

Coach Knowledge and Attitudes Towards Sport Injury Prevention
in Youth Basketball

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Abstract

There is a large number of youth sport participants internationally and in recent years, there has been an increasing concern regarding increased injuries. Specifically, basketball is a fast-growing youth sport in New Zealand (NZ) and players commonly experience significant musculoskeletal injuries. Coaches play a key role in facilitating injury prevention strategies to reduce the risk of injury in youth sport; however, this is likely influenced by their knowledge of, and attitude towards, injuries and injury prevention programmes. There is limited research in youth basketball and specifically in the NZ context investigating coach knowledge and attitudes towards injury. Therefore, the overall purpose of this dissertation was to investigate coach knowledge and attitudes towards sport injury prevention in youth basketball. A specific focus was coach knowledge and implementation of the SportSmart warm-up, a component of a nationwide injury prevention programme developed by NZ's national insurer, the Accident Compensation Corporation (ACC).

A cross-sectional study was conducted in which 36 secondary school basketball coaches completed a survey including a series of closed and open-ended questions regarding their knowledge and attitudes towards sport injury prevention in NZ youth basketball. Coaches were less knowledgeable about common upper body injuries and associated risk factors than lower body injuries and common injury types. In particular, there was a lack of awareness that injuries to the head/face were common. Coaches had a positive attitude towards sport injury prevention, including the ACC SportSmart warm-up programme which most coaches were aware of. However, constraints of time and space are major barriers to coaches implementing the SportSmart warm-up or any other similar neuromuscular (NM) warm-up. Greater levels of knowledge and more positive attitudes were reported by coaches with more experience. Half of coaches reported witnessing coaches putting pressure on players to play when injured and 72% reported seeing injured players play on when they thought they should not have. Wanting to win, support the team, and not let the team/coach down were key reasons given for this behaviour. Although the sample size was small, these findings provide preliminary evidence as to the current state of coach knowledge and attitudes towards sport injury prevention in NZ youth basketball.

Recommendations based on these findings include basketball organisations improving coach education about common basketball-related injuries and injury risk factors, such as dental injuries and mouthguard protection, and effective injury prevention-based resources. Additionally, coaches would benefit from a developed basketball-specific warm-up programme, and appropriate adjustments to game and training schedules/rules. This would likely allow teams to manage time, and utilise available venue space to perform a NM warm-up before games and at training sessions more effectively.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made.

Chapter 3 of this dissertation represents a separate paper that has either been published, submitted, or is in preparation for peer-reviewed journals. My contribution and the contribution by the various co-authors to this paper is outlined at the beginning of the dissertation. All co-authors have approved the inclusion of the joint work in this Masters dissertation.

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Candidate Contributions to Co-Authored Papers

Chapter 3 Callaghan, B., Lucas, P., & Whatman, C. (2021). Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball. To be submitted to the <i>International Sport Coaching Journal</i> .	Callaghan: 80% Whatman: 10% Lucas: 10%
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We, the undersigned, hereby agree to the percentages of participation to the chapter identified above:

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Ethical Approval

Ethical approval for this research was granted by the Auckland University of Technology Ethics Committee (AUTEC) on 14th April 2021 for a period of three years:

- AUTEC: 21/90 – Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball.

Chapter 1: Introduction and Rationale

Background

There is a high number of participants in sport and physical activity in New Zealand (NZ), with data from Sport NZ's Active NZ Survey (2019) reporting 94% of children and young people aged 5–17 years (n=4,799), and 72% of adults aged 18 years and older (n=21,972) participated in some form of sport or physical activity per week between 2019–2020 (Sport NZ, 2020). As a result, sport-related injuries are common, with data from the Accident Compensation Corporation (ACC) Sports Claims Overview (2019) suggesting the highest proportion of claims (over 60,000) were made by the teenage cohort (15–19 years) during 2018/2019 (ACC, 2019). Based on the ACC data, injury prevention in youth sport is an important issue worth understanding further. Injury prevention for youth and adolescent-aged sport participants is important as they are more susceptible to serious musculoskeletal injuries (Iversen & Friden, 2009; Orr et al., 2013; Wild et al., 2013; Sabato et al., 2016). The most common injuries reported to ACC are soft tissue sprains of several body sites, including: the neck, shoulder and/or upper arm, knee and/or leg, and ankle (ACC, 2021a). These injuries can lead to significant long-term consequences, including decreased participation and/or drop out from sports, risk of re-injury, and further issues at the site of injury (Cain et al., 2006; Frisch et al., 2009; Neuman et al., 2009; Orr et al., 2013; Emery et al., 2015). Additionally, the high number of claims have resulted in high treatment costs to ACC. Annually, the overall cost to ACC based on an average 448,000 sport-related claims is over \$570 million (2021a), while the injury costs of all active claims in 2021 alone is over \$520 million (ACC, 2021b). Targeting children and adolescents is important as they can absorb key messages for sport injury prevention more efficiently and long-term (Koester, 2001; Cain et al., 2008). Therefore, implementing effective injury prevention strategies to reduce injuries and injury-related costs in youth sport is key.

In terms of injury prevention in youth sport, one sport of particular interest is basketball. The ACC database of Sport and Recreation Injury Statistics shows a high rate of injury claims in basketball as a team sport, with a regional breakdown reporting the highest claims within the Auckland region (ACC, n.d.-b). Additionally, data from the NZ Secondary Schools Sports Council Census (2020) shows basketball is one of the fastest growing youth team sports in the country (School Sport NZ, 2021). Greater emphasis is clearly required for youth-aged basketball players in Auckland, considering the high risk of common lower extremity injuries in youth basketball, including ankle sprains and knee ligament tears (Iversen & Friden, 2009; Pasanen et al., 2017; Owoeye et al., 2018; Räsänen et al., 2021). There is limited research regarding youth basketball injury prevention (DiFiori et al., 2018) as most research has focused on netball and football in America and Europe, with only a small number

of studies involving high school basketball players (Koutures & Gregory, 2010). One strategy reported to help reduce injuries in youth sport is neuromuscular (NM) training (McGuine et al., 2006; Soligard et al., 2008; Kiani et al., 2010; Hägglund et al., 2013). It is believed that physical preparation of youth sport participants should be specific and while there is inherent risk of injury in team sports, there is evidence that NM warm-up programmes can effectively reduce sport-related injuries (Gamble, 2008; Sabato et al., 2016; Fulcher et al., 2018). In recent years, ACC have developed and promoted the ACC SportSmart warm-up (<https://www.accsportsmart.co.nz/>), a NM warm-up based on the FIFA 11+ warm-up which was developed 15 years ago to help reduce injuries among football players (Soligard et al., 2008; Bizzini et al., 2013; Bizzini & Dvorak, 2015; Sadigursky et al., 2017; Fulcher et al., 2018; King et al., 2019). The SportSmart programme aims to reduce injuries and injury-related costs, and enhance performance of participants in sport and recreation in NZ (McNoe et al., 2010; Fulcher et al., 2018; Cochrane, 2020). Through the collaborative efforts of ACC, National Sports Organisations and Sport NZ, the SportSmart warm-up has been specifically adapted for players, coaches, and referees to adopt across five major sport codes, including: NZ Football (Fit4Football), Netball NZ (NetballSmart), Touch NZ (TouchFit 360), NZ Rugby (RugbySmart), and NZ Rugby League (LeagueSmart) (McNoe & Chalmers, 2011; Fulcher et al., 2018). There is limited research in the context of youth sport and in NZ regarding the effectiveness of these programmes. However, an international study in youth football reported a 41% reduction in the overall rate of injuries and a 48% reduction in all lower extremity injuries following the implementation of the FIFA 11+ warm-up (Owoeye et al., 2014). With improved coach education and facilitation of effective injury prevention programmes, this evidence suggests youth basketball players in NZ would benefit from using the ACC SportSmart warm-up and/or a basketball-specific version.

Coaches play a key role in facilitating injury prevention initiatives in youth sport and as the field of youth sport injury prevention develops, appropriate coach education for effective delivery of suitable sport injury prevention strategies is key (Gianotti et al., 2010). The impact of coaches on the magnitude of player adherence to sport injury prevention initiatives remains unclear (McKay et al., 2014); however, it is commonly thought by sport organisations, team staff, team players, and parents that adherence to effective initiatives is greater if coaches are actively implementing relevant strategies into their training sessions (Keats et al., 2012; Lindblom et al., 2014). Coach behaviours, values, and priorities are paramount for creating positive environments and experiences for youth sport participants; thus, educating coaches regarding safer strategies to prevent injuries and manage the risk of injuries is imperative (McKay et al., 2014).

A key for successful injury prevention is coach knowledge of, and positive attitudes towards, adopting sport injury prevention strategies. McKay et al. (2014) conducted a cluster-randomised controlled trial using female youth soccer coaches (n=29) and players (13–18 years, n=158) to understand their knowledge, attitudes, and beliefs regarding adherence to the FIFA 11+ warm-up programme. Despite coaches understanding an adequate warm up would help reduce injury risk, there was no increase in delivering this programme that can successfully reduce injuries in football. Additionally, a number of cross-sectional studies have been conducted in similar contexts. A study investigating coach (n=117) and player (n=226) attitudes to injury in NZ secondary school netball, football, and basketball found a lack of knowledge, the desire to win, and not wanting to let the team down influences coach and player attitudes to injury prevention (Whatman et al., 2018). Furthermore, coaches of youth football and basketball coaches (n=141) require further education to increase awareness of effective injury prevention programmes, including the FIFA 11+ warm-up (Norcross et al., 2016). These findings are similar to those previously reported among youth basketball coaches (n=50) who require improved coach education regarding effective implementation of NM warm-up programmes and knowledge translation of injury prevention-related information (Räisänen et al., 2021).

Based on the literature, it is evident youth sport injuries are a growing concern and while effective prevention programmes exist to reduce risk, adherence in the real-world setting is a problem. A key driver of uptake is the knowledge, attitudes, and behaviour of coaches in youth sport. Therefore, this research study will focus on coach knowledge and attitudes towards sport injury prevention in NZ secondary school basketball.

Structure of the Dissertation

In accordance with the Auckland University of Technology's Format Two, this dissertation contains an introduction/rationale of the overall dissertation, a literature review, and one chapter (Chapter 3) has been formatted to be suitable for journal publication. The chapter is presented as it has been submitted to, or formatted for, the target journal, and as such, the repetition of some information occurs. Each chapter in the dissertation begins with a prelude which helps form the sequential progression and cohesion of the dissertation as a whole. Lastly, the dissertation concludes with a general discussion integrating findings from the preceding chapters, while also outlining the practical implications of this research, study limitations, and directions for future research. The referencing format has been standardised to the American Psychological Association 7th Edition, with a single reference list prepared for the dissertation.

Purpose of the Dissertation

This dissertation had four primary questions:

1. What knowledge do coaches have of common injuries and injury prevention in youth basketball? Specifically, are coaches aware of the ACC SportSmart warm-up?
2. What are the barriers to coaches implementing injury prevention programmes?
3. What are coach attitudes towards injury prevention programmes?
4. Does coach knowledge and attitude differ based on experience?

Chapter 2 is a narrative review of the current literature surrounding the state of coach knowledge and attitudes regarding injuries and injury prevention in youth sport. Chapter 3 is a cross-sectional study investigating youth basketball coaches' knowledge of common sport-related injuries, associated risk factors, and injury prevention programmes, and their attitude towards sport injury prevention and implementing NM warm-up programmes. Finally, Chapter 4 is a discussion/conclusion on the key findings of the overall dissertation, including any limitations and practical applications/recommendations for future research.

Prelude to Chapter 2

A narrative literature review was conducted to examine the current state of injury-related knowledge and attitudes of coaches in youth sport. During the search for relevant evidence, it became clear studies had been conducted in two main injury contexts: concussion and general musculoskeletal injuries.

