Benita Olivier
John W. Orchard
Editors

Cricket Sports Medicine

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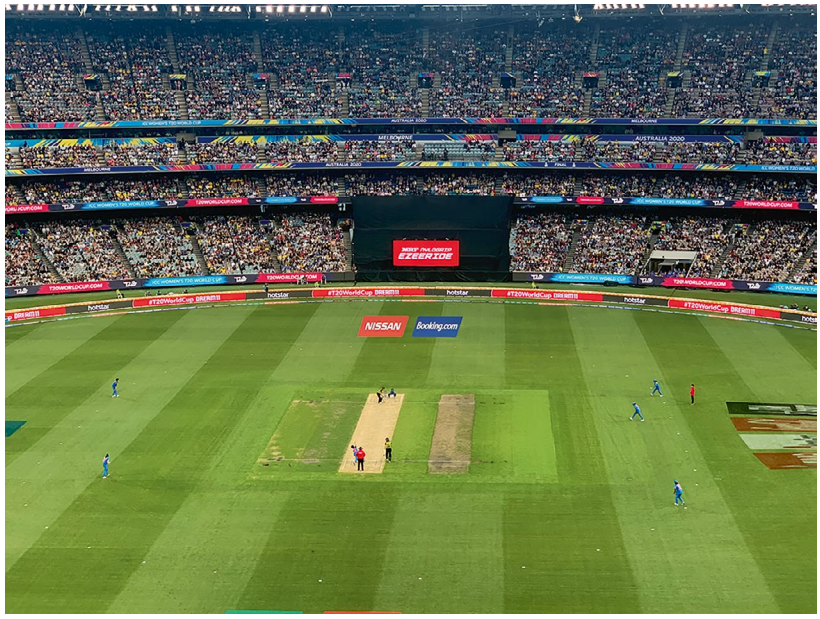

The women's T20 World Cup final at the MCG in 2020 between Australia and India, before a crowd of 86,174 people

Benita Olivier • John W. Orchard
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Foreword

'What's been the biggest change in cricket since you played?' I asked the ex-Australian cricket captain.

Without hesitation, and before my last syllable dropped, came the reflex answer: 'Helmets'.

The answer was delivered decisively, like a yorker aimed at the base of the stumps. I was curious.

'Helmets?' I fished for an explanation.

My companion, now a slight man in his mid-70s, leaned back and focused on a distant past, when a cloth baggy green cap was the only protective partition between a skull and a red-rock ball; I was aware of entering a part of his mind that was part-pleased, part-fearful of where it was going.

'When I went out to bat and the bowler was at the far end of his run, my first thought was always "don't get hit, watch the ball". In that split moment between knowing I was safe, and needing to make runs, that's when I decided what shot to play. If you watch a batsman today, they skip the middleman. There's no thought of safety. They assume they'll never get hurt … because of the helmet. Their first instinct is to hit the ball. My first instinct was "don't get hit".'

I was sitting in a coffee shop in Bowral when this conversation took place just over 10 years ago. Next to me sat Ian Craig, Australia's youngest-ever cricket captain. Burdened by expectation (as the next Bradman) and compromised by illness, his shooting star skied heavenwards in the 1950s, faded, spluttered and was soon extinguished. By 26 years of age, he was out of the First-class game.

A lot has happened since my conversation with Ian Craig. As I write this foreword, it is only days since the tenth anniversary of the death of Phillip Hughes, felled by a cricket ball on the Sydney Cricket Ground. The death of a young man in full public view has left a sensitivity and concern about the welfare of players that shows no sign of diminishing and has altered the mood of the game. Head injury in cricket is not new, but the response is new, shaped by a sense of medical and legal responsibility, and an overriding moral sentiment that we must care for those who play the game of cricket. The list of players seriously injured by ball smashing into bone and flesh is long: Bert Sutcliffe struck in the head while batting for New Zealand against South Africa (1953), Nari Contractor (Indian captain) also brutally struck in the head while batting in the West Indies (1962) and Rick McCosker batting with

a shattered jaw and disfigured face in the Australia-England Centenary Test (1977). There are many others.

Fortunately, life-threatening injuries and illnesses in cricket are rare. This important book on *Cricket Sports Medicine*, edited by Benita Olivier and John Orchard—both distinguished researchers in the field—is the first attempt to draw the experiences of expert clinicians and academics into a single volume. It ranges over and explores the varied physical injuries suffered by players; the erosive changes in the body as years of wear and tear take their toll; the illnesses commonly afflicting cricketers; and it documents studies from epidemiology to biomechanics.

If there is any signature injury in cricket, it is lower back bone stress suffered by fast bowlers, and this book delves into the history and treatment of this breakdown of the body's frame. The history of fast bowling and its associated injuries can be traced to the nineteenth century. In 1864, the Marylebone Cricket Club (MCC) ordained that bowlers were permitted to bowl by raising their arm above the horizontal plane. Prior to that, if a bowler raised his arm above the horizontal as his arm swung into action, he would be no-balled. In a flash, the modern biomechanics of fast bowling was sealed by the MCC.

To see a young fast bowler with stress fractures of the lower vertebrae is to see much more than a physical injury. They are bedevilled by troubling thoughts of insecurity, and the dual fears of performance failure and that of recurring fractures. Coupled with the sometimes-unbearable expectations of those around them, it is hardly surprising that dissatisfaction, anger and depression are common bedfellows of chronic back pain in the fast bowler. The assessment of mental state and treatment of any associated psychiatric disorder is a crucial component of the care and treatment of all cricketers in the twenty-first century.

