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PRACTITIONER'S CORNER

Optimizing Approaches to Pitch-Related Injury Prevention by Coaches in Little League

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Abstract

Background: In Curaçao, youth baseball holds importance in the social fabric of the community. Keeping youth players healthy provides social and economic opportunities. Pitchers are at risk for repetitive throwing arm injuries. While research suggests injury risk can be reduced, few strategies are translated into practice. Coaches play a pivotal role in youth player safety, yet little is known about how or why they do not implement injury prevention. **Purpose:** To create inclusive first steps towards pitch-related injury prevention informed by coaches' attitude, experience, and actions in Curaçao. **Methods:** Online focus group discussions with 7 coaches contributed to a confirmatory survey with a 22% response rate. **Results:** Thematic analysis generated three general dimensions of attitude towards risk reduction, action towards risk reduction, and contextual factors, and these contained five themes: (a) coaches' knowledge and decision-making directly influence risk reduction, (b) coaches feel primarily responsible for the health and safety of their players, (c) coaches target risk factors to minimize injury, (d) coaches acknowledge the protective role of strength training and recovery in injury prevention, and (e) environmental and organizational factors affect risk reduction strategies. Survey results demonstrated strong agreement for nine themes, while three themes require further investigation. Perceived injury prevention barriers include insufficient training, lack of resources, pressure to win, and poor stakeholder communication. **Conclusion:** A multifactorial injury prevention approach is needed to address the specific learning needs of coaches. Implementation must consider the location-specific factors influencing coaches' behaviour. **Health & Fitness Journal of Canada 2023;16(4):3-14.**

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Introduction

Baseball is the most played sport in Curaçao. For an island with a population of almost 165,000, Curaçao currently has five active professional baseball players in Major League Baseball and has become a significant hub for scouting and player development in the Caribbean. Little

League Curaçao (LLC) is one of two organized leagues in the country to offer baseball to children between the ages of 6–16 years. LLC is a member of Little League Baseball, an American-based, international organization that organizes youth baseball programs in over 80 countries.

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While participation in baseball can be beneficial for social, mental, and physical health, its repetitive throwing nature contributes to the development of overuse injuries (Greiner et al., 2021). Injuries are the product of complex interactions between a variety of internal and external risk factors (Bahr & Krosshaug, 2005). In baseball, overuse injuries are associated with certain behaviours, such as high pitch counts, inadequate rest, and participation in year-round throwing (Fleisig et al., 2011; Olsen et al., 2006). Due to the stress and fatigue of repeatedly throwing high volumes of pitches at maximum velocities, pitchers are at a significantly higher risk of injury when compared to players in other positions (Atanda et al. 2016; Fleisig et al., 1995). The consequences of throwing injuries can range from missing games or practices to more severe outcomes such as Tommy John surgeries (Ulnar Collateral Ligament Reconstructions) or life-long upper extremity functional impairments.

Although national baseball injury data does not exist in Curaçao, observations from the Santa Rosa Medical Centre (Willemstad, Curaçao) report a dramatic increase in upper extremity injuries in youth pitchers. These observed increases follow global trends in youth baseball injuries (Fazarale et al., 2012; Fleisig & Andrews, 2012; Yukutake et al., 2013). Coincidentally, an overwhelming body of research has found a lack of implementation and poor compliance with injury prevention strategies within Little League at a global level (Pamias-Velázquez et al., 2016). Emery et al. (2006) suggested injury prevention in youth athletes is the shared responsibility of all stakeholders such as the government, organizations, coaches, parents, and youth athletes; however, the highest level of responsibility should be assigned to those

with the potential to affect the most change. Within the structure of LLC, coaches appear to have the most significant influence and responsibility for pitch-related injury prevention. Researchers have demonstrated that the attitude and knowledge of coaches toward injury prevention may influence non-compliance of athletes to injury prevention initiative (Finch, 2006). As Verhagen and Bolling (2018) noted, until consideration is given to factors such as the attitudes and behaviours of key stakeholders, implementation of injury prevention strategies is unlikely to be successful.

Despite the need for a better understanding of the contextual factors underpinning stakeholders' decisions to engage in risk reduction, youth baseball research has largely focused on injury rate (Farooqi et al., 2021; Sakata et al., 2017) and injury prevention compliance (Fazarale et al., 2012; Pamias-Velázquez et al., 2016; Yukutake et al., 2013). The purpose of this research was to investigate coaches' attitudes, experiences, and actions that hinder the application of injury prevention strategies. Applying a qualitative approach to explore LLC coaches' perceptions of injury and risk reduction provided a richer understanding of the contextual factors and attitudes that shape coaches' intentions to comply with an injury prevention program. Using this information to address the potential gaps and barriers between research recommendations and practice helped to direct future interventions informed by the needs and experiences of coaches in LLC.