Chapter 2: Coach Knowledge and Attitudes Towards Injuries and Injury Prevention in Youth Sport: A Narrative Review

Introduction

The purpose of this chapter is to provide a narrative review, critiquing the evidence for coach knowledge and attitudes to injuries and injury prevention in youth sport. The chapter is divided into three main sections. The first section focuses on coach knowledge of common sport-related injuries and injury prevention strategies in youth sport. The second section focuses on coach attitudes towards prevention of common sport-related injuries in youth sport. The final section of this review focuses on the specific NM warm-up programmes coaches are utilising in youth sport, including the barriers and facilitators to coaches utilising the identified programmes.

A literature search was conducted in March 2021 using the AUT Library, AUT Google Scholar, and EBSCOhost databases. Search terms that were used included: coach, knowledge, attitude, youth, sport injury, and injury prevention. The search was limited to English language studies published in peer reviewed journals between January 2000–May 2021. This search identified 22 studies suitable to be included in the review and 4 additional studies were identified from the reference lists of these studies.

When examining the studies identified for this review, it became clear the studies had been conducted in two main injury contexts: concussion and general musculoskeletal injuries. Thus, the evidence in the main sections of this review are summarised in these two injury contexts.

Coach Knowledge of Common Sport-Related Injuries and Injury Prevention Strategies in Youth Sport

Concussion injury and prevention

It is important to understand coach knowledge of concussions in youth sport as concussions are a growing concern among youth-aged sport participants (Kirkwood et al., 2006). This is due to an increasing rate of concussion injuries among youth athletes (Kirkwood et al., 2006; Hunt et al., 2018; Kerr et al., 2020), their vulnerability to the effects of concussions, and the negative impacts a concussion has on their developing brains (McCrory et al., 2017; Black et al., 2020). Globally, coach knowledge of concussions in youth sport is mostly good, depending on the sport, coaching experience, and level of competition. Coaches of youth sports, including: ice hockey in Canada, American football and football in America; and rugby in NZ all report a good level of concussion knowledge (Mrazik et al., 2011; Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020). In contrast, youth hockey

coaches in Canada reported poor overall concussion knowledge, despite some coaches having more knowledge stemming from their own concussion history (Hunt et al., 2018).

There are several factors influencing the level of coach concussion knowledge. Studies reporting a good level of coach knowledge included education programmes within their sport system to help improve concussion knowledge (Kerr et al., 2020; Salmon et al., 2020). Some studies emphasise a positive correlation between coach knowledge and attitude, while the coaches in these studies appreciate the seriousness of concussions and have greater coaching experience (Mrazik et al., 2011; Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020). Poor levels of coach knowledge about concussions were influenced by less education, coaching experience, and a lack of motivation to improve overall concussion knowledge; therefore, suggesting a link to the coaches' attitudes (Hunt et al., 2018).

Coaches in youth sport display varying levels of knowledge regarding the seriousness and prevalence of concussions among youth sport participants, but display limited knowledge in the area of concussion symptomology (Kirkwood et al., 2006; Hunt et al., 2018; Kerr et al., 2020). Coaches of youth rugby in NZ have a good understanding of concussions and a higher level of knowledge regarding concussion symptoms (Salmon et al., 2020). In contrast, coaches of youth ice hockey, American football, and football in America demonstrate poor levels of knowledge regarding concussion symptomology (Mrazik et al., 2011; Hunt et al., 2018; Kerr et al., 2020; Sungwon et al., 2020).

Coach knowledge of injury prevention strategies in youth sport, including NM training and protective equipment to reduce the severity of a concussion, has been shown to have an important influence on injury risk (Fu & Stone, 1994; Sabato et al., 2016). Youth hockey coaches in Canada reported an average level of knowledge regarding mouthguards as protective gear in preventing concussions (Mrazik et al., 2011; Hunt et al., 2018). Similarly, coaches of youth football in America reported an average level of knowledge regarding concussion risk management practices, including adequate reporting intentions by players and utilising protective headgear (Sungwon et al., 2020). Coaches of youth American football and rugby also displayed poor levels of knowledge about specific concussion injury prevention strategies, and authors emphasise the importance of improving coach education about concussion prevention and return-to-play practices (Kerr et al., 2020; Salmon et al., 2020). Coaches of youth rugby players require more knowledge about concussions, specifically in female players who have a higher risk of sustaining this injury (Salmon et al., 2020).

Musculoskeletal injuries and prevention

Coaches should be knowledgeable about common and serious musculoskeletal injuries among youth sport participants, given their influence to reduce the risk of injury (White et al., 2012; Croix et al., 2020). Specifically, knowledge of serious lower extremity injuries, such as knee anterior cruciate ligament (ACL) tears and ankle sprains which are highly prevalent injuries among young players, is needed (Iversen & Friden, 2009; Orr et al., 2013; Sabato et al., 2016). These injuries can have long-term effects, including ongoing problems at the site of injury and restrictions in the type of physical activity they may participate in (Neuman et al., 2009; Orr et al., 2013). Internationally, most youth sport coaches have a good level of knowledge regarding musculoskeletal injuries, such as soft tissue and bone injuries. Youth sport coaches of basketball in America, indoor football in Canada, and football in Australia all reported good knowledge of knee injuries (Iversen & Friden, 2009; Orr et al., 2013; Donaldson et al., 2018). Coaches identified ACL tears as common among female youth players and were able to attribute this to poor landing technique and unsuccessful implementation of a NM warm-up programme (Iversen & Friden, 2009; Orr et al., 2013; Donaldson et al., 2018). Similarly, youth football coaches in Canada reported good knowledge about knee and ankle injuries (McKay et al., 2014). Coaches of youth rugby in Australia had a better understanding of injuries to the upper extremity than the lower extremity, identifying shoulder injuries as more common due to poor tackle and collision technique (Carter & Muller, 2008).

Coaches in female youth sport need specific understanding of ACL injury risk as young female players have an increased risk of ACL tears compared to male players due to factors such as biomechanical, anatomical, and hormonal differences (Huston et al., 2000; Iversen & Friden, 2009). Coaches of youth female basketball in America, and football in Canada and Australia have a good understanding of ACL injury risk in relation to landing, jumping, and cutting movements (Iversen & Friden, 2009; Orr et al., 2013; McKay et al., 2014; Donaldson et al., 2018). However, some coaches display limited knowledge regarding ACL-specific injury risk management practices (Iversen & Friden, 2009; Orr et al., 2013). In terms of other ligament and soft tissue injuries more generally, coaches of male youth rugby players in Australia report a similar gap in the knowledge of specific mechanisms of injury and procedures for early management of minor and major injuries (Carter & Muller, 2008). The level of knowledge in this area is poor, suggesting specific coaching courses need to be developed to educate less experienced coaches about common soft tissue injuries and prevention.

Coaches play an essential role in facilitating injury prevention strategies, while encouraging participants to effectively adopt them (Gianotti et al., 2010; White et al., 2012; Croix et al., 2020; Shamlaye et al., 2020). The level of coach knowledge of musculoskeletal-related injury prevention strategies is average in youth sport, which is mostly dependent on coaching experience and education about injury prevention strategies, as coaches often do not receive information about injuries and injury prevention. A common suggestion for better coach education is to improve knowledge translation via more effective and informative online and physical resources (Iversen & Friden, 2009; Orr et al., 2013; Salmon et al., 2020; Sungwon et al., 2020). Other suggestions include more development of effective sport injury prevention courses, and greater motivation for coaches to utilise resources currently provided to them by schools and sport organisations (Mrazik et al., 2011; Hunt et al., 2018; Kerr et al., 2020). Coaches of female youth basketball and football have an average understanding of knee injury prevention strategies, demonstrated by the NM techniques they could identify, including stretching and an adequate NM warm-up (Iversen & Friden, 2009; Orr et al., 2013). Coaches of youth basketball were more successful at identifying injury prevention strategies after participating in an ACL injury prevention intervention for coaches and receiving a range of physical information resources (Iversen & Friden, 2009). Coaches of youth rugby in Australia have less understanding of shoulder injury prevention strategies compared to coaches of female youth basketball and football (Carter & Muller, 2008; Iversen & Friden, 2009; Orr et al., 2013). Coaches of female youth football in Canada and Australia show a poor level of knowledge regarding specific knee and ankle injury prevention strategies; however, coaches could identify inadequate warm-up as a key risk factor for soft tissue injuries, while specifically acknowledging the FIFA 11+ warm-up to be an effective injury prevention programme (McKay et al., 2014; Donaldson et al., 2018).

A limitation of these studies is the predominant focus on youth sport internationally as few studies were conducted in NZ (Salmon et al., 2020) and in the context of youth basketball (Iversen & Friden, 2009). As a result, evaluating the current state of coach knowledge of injuries and injury prevention strategies in NZ youth basketball is difficult. Another limitation is the limited investigation of female coaches of female and/or male players. Gender imbalance within a sample size is a limitation as primary focus on males misrepresents the coaching population and can make the findings of studies less applicable to other contexts (Dickinson et al., 2012). Additionally, several of the studies reviewed have small sample sizes and this further limits the generalizability of findings to the wider population of coaches (Dickinson et al., 2012). Lastly, there were more studies investigating knowledge of concussion than musculoskeletal injuries. This limits the application of these findings in sports like basketball where knee and ankle injuries are common, and concussion is less of an issue (Baugh et al., 2014; Zuckerman et al., 2016).

Section summary

Most of the evidence for coach knowledge of injury and injury prevention in youth sport comes from studies of concussion, with less known about knowledge of other musculoskeletal injuries. Coach knowledge of common sport-related injuries and injury prevention strategies is largely influenced by greater coaching experience, positive attitudes, and effective translation of, and access to, injury-related information. Higher levels of knowledge were reported among coaches who had more coaching experience, and a more positive attitude towards increasing their knowledge about injuries and injury prevention in youth sport. Additionally, most coaches who did have a good understanding of concussion and musculoskeletal injuries and injury prevention strategies had been previously educated through relevant programmes and had received resources about sport injury-related information. In contrast, some coaches displayed poorer levels of knowledge regarding injury risk and injury prevention strategies due to having less coaching experience and not receiving some form of sport injury-related education. It is important to increase coach knowledge of concussion symptomology and ACL-specific injury prevention for knee injuries among female youth players as there is a gap in these specific areas. Many studies suggest improving coach education and knowledge translation of sport-related injuries, injury risk management, and injury prevention information to help increase coach knowledge in youth sport. Finally, the level of coach knowledge in youth sport was significantly influenced by the coaches' attitudes towards sport injury prevention.

Coach Attitudes Towards Prevention of Common Sport-Related Injuries in Youth Sport

Concussion prevention

Multiple studies report positive attitudes towards concussion among coaches of high-risk contact sports (Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020). Coaches of youth sports, including: male American football, female football in America, and rugby in NZ all report positive attitudes towards concussion prevention (Kerr et al., 2020; Sungwon et al., 2020; Salmon et al., 2020). Specifically, a correlation has been reported between coaches' positive attitudes, coaching experience, and education. Coaches with greater coaching experience and some education understand the seriousness of a concussion among youth players of high-risk contact sports better, are more aware of concussion prevention strategies, and have safer intentions to report a concussion than less experienced and educated coaches (Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020). As a result, coaches were more likely adopt recommended risk management practices and create safer environments for their players to want to report concussions as they feel this is an effective way to help reduce concussion injuries (Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020).

These studies suggest that more coach education regarding concussion diagnosis, treatment, and prevention should be developed to increase coaches' awareness of recommended programmes to reduce concussion in youth sport (Kerr et al., 2020). Effectively, greater coach education and awareness of concussion prevention strategies will help improve coaches' attitudes towards concussion prevention (Kerr et al., 2020; Sungwon et al., 2020). Educational resources should be designed to better inform coaches and players about the importance of reporting a concussion due to the growing concern and serious impact a concussion can have long-term on youth sport participants, including details as to how concussion differ in female players (Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020).