If I were to ask Virat Kohli, or Alyssa Healy in 50 years' time, the same reflective question I asked Ian Craig: 'What's been the biggest change in cricket since you played?' they might touch upon the commercial or legal aspects of the game, but I suspect part of their answer would focus on the advances in physical and psychological care for the cricketer of 2074. This new book is a step along this path.

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Preface

Cricket is played in 104 countries and enjoyed by over 2.5 billion people worldwide. Keeping our cricketers safe, healthy and happy is essential. It is, therefore, our pleasure and pride to have edited the first book on Cricket Sports Medicine.

The book was born from the recognised need to consolidate practical knowledge in one place. The chapters were identified through a co-production process, where professionals, cricketers and even parents from around the world shared their thoughts on what should be included. The project evolved into a global collaboration among experts. We are thrilled at the depth of both nations and professions represented amongst the contributors. Sports Science Sports Medicine (SSSM) requires a team approach, and the team has participated in this text. We are deeply grateful for the time, energy and dedication every author has contributed to this book. Each author has brought their unique expertise, professional background and perspective, enriching the book's impact through these diverse contributions.

We've also succeeded in having a book that is 'cricket-specific', with the section on lumbar stress fractures, the signature injury in cricket fast bowlers, a great example. There are 39 chapters, illustrating a very broad coverage of the field. We are aware that there are still some potential chapters that have been left out. There are some injuries we haven't covered, including the hip joint, testicular trauma, facial fractures and neck pain. There are some missing topics that may, in hindsight, be still traumatic, such as learnings from the COVID pandemic, or the even sadder topic of deaths in cricket. There is the potential for a second edition to cover additional relevant material—watch this space!

While each chapter has been written by experts in medical and scientific research and practice, the ultimate beneficiary of our knowledge and efforts is the cricketer. Cricketers strive to perform at their highest potential, and maintaining their health and well-being is essential for optimal performance.

The perspective of cricketers themselves matters in ensuring that we practise medicine and science 'with' rather than 'for' them. Therefore, we have included a chapter written by a cricketer, sharing his lived experience with injury and its impact on performance and quality of life.

This book is dedicated to those passionate about cricket and those who work tirelessly behind the scenes to keep our cricketers safe, healthy and happy. Enjoy it!

Oxford, UK — Benita Olivier
Sydney, NSW, Australia — John W. Orchard

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Warm-up for a BBL cricket match at Docklands (Marvel) Stadium

Injury Epidemiology in Cricket

1

Benita Olivier, Akshai Mansingh, John W. Orchard, Mandeep S. Dhillon, and Sibi Walter

1.1 Introduction

Injury epidemiology refers to the quantification and analysis of the frequency, type and nature of injuries. Knowing how and how many injuries occur in a sport and the different roles within a sport helps us better plan our injury prevention, treatment and rehabilitation approaches. As the game continues to evolve, new injury patterns may arise with the rising popularity of shorter formats and greater physical demands. Ongoing monitoring and analysis of injury data will be crucial for developing targeted preventive strategies, optimising medical support and safeguarding cricketers' health and longevity at all levels.

This chapter will give an overview of the prevalence and incidence of injuries in cricket, including injury prevalence in the different playing positions and activities of cricket, namely bowling, batting, fielding and wicketkeeping. Injury predisposition by body areas and injury patterns per activity will also be provided.

1.2 Injury Incidence and Prevalence

1.2.1 Overall Injury Rates

The prevalence of injury in cricket has been a concern in published research since early 1965 [1]. Cricketers are playing cricket with the primary purpose of performing well and enjoying the game, not remaining injury-free as a purpose in itself. A reduction in injury rates seems to be associated with a positive effect on the perfor-

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mance of a cricket team [2]. Remaining injury-free is, therefore, a means to achieve good performance and enjoyment of the game, as well as an opportunity to draw on the health benefits of sports participation.

The epidemiology of cricket injury has been explored amongst males and females and at various levels of play, from grassroots to elite. Injury rates are often presented as incidence or prevalence. While we are tempted to use these terms interchangeably, they have two different meanings (Box 1.1).

Box 1.1 Definitions of Prevalence and Incidence

Incidence: "…the number of new injuries (or new plus recurrent) occurring over a given time period"

Prevalence: "…the average number of squad members not available for selection through injury or illness for a given time period, divided by the total number of squad members. Injury prevalence should be expressed as a percentage, representing the percentage of players missing through injury on average for that team for the season in question." [3, p. 1248]

1.2.2 Injury Rates Among Elite Male Cricketers

Let's start by looking at injury rates among male cricket players. When Soomro et al. [4] combined data from 15 studies involving 12,511 able-bodied male players and 7627 injuries, the overall injury rate was approximately 53 injuries per 10,000 hours of play. Injuries at the community level are far lower than at the elite level [5, 6]. However, injury rates among elite male players can vary considerably between countries. For instance, a nine-season review from 2010 to 2018 found that English and Welsh players sustained 102 injuries per 1000 days of play [7]. Among elite senior male Australian cricketers, a study found an injury rate of 155 injuries per 1000 days of play, with an annual injury incidence of 64 injuries per 100 players per season [8]. In New Zealand, the total new match injury incidence rates for domestic and international male cricketers ranged from 37.0 to 58.0 injuries per 10,000 player hours, depending on the level of play [9]. In contrast, a study on one elite North Indian male cricket team reported a lower rate of 3.27 injuries per 10,000 hours of play [10].

