https://doi.org/10.1097/j.pain.0000000000001939>
- Raya-González, J., Clemente, F. M., Beato, M., & Castillo, D. (2020). Injury profile of male and female senior and youth handball players: a systematic review. *International journal of environmental research and public health*, 17(11), 3925.  
<https://doi.org/10.3390/ijerph17113925>
- 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. <https://doi.org/10.1037/spy0000252>
- Repko, A. F., & Szostak, R. (2020). *Interdisciplinary research: Process and theory*. Sage publications.
- Reussner, A. K., Bursik, J., Kuehnle, F., Thiel, A., & John, J. M. (2023). The meaning of injury to the elite athlete: A systematic review. *Psychology of sport and exercise*, 71, 102571. <https://doi.org/10.1016/j.psychsport.2023.102571>
- Roderick, M. (2006a). Adding insult to injury: Workplace injury in English professional football. *Sociology of health & illness*, 28(1), 76-97. <https://doi.org/10.1111/j.1467-9566.2006.00483.x>
- Roderick, M. (2006b). A very precarious profession: Uncertainty in the working lives of professional footballers. *Work, employment and society*, 20(2), 245-265.  
<https://doi.org/10.1177/0950017006064113>
- Roderick, M., Waddington, I., & Parker, G. (2000). Playing hurt: Managing injuries in English professional football. *International Review for the Sociology of Sport*, 35(2), 165-180. <https://doi.org/10.1177/101269000035002003>
- Ronkainen, N. J., & Ryba, T. V. (2017). Is hockey just a game? Contesting meanings of the ice hockey life projects through a career-threatening injury. *Journal of sports sciences*, 35(10), 923-928. <https://doi.org/10.1080/02640414.2016.1201211>
- Roos, K. G., & Marshall, S. W. (2014). Definition and usage of the term “overuse injury” in the US high school and collegiate sport epidemiology literature: a systematic review. *Sports Medicine*, 44, 405-421. <https://doi.org/10.1007/s40279-013-0124-z>
- Ruddock-Hudson, M., O’Halloran, P., & Murphy, G. (2014). The psychological impact of long-term injury on Australian football league players. *Journal of applied sport psychology*, 26(4), 377-394. <https://doi.org/10.1080/10413200.2014.897269>

- Safai, P. (2003). Healing the body in the “culture of risk”: Examining the negotiation of treatment between sport medicine clinicians and injured athletes in Canadian intercollegiate sport. *Sociology of sport journal*, 20(2), 127-146.  
<https://doi.org/10.1123/ssj.20.2.127>
- Sanderson, J., Weathers, M., Grevious, A., Tehan, M., & Warren, S. (2016). A hero or sissy? Exploring media framing of NFL quarterbacks injury decisions. *Communication & Sport*, 4(1), 3-22. <https://doi.org/10.1177/2167479514536982>
- Schinke, R. J., Giffin, C., Cosh, S., Douglas, K., Rhind, D., Harwood, C., Si, G., & Papaionnou, A. (2022). International society of sport psychology position stand: Mental health through occupational health and safety in high performance sport. *International journal of sport and exercise psychology*, 20(6), 1711-1733.  
<https://doi.org/10.1080/1612197X.2021.1992857>
- Schmidt, J., & Göbel, M. (1998). Inklusion/Exklusion: Karriere, Probleme und Differenzierungen eines systemtheoretischen Begriffspaars. *Soziale Systeme. Zeitschrift für soziologische Theorie*, 4(1).
- Schneider, S., Sauer, J., Berrsche, G., Löbel, C., & Schmitt, H. (2019). Playing hurt “– competitive sport despite being injured or in pain. *Deutsche Zeitschrift für Sportmedizin*, 2019, 43-52. <https://doi.org/10.5960/dzsm.2019.365>
- Schnell, A., Mayer, J., Diehl, K., Zipfel, S., & Thiel, A. (2014). Giving everything for athletic success!–Sports-specific risk acceptance of elite adolescent athletes. *Psychology of sport and exercise*, 15(2), 165-172.  
<https://doi.org/10.1016/j.psychsport.2013.10.012>
- Schubring, A. (2024). Biographical Mapping Interviews. In *Participatory Research in Sport and Physical Activity* (pp. 126). Routledge. <https://doi.org/10.4324/9781003430339-12>
- Schubring, A., Halltén, M., Barker-Ruchti, N., & Post, A. (2023). Balancing risk-taking and self-care: The ecology of athlete health behaviour during the Olympic qualification phase. *International Review for the Sociology of Sport*, 58(8), 1326-1348.  
<https://doi.org/10.1177/10126902231168098>
- Schubring, A., & Thiel, A. (2014). Coping with growth in adolescent elite sport. *Sociology of sport journal*, 31(3), 304-326. <https://doi.org/10.1123/ssj.2013-0071>
- Schwandt, T. (1994). Constructivist, interpretivist approaches to human inquiry. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 118-137). Sage Publications. <https://doi.org/10.1177/1468794111413235>