Musculoskeletal-related injury prevention

Specific types of injury prevention programmes have been commonly adopted by coaches in youth sport to help reduce the risk of common upper and lower extremity injuries. Coaches of youth football in Canada, NZ, and Norway report positive attitudes towards using a NM warm-up programme, including the FIFA 11+ warm-up (Soligard et al., 2010; Mawson et al., 2018; Shamlaye et al., 2020). Similarly, coaches of youth camogie in Ireland and youth basketball in Canada also report positive attitudes towards NM warm-up programmes as they believe implementing this strategy with their teams is effective in preventing injuries (O'Connor & Lacey, 2020; Räsänen et al., 2021). Coaches of female youth basketball in Canada, who reported a good level of knowledge regarding knee injuries, also have a positive attitude towards ACL-specific injury prevention strategies, considering them effective in reducing knee injuries (Iversen & Friden, 2009). Similarly, coaches of youth rugby in South Africa were highly aware of injury risk to the shoulder and believe that injuries sustained due to improper tackle technique were preventable, and thus, had a positive attitude towards using a shoulder-specific injury prevention programme with their teams (Hendricks & Sarembock, 2013; Hendricks et al., 2017).

Many factors contribute to coaches developing a positive attitude towards facilitating injury prevention strategies with their teams. Studies report that most coaches with greater coaching experience and those who had completed an injury prevention-based course were more likely to adopt recommended programmes (Iversen & Friden, 2009; Hendricks & Sarembock, 2013; Mawson et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020). Coaches also believed they would feel more confident to facilitate injury prevention strategies with their teams if they were more knowledgeable about injuries, aware of recommended programmes, and were educated about how to correctly facilitate programmes (Iversen & Friden, 2009; Soligard et al., 2010; Mawson et al., 2018; Räsänen et al., 2021). Additionally, some studies suggest targeting the less experienced coaches to increase awareness and promote the performance enhancing effects of injury prevention

programmes, such as the FIFA 11+ warm-up and other NM techniques (Iversen & Friden, 2009; Soligard 2010; Mawson et al., 2018; Räsänen et al., 2021).

Some studies report negative attitudes towards sport injury prevention among coaches of youth sports, including: football in Canada, America and Europe; and female and male football and basketball in America (McKay et al., 2014; Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). Many of the coaches in these groups report not using injury prevention programmes with their teams, as they do not believe there is much advantage to adopting injury prevention programmes (Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). Specifically, coaches of youth football in America believe a NM warm-up programme can prevent muscle injuries more generally, but are not effective in reducing knee and ankle injuries (McKay et al., 2014).

There are several factors influencing coaches' negative attitudes towards injury prevention in youth sport. Coaches of youth football and basketball, who did not believe implementing injury prevention programmes were effective in reducing injuries, also lacked awareness of recommended programmes, such as lower extremity-specific injury prevention programmes and the FIFA 11+ warm-up (Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). Additionally, coaches' decisions to adopt recommended programmes were also influenced by their limited knowledge of injury prevention strategies generally, lack of confidence to facilitate strategies with their teams, and time constraints (Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). A lack of coaching experience and qualifications among youth female football coaches in America also negatively impacted attitudes, despite having good knowledge regarding common lower extremity injuries among their players and understanding the serious long-term effects of an ACL injury (McKay et al., 2014).

To promote a better attitude towards injury prevention in youth sport, it is suggested sport organisations improve coach education to help increase coach awareness and adoption of effective injury prevention programmes (McKay et al., 2014; Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). Specifically, practical workshops and other informative resources should become more accessible to coaches, including various types of strategies that can be modified to suit the constraints of time and exercise specificity (Mawson et al., 2018; Shamlaye et al., 2020).

Some studies identified in this theme are also limited by the studies context, gender imbalance, and sample size, as identified in the previous theme (Norcross et al., 2016; Shamlaye et al., 2020; Räsänen et al., 2021).

Section summary

Overall, the evidence shows coach attitudes towards sport injury prevention in youth sport are mostly positive, although some coaches still display a negative attitude. There is also more evidence regarding coaches' attitudes towards musculoskeletal-related injury prevention than concussion prevention. Positive attitudes were reported among coaches who had a greater level of injury knowledge, coaching experience, education, and awareness of injury prevention strategies. As a result, these experienced and better educated coaches were more likely to adopt and implement recommended injury prevention strategies with their teams. Coaches with lower levels of injury knowledge, coaching experiences, education, and awareness of injury prevention strategies reported more negative attitudes, and were less likely to adopt and implement recommended strategies. Coaches of high-risk contact sports have a positive attitude towards concussion prevention, as they understand the serious impact a concussion has on youth-aged sport participants. Similarly, coaches of sports where knee and ankle injuries are common also report positive attitudes towards implementing a NM warm-up to help reduce these injuries. In contrast, some coaches with minimal coaching experience and qualifications, and limited knowledge of effective injury prevention strategies had a negative attitude towards injury prevention, and thus, adopting injury prevention programmes was less likely. Many studies suggest that sport organisations should improve coach education regarding injury prevention to help increase coaches' injury-related knowledge, programme awareness, and confidence as key facilitators of injury prevention in youth sport.

The Injury Prevention Strategies Utilised by Coaches in Youth Sport

NM warm-up programmes

A NM warm-up is considered essential for preparing the body for training or competition by increasing body temperature and activating the NM system (Bishop, 2003; Räsänen et al., 2021). A NM warm-up is a key injury prevention strategy and typically includes components of aerobic activity, such as jogging, dynamic stretching, strength, balance, and agility (Hübscher et al., 2010; Brunner et al., 2019). Past studies have shown adopting a NM warm-up can improve long-term athletic performance (Faude et al., 2017; Hanlon et al., 2020), improve landing and change of direction techniques (Weir et al., 2019; Räsänen et al., 2021), and reduce the risk of injury (Lauersen et al., 2014; Emery et al., 2015; Brunner et al., 2019; Räsänen et al., 2021).

There is evidence of coaches in youth sport using a range of sport-specific and injury-specific warm-up programmes. Many studies report coaches of youth football in Canada, Australia, Norway, and NZ specifically use the FIFA 11+ warm-up programme designed to reduce the risk of injury in football (Soligard et al., 2010; McKay et al., 2014; Donaldson et al., 2018; Mawson et al., 2018; Shamlaye et

al., 2020). Similarly, coaches of female and male youth basketball players in America and Canada have been reported to use a NM warm-up, although a specific programme was not identified (Munoz-Plaza et al., 2021; Räisänen et al., 2021). Coaches of youth rugby in South Africa use a warm-up called the BokSmart Safe Six Injury Prevention Programme, specifically designed for rugby which includes exercises focused on proper tackle technique (Sewry et al., 2017). A sport-specific programme is also used by coaches of youth female camogie in Ireland called the Camogie Injury Prevention Programme replicating a NM warm-up (O'Connor & Lacey, 2020).

As well as these sport-specific warm-ups, coaches have been shown to use injury specific-programmes designed to prevent common musculoskeletal injuries, including ACL tears, ankle sprains, and shoulder injuries. Coaches of female youth basketball in America participated in an ACL injury-specific workshop to educate coaches about the benefits of using a NM warm-up, stretching exercises, and two-footed landing techniques (Iversen & Friden, 2009). Similarly, coaches of female youth netball use the Down2Earth programme, a netball-specific warm-up designed to improve landing technique and reduce lower extremity injuries (Saunders et al., 2010). Furthermore, coaches of female youth football in Sweden and youth handball in Denmark used a programme called Knee Control, this was again developed to help prevent ACL injuries (Lindholm et al., 2018; Møller et al., 2021). A shoulder injury-specific programme was also used by coaches of youth handball (Møller et al., 2021). Youth female football coaches in America understand the risk of lower extremity injuries and the importance of implementing lower extremity injury prevention programmes; however, no specific programme was identified (Joy et al., 2013; Morgan et al., 2018).

Key barriers and facilitators

In implementing a NM warm-up and participating in injury-specific prevention workshops, studies show there are several key barriers to coaches adopting injury prevention programmes. Most studies identified that time constraints and a lack of space to implement programmes are major barriers for coaches of youth netball, football, handball, basketball, and camogie (Saunders et al., 2010; Soligard et al., 2010; Joy et al., 2013; Donaldson et al., 2018; Morgan et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020; Munoz-Plaza et al., 2021; Møller et al., 2021; Räisänen et al., 2021). Additionally, coaches of youth football, basketball, and handball are less likely to adopt a NM warm-up programme based on how difficult certain exercises are to demonstrate, how difficult players find performing the exercises, and how specific the exercises are to the required movements of the sport (Saunders et al., 2010; Soligard et al., 2010; Møller et al., 2021; Räisänen et al., 2021). Another barrier for coaches in youth sport is poor access to available injury prevention resources. Coaches of youth sports, including: football, basketball, rugby, and handball are less likely to practically facilitate programmes with their teams due to a lack of awareness of successful programmes, and inadequate understanding of

programme efficacy regarding performance enhancement and injury reduction (Soligard et al., 2010; Joy et al., 2013; McKay et al., 2014; Sewry et al., 2017; Donaldson et al., 2018; Lindblom et al., 2018; Mawson et al., 2018; Morgan et al., 2018; Shamlaye et al., 2020; Møller et al., 2021; Munoz-Plaza et al., 2021). It is suggested that informative resources and practical workshops regarding injury prevention programmes need to become more accessible to coaches through their relevant sport organisations to help improve awareness, and increase coaches' confidence and motivation to implement programmes with their teams more frequently (Soligard et al., 2010; Donaldson et al., 2018; Lindblom et al., 2018; Mawson et al., 2018; Morgan et al., 2018; Shamlaye et al., 2020; Møller et al., 2021).

There are also several key facilitators to coaches using injury prevention programmes with their teams. Time is an important facilitator for coaches of female and male youth football in Canada as they are more likely to implement a NM warm-up in a training session if it is not too time consuming (Mawson et al., 2018). Coaches of youth football and basketball were also more likely to implement a NM warm-up with their teams based on higher levels of coaching experience, experience with injured players, and previous use of an injury prevention programme (Soligard et al., 2010; Morgan et al., 2018; Munoz-Plaza et al., 2021). Additionally, coaches of youth football, handball, and camogie are more likely to use injury prevention programmes if they have adequate access to informative resources as this helps to enhance awareness of effective programmes (Soligard et al., 2010; Joy et al., 2013; Lindbolm et al., 2018; Mawson et al., 2018; Morgan et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020; Møller et al., 2021). Coaches of female youth sports, including: netball in Australia; and football, basketball, and volleyball in America were more likely to adopt a NM warm-up programme based on its proven ability to enhance performance (Saunders et al., 2010; Joy et al., 2013; Sugimoto et al., 2017). Some coaches of youth football and netball are encouraged to use a programme if they can modify exercises to suit the coaching environment and player ability; thus, minimising boredom and enhancing long-term engagement (Saunders et al., 2010; Lindbolm et al., 2018). Some studies suggest that coaches who modify such programmes should consider the negative affects modifications can have on their players if the recommended programmes are not implemented as designed, depending on the sport and level of competition (Saunders et al., 2010; O'Brien & Finch, 2016; O'Brien et al., 2017; Lindbolm et al., 2018; Morgan et al., 2018; Møller et al., 2021).

The limitations regarding study context, gender imbalance, and sample size remain prevalent among the studies identified in this theme. Overall, future research is needed to better understand the gaps in male and female coach knowledge and attitudes of common injuries and injury prevention strategies in NZ youth basketball.