1.2.3 Injury Rates Among Elite Female Cricketers

While research on women's cricket is significantly less than research on their male counterparts, an increasing number of studies are being published on injuries among female players. The pooled injury rate among female players was 71.9 injuries per 1000 player hours [11]. For female players participating in elite cricket, injury trends described in a study from Australia revealed 600 medical-attention injuries sustained over two seasons, with 77.7% of players sustaining at least one injury. Of the injuries sustained that warranted medical treatment, around one-fifth (20.2%) caused the athletes to have some time away from the sport, while over one-third (34.7%) resulted in missed match time specifically [12]. In the United Kingdom (UK), a four-year study tracked injuries among female players enrolled in the England and Wales Cricket Board's international development academy squads. It revealed a rate of seven match time-loss injuries per 1000 player match days. Additionally, around 8.4% of players were affected by injury or illness over the course of a year. On any given day, 2.3% of players were completely unavailable due to injury or illness [13].

1.2.4 Comparing Injury Rates in Male and Female Cricketers

Comparing injury rates between males and females across different studies can be challenging due to variations in how researchers calculate

and analyse the data. However, one study by Orchard et al. [14] directly compared injury rates between elite Australian male and female cricketers. The study looked at data from 453 and 297 unique male and female elite players in Australia, respectively, over seven seasons, considering that many players were involved in more than one season in their data analyses.

Some notable differences in injury patterns between the sexes were observed. Male players had a higher incidence of injuries compared to females, averaging 136 injuries per 1000 match days for males versus 101 injuries per 1000 match days for females. Additionally, a higher percentage of male players experienced match time-loss injuries, with an average of 10.4% being unavailable compared to 6.5% of female players. However, when considering all medical-attention injuries, regardless of time loss, the overall incidence was similar between male and female elite cricketers. These findings may mean that males tend to sustain more severe injuries, which leads to not being available for selection in matches, while both males and females sustained the same number of overall documented injuries (time-loss and non-time-loss injuries combined). In a separate study, researchers analysed injury data from eight men's and women's teams participating in 'The Hundred' competitions from 2021 to 2023. They described higher injury rates among males for both time-loss and non-time-loss injuries. Specifically, the study revealed that the incidence of time-loss injuries among men was 10.0 per 100 players per tournament compared to 7.9 for women. Similarly, the incidence of non-time-loss injuries among men was 26.6 per 100 players per tournament, whereas for women, it was 24.6 [15].

1.2.5 Injury Rates in Different Formats of the Game

Injury rates also seem to vary depending on the format of cricket being played. A study by Goggins et al. [7] in the UK found that more injuries occurred during One-Day matches (254 injuries per 1000 days of play), followed by T20 matches (136 injuries per 1000 days) and then First-Class Cricket (68 injuries per 1000 days). In the West Indies [16], the mean match injury rate among international and domestic male cricketers was 48.7 per 10,000 player hours in Test cricket and 40.6 per 10,000 player hours in one-day international matches. For elite Australian female players, Perera and colleagues [12] reported that the match injury rate per 10,000 player hours was highest in Twenty20 matches (600.4), followed by One-day matches (341.0) and lowest in Multi-day matches (186.5). Orchard et al.'s study [8] among elite senior male Australian cricketers over 10 seasons also found the highest match injury rates occurred in 50-over cricket, followed by 20-over matches and then First-Class matches.

1.2.6 Injury Rates in Different Levels of Play in Cricket

Injury rates differ at different levels of play. The New Zealand study by Dovbysh et al. [9] found that male cricketers in the domestic circuit had a total new match injury rate of 37.0 per 10,000 player hours, while the rate was higher at 58.0 per 10,000 player hours for international-level male players. In addition to elite and domestic levels, researchers have examined injury rates across all levels of play combined, including community and recreational cricket. To do this, some researchers have used data from emergency department or accident compensation fund records to gain insights into cricket-related injuries occurring at all levels of play, including elite, community and recreational. Injury rates at community-level cricket are lower than at the elite level (Fig. 1.1). In New Zealand, data from the national Accident Compensation Corporation (ACC) between 2005 and 2016, combining all age groups and levels, revealed that males had a higher cricket injury incidence of 64.1 per 1000 participants, compared to 36.1 injuries per 1000 female participants [17]. For Australian female cricketers across all ages and levels, Perera et al. [18] found an overall participation-adjusted injury rate of 1.5 emergency department presen-

Fig. 1.1 Injury rates at community-level cricket are lower than at the elite level

tations per 1000 participants and 0.3 hospital admissions per 1000 participants. No fatalities were reported in this study. These findings are interesting as they portray the more serious incidents requiring a visit to the emergency department or leading to an accident compensation fund claim. Table 1.1 shows the injury incidence and prevalence rates amongst elite cricket players in different countries.

When looking at a comparison between injuries in junior players versus adults, the average injury incidence for junior players is 129.7 injuries per 10,000 hours of play and for adults, it is 98.2 injuries per 10,000 hours of play. While the findings come from a systematic review, one should exercise caution in interpreting them because the meta-analyses included a limited number of studies on junior participants (only three), whereas a larger number of studies (ten) focused on adult participants [4].