- Sheridan, J., Chamberlain, K., & Dupuis, A. (2011). Timelining: visualizing experience. *Qualitative research, 11*(5), 552-569. <https://doi.org/10.1177/14687941114132>
- Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annu. Rev. Clin. Psychol., 4*(1), 1-32. <https://doi.org/10.1146/annurev.clinpsy.3.022806.091415>
- Shrier, I. (2015). Strategic Assessment of Risk and Risk Tolerance (StARRT) framework for return-to-play decision-making. *British Journal of Sports Medicine, 49*(20), 1311-1315. <https://doi.org/10.1136/bjsports-2014-094569>
- Soligard, T., Schwelunus, M., Alonso, J.-M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T., Gleeson, M., Hägglund, M., & Hutchinson, M. R. (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>
- Steinfeldt, M., & Steinfeldt, J. A. (2012). Athletic identity and conformity to masculine norms among college football players. *Journal of applied sport psychology, 24*(2), 115-128. <https://doi.org/doi/10.1080/10413200.2011.603405>
- Theberge, N. (2008). "Just a normal bad part of what I do": Elite athletes' accounts of the relationship between health and sport. *Sociology of sport journal, 25*(2), 206-222. <https://doi.org/10.1123/ssj.25.2.206>
- Theisen, D., Malisoux, L., Seil, R., & Urhausen, A. (2014). Injuries in youth sports: Epidemiology, risk factors and prevention. *Deutsche Zeitschrift für Sportmedizin, 65*(9), 248-252. <https://doi.org/10.5960/dzsm.2014.137>
- Thiel, A., Gropper, H., John, J. M., Keppler, V., & Mayer, J. (2020). bioMAP-Development of a software for the retrospective analysis of biopsychosocial health trajectories in elite sport. <https://doi.org/10.15496/publikation-38957>
- Thiel, A., Renner, T., & Zipfel, S. (2018a). Gemeinschaftlich verschlungen—Anorexia nervosa als hyperinklusives Phänomen. *PPmP-Psychotherapie· Psychosomatik· Medizinische Psychologie, 68*(06), 231-233. <https://doi.org/10.1055/a-0624-6964>
- Thiel, A., Schubring, A., Schneider, S., Zipfel, S., & Mayer, J. (2015). Health in Elite Sports—a "Bio-Psycho-Social" Perspective. *German Journal of Sports Medicine/Deutsche Zeitschrift Fur Sportmedizin, 66*(9). <https://doi.org/10.5960/dzsm.2015.194>