Section summary

It is evident that NM warm-up programmes are adopted by coaches more commonly compared to other injury prevention strategies in youth sport. Many studies have reported that coaches are using a range of sport-specific and injury-specific NM warm-up programmes with their teams to help enhance performance, and reduce the risk of common upper and lower extremity injuries. Specifically, it is most commonly reported that coaches of youth football use the FIFA 11+ warm-up programme, while other football and some basketball coaches use non-specific NM warm-up programmes. Additionally, other coaches in youth sport, including: football, basketball, netball, handball, rugby, and camogie utilise NM warm-up programmes that are specifically designed to prevent common injuries of the shoulder, knee, and ankle among their players. It has also been reported that coaches of basketball and netball participated in educational workshops regarding programmes that are designed to improve landing technique, and prevent ACL tears and ankle sprains. While many coaches believe these programmes are effective to use, it is clear that coaches also experience several barriers and facilitators to using these programmes frequently or as designed with their teams. These include: the time and space to facilitate an adequate warm-up; coaching experience and education; awareness and knowledge of successful programmes; and access to informative injury prevention resources.

Prelude to Chapter 3

The literature review in chapter 2 highlighted the lack of literature focusing on injury-related knowledge and attitudes in the context of youth basketball coaches, and specifically in NZ. Key findings from the review identified coaches' level of knowledge about common sport-related injuries and risk factors, and attitudes towards sport injury prevention programmes in youth sport is variable by sport code, experience, and level of competition. However, most evidence is reported in youth football, rugby, and hockey. Therefore, more evidence focusing on youth basketball coaches and their level of injury-related knowledge and attitudes is needed.

Thus, chapter 3 reports on a cross-sectional study using a mixed methods approach, conducted to examine the current state of coach knowledge and attitudes towards sport injury prevention in NZ secondary school basketball. This study design allows data to be collected at a single time point from a sample of youth basketball coaches within one region which can potentially be generalised to a larger population of youth basketball coaches throughout NZ (Levin, 2006; Setia, 2016). Key strengths of this study design include time and cost-efficient nature of data collection, and minimal ethical threat; however, key weaknesses include a potentially low survey response rate and only capturing data at a single time point rather than over an extended period (Levin, 2006; Setia, 2016; Wang & Cheng, 2020). A mixed methods approach is used for this study as integrating quantitative numerical data and qualitative survey responses is needed to help strengthen the study's findings, and provide the best understanding of coach knowledge and attitudes (Giddings & Grant, 2006; Zhang & Creswell, 2013; McCusker & Gunaydin, 2015).

Chapter 3: Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball: A Cross-Sectional Study

Overview

The aim of this study was to examine youth basketball coaches' knowledge and attitudes to injury and injury prevention, and specifically, the use of neuromuscular (NM) warm-up programmes. Coaches (n=36, female=10) in New Zealand (NZ) secondary school basketball completed a survey designed to understand their knowledge of, and attitude towards, injuries and injury prevention. Coach experience and injury (management and prevention) qualifications were also elicited. General knowledge of injuries and prevention was good, but coaches lacked knowledge of head/face-related injuries and associated injury risk factors. Most coaches had a positive attitude towards NM warm-up programmes; however, constraints of time and space are major barriers to implementation. Half of coaches had witnessed coaches putting pressure on injured players to continue and many (72%) had seen injured players play on. A greater proportion of more experienced coaches, compared to less experienced, had a better understanding of injuries/injury risk factors (difference in proportions=25% [95% CI = -4 to 50]; p=0.09), prevention programmes (difference in proportions=29% [95% CI = -3 to 54]; p=0.08), and adequate access to resources (difference in proportions=29% [95% CI = -3 to 54]; p=0.08), although these differences were not statistically significant. These findings suggest the need to improve coach education regarding common basketball-related injuries, injury risk factors and effective NM warm-up programmes, with greater focus on less experienced coaches. Pressure on injured youth playing sport and the barriers to coaches implementing a NM warm-up should be explored further. More research is needed in the context of youth basketball, including the key factors influencing coaches' level of knowledge of, and attitude towards, injuries and injury prevention.

Introduction

The number of participants in youth sports has increased significantly across several sport codes in recent years (Cain, 2010; Sabato et al., 2016). While there are many acknowledged benefits to sport participation, studies show adolescent-aged participants are more susceptible to injury due to a variety of growth-related factors (Wild et al., 2013; Sabato et al., 2016). As a result, there is a positive correlation between sport participation and physical injury risk among youth sport participants aged 14 to 18 years (Sabato et al., 2016). Many NZ youth participate in various sport and recreational activities (Sport NZ, 2020), and sport-related injuries are commonly reported. The Accident Compensation Corporation (ACC) sports claims data (2019) shows participants aged 15 to 19 years contributed the highest proportion of claims made in 2018/2019 (ACC, 2019). Specifically, basketball has become one of the most popular youth team sports in NZ (School Sport NZ, 2021) and

internationally for participants aged 12 to 17 years (DiFiori et al., 2018; Gryko et al., 2019; Owoeye et al., 2020; Post et al., 2021). This has led to concerns regarding injury risk among youth basketball players (Pasanen et al., 2017; Räsänen et al., 2021).

Previous studies have established there is a high risk of lower extremity injuries in basketball due to the frequent landing, jumping, and cutting movements (Iversen & Friden, 2009; Owoeye et al., 2018). As a result, ankle sprains and knee ligament injuries are common in youth basketball (Pasanen et al., 2017; Owoeye et al., 2018; Räsänen et al., 2021). These injuries can have significant long-term effects, including ongoing ankle and knee issues, and decreased participation in sport and other recreational activities (Neuman et al., 2009; Orr et al., 2013). To date, there is little research in the context of youth basketball injury prevention (DiFiori et al., 2018) and no previous research in NZ. Past studies primarily focus on injuries and injury prevention among youth football and netball players in Europe and America (Koutures & Gregory, 2010). Further research is needed to investigate effective injury prevention implementation in youth basketball and specifically in the NZ context.

Coaches play an essential role in facilitating effective injury prevention strategies in youth sport (Gianotti et al., 2010; White et al., 2012; Croix et al., 2020), including neuromuscular (NM) warm-up programmes (Norcross et al., 2016; Lindblom et al., 2018; Räsänen et al., 2021). A NM warm-up normally includes components of aerobic activity, such as jogging, dynamic stretching, balance, agility, and strength (Hübscher et al., 2010; Brunner et al., 2019). These warm-up programmes have been successfully shown to prevent injuries in sport and improve long-term athletic performance (Gamble, 2008; Sabato et al., 2016; Faude et al., 2017; Fulcher et al., 2018; Hanlon et al., 2020). Specific evidence from youth sport shows a NM warm-up can reduce acute lower extremity injuries by up to 60% (Owoeye et al., 2018). While there is some suggestion the athlete is responsible for their own adherence to injury prevention strategies (Steffen et al., 2013; McKay et al., 2014), coaches can influence adherence as they are often responsible for whether or not NM warm-ups are included in training sessions (Fu & Stone, 1994; Iversen & Friden, 2009; Kerr et al., 2020). Therefore, youth basketball coaches need to be knowledgeable about, and encouraged to adopt, NM warm-up programmes to help prevent common lower extremity injuries (Iversen & Friden, 2009; Sabato et al., 2016; Croix et al., 2020).

To date, one of the most adopted NM warm-up programmes in sport is the FIFA 11+ warm-up designed to help reduce injuries in football (Soligard et al., 2010; McKay et al., 2014; Donaldson et al., 2018; Mawson et al., 2018; Shamlaye et al., 2020). Since its development in 2006 (Bizzini et al., 2013; Sadigursky et al., 2017), the FIFA 11+ warm-up has been adapted for players, coaches, and referees to adopt across various sport codes. Specifically, ACC have adapted the ACC SportSmart warm-up

programme to help reduce injuries and improve athletic performance in NZ sport and recreation (McNoe et al., 2010; Fulcher et al., 2018; Cochrane, 2020). There are currently five National Sports Organisations in NZ that have aligned with ACC to develop a sport-specific warm-up, including: Rugby NZ (<https://www.rugbysmart.co.nz/>), Touch NZ (www.touchnz.co.nz/Our-Programmes/TouchFit-360/), NZ Netball (<https://www.netballsmart.co.nz/>), NZ Football (<https://fit4football.co.nz/>), and NZ Rugby League (<https://nzrl.co.nz/leaguesmart/>) (McNoe & Chalmers, 2011; Fulcher et al., 2018). Despite the concerning high risk of injury and growing participant numbers in youth basketball, there is no evidence of a basketball-specific version adapted by Basketball NZ (BBNZ). This suggests youth basketball players would likely benefit from education about, and encouragement to use, the ACC SportSmart warm-up or a basketball-specific version to help prevent common lower body injuries.

To best facilitate injury prevention and create a safe environment for youth, coaches need a good level of injury-related knowledge and a positive attitude towards prevention (McKay et al., 2014; Emery et al., 2015; Whatman et al., 2018; Croix et al., 2020). More experienced coaches have reported greater levels of injury-related knowledge and more positive attitudes, likely due to better education and awareness of effective injury prevention resources (Iversen & Friden, 2009; Mawson et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020). Most studies focus on injury prevention in youth football where coaches reported using, and positive attitudes towards, the FIFA 11+ warm-up (Donaldson et al., 2018; Mawson et al., 2018; Shamlaye et al., 2020). Similarly, a study conducted in youth netball reported 88% of coaches had a positive attitude towards a netball warm-up designed to help improve landing technique and reduce lower extremity injuries (Saunders et al., 2010). In contrast, less experienced and qualified youth football coaches reported negative attitudes towards using a NM warm-up, mostly due to a lack of programme awareness, knowledge of programme efficacy, and confidence to implement a NM warm-up successfully (McKay et al., 2014; Donaldson et al., 2018; Croix et al., 2020).

In basketball-specific literature, there is little known about coach knowledge and attitudes towards NM warm-up programmes and injury prevention in general (Munoz-Plaza et al., 2021; Räsänen et al., 2021). Negative attitudes towards using a lower extremity injury prevention programme in youth basketball have been reported due to poor programme awareness and a lack of confidence in programme efficacy compared to a generic warm-up programme (Norcross et al., 2016). Further research investigating coach knowledge and attitudes towards NM warm-up programmes in youth basketball is required. Understanding what coaches know about, and their attitude towards, injuries and prevention in youth basketball is likely to have a significant impact on the effectiveness of any injury prevention programme. Therefore, using a mixed methods approach, the aim of this study was to examine youth basketball coaches': (a) knowledge of common basketball-related injuries, risk

factors and injury prevention strategies; and (b) attitude towards sport injury prevention and implementing NM warm-up programmes in NZ secondary school basketball.

Methods

Study participants

Thirty-six (male = 26, female = 10) secondary school coaches of youth-aged basketball players (school years 10–13) within the greater Auckland region were recruited to participate in this study. The participants were recruited through key basketball associations in various Auckland communities, including Rodney Basketball Association, Auckland Basketball Services Limited, and North Harbour Basketball Association. Prior to participation, all participants were informed of the purpose, benefits, and risks of this study before completing a survey, and thereby giving consent to participate. Ethical approval was given for this study by the University Ethics Committee (#21/90).

Survey design

A survey was developed using both closed and open-ended questions based on similar surveys from previous publications investigating coach knowledge and attitudes to sport injuries and their prevention (McKenzie, 2019; Reid et al., 2019; Whatman et al., 2018). A quantitative descriptive approach was used for the closed-ended questions which were designed to provide information relating to the coaches' knowledge of common sport-related injuries, sport injury prevention, and injury prevention programmes. A qualitative approach was used for the open-ended questions which were designed to help explore the coaches' attitudes towards sport-related injuries and injury prevention, and implementing injury prevention programmes with youth basketball teams. In total, the survey was comprised of 32 questions across four sections: (a) general information; (b) knowledge about common injuries and associated risk factors in youth basketball; (c) attitude towards sport injury prevention and implementation of injury prevention programmes in youth basketball; and (d) NM warm-up programmes. The survey was piloted on two coaches and the feedback was used to inform the final survey design. The survey was also reviewed for face validity by two researchers experienced in survey design.