1.2.7 Injury Rates During Specific Cricket Tournaments

Some studies have specifically examined injury rates during major cricket tournaments and events instead of injury surveillance over a season. This data provides valuable insights into the injury risks players face in these high-intensity competition environments. For instance, during a professional women's T20 tournament in 2016 and 2017, researchers prospectively recorded injuries across 68 matches involving six teams of 15 players each [19]. They found a rate of 2.1 time-loss injuries and 12.2 non-time-loss injuries per 100 match days. On average, 4.6% of players were unavailable for match selection due to injuries during this tournament. Injury prevalence rates in tournaments will automatically be lower than year-round surveillance as players with chronic injuries who are unavailable will be excluded from tournament selection. A different study examined the injuries during the 2013 Asian Cricket Council (ACC) Under-19 Elite Cup. Among the 28 players who sustained 31 injuries throughout the tournament, seven occurred during practice sessions. The overall injury incidence rate was 292.0 per 10,000 player hours [20]. During the 2011 ICC Cricket World Cup for male players, there were 23 injuries resulting in time loss and 97 injuries without time loss, leading to an overall injury rate of 3.7 per 100 player-days (0.7 injuries with time loss and 3.0 injuries without time loss) [21]. When a research team from New Zealand realised that no formal injury surveillance was being planned for the 2015 ICC Cricket World Cup, they decided to prospectively quantify the number and type of media-reported injuries on the tournament website, official team web pages and major news websites. The media reported that 23 of the 219 players (11%) sustained injuries during the tournament [22].

1.2.8 Injury Rates in Terms of Different Roles and Activities in Cricket

Different positions and activities carry unique demands and injury risks in cricket, whether you're bowling, batting or keeping wicket. Pooled data from a systematic review [4] show that male bowlers, for instance, face a higher risk, with an average injury rate of 188.38 per 10,000 hours of play, compared to the overall rate of 53.7 hours of play. English and Welsh players tend to sustain the most injuries while bowling (41.6 injuries per 1000 days of play), followed by

Table 1.1 Injury incidence and prevalence rates amongst elite cricket players in different countries

Country	Population	Incidence	Prevalence
Australia [12]	Elite senior female players	Total match injury incidence: 424.7 injuries per 10,000 player hours	77.7% players reporting ≥1 injury
Australia [8]	Elite senior male cricketers	Match time-loss injuries: 155 injuries/1000 days of play. Annual injury incidence: 64 injuries per 100 players per season	Annual injury prevalence: 12.5%
England and Wales [13]	Female pathway players registered to an academy squad on the England and Wales Cricket Board (ECB)	Match time-loss injuries: 7 per 1000 player match days	2.3% of players unavailable for selection on any given day
England and Wales [7]	Male players from the 18 First-Class County Cricket (FCCC) clubs	Match injury incidence: 102 injuries per 1000 days of play	7.5% of players were unavailable on any given day during the domestic season when all injuries were considered (match and training)
India [10]	One elite North Indian male cricket team	'Significant' injury: 3.27 injuries per 10,000 hours of play	10.14% of players not available for selection during match and training
New Zealand [9]	Domestic and international-level male cricketers	Total new match injury incidence rates - Domestic: 37 injuries per 10,000 player hours; International: 58.0 injuries per 10,000 player hours	Domestic: 7.6% International: 10.0% not available for selection
South Africa [23]	International male cricket players	Match injury incidence: 90 injuries per 10,000 hours of matches	Match injury prevalence: 3.8%
West Indies [16]	International and domestic male cricket players	Mean match injury Incidence: Test cricket: 48.7 per 10,000 player hours One day; International cricket: 40.6 per 10,000 player hours	Test cricket: 11.3%; One-day international cricket: 8.1%

fielding (26.8 injuries per 1000 days of play) and batting (22.3 injuries per 1000 days of play) [7].

For Indian players, most lower limb injuries occur during bowling, with equal numbers during batting and fielding and fewer during wicket-keeping [10]. Among T20 female players in the World Cup, fielding has been shown to have the highest incidence of injuries (5.2 injuries per 100 match days), followed by the category 'other activities and sports' (3.5 injuries per 100 match days), fast bowling (2.5 injuries per 100 match days), batting (1.5), slow bowling (0.6) and wicketkeeping (0.3) [19].

In Australian male elite players, injury prevalence has been shown to vary by player position: Bowlers experience the highest at 20.6%, followed by batters at 7.4%, wicketkeepers at 4.7% and spinners at 6.7%. In addition, fast bowlers also tend to have more time-loss injuries [8]. Conversely, a study in the West Indies found that batters and bowlers lose an equal number of days due to injury [16].

1.2.9 Injury Rates in Terms of Body Regions and Types of Injuries

Orchard et al. [14] analysed the injury data from elite Australian male and female cricket players contracted to play for a national and/or state/ter-