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Methods

Methodology and Theoretical Model

A qualitative descriptive research design was used to explore coaches' attitudes, experience, and actions towards injury prevention in LLC. This approach provided a comprehensive summary of a construct within its everyday context, which is essential in understanding the unique perspective of coaches in Curaçao (Colorafi & Evans, 2016).

The theory of planned behaviour is a theoretical framework used to explain and predict human behaviour (Ajzen, 1991). It posits three independent factors shape one's intention to engage in an explicit behaviour: the attitude toward the behaviour, subjective norms, and behavioural control (Sagas et al., 2006). The theory of planned behaviour is particularly insightful for understanding the attitudinal context within which health behaviours are likely to change (Bastable et al., 2020). Within the context of LLC, the theory of planned behaviour could be used to predict the coaches' decision to engage in injury prevention. Predictions are informed by the strength of coaches' personal attitudes concerning pitching injuries (i.e., do coaches believe that pitch-related injury risk can be modified?), coaches' perception of the attitudes of others (i.e., what do players, colleagues, or parents of players think about reducing injury risk?), and coaches' perceived control over injury prevention (i.e., do coaches believe they can have an impact on their pitcher's arm health).

Interventions

A mixed methods investigation using semi-structured focus group discussions, followed by a leaguwide confirmatory survey was used to capture LLC coaches' attitudes, beliefs, and actions toward

injury prevention. Data collected from the focus group sessions were tested for level of agreement through a survey which helped bolster the credibility of the study's design and assisted in confirming the study's findings (Hoffmann et al., 2017).

Focus groups provide information on an individual's ideas and feelings and are unique in generating deep and rich conversation based on the synergy of social interactions (Rabiee, 2004) and promote spontaneity by encouraging the participants to exchange, define, disagree, build, and share their opinions.

Two focus group sessions comprising seven LLC coaches were used to explore the factors influencing participants' attitudes, social norms, and perceived control on behaviours toward injury prevention. These sessions, approximately 65–80 minutes in duration, were hosted on Zoom, 2 weeks apart. This time allowed participants to reflect on their responses and allowed the researcher to analyze and follow up on discussion from the first session.

Figure 1: Semi-structure focus group questions guided by constructs within the theory of planned behaviour.

Determinants of Predicted Behaviour	Focus Group Discussion Questions
Attitude towards injury prevention	What are your thoughts on cross-training as a method of preventing injury? How do you feel about age-related pitch count limits? Which Pitch Smart recommendations do you agree with most/least?
Social pressure to protect players	Whose responsibility is injury prevention? How have players, parents and/or other coaches influenced the way you manage your training?
Perceived behavioural control over injury	Do you feel that injuries can be prevented for youth pitchers? How would you reduce injury risk? <ul style="list-style-type: none">• What factors do you feel are attributed to throwing injuries? Do you believe that your decision-making can influence the health of your pitchers? <ul style="list-style-type: none">• What risk factors can you control for?• What risk factors are out of your control?

The researcher facilitated group discussion using semi-structured, open-

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ended questions guided by the theory of planned behaviour framework (Figure 1). The discussion was guided by Azjen's (1991) determinants of predicted behaviour (behavioural control, subjective norms, and attitude) to explore injury prevention research recommendations such as pitch count, strengthening and stretching programs, and identifying risk factors.

Themes identified through thematic analysis were then sent back to focus group participants. Participants were asked for feedback on the discovered themes and the research adapted the themes to more accurately represent the focus group discussion.

Both focus group discussions were audio recorded through Zoom's recording software. All focus group data were kept secure by password protection and data encryption in a cloud-based storage system to be held for 5 years post-study publication or presentation. All transcriptions were coded and anonymized to ensure transcribed information could not be traced back to individual participants.

Following the focus group sessions, a survey was conducted to allow the researcher to hear more extensive and diverse perspectives than one-on-one interviews or focus groups would allow (Braun et al., 2021). Connecting with a larger group of participants allowed the researcher to be more confident about the topic of interest for the sampled population (Braun et al., 2021).

The researcher distributed a survey letter of information to all interested LLC coaches. After reading the consent form, participants provided consent by clicking through the survey link and submitting their responses or declined by not completing the survey. The survey,

developed in Qualtrics (Qualtrics, Provo, UT), was active for 4 weeks from the distribution day.

Participants were anonymous, meaning responses could not be traced back to the participant. Due to the nature of anonymity, had a participant elected to remove themselves from the study, their survey data could not be retracted. The survey was developed once themes from the focus group were analyzed. The 13-item survey asked participants to read a statement and respond along a 5-point Likert scale ranging from "strongly agree" to "strongly disagree." The survey took approximately 3 minutes to complete. Data from the survey will be securely stored in Qualtrics for 5 years from the date of project completion.

Participants

All active LLC coaches were invited to participate in this study. A total of seven participants took part in the focus group session, and eleven individuals responded to the survey. Due to the anonymity of the survey responses, it is not possible to verify the number of focus group participants who also completed the online survey. Focus group and survey participants provided informed consent prior to taking part in the study. Ethical approval was obtained from the University of British Columbia Research Ethics Board, and the study adhered to research guidelines established by the University of British Columbia.