Data Collection

An electronic (online) version of the survey was made available to coaches who were registered with Auckland-based basketball associations and secondary schools via online databases. The data was collected through the Qualtrics software survey tool (<https://www.qualtrics.com>) and the survey was distributed using the Qualtrics Mailer with an anonymous survey link attached in an email invitation (Qualtrics, Inc., Provo, Utah, USA). A hard copy version of the survey was also distributed to coaches at secondary school basketball events to physically complete. The data collected from the survey

software package was exported or manually transferred (in the case of hard copies) into a Microsoft Excel spreadsheet.

Data Analysis

Descriptive statistics were used to summarise the responses to the close-ended questions in the survey (frequencies and percentages of responses). A Chi-square test was used to calculate differences in proportions of responses to knowledge and attitude items between more (> 5 years) and less (< 5 years) experienced coaches. Results are presented as difference in proportion and 95% confidence intervals. All analyses were performed in SPSS 27.0 (IBM Inc., Armonk, NY) or MedCalc (MedCalc Software, 2021) and statistical significance was defined as $p < 0.05$.

The qualitative data from the open-ended questions was analysed using an inductive thematic analysis approach (Braun & Clarke, 2006; Braun & Clarke, 2013). Inductive Thematic Analysis is a data-driven way of identifying codes and developing themes across a dataset from the bottom-up; no existing theoretical concepts beyond the dataset are used to shape the analysis (Braun & Clarke, 2006; Braun & Clarke, 2013). A shared Microsoft Excel spreadsheet containing raw data was the platform for examining the data. The researchers discussed their codes alongside the responses to the questions and mutually agreed upon the most appropriate code for a given response. The themes identified were based on the most common responses given by the participants across all questions and were discussed until no new themes could be identified. No specific coding software, such as NVivo, was used for the analysis; however, inter-rater reliability was used to ensure trustworthiness of the themes in the findings. Lastly, the themes were finalised after being reviewed by a third researcher.

Results

Participant Information

A total of 36 coaches participated in this study (72% male, $n=26$). The distribution of ages was 21–32 years (50%, $n=18$), 33–44 years (25%, $n=9$), 45–56 years (17%, $n=6$), and above 57 years (8%, $n=3$). More coaches reported coaching male players (42%, $n=15$) and both male and female players (33%, $n=12$) than female players alone (25%, $n=9$). All coaches coached secondary school teams with 39% ($n=14$) also coaching at other levels. Just over half of coaches had more than 5 years of coaching experience (53%, $n=19$). Of the coaches responding ($n=27$) to the question regarding coaching qualifications, over half reported not having one (63%, $n=17$). In our sample, coaches with greater coaching experience (more than 5 years) were more likely to have a coaching qualification (44%, $n=7$) than those with less experience (27%, $n=3$); however, this difference was not statistically significant ($p=0.38$). Common types of coaching qualifications reported included national and international basketball-specific coaching certifications, other sport-specific coaching certifications, and tertiary

degrees. In contrast, 63% (n=17) of those responding (n=26) had a current first-aid certificate and a similar proportion had completed a sport-related first-aid/injury prevention course (56%, n=14/25).

Coach Knowledge of Common Injuries and Injury Risk Factors

Most coaches correctly answered “ankle/foot” as the most common lower body injury site (64%, n=23), while very few coaches correctly identified “head/face” as the most common upper body injury site (11%, n=4). A majority of coaches correctly identified “soft tissue injuries” as the most common injury type (86%, n=31). Of those responding (n=35), a majority of coaches also correctly identified that common injuries in youth basketball can be prevented (86%, n=31). Few coaches (22%, n=8) could correctly identify two common injury risk factors, with the most common risk factors identified including players not warming up sufficiently and playing on with previous injuries. Knowledge of injuries and injury prevention was not associated with experience (**Table 1**).

Table 1

Proportion of less experienced and more experienced coaches that agreed (or correctly answered) the attitude and knowledge items.

Attitude/Knowledge Item	Less Experience (%)	More Experience (%)	Percent Difference (95%CL)	p-value
Coach knowledge of injury prevention is important.	100 (n=17)	95 (n=18)	5 (-14 to 24)	0.36
Coach implementation of injury prevention is important.	88 (n=15)	95 (n=18)	7 (-14 to 30)	0.45
I have a good understanding about common basketball-related injuries and associated risk factors.	59 (n=10)	84 (n=16)	25 (-4 to 50)	0.09
I have a good understanding of injury prevention programmes.	29 (n=5)	58 (n=11)	29 (-3 to 54)	0.08
I have adequate access to injury prevention resources.	29 (n=5)	58 (n=11)	29 (-3 to 54)	0.08
Coaches are responsible for educating themselves about injury prevention.	59 (n=10)	63 (n=12)	4 (-25 to 33)	0.81
I am confident I can effectively implement injury prevention strategies.	65 (n=11)	79 (n=15)	14 (-14 to 40)	0.36
Identify the most common lower body injury site.	65 (n=11)	63 (n=12)	2 (-27 to 30)	0.90
Identify the most common upper body injury site.	12 (n=2)	11 (n=2)	1 (-22 to 25)	0.93
Identify the most common injury type.	82 (n=14)	90 (n=17)	8 (-16 to 33)	0.49
Identify common injuries can be prevented.	88 (n=15)	89 (n=16)	1 (-21 to 25)	0.92

Coach Attitudes Towards Injury Prevention

Coaches' responses to the statements regarding attitudes towards injury prevention in youth basketball are presented in **Table 2**. Almost all coaches think it is important for coaches to have current knowledge of injury prevention programmes for youth basketball teams (97%, n=35) and it is important for coaches to actively implement injury prevention programmes with their teams (92%, n=33). Most coaches also believe they have a good understanding about common basketball-related injuries and associated risk factors in youth basketball (72%, n=26). Less than half of coaches believe they have a good understanding of injury prevention programmes in youth basketball and have adequate access to injury prevention resources (44%, n=16). More than half of coaches believe they are responsible for educating themselves about injury prevention (61%, n=22), while most coaches feel they are confident to effectively implement injury prevention strategies in youth basketball (72%, n=26). Although not statistically significant, our estimates suggests a greater proportion of more experienced coaches, compared to less experienced, had a better understanding of injuries/injury risk factors (difference in proportions–25% [95% CI = -4 to 50]; p=0.09), prevention programmes (difference in proportions–29% [95% CI = -3 to 54]; p=0.08), and adequate access to resources (difference in proportions–29% [95% CI = -3 to 54]; p=0.08) (**Table 1**).

Table 2

Coaches' responses to statements regarding attitudes towards injury prevention in youth basketball (n=36).

	Agree (1)	Neutral (2)	Disagree (3)
1. It is important for coaches to have current knowledge of injury prevention programmes for youth basketball teams.	(97%, n=35)	(3%, n=1)	
2. It is important for coaches to actively implement injury prevention strategies with youth basketball teams.	(92%, n=33)	(6%, n=2)	(3%, n=1)
3. I have a good understanding about common basketball-related injuries and associated risk factors in youth basketball.	(72%, n=26)	(25%, n=9)	(3%, n=1)
4. I have a good understanding of injury prevention programmes in youth basketball.	(44%, n=16)	(42%, n=15)	(14%, n=5)
5. I have adequate access to injury prevention resources.	(44%, n=16)	(36%, n=13)	(19%, n=7)
6. Coaches are responsible for educating themselves about injury prevention.	(61%, n=22)	(33%, n=12)	(6%, n=2)
7. I am confident I can effectively implement injury prevention strategies with youth basketball teams.	(72%, n=26)	(22%, n=8)	(6%, n=2)

Coaches' Perceptions of Why Players Continue to Play When Injured

The quantitative findings show that half of coaches have witnessed coaches putting pressure on players (50%, n=18) to play when injured, while almost three quarters of coaches have witnessed players playing on with an injury when they thought they should not have (72%, n=26). The coaches' perceptions help to explain why players might continue to play when injured. The following quotes support this observation:

"Competitive nature of sport, wanting to win, and not wanting to let their coach and parents down." (C17).

"Players don't want to let their team mates down so they feel it's necessary to continue playing even though that's a short term decision instead of thinking long term." (C10).

"Underestimating risk, underestimating severity, underestimating required healing time, and conditions." (C1).

It seems there are two key reasons, identified by the coaches, for injured players continuing to play. These may stem from factors intrinsically or extrinsically motivating the player:

Intrinsic Motivation

Coaches perceive players to be intrinsically motivated because of a personal drive: "wanting to win", "to stay in the game" and "support the team". Players seem to have an internal drive to not let their teammates down, especially if it could mean losing the game. One coach highlighted the internal drive "They want to win." (C12).

Extrinsic Motivation

Secondly, extrinsic motivation of the player occurs because they want to win the game for their teammates and feel pressured by coaches and parents to play on. One coach highlighted the external pressure experienced by the player by responding "So coaches don't get angry at them." (C19), while another coach explained: "Coaches want to win, they don't see the bigger picture of 'if this kid plays through this concussion, sprain, etc what are the effects on this player going to be in 10–15 years' time?." (C7).

Use of NM Warm-Up Programmes

Barriers to Coaches Implementing Injury Prevention Programmes

The quantitative findings show the majority of coaches perform a NM warm-up before games (86%, n=31) and at trainings (92%, n=33), and spent up to 15 minutes facilitating a NM warm-up with their team within a training session (81%, n=29). When asked about what factors influence their decision to implement a NM warm-up before games and at training sessions, coaches commonly identified in their responses: “time”, “space availability” and “player motivation” as key barriers. Barriers before games seem more challenging for coaches to overcome due to external circumstances out of their control, including issues related to game scheduling. One coach highlighted this barrier in their response “Time, especially before games” (C21). The following quotes help illustrate the barriers coaches experience:

“Every training we do this because it is given time for it at the beginning of training. Often on game night the venues are running behind schedule which means you only have time to turn up and play.” (C7).

“Time between games and space at venues. Also if the players are willing to follow instructions.” (C9).

“Time (usually dependent on prior games or when players all arrive at training). If there are enough players at training.” (C13).

It was also reported in the quantitative findings that most coaches thought NM warm-up programmes were effective at reducing common injuries in youth basketball (83%, n=30). It seems programme effectiveness for the “prevention of injury/soreness” is important to coaches when deciding to implement a warm-up, with one coach noting this influence in their response “Helps prevent injuries” (C30). However, some coaches identified their level of “knowledge” about NM warm-up programmes and “past experience” of using a NM warm-up as additional barriers to them implementing one with their teams.

Adherence to a Basketball-Specific Warm-Up Programme

In relation to using a specific NM warm-up programme, the quantitative findings show over half of coaches were aware of the ACC SportSmart warm-up programme (61%, n=22), and of the coaches aware of this programme, almost all have used it with their team (95%, n=21). In addition to using the ACC SportSmart warm-up, it appears coaches use a combination of NM exercises to deliver a variety of NM warm-ups. One coach highlighted the combining of different exercises in their response “We try to follow SportSmart, otherwise we do use a variation of exercises and drills as a combination of

warm-up activities.” (C11). Exercise choice is mostly influenced by “past experience as a player”, “from different coaches in the past”, and “online” resources of programmes and video tutorials.

The quantitative findings show every responding coach (n=31) reported they would be more likely to use/continue to use a NM warm-up if there was a basketball-specific version. Based on coaches’ responses to this question, this basketball-specific injury prevention resource seems appealing to coaches as they believe it would be more “convenient” for them to use. Coaches also appear to be encouraged to use a basketball-specific version with “related drills” as it could help to increase “player adherence” to a NM warm-up. These views are supported by the following quotes:

“Yes, because if it’s specific to basketball then that means that the creator/s took into account the most common injuries in basketball with the most effective warm-up to prevent injuries from happening to the best of the players’ abilities.” (C5).

“Yes, but also if there were resources around it. If it such an important warm up you would think it would be more included or at least mentioned by regional associations or sport providers as apart of injury prevention resources.” (C7).