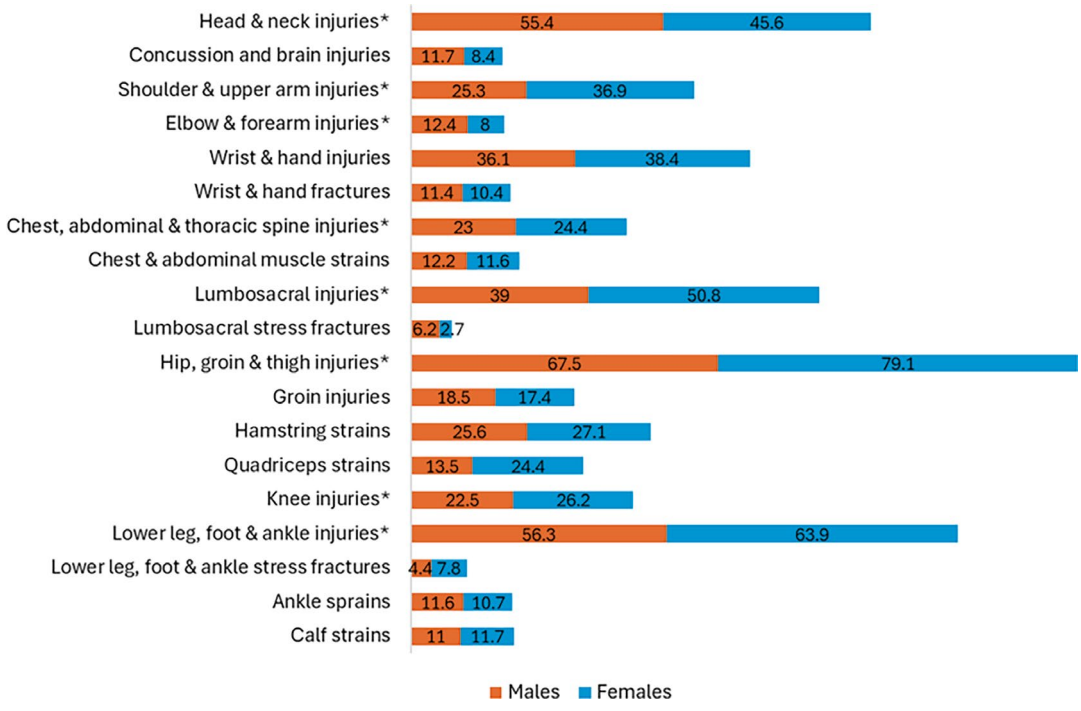

Fig. 1.2 Incidence of all injuries (incl. non-time loss) per 100 players per season by injury category (Orchard et al. [14]). (*Overarching injury category)

ritory team and/or T20 franchise between 2015–16 and 2021–22 (i.e. over seven seasons). Injury incidence per 100 players per season is categorised by injury category in Fig. 1.2, for both male and female players, hip, groin and thigh injuries were the most common, followed by lower leg, foot and ankle injuries.

1.2.9.1 Injury Rates by Body Region in Male Cricketers

Injury epidemiology studies have identified the body areas most commonly affected by injuries in cricketers across different levels and regions. Among elite male players in England and Wales, thigh injuries had the highest incidence rate at 7.4 injuries per 100 players per season. However, lumbar (lower back) injuries resulted in the highest prevalence, with 1.3% of players being unavailable on any given day during the season due to such injuries [7]. For elite male Indian players, lower limb injuries were the most frequent, followed by upper limb injuries and then back and trunk injuries. Within lower limb injuries, the ankle was the most commonly affected area, followed by the lower leg, knee and foot [10].

In the West Indies, finger injuries followed by lumbar spine were the most frequent site of injury overall [16]. Across all levels and age groups of male cricketers in New Zealand, the highest injury rates were for the hand and fingers (10.0 per 1000 participants), followed by the lumbar spine (9.1 per 1000), shoulder (7.8 per 1000), knee (7.5 per 1000) and head (7.4 per 1000) [17].

In a study on domestic and international male New Zealand cricketers, lumbar spine injuries caused the most domestic match days lost. In contrast, groin injuries resulted in the most international match days lost. Hamstring injuries were the most common during domestic play, while groin injuries were the most frequent in international cricket [9].

Among elite senior male Australian cricketers, the most common injuries were hamstring strains (8.7 per 100 players per year), followed by side and abdominal strains (6.1), wrist and hand frac-

tures (4.7), groin injuries (4.5), lumbar injuries other than stress fractures (4.0) and lumbar stress fractures (3.2) [8].

1.2.9.2 Injury Rates by Body Region in Female Cricketers

Studies have revealed some common patterns in the body areas most prone to injuries among female cricketers across different levels of play. A systematic review by Jacobs et al. [11] found that the shoulder and knee were the body regions with the highest prevalence of injuries in female players. However, hand, wrist and fingers injuries had the highest incidence rates. In New Zealand, data from female cricketers of all ages and levels showed the highest injury rates were to the head (6.0 per 1000 participants), hand and fingers (5.1 per 1000), knee (4.2 per 1000), lower back or lumbar spine (3.6 per 1000) and ankle (3.5 per 1000) [17]. During the women's T20 World Cup, shoulder injuries were the most common (12.4% of all injuries, 1.8 per 100 match days), closely followed by lower back and knee injuries (each accounting for 11.7% of all injuries, 1.7 per 100 match days) [19]. For female cricket injuries requiring emergency department visits or hospital admissions in Australia, the head was the most frequently affected area (27.8% of emergency department visits and 28.1% of hospital admissions), followed closely by the wrist and hand (27.8% of emergency department visits and 17.4% of hospital admissions) [18]. Among elite Australian female cricketers, the most frequently injured body regions were the thigh (14.0%), wrist (12.8%), knee (11.3%), shoulder (11.0%) and lower back or lumbar spine (10.5%) [12].

1.2.9.3 Injury Rates by Body Region in Terms of Role or Activity

Among elite Australian female cricketers, the most common injury sustained during bowling was to the lower back or lumbar spine, while batters were most prone to thigh injuries. For both fielders and wicketkeepers, wrist and hand injuries were the most frequent [12]. In a study on elite male Indian cricket players, Dhillon et al. [10] found that bowling was more likely to cause lower limb injuries, while fielding was associated with a higher risk of upper limb injuries. Furthermore, they observed that fast bowlers were more prone to lower back injuries. A study on male West Indies cricketers revealed that most injuries affected either the fingers of batters or the lower backs of fast bowlers. Of the 10 lower back injuries reported in their study, four were stress fractures, with one occurring in a spin bowler. Two fast bowlers had symptomatic prolapsed intervertebral discs, and another two had facet joint inflammation. In addition, one fast bowler and one wicketkeeper had muscle strains in the lower back region [16].