- Thiel, A., Seiberth, K., & Mayer, J. (2018b). Why does theory matter? Reflections on an apparently self-evident question in sport sociology. *IS(1)*, 1-4.  
<https://doi.org/10.1080/16138171.2018.1437689>
- Thompson, N. J., & Morris, R. D. (1994). Predicting injury risk in adolescent football players: The importance of psychological variables. *Journal of pediatric psychology*, *19*(4), 415-429. <https://doi.org/10.1093/jpepsy/19.4.415>
- Tipton, C. M. (1997). Sports medicine: a century of progress. *The Journal of nutrition*, *127*(5), 878S-885S. <https://doi.org/10.1093/jn/127.5.878S>
- 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*, 1-16. <https://doi.org/10.1007/s40279-024-02045-w>
- Tranaeus, U., Martin, S., & Ivarsson, A. (2022). Psychosocial risk factors for overuse injuries in competitive athletes: a mixed-studies systematic review. *Sports Medicine*, 1-16. <https://doi.org/10.1007/s40279-021-01597-5>
- Tricker, R. (2000). Painkilling drugs in collegiate athletics: knowledge, attitudes, and use of student athletes. *Journal of drug education*, *30*(3), 313-324.  
<https://doi.org/10.2190/N1K3-V8BK-90GH-TTHU>
- Van den Besselaar, P., & Heimeriks, G. (2001). Disciplinary, multidisciplinary, interdisciplinary: Concepts and indicators. Proceedings of the 8th International Conference on Scientometrics & Informetrics (ISSI), University of New South Wales.
- van Mechelen, W., Hlobil, H., & Kemper, H. C. (1992). Incidence, severity, aetiology and prevention of sports injuries: a review of concepts. *Sports Medicine*, *14*, 82-99.  
<https://doi.org/10.2165/00007256-199214020-00002>
- Van Mechelen, W., Twisk, J., Molendijk, A., Blom, B., Snel, J., & Kemper, H. (1996). Subject-related risk factors for sports injuries: a 1-yr prospective study in young adults. *Medicine and Science in Sports and Exercise*, *28*(9), 1171-1179.  
<https://doi.org/10.1097/00005768-199609000-00014>
- Vergeer, I. (2006). Exploring the mental representation of athletic injury: A longitudinal case study. *Psychology of sport and exercise*, *7*(1), 99-114.  
<https://doi.org/10.1016/j.psychsport.2005.07.003>

- von Glasersfeld, E. (1992). Konstruktion der Wirklichkeit und des Begriffs der Objektivität. In *Einführung in den Konstruktivismus* (Vol. 3, pp. 9-40). Piper.
- von Rosen, P., Frohm, A., Kottorp, A., Fridén, C., & Heijne, A. (2017). Multiple factors explain injury risk in adolescent elite athletes: applying a biopsychosocial perspective. *Scandinavian journal of medicine & science in sports*, 27(12), 2059-2069. <https://doi.org/10.1111/sms.12855>
- 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>
- Waddington, I. (2000). Sport and health: A sociological perspective. In E. Dunning & J. Coakley (Eds.), *Handbook of sports studies* (pp. 408-421). <https://doi.org/10.4324/9780203478660>
- Waddington, I. (2006). Ethical problems in the medical management of sports injuries: a case study of English professional football. In *Pain and Injury in Sport* (pp. 182-198). Routledge.
- Wadey, R., Evans, L., Hanton, S., & Neil, R. (2013). Effect of dispositional optimism before and after injury. *Medicine & Science in Sports & Exercise*, 45(2), 387-394. <https://doi.org/10.1249/MSS.0b013e31826ea8e3>
- Warden, S. J. (2009). Prophylactic misuse and recommended use of non-steroidal anti-inflammatory drugs by athletes. 43(8), 548-549. <https://doi.org/10.1136/bjism.2008.056697>
- Wellman, B., & Berkowitz, S. D. (1988). *Social structures: A network approach*. Cambridge University Press.
- 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. (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, 103-111. <https://doi.org/10.1111/j.1600-0838.2010.01195.x>
- Williams, J. M. (1996). Stress, coping resources, and injury risk. *International Journal of Stress Management*, 3, 209-221. <https://doi.org/10.1007/BF01857684>

- 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*(1), 5-25. <https://doi.org/10.1080/10413209808406375>
- Wylleman, P., & Lavallee, D. (2004). A developmental perspective on transitions faced by athletes. *Developmental sport and exercise psychology: A lifespan perspective, 507-527*. <https://doi.org/10.1080/10413209808406375>
- Young, K. (1993). Violence, risk, and liability in male sports culture. *Sociology of sport journal, 10*(4), 373-396. <https://doi.org/10.1123/ssj.10.4.373>
- Young, K. A. (2019). *The suffering body in sport: Shifting thresholds of pain, risk and injury*. Emerald Group Publishing.

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*I hereby declare that the here presented dissertation thesis was written by me. I indicated all sources and aids. I indicated all texts which I quoted directly or paraphrased with regard to content by in-text citations. Full bibliographic information about all citations is provided in the Reference chapter.*

*I hereby affirm in lieu of oath that this is true and I have not withheld or omitted anything. I am aware that making false declarations in an affidavit is punishable with a prison term of up to three years or a fine.*

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Signature

Jan Bursik, Tübingen, 07.03.2025