“Yes. I think my teams would be more willing to follow a programme about basketball with related drills.” (C11).

Discussion

Coach Knowledge of Common Basketball-Related Injuries and Associated Risk Factors

In this study, youth basketball coaches reported a reasonable level of injury-related knowledge, although this varied by topic. The state of coach knowledge regarding injury risk factors is poor, with only 22% of coaches able to identify two risk factors correctly. This is cause for concern given the potential they have in their role to influence injury risk (White et al., 2012). While “players not warming up sufficiently” was identified, and is a commonly reported risk factor in youth football (Orr et al., 2013; McKay et al., 2014; Donaldson et al., 2018) and youth basketball (Iversen & Friden, 2009), a lack of protective equipment, such as a mouthguard, was not. Only 11% of coaches knew the head/face is the most common upper body injury site in basketball. This suggests coaches have a poor level of knowledge regarding head/facial injuries and the importance of mouthguards. Recently, BBNZ developed a mouthguard policy to help improve player welfare and reduce the risk of dental injuries following an increase in dental claims made to ACC. It is now compulsory for players under 19 years participating in a BBNZ event to wear a protective mouthguard while playing (BBNZ, 2016). However, despite their lack of knowledge of dental injuries and associated risk factors, most coaches (72%) believe they have a good understanding of information in these two areas. It appears coaches need further education about injury risk factors for common injuries and current risk management practices imposed by BBNZ.

In contrast, most coaches knew soft tissue injuries (86%) and ankle injuries (64%) are most common in youth basketball (Borowski et al., 2008; Pasanen et al., 2017; Räisänen et al., 2021), and most (86%) knew these common injuries are preventable. This might be expected as coaches play an important role in facilitating injury prevention strategies (Gianotti et al., 2010; White et al., 2012; Croix et al., 2020). These findings are similar to those from previous studies reporting good levels of coach knowledge regarding ankle and knee injuries in youth football (Orr et al., 2013; McKay et al., 2014; Donaldson et al., 2018) and youth basketball (Iversen & Friden, 2009). This is encouraging as soft tissue injury claims remain common in basketball and ankle sprains are one of the most common sport-related injuries of the lower extremity (ACC, n.d.-a; ACC, 2021a).

Coach Attitudes Towards Injury Prevention and Implementing Injury Prevention Programmes

The youth basketball coaches in this study displayed a positive attitude towards injury prevention and implementing injury prevention programmes. This is similar to the research findings reported previously in youth football coaches (Soligard et al., 2010; Mawson et al., 2018; Shamlaye et al., 2020) and youth basketball coaches (Iversen & Friden, 2009). Given the knowledge coaches have about soft tissue ankle injuries and the ability to prevent them, it follows they believe it is important to have current knowledge of injury prevention programmes (97%) and to actively implement injury prevention strategies with their teams (92%). Considering coaches' poor knowledge regarding dental injuries and associated risk factors, our findings are similar to those previously reported among youth football coaches who have a positive attitude towards the FIFA 11+ warm-up, despite having poor knowledge of knee and ankle injury prevention strategies (McKay et al., 2014; Donaldson et al., 2018). This suggests coaches' positive attitudes can be influenced by their awareness of, and experience in using, injury prevention programmes (McKay et al., 2014; Norcross et al., 2016; Donaldson et al., 2018; Croix et al., 2020). Therefore, youth basketball coaches would likely benefit from improved coach education to increase awareness and adoption of effective injury prevention programmes.

A higher proportion of coaches with more experience believed they have a good understanding of injury prevention programmes, have better access to resources, and are more confident in implementing injury prevention strategies. These findings might be expected as coaches of various youth sports who have greater coaching experience and injury prevention-based qualifications have previously been shown to be more likely to adopt an injury prevention programme (Iversen & Friden, 2009; Hendricks & Sarembock, 2013; Mawson et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020). Furthermore, sport organisations are generally considered responsible for ensuring coaches in their system are educated about common injuries and injury prevention (Donaldson et al., 2018; Lindblom et al., 2018; Mawson et al., 2018; Morgan et al., 2018; Shamlaye et al., 2020; Møller et al., 2021). Despite this, many coaches (61%) believed they are responsible for educating themselves about

injury prevention programmes. Therefore, less experienced coaches may benefit from basketball organisations improving coach education regarding effective prevention strategies for common injuries. This will likely improve the knowledge and attitudes of less experienced coaches (Iversen & Friden, 2009; Soligard 2010; Mrazik et al., 2011; Mawson et al., 2018; Kerr et al., 2020; Salmon et al., 2020; Räsänen et al., 2021).

A key theme developed from our findings was based on coaches' perceptions of why players continue to play when injured. This theme implies that injured players are influenced by a performance-oriented climate which focuses on performance goals and outcomes, including: outperforming others and winning (Duda & Nicholls, 1992); and is associated with lower levels of extrinsic motivation, sporting experiences, and perceived autonomy and relatedness (Weiss, 2019). Injured players are likely to benefit from a climate that is task/mastery-oriented which focuses on the players learning, progress and effort (Nicholls, 1989); and provides positive motivational outcomes for players, such as higher perceived competence, autonomy, relatedness, and increased intrinsic motivation (Weiss, 2019). These findings suggest it is less likely injured players will continue playing in a climate encouraging player development compared to expectations to achieve performance outcomes.

Most coaches in our study had witnessed players continuing to play on with an injury when they thought they should not have and half of coaches had witnessed coaches putting pressure on players to play when injured. These findings are similar to those previously reported among high school coaches and players of youth football, netball, and basketball in NZ (Whatman et al., 2018). Additionally, past research framed by Self-Determination Theory (SDT) (Deci & Ryan, 1985; Deci & Ryan, 2000) reported youth sport participants to be motivated to continue participating based on pressure from parents and coaches (Weiss & Williams, 2004; Fraser-Thomas et al., 2008; De Pero et al., 2013; Wendling et al., 2018), including winning and performing their best to not let parents and coaches down (Coakley, 1992; Weiss & Ferrer-Caja, 2002). This supports our findings as coaches perceive injured players to be motivated by intrinsic factors (i.e. performing an activity for internal reward or satisfaction of the activity itself), including: wanting to win, staying in the game, and supporting the team; and extrinsic factors (i.e. performing an activity for external rewards or reinforced outcomes), including: not wanting to let their coaches, parents, and teammates down because winning is important. Evidently, pressure is a key motivating factor for players to continue playing on when injured. However, it is important for coaches, parents, and teammates to consider the negative long-term consequences associated with pressuring injured players to continue playing, such as the risk of re-injury and decreased sport participation (Cain et al., 2006; Frisch et al., 2009; Emery et al., 2015).

The role of coaches, parents, and teammates has been linked to the three basic psychological needs: autonomy, competence, and relatedness which need to be satisfied for players to achieve intrinsic motivation and self-determined extrinsic motivation (Deci & Ryan, 2000). In relation to SDT, Achievement Goal Theory (Nicholls, 1989) explains how coaches, parents, and teammates play significant roles in creating climates that influence self-determined motivation based on their attitude and behaviour, which is important for ongoing sport participation, performance, and positive sporting experiences (Treasure & Roberts, 1995; Greenbaum, 1998; Deci & Ryan, 2000; Vallerand & Rousseau, 2001; Gurland & Grolnick, 2005). A deficit in autonomy, competence, and relatedness suggests players' motivation is influenced by controlling behaviours (Balaguer et al., 2012; Deci & Ryan, 1987; Deci & Ryan, 2000). As the perceived extrinsic motivation of injured players is non-self-determined, it is recommended that youth basketball coaches, parents, and teammates adopt autonomy-supporting behaviours (Mageau & Vallerand, 2003; Keegan et al., 2009) within a task/mastery-oriented climate. This will help improve the injured players' self-determination to achieve positive motivational outcomes, and decrease the pressure they feel to win and not let others down. As a result, it is likely injured players will feel less pressure to continue playing on when injured; thus, reducing the risk of experiencing long-term consequences of sport-related injuries.

There is limited research investigating coach perceptions in relation to youth sport motivation, basketball, and injuries. Understanding player motivation in greater-depth is also limited as this study relies on what coaches have witnessed and perceive to be motivating factors for the injured players. However, these findings suggest coaches, parents, and players require education about pressure in youth sport, including how their behaviour and attitude can influence self-determined motivation. It is recommended that educational resources are utilised, including: Aktive–Auckland Sport & Recreation's (Aktive) Good Sports initiative to help understand the importance of positive side-line behaviour to create better experiences in youth sport (Aktive, n.d.); and the TARGET framework (Task, Authority, Recognition, Grouping, Evaluation, Time) to help explore the advantages of creating a task/mastery-oriented motivational climate (Ames, 1990; Ames, 1992) in youth basketball.

NM Warm-Up Programmes

These findings show the main barriers to implementing a NM warm-up are time and space, as previously reported by many researchers (Saunders et al., 2010; Joy et al., 2013; Donaldson et al., 2018; Morgan et al., 2018; Shamlaye et al., 2020; Munoz-Plaza et al., 2021; Møller et al., 2021; Räsänen et al., 2021). An adequate warm-up typically takes up to 20 minutes (Pasanen et al., 2008; Soligard et al., 2008; LaBella et al., 2011), with most coaches in this study spending up to 15 minutes performing a warm-up at training sessions and before games. Time and space before games is often dependent on external factors, such as game scheduling and venue space. This is concerning as

younger basketball players are more susceptible to lower extremity injuries, especially during game situations, which can be reduced by regular use of a NM warm-up (Borowski et al., 2008; Pasanen et al., 2017; Räsänen et al., 2021). Therefore, coaches should adopt an effective NM warm-up that can be adapted to overcome time and space constraints often experienced before games and at training sessions. Additionally, basketball organisations are strongly encouraged to review and make appropriate adjustments to the secondary school game and training schedules/rules, ensuring teams can effectively manage time and utilise available venue space to perform a NM warm-up before games and at training sessions successfully.

Another key theme identified was the likely adherence to a basketball-specific warm-up programme. Recently, BBNZ adopted the ACC SportSmart Warm-up programme following the success of adapted sport-specific versions, such as NetballSmart, LeagueSmart, and RugbySmart (Fulcher et al., 2018). While it was encouraging to see 95% of coaches who were aware of the SportSmart warm-up used it, only 61% of coaches were aware of the warm-up. This implies coaches lack knowledge of, or motivation to use, the SportSmart resource and this could explain why most coaches (86%) were in favour of a sport-specific version. Coaches often incorporate basketball-specific drills into a generic warm-up (Slauterbeck et al., 2017), and the coaches in this study believe a sport-specific version would be more convenient for them to adopt and implement with their teams based on a relatable programme design to help enhance performance, reduce common injuries, and increase player adherence. These findings are similar to those previously reported by several researchers who investigated sport-specific injury prevention programmes in youth sport, including the FIFA11+ warm-up in football (Soligard et al., 2010; McKay et al., 2014; Donaldson et al., 2018; Mawson et al., 2018; Shamlaye et al., 2020). Given coaches display a positive attitude towards a basketball-specific warm-up programme, BBNZ should consider developing a SportSmart version in the near future as coaches are likely to adhere to this version and implement it with their teams more frequently.

The primary strength of this study is the focus on the local context of injury-related knowledge and attitudes of youth basketball coaches that can be used to improve coach education in the future. There were still some limitations experienced in this study. As the sample size was small, generalising the findings to the wider population may not be appropriate. Additionally, our quantitative analysis could not adjust for coaching qualifications, only coaching experience. Understanding how the difference in qualifications impacts coaches' level of knowledge and attitudes is an area worthy of further research, while our qualitative analysis was conducted using limited responses given by our small sample size.