1.2.10 Injury Rates for the Various Injury Types

Looking at injury types across all ages and levels of play, soft tissue injuries were the most common in both male (54.0 per 1000 participants) and female (30.2 per 1000 participants) cricketers. Fractures and dislocations were the second most frequent, occurring at rates of 7.5 per 1000 male participants and 3.3 per 1000 female participants [17]. Data from cricket-related injuries treated at emergency departments in the United States between 2000 and 2019 showed that lacerations were the most common type reported, followed by strains, sprains and then fractures. This data captures more serious injuries across all ages and levels [24]. In Australia, a study of female cricket injuries requiring emergency care found that dislocations, sprains and strains accounted for 36.4% of cases. While fractures made up a lower percentage (17.2%) of emergency department visits, they were the most common cause (19.9%) of hospital admissions [18]. Regarding injury occurrences, the vast majority (80%) were first-time injuries. Around 10% were recurrences from the same season, while the remaining 10% were recurring injuries initially sustained in previous seasons. Most (76%) were acute injuries, 16% were acute-on-chronic and 8% were chronic overuse injuries [16].

1.2.11 Injury Rates of Contact and Non-contact Injuries

When looking at the mechanisms of cricket injuries across all ages and levels of play, contact-related injuries were the most common cause for both male (48.2 per 1000 participants) and female (28.6 per 1000 participants) players. Non-contact mechanisms accounted for substantially fewer injuries, with rates of 21.3 per 1000 male participants and 10.4 per 1000 female participants [17]. However, a different pattern emerged at the elite level during the Women's T20 World Cup. Gradual onset or overuse injuries had the highest incidence at 7.9 per 100 match days, while impact or traumatic injuries occurred less frequently at 2.0 per 100 match days [19]. Among developmental- and community-level cricket contact-type injuries are more prevalent, but as the playing level increases more non-contact-type injuries are prevalent. Also, contact-type injuries are more frequent in the hand and wrist among all levels of play in comparison to lumbar and thigh injuries which are due to overuse mainly among higher levels of competition.

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Injury Surveillance in Cricket: Imperatives and Challenges

2

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2.1 Introduction

Injury surveillance plays a vital role in identifying injury patterns, understanding risk factors and informing the development of targeted injury prevention strategies. Implementing an effective injury surveillance system is crucial for monitoring the prevalence and incidence of injuries across all levels of cricket, from the elite ranks down to the grassroots community-level. However, establishing such a system poses significant challenges, including issues related to resources, compliance, standardisation and data quality. This chapter delves into the importance of injury surveillance in cricket, outlining its key benefits and exploring the obstacles that must be overcome to ensure successful implementation and long-term sustainability of these initiatives. Additionally, it discusses the essential components of an effective injury-tracking system, emphasising the need for standardised injury definitions, systematic data collection processes and user-friendly platforms to facilitate accurate and comprehensive injury reporting.

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2.2 The Importance of Injury Surveillance

Injury surveillance is the ongoing and systematic collection, analysis, interpretation and dissemination of data related to injuries occurring in a sport or athletic population. It involves monitoring the incidence, severity, causes and patterns of injuries to identify risk factors, detect clusters or trends and inform the development and evaluation of injury prevention and treatment strategies.

The Translating Research into Injury Prevention Practice (TRIPP) model, shown in Fig. 2.1, emphasises the importance of injury surveillance as a crucial first step towards effective injury prevention. Finch [1] proposed the TRIPP model, which is a framework that outlines the systematic process of developing and implementing effective injury prevention strategies in sports.

The key steps involved are as follows:

- Step 1: Injury surveillance: The ongoing and systematic collection of injury data to establish the extent of the injury problem, identify risk factors and inform subsequent prevention efforts.
- Step 2: Establish the causes and mechanisms of injury: Using injury surveillance data to investigate and understand the causes and mechanisms underlying the injuries.
- Step 3: Develop preventative measures: Based on the knowledge gained from the previous steps, designing and implementing preventive measures or interventions tailored to the specific injury problem.
- Step 4: 'Ideal conditions'/scientific evaluation of prevention strategies: Rigorously evaluating the effectiveness of the implemented prevention strategies through further injury surveillance and research.
- Step 5: Describe the intervention context to inform the implementation strategies: Examine the facilitators and barriers to adopting and implementing the prevention strategies in the real-world.
- Step 6: Evaluate the effectiveness of the preventative measures in the implementation context: Ongoing monitoring, evaluation and refinement of prevention strategies implemented in the real-world based on the feedback loop provided by injury surveillance data.

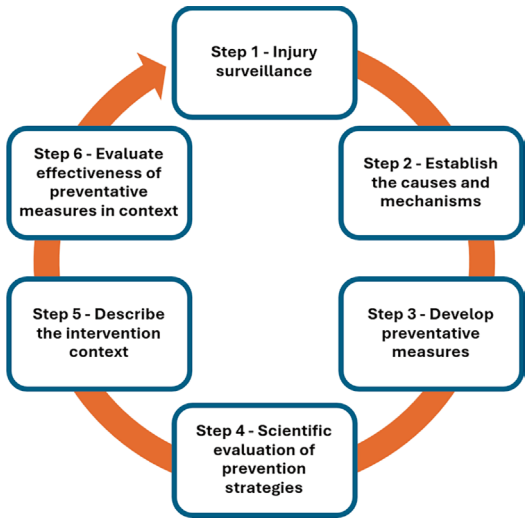

Fig. 2.1 The key steps involved in the Translating Research into Injury Prevention Practice (TRIPP) model

The TRIPP model emphasises the crucial role of injury surveillance as the foundation for developing evidence-based, targeted and effective injury prevention approaches in sports. Injury surveillance has helped us identify the types of injuries more common to the sport and has led to many reductions in incidence. For example, the severity of lumbar stress fractures in young fast bowlers has decreased over the past decades due to the emphasis on early detection [2] and the advances in treatment techniques [3]. This is due to the clear identification of prevalence and incidence, as well as causative factors (body strength, style of bowling and bowling demands) and their correction or control. Close monitoring of the changes in injury trends may lead to reductions in these new injuries with similar interventions.

There are several significant benefits of implementing injury surveillance systems for cricket teams (see Box 2.1 for a summary):

- Identify injury patterns and trends: Systematic injury data collection quantifies the impact of injuries through metrics like injury incidence rates and time lost from the sport. It allows for recognising common injury types, body regions affected and patterns over time.
- Determine injury risk factors: With detailed data on athlete exposures (training/competition loads) and contextual factors, risk factors like playing positions, training loads, equipment issues, etc., can be investigated.
- Develop targeted prevention plans: The insights from injury surveillance inform the design of evidence-based preventive interventions tailored to the specific injury problem in that sport/team. This leads to the evidence-based design of position-specific strength and conditioning programmes and bowling and throwing workload guidelines for developmental stage cricketers.
- Evaluate prevention effectiveness: Continued surveillance after implementing preventive measures tracks changes in injury rates over time, evaluating the real-world impact of the interventions.
- Facilitate research: The centralised injury database enables further epidemiological studies on injury causation and mechanisms to guide future prevention strategies.
- Benchmark and compare to learn: Standard injury definitions allow comparing injury rates/patterns across teams, leagues and regions to identify best practices and areas for improvement.

Box 2.1 The Benefits of a Functional Injury Surveillance System

- Identify injury patterns and trends.
- Determine injury risk factors.
- Develop targeted prevention plans.
- Evaluate prevention effectiveness.
- Facilitate research.
- Benchmark and compare to learn.

Overall, implementing injury surveillance provides the critical data-driven foundation for a practical sports injury prevention cycle, from problem identification to intervention design, implementation and evaluation.

2.3 Challenges of Injury Surveillance

Implementing a structured, standardised injury-tracking system is the optimal thing to do but does not come without challenges. Many of these challenges are more pronounced at lower resourced levels, such as the community-level of play, which involves clubs and schools.

Ekegren et al. [4] identified several obstacles that can hinder the successful implementation and long-term sustainability of an injury surveillance system:

- Personal factors: Injury surveillance may not be considered a priority or essential task by those involved.
- Social and contextual factors: staff turnover, injuries not being reported consistently, lack of support from leadership and lack of dedicated staff.
- System-related factors: the time-consuming process of uploading injury data, technical issues with the system, extensive data requirements and the adjustment period needed to get used to a new system.

Making an injury-tracking system work by overcoming these barriers largely depends on having enough financial and operational resources [5]. This includes costs like purchasing software licenses, getting technical support, ensuring people comply with the system and providing training on data collection [6]. Community-level cricket organisations, especially, often lack the resources or expertise to implement and maintain an ongoing injury surveillance system.

Injury data collection in community sports often relies on volunteers, and tracking injuries is not considered mandatory [4]. Many community-level teams don't have a dedicated sports physician or physiotherapist. When an injury-tracking system is in place, the coaching staff are expected

to record injuries since they are the closest and most consistent members working with the team. However, capturing injury data is not part of a coach's typical responsibilities, and it's not mandatory for them to do so, which makes them less likely to comply [4]. In contrast, at the elite level, there's often a contractual obligation for team medical staff, like sports physicians or physiotherapists, to report injuries as part of their job duties. They understand and accept this responsibility as part of their role.

These hurdles in injury-tracking can lead to unreliable data. This makes it hard to create targeted prevention plans, assess their effectiveness over time, or compare them to other sports. Data issues can stem from unclear injury definitions, missing information, misdiagnoses, missed cases and entry errors. Having a transparent system with consistent injury definitions is one way to enhance data quality and usefulness.

In the absence of a cricket-specific injury surveillance system, alternative data sources may be helpful, although not ideal. In New Zealand, residents of all age groups can claim treatment and rehabilitation costs for any sporting injury through the Accident Compensation Corporation (ACC) [7]. The ACC maintains these longitudinal sports injury records. The ACC records specific to cricket injuries can be used to understand cricket-related injury information. Even though these records provide valuable injury information, they have limitations, as important injury information such as cricket playing position, cricket-specific injury onset activity, specific injury diagnosis and time loss due to injury are not recorded. Therefore, national cricket boards are recommended to implement a rigorous injury surveillance system for community-level cricketers. If national boards do not oversee community-level cricket, it may be more realistic to request that any insurers for community cricket need to conduct injury surveillance and periodically publicly release the results.

Overcoming the various personal, social, operational and resource barriers remains a significant challenge when implementing a standardised injury surveillance system, especially at the community-level, where dedicated staffing and budgets are limited. However, recognising and proactively addressing these potential obstacles is crucial for successfully implementing and sustaining an effective injury-tracking programme across all levels of cricket. In the next section, we'll discuss the key characteristics a cricket injury-tracking system must have to succeed.