Conclusion

The main aims of this study were to examine youth basketball coaches' knowledge of common basketball-related injuries, risk factors, and injury prevention strategies, and their attitudes towards sport injury prevention and implementing prevention programmes. Coaches have a good level of injury-related knowledge in the areas of lower body injuries and common injury types, and a positive attitude towards using NM warm-up programmes with their teams. However, constraints of time and space are major barriers to coaches performing a NM warm-up with their teams before games and at training sessions. The findings identify a need to improve coach education to increase levels of coach knowledge in the areas of dental injuries and risk management, and risk factors of common lower body injuries. There is also a need to improve coach education to increase awareness of effective NM warm-up programmes and informative resources about creating positive experiences and appropriate motivational climates for youth basketball players. Basketball organisations should also consider ways to help coaches facilitate a NM warm-up before games and at training sessions regarding better time and space management. With more focus required on less experienced coaches, these findings will be useful in guiding the knowledge translation of, and promotion of a positive attitude towards, common injuries and injury prevention in youth basketball.

Chapter 4: Discussion and Conclusion

Discussion

In recent years, the number of youth participants in sport has increased significantly across many sport codes internationally (Cain, 2010; Sabato et al., 2016). In NZ, a large number of participants engage in various sport and recreational activities (Sport NZ, 2020), and this often results in common sport-related injuries. This is supported by recent data from ACC reporting a high rate of sport-related injury claims made by adolescent-aged sport participants (15–19 years) (ACC, 2019). Specifically, basketball is a fast-growing team sport for NZ secondary school participants (NZSSSC, 2020), with a high rate of injury claims reported to ACC (ACC, 2021b). Additionally, previous research has shown that youth basketball players are vulnerable to common musculoskeletal injuries, such as knee and ankle injuries (Iversen & Friden, 2009; Orr et al., 2013; Wild et al., 2013; Sabato et al., 2016; Pasanen et al., 2017; Owoeye et al., 2018; Räisänen et al., 2021). As a result, injury prevention in youth basketball is an important issue.

There is limited research investigating injury prevention in youth basketball (DiFiori et al., 2018) and in particular, little in the NZ context. It is believed by sport organisations, teams, and parents that coaches play a critical role in facilitating injury prevention strategies while ensuring participants adopt them (Gianotti et al., 2010; White et al., 2012; Croix et al., 2020; Shamlaye et al., 2020). Therefore, this dissertation sought to investigate coach knowledge and attitudes towards sport injury prevention in youth basketball by examining four primary questions: (1) What knowledge do coaches have of common injuries and injury prevention in youth basketball? Specifically, are coaches aware of the ACC SportSmart warm-up?; (2) What are the barriers to coaches implementing injury prevention programmes?; (3) What are coach attitudes towards injury prevention programmes?; and (4) Does coach knowledge and attitude differ based on experience?.

Previous literature has reported a positive association between coach knowledge and attitudes, and coaching experience and injury-related education (Chapter 2). Additionally, greater levels of coach knowledge and a more positive attitude towards injuries and injury prevention in youth sport are associated with their access to, and awareness of, effective injury-related resources, adherence to injury prevention strategies, and confidence to implement prevention programmes successfully (Iversen & Friden, 2009; Soligard et al., 2010; Hendricks & Sarembock, 2013; Mawson et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020; Räisänen et al., 2021). This implies that less experienced coaches are less likely to adopt recommended injury prevention programmes based on a lack of injury-related knowledge and a negative attitude towards injury prevention. However, these associations were identified in studies conducted in high-contact youth sports exploring the impacts

of concussion, such as hockey, American football, rugby, and football (Mrazik et al., 2011; Kerr et al., 2020; Salmon et al., 2020; Sungwon et al., 2020). Basketball is considered a low-contact sport, and very few studies have investigated coach knowledge and attitudes towards injury prevention in the context of youth basketball (Iversen & Friden, 2009; Norcross et al., 2016; Räisänen et al., 2021).

This dissertation provides new insights into the state of coach knowledge and attitudes towards injuries and injury prevention in NZ secondary school youth basketball. Overall, this study found that coaches have good knowledge about common soft tissue ankle injuries and injury prevention, similar to coaches of youth football (McKay et al., 2014). In contrast, coaches have poor knowledge about common upper body injuries to the head/face and associated injury risk factors, although warming up insufficiently has been commonly identified by coaches of youth basketball and football (Iversen & Friden, 2009; Orr et al., 2013; McKay et al., 2014; Donaldson et al., 2018). Additionally, coaches have a positive attitude towards injury prevention and implementing injury prevention programmes, including the use of the ACC SportSmart warm-up programme and the development of a basketball-specific version. Coaches of several youth sports display positive attitudes towards using the FIFA 11+ warm-up and other sport-specific programmes (Iversen & Friden, 2009; Soligard et al., 2010; Hendricks & Sarembok, 2013; Mawson et al., 2018; Hendricks et al., 2017; O'Connor & Lacey, 2020; Shamlaye et al., 2020; Räisänen et al., 2021). Furthermore, coaches, parents, and teammates pressure injured players to continue playing on, and this behaviour has been previously reported among NZ secondary school coaches of football, netball, and basketball (Whatman et al., 2018). Lastly, a greater proportion of experienced coaches were more knowledgeable and had a more positive attitude than less experienced coaches, although the difference in proportion was not statistically significant. Coaches of various youth sports are more likely to adopt injury prevention programmes based on greater levels of experience and injury-related education (Iversen & Friden, 2009; Hendricks & Sarembok, 2013; Mawson et al., 2018; O'Connor & Lacey, 2020; Shamlaye et al., 2020).

A key finding from this study is the lack of coaches who could correctly identify the head/face as the most common upper body injury site in youth basketball, despite the recently imposed mouthguard policies by BBNZ. This suggests coaches have poor knowledge regarding the high rate of dental injuries in basketball and the importance of players wearing mouthguards for protection. To date, there are more studies that have investigated head/face-related injuries in youth hockey, where the use of mouthguards as proactive wear was examined (Mrazik et al., 2011; Hunt et al., 2018), and limited focus on youth basketball. Therefore, future research should consider investigating dental injuries and the use of mouthguards as protective wear in youth basketball, while basketball organisations should improve coach education to increase awareness of the current mouthguard policies for basketball in NZ.

Youth basketball coaches in NZ commonly use the ACC SportSmart warm-up programme or a combination of other NM activities and basketball-specific drills. Additionally, coaches' positive attitudes towards using a sport-specific version implies they will likely adhere to it frequently. Currently, there is little evidence to suggest a basketball-specific warm-up programme has been developed, and as a result, basketball coaches are often required to specifically adapt a generic warm-up programme (Slauterbeck et al., 2017). This suggests it is possible for an effective warm-up to be developed for basketball players. The design of a basketball-specific warm-up should include the typical components of aerobic activity, dynamic stretching, strength, balance, and agility (Hübscher et al., 2010; Brunner et al., 2019). This study recommends the exercises within the typical components are tailored to adequately prepare players to perform by reflecting the landing, jumping, and change of direction movements expected in basketball (Iversen & Friden, 2009; Noyes et al., 2012; Räsänen et al., 2021). Additionally, it is important to integrate drills involving relevant shooting, dribbling, and passing skills in this programme (Noyes et al., 2012; Slauterback et al., 2017; Munoz-Plaza et al., 2021; Räsänen et al., 2021). This potential programme design implies the risk of common lower body injuries in youth basketball can be reduced and performance can be enhanced effectively.

Common barriers of time and space can make facilitating a NM warm-up before games or at training sessions challenging. There are few studies conducted in youth basketball that have also identified constraints of time and space effecting coaches ability to implement a warm-up with their teams (Munoz-Plaza et al., 2021; Räsänen et al., 2021). Further research is needed to examine the barriers and facilitators to coaches implementing a NM warm-up in youth basketball, including their awareness of effective programmes with an adaptable design to overcome common barriers. It is also recommended that basketball organisations consider how the current secondary school game and training schedules/rules, and venues can be adapted to allow teams more time and/or space to warm-up effectively before games and at training sessions.

Coaches have witnessed other coaches pressuring injured players and injured players continuing to play when they thought they should not have. It seems clear from the results that pressure by coaches, parents, and teammates to win games and not let them down are key motivating factors. This implies players are pressured within a performance-oriented climate where the outcome of winning is important (Duda & Nicholls, 1992). It is recommended that coaches, parents, and teammates work to create positive motivational climates for players to feel less pressured to achieve performance outcomes (Nicholls, 1989; Duda, 2001). Additionally, these findings suggest coaches, parents, and teammates lack knowledge of the negative outcomes of playing on when injured, including decreased sport participation, risk of re-injury, and further long-term health consequences (Cain et al., 2006; Frisch et al., 2009; Neuman et al., 2009; Orr et al., 2013; Emery et al., 2015). It is recommended

basketball organisations educate coaches, parents, and players about initiatives regarding the benefits of positive side-line behaviour, and creating positive motivational climates for positive sporting experiences and long-term participation in youth sport. Pressure from coaches, parents, and teammates to play when injured appears to be a common issue (Whatman et al., 2018); however, further research is needed to investigate the space of pressure in youth sport and the implications of ongoing participation with an injury.

Lastly, coaches in this study with greater experience and awareness of injury prevention programmes were more knowledgeable about, and had a more positive attitude towards, injuries and injury prevention than coaches with less experience. This implies more experienced coaches are likely to adopt effective injury prevention programmes to reduce common injuries compared to less experienced coaches. It is recommended that basketball organisations improve coach education to increase knowledge and awareness of common injuries and injury prevention programmes, with greater focus on less experienced coaches. Based on the findings of this study, further research should explore how coaches' level of injury knowledge and attitude differ based on coaching experience, including their access to, and awareness of, injury prevention resources.

Limitations and Future Research Recommendations

There are some limitations to this research to be considered when interpreting the results. Based on these limitations and key findings of this dissertation, recommendations for future research have also been provided:

- The main limitation of this study was the small sample size; however, this may be explained by the age inclusion criteria targeting adult coaches (above 21 years) as younger student coaches were excluded. The survey was also distributed by one primary researcher to relevant school sport contacts within the greater Auckland region. This meant managing the process of having the reusable electronic survey link distributed further and assistance to distribute the hardcopy survey at basketball-related events was challenging. Future research should aim to broaden the inclusion criteria for age, and utilise the national and regional associations for greater survey distribution and participant engagement.
- Additionally, the small sample size did not allow the quantitative analysis to adjust for coaching qualifications. A greater sample size and variety of coaching qualifications would provide a better understanding of the effect coaching qualifications has on coaches' level of injury-related knowledge and attitudes towards sport injury prevention.
- The small sample size from one specific geographical region makes generalising the findings to the wider population of secondary school coaches beyond Auckland difficult. It is

recommended that further research consider collecting data on a national scope to cover a broader sociodemographic area.

- Lastly, the study focused on coaches' knowledge and attitudes; however, it did not focus on the educational resources coaches utilise to help influence their knowledge of, and attitude towards, injuries and injury prevention. This area is important as past research shows a positive correlation between greater levels of coach knowledge and positive attitudes, and injury prevention-based education. Therefore, future research investigating coach education could examine the injury prevention resources coaches have access to and how these resources are being delivered to effectively translate injury-related information to youth basketball coaches.

Practical Applications

Based on the key findings and recommendations of the research study (Chapter 3), BBNZ should consider the following practical applications regarding better injury-related coach education in youth basketball:

- Increase coach knowledge of dental injuries and mouthguard policies for players.
- Develop and promote a basketball-specific NM warm-up programme for regional associations to deliver to community-level coaches.
- Adapt game and training schedules/rules to specifically allocate time within the game schedule to allow coaches to perform an effective NM warm-up before games.
- Designate available court space at game venues for teams to warm-up prior to their game if game scheduling restricts them from warming up during their allocated game time.
- Inform coaches about how to manage available court time and space at game and training venues to ensure these factors are utilised to successfully perform a NM warm-up.
- Improve knowledge translation of injury prevention information to coaches through online resources, coaching seminars/courses, and physical sources of information, with greater focus on less experienced coaches.
- Educate coaches, parents, and players about appropriate initiatives regarding the importance of positive side-line behaviour and the benefits of creating supportive environments, such as long-term sport participation and better sporting experiences for players.