2.4 Effective Injury Surveillance Implementation

An injury-tracking system aligned with global consensus standards is crucial for elite and community cricket. Clear, standardised and systematic data collection processes and standard definitions of injuries help ensure the data gathered is accurate and useful. It also enables meaningful comparisons across communities, countries and regions by ensuring consistent injury definitions and data collection methods.

One initiative to promote consistency has been the development of an international consensus statement with standard injury definitions and surveillance methods [8]. While already implemented at the elite level in some nations, community cricket should adopt these internationally accepted standards for optimal data sharing and analysis. This chapter includes supplementary material, which is a downloadable injury report form.

Injury definitions can be more easily implemented at the elite or professional level since the sports medicine staff have medical training. However, at the community-level, the injury definition shouldn't rely on a healthcare professional's diagnosis since they may not be readily available. A consistent player-reported injury definition should be used to ensure all injuries are captured and enhance the system's effectiveness [8] (see Box 2.2). It's ideal to record both injuries requiring time off and those not, as non-time-loss injuries often progress to time-loss injuries; however, reporting of non-time-loss injuries is often less complete [9]. If only time-loss injuries are recorded, this leads to underreporting of overall injuries. Also, at the developmental and community-levels of cricket, athletes might play multiple sports and injuries might not be solely due to cricket. It is ideal to record injuries that occur when playing other sports but which impact participation and performance in cricket.

An injury classification system in sports medicine is a standardised framework or taxonomy used to accurately categorise and code different types of injuries. It serves two primary purposes:

- To classify diagnoses into broader parent categories allows for easy tabulation and summarisation of injury data from various studies or sources. This promotes clarity and consistency when reporting overall injury patterns or trends.
- To create a comprehensive database from which specific injury cases can be extracted for detailed research. Here, the level of diagnostic detail is fundamental to enable in-depth analysis of certain injury types.

The Orchard Sports Injury and Illness Classification System (OSIICS) [10] is an example of a system designed to meet these objectives. It offers a comprehensive taxonomy to consistently code and organise sports injury data, enabling clear communication of overall injury patterns and detailed analysis of particular injury types for research purposes in sports medicine.

Online injury-tracking can work well if thorough data collection processes are followed [11]. Moreover, making the system and platform user-friendly is key to success, encouraging participation and accurate reporting [4, 6]. One challenge is that players may have recall bias, struggling to accurately remember injuries after a long period [1]. Using a weekly injury questionnaire can help limit this bias.

2.5 Research-Practice Partnerships toward Successful Injury Surveillance

Establishing a purposeful collaboration between a research institution, such as a university, and a community cricket entity, such as a high school or cricket club, could serve as an effective approach to surmount common obstacles and yield reciprocal advantages [12]. During the planning phase of their cricket injury research, researchers encounter obstacles in pinpointing the pressing real-world issues, translating them into relevant research questions and securing access to research participants. Furthermore, research entities critically require a platform where research findings can be applied in a sports context to catalyse positive change. Conversely, schools and clubs often lack the necessary resources to design or implement an evidence-based injury surveillance system and may even be unaware of its advantages. By working closely together, practice-informed research can be generated which has the potential for vast impact.

Implementing a user-friendly system with clear injury definitions and systematic data collection processes is vital for capturing comprehensive, high-quality injury data that can inform prevention and management strategies across all levels of cricket.

Box 2.2 Injury Definitions

Match time-loss injury: **‘**Any injury or other medical condition that either: (1) prevents a player from being fully available for selection for a major match or (2), during a major match, causes a player to be unable to bat, bowl or keep wicket when required by either the rules or the team’s captain’.

General time-loss injury: **‘**A general time-loss injury is any injury (or illness) that would have resulted in a player being considered unavailable for match-play, irrespective of whether a match or training was actually scheduled’.

Medical attention injury: **‘**A medical attention injury (or illness) is any health-related condition that required medical (or medical staff) attention and had the potential to affect cricket training or playing. It therefore includes time-loss and non-time-loss injuries’.

Player-reported injury: ‘A player-reported injury is any condition which was considered to represent an injury by a player who is under survey’. [8]

2.6 Supplementary Material: Recommended Variables and Example Injury Report Form

2.6.1 Recommended Variables to Include in an Injury Report Form

Use these variables to create a basic online or hard copy data capture form to monitor injuries in cricket. Add more variables to this form based on your context's needs. The definition of injury needs to be defined beforehand, and guidance can be found in Orchard et al. [8]. The Injury Consensus paper of Orchard et al. [8] will be a helpful guide in creating an injury report form.

Player name and surname.
Date of injury.
Injury captured by.
Date injury resolved.
Date cleared to play.

Diagnoses: Use the Orchard Sports Injury and Illness Classification System (OSIICS) [10].

If it is not practical to use the OSIICS, add the following to the injury report form:

Injury type.
Injury region/body area.
Dominant/non-dominant.
Impact/non-impact.
First-time/recurring.

Injury significance:

- Time-loss.
- Non-time-loss.

Activity of onset:

- Bowling.
- Batting.
- Fielding.
- Wicket keeping.
- Other.

2.6.2 Example Injury Report Form

The following injury report form was used by Benita Olivier as part of the Fearless Fast Bowling project. The form was built in REDCap, and branching logic was used to ensure that only the relevant questions were shown. Download the Microsoft Word version or the exported REDCap form as Electronic Supplementary Material.

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