Conclusion

This dissertation consisted of an introduction/rationale, literature review, and one original study aimed at investigating coach knowledge and attitudes towards sport injury prevention in youth basketball. This was the first study to investigate injury-related knowledge and attitudes of youth basketball coaches in NZ. Generally, coaches have poor knowledge of upper body injuries and injury risk factors, but have good knowledge about soft tissue lower body injuries and the ACC SportSmart warm-up programme. Similar to past studies, coaches with greater coaching experience and awareness of injury prevention programmes were more knowledgeable about common basketball-related injuries, and had a more positive attitude towards using a NM warm-up with their teams. Additionally, coaches, parents, and players require further education about how pressure in youth sport, including the importance of youth sport participants not playing on when injured, can cause several negative long-term outcomes. Lastly, constraints of time and space are key barriers to coaches more frequent implementation of a NM warm-up. Further research focusing on the limitations and key findings addressed in this dissertation is needed to further understand the state of coach knowledge and attitudes towards sport injury prevention in youth basketball. This will help to guide the development of appropriate injury prevention-related education and resources for youth basketball coaches in NZ.

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Appendices

Appendix A: Ethics Approval



TE WĀNANGA ARONUI
O TĀMAKI MAKĀU RAU

Auckland University of Technology Ethics Committee (AUTEK)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

14 April 2021

Chris Whatman
Faculty of Health and Environmental Sciences

Dear Chris

Re Ethics Application: **21/90 Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball.**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEK).

Your ethics application has been approved for three years until 14 April 2024.

Non-Standard Conditions of Approval

1. In the statement on the Information Sheet about withdrawal please remove the following words 'and the findings have been produced'.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by AUTEK before commencing your study.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEK in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEK prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEK Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEK Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.

AUTEK grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact ethics@aut.ac.nz. The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>

(This is a computer-generated letter for which no signature is required)

The AUTEK Secretariat
Auckland University of Technology Ethics Committee

Cc: mdq3478@aut.ac.nz; Patricia Lucas

Participant Information Sheet

Date Information Sheet Produced:

11/03/2021

Project Title

Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball.

An Invitation

My name is Braityn Callaghan. I am a postgraduate student at AUT University in Auckland, and I am completing a Master of Sport, Exercise and Health degree. I am conducting research on secondary school youth basketball coaches and I would like to invite you to be a part of my study.

You do not in any way have to participate and may stop being a part of this study at any time. If you agree to be part of this study, completing the survey will be regarded as your consent to participate.

What is the purpose of this research?

Basketball is a fast-growing youth sport with a large number of injury claims in recent years.

Coaches are recognized as key facilitators of injury prevention initiatives in youth sport and thus understanding your knowledge and attitude is important. Interventions are only effective if coaches actively adopt them into their training sessions, so it is also important to further understand what injury prevention initiatives coaches are aware of, the barriers to coaches implementing such initiatives and how player adherence may be affected as a result.

This study is being conducted as part of my master's degree qualification and the findings of this research may also be used for future academic publications and presentations.

How was I identified and why am I being invited to participate in this research?

You have been invited to participate because you are a coach of secondary school basketball in the Auckland region.

How do I agree to participate in this research?

If you would like to participate in this study, please complete the attached survey. There is no official Consent Form to complete, so you are reminded that by completing the survey, you are giving your consent to participate.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time before the findings are produced.

If you choose to withdraw from the study, then you will be offered the choice between having any data that is identifiable as belonging to you removed or allowing it to continue to be used. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

In this research, you will be asked to complete a survey that is designed to help understand the current state of coach knowledge and attitudes towards sport injury prevention in youth basketball.

Your survey responses will be analysed to identify key themes from the answers you provide. Once completed, all information will be collated and analysed and will form the bases of reports, papers, and presentations.

What are the discomforts and risks?

You are not expected to experience any level of discomfort or embarrassment while participating in this research. You are reminded that your participation is voluntary, and you do not have to answer any questions they do not feel comfortable in answering.

What are the benefits?

As the researcher, I will benefit from the successful completion of this research project as part of obtaining my postgraduate qualification of a master's degree.

The main benefits of this research to you, the wider community and myself include:

- Providing evidence of coach knowledge and attitudes towards sport injury prevention in secondary school youth basketball as an important social group for facilitating key injury prevention messages to a vulnerable group of youth sport participants.
- Emphasising awareness of coach knowledge about sports injuries and effective sport injury prevention programmes that would benefit youth basketball players, including the ACC SportSmart warm-up.
- Informing how coaches implement effective sport injury prevention strategies in their training sessions to help reduce the risk of sport-related injuries in youth participants.
- Developing new ideas to improve player adherence to the injury prevention strategies implemented by coaches given the high injury rate and claims made within the basketball sport code and Auckland region most notably.

How will my privacy be protected?

- All information collected will be used for research purposes only.
- You will keep your copy of the Participant Information Sheet as a record of consent as there is no official Consent Form.
- Information collected in this study through both hard-copy and electronic completion of the survey will be anonymous and individuals will not be identified in this research.
- All personal information, questions, answers, and results from this project will be treated as confidential and will be handled in accordance with the principles of the Privacy Act 1993. The identity of participants will be protected at all stages of the project.
- Only the researcher and supervisors of this study will have access to physical and computerised data that will be secured safely at AUT Millennium and on an external hard drive which will be deleted after a standard 6-year time period.

What are the costs of participating in this research?

There is no monetary cost to you to be involved in this research, the only cost is time. The survey will require approximately 10 – 15 minutes of time to complete.

What opportunity do I have to consider this invitation?

You will have 2 weeks to consider the invitation before responding.

Will I receive feedback on the results of this research?

A summary report of findings will be distributed to you via your school and/or basketball association website.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Chris Whatman, chris.whatman@aut.ac.nz, +64 9 921 9999 ext. 7037

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEK, ethics@aut.ac.nz, (+649) 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Braityn Callaghan, School of Sport and Recreation, AUT University. Email: mdq3478@aut.ac.nz

or phone +64 27 8232 505.

Project Supervisor Contact Details:

Primary Project Supervisor: Dr Chris Whatman, Faculty of Health and Environmental Sciences, School of Sport and Recreation, AUT University. Email: chris.whatman@aut.ac.nz or phone +64 9 921 9999 ext. 7037.

Secondary Project Supervisor: Dr Patricia Lucas, Faculty of Health and Environmental Sciences, School of Sport and Recreation, AUT University. Email: patricia.lucas@aut.ac.nz or phone +64 9 921 9999 ext. 7134.

Thank you for considering participating in this research.

Approved by the Auckland University of Technology Ethics Committee on 14th April 2021 AUTEK Reference number 21/90.

Coach Knowledge and Attitudes Towards Sport Injury Prevention in Youth Basketball:

Thank you for being part of this research study. Basketball is a fast-growing youth sport and as with all youth sports, injuries are a concern. Coaches are recognized as key facilitators of effective injury prevention initiatives in youth sport and thus understanding your current knowledge and attitude toward injuries is important.

The completion of this survey will imply that you give consent to be a participant in this study. Your participation is voluntary, and you are able to withdraw from the study at any point before the findings have been produced. However, once the findings have been produced, your data cannot be identified or removed.

When completing this survey, please tick the appropriate box of your selected answer or please type/write in the space provided.

Section 1 – This section asks you to provide general information about yourself and your coaching experience.

1. What is your age (years)?

- 21 – 26 27 – 32 33 – 38 39 – 44 45 – 50
 51 – 56 57 – 62 63 – 68 69+

2. What gender do you identify as?

- Male Female Other

3. Do you coach...

- Male players Female players Both males and females

4. Which type of organizations do you currently coach in? Please select all answers that apply.

- Secondary school Intermediate school Primary school
 Representative association Club Private coaching Other

If "other", please provide more detail.

5. What level do you currently coach? (i.e. year level/grade).

1. How many years of coaching experience do you have?

- Less than 2 2 – 4 5 – 10 11 or more

2. Do you have a formal coaching qualification? *If so, please provide more detail of your coaching qualification(s).*

3. Do you have a current first aid certificate? *If so, please provide more detail if known.*

9. Have you completed any sport-related first-aid/injury prevention course(s)? *If so, please provide more detail.*

Section 2 – This section asks you about what you know about common injuries and associated risk factors in youth basketball.

1. What do you think is the most common lower body injury site in youth basketball?

Please select one of the following options:

- Hip/groin Thigh Knee Calf/shin Ankle/foot

2. What do you think is the most common upper body injury site in youth basketball?

Please select one of the following options:

- Head/face Shoulder/arm Wrist/hand Torso Back

3. What do you think is the most common injury type in youth basketball?

Please select one of the following options:

- Soft tissue injuries (e.g. muscle/ligament strain) Bone fractures Dislocated joints
 Concussion Cuts and abrasions Contusions (bruises)

4. Can you identify 2 important injury risk factors in youth basketball?

1.
2.

5. Do you think common injuries in youth basketball can be prevented?

- Yes No

Section 3 – This section asks you about your attitude towards sport injury prevention and implementing injury prevention programmes with your teams.

It is important for coaches to have current knowledge of injury prevention programmes for youth basketball teams.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

It is important for coaches to actively implement injury prevention strategies with youth basketball teams.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

I have a good understanding about common basketball-related injuries and associated risk factors in youth basketball.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

I have a good understanding of injury prevention programmes in youth basketball.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

I have adequate access to injury prevention resources.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

Coaches are responsible for educating themselves about injury prevention.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

I am confident I can effectively implement injury prevention strategies with youth basketball teams.

1 – Strongly Agree 2 – Agree 3 – Neutral 4 – Disagree 5 – Strongly disagree

Have you witnessed coaches putting pressure on players to play on when injured?

Yes No

If “yes”, please explain why you think coaches do this.

Have you witnessed players playing on with an injury where you thought they should not have?

Yes No

If “yes”, please explain why you think players do this.

Section 4 – This section asks you about neuromuscular warm-up programmes.

Note: A neuromuscular warm-up is a warm-up typically including a combination of aerobic activity (e.g. jogging, running), dynamic stretching, strength, balance, and sport-specific movements. An example is the ACC SportSmart Warm-up.

1. How often do you have your team perform a neuromuscular warm-up before games?

- 1 – Always 2 – Often 3 – Sometimes 4 – Seldom 5 – Never

2. How often do you have your team perform a neuromuscular warm-up at trainings?

- 1 – Always 2 – Often 3 – Sometimes 4 – Seldom 5 – Never

3. How effective do you think neuromuscular warm-up programmes are at reducing common injuries in youth basketball?

- 1 – Extremely 2 – Very 3 – Moderately 4 – Slightly 5 – Not at all

4. What things influence your decision to implement a neuromuscular warm-up before games and in training sessions?

5. Within a training session, how much time do you spend facilitating a neuromuscular warm-up with your team?

- No time 10 minutes or less 15 minutes or less 20 minutes or less
 More than 20 minutes

6. Are you aware of the ACC SportSmart warm-up? If “no” please go to question 8.

- Yes No

7. Have you used the ACC SportSmart warm-up with your team?

- Yes No

If “no” please explain why.

8. If you are currently using a neuromuscular warm-up programme, what is it called and/or where did you learn about it? Please identify.

9. Would you be more likely to use/continue to use a neuromuscular warm-up programme if there was a basketball-specific version? *If so, please explain why.*

THANK YOU FOR COMPLETING THIS SURVEY!

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Chris Whatman, chris.whatman@aut.ac.nz, +64 9 921 9999 ext. 7037.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTECH, ethics@aut.ac.nz, (+649) 921 9999 ext 6038.