Data Analysis

Thematic analysis was used to explore patterns and their relationships across focus group discussions. The researcher used a computer-based approach to sort, contrast, and compare relevant data. Following the procedures of Krueger and

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Casey (2015), the researcher transcribed all audio content of the focus groups verbatim. The lines of the transcript were then numbered in the right margin. Participants were colour-coded, and the focus group transcripts were reorganized by placing all coloured responses under the appropriate questions.

Interpretation of data and theme generation was achieved by identifying frequency and extensiveness of comments, internal consistency, and big ideas that cut across various discussion points (Rabiee, 2004).

Emerging themes and subthemes were compared to establish relationships in responses. A list of generated focus group themes and subthemes was provided to focus group participants for respondent validation. Themes and discussion excerpts compared the attitudes, beliefs, and behaviours of LLC coaches with current research recommendations. Discrepancies identified between research and practice were used to inform interventions tailored to the needs of coaches in LLC.

A follow-up survey was sent out to all coaches in LLC through Qualtrics (Qualtrics, Provo, UT) to verify themes and relationships discovered through focus group discussions. The survey questions were determined by the results yielded in the thematic analysis. The survey ascertained the amount of agreement between the opinions and behaviours of our focus group with those of all participating LLC coaches. The survey consisted of 12 themes. The survey closed by asking participants how they would design an injury prevention program if given a “magic wand”. The authors of this study pre-established a level of agreement criteria to classify the level of agreement for each theme based on the average score

for each item. Levels of agreement were based on the following criteria:

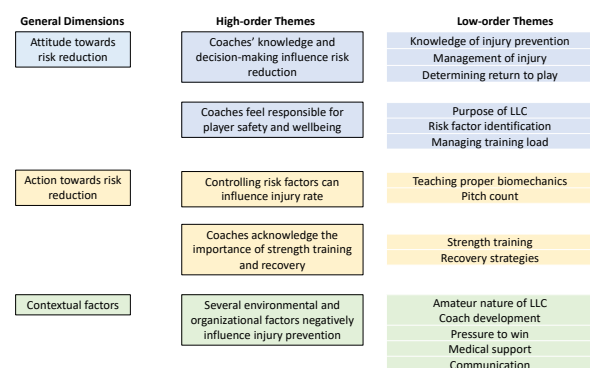
- Average scores of 3.5 or greater indicated a high level of agreement.
- Average scores between 2.5–3.4 indicated inconclusive data requiring further exploration.
- Average scores of 2.4 or less indicated low levels of agreement.

Used in combination, the results from the focus group discussion provided rich themes and excerpts that helped guide recommendations for how injury prevention can be optimized within the context of LLC. The themes that emerged from the focus group were verified through the survey to assess the generalizability to all LLC coaches.

Results

Focus group discussion resulted in five high-order themes and twelve low-order themes categorized under three general dimensions (Figure 2).

Figure 2: The development of general dimensions, high-order themes, low-order themes through thematic analysis.



Survey results indicated nine themes with high levels of agreement (S1-S9, Figure 3), while three themes were inconclusive, requiring further exploration (S10-S12, Figure 3). Analysis

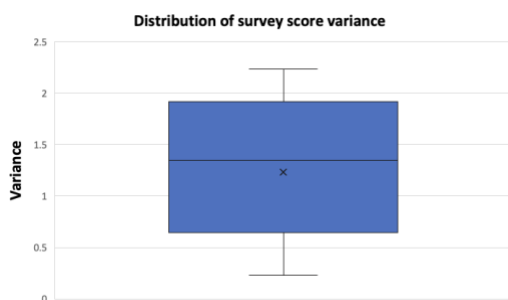
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of variance for the themes did not show any outliers in the data (upper limit 3.8, lower limit 0; Figure 4).

Figure 3: Survey results: Level of agreement towards focus group generated themes.

Theme (S)	Minimum	Maximum	Mean	Standard Deviation	Variance	Count
S1 When properly implemented, teaching proper throwing biomechanics to pitchers could reduce injury rate	4	5	4.64	0.48	0.23	11
S2 When properly implemented, giving enough rest to pitchers between games/training could reduce injury rate	3	5	4.64	0.77	0.60	11
S3 Poor communication between coaches, players, parents, the LLC organization, and special schools could put players at a greater risk for injury	3	5	4.45	0.89	0.79	11
S4 Cross-training exercises (i.e., tube and resistance training) can be protective against pitch-related injuries when introduced at an appropriate age	4	5	4.36	0.48	0.23	11
S5 Most coaches in LLC don't have enough knowledge of injury prevention to protect a player from pitch-related injuries	2	5	4.36	0.98	0.96	11
S6 When properly implemented, enforcing pitch counts could reduce injury rate	2	5	4.09	1.16	1.36	11
S7 Most coaches in LLC experience pressure to prioritize winning over development	1	5	3.82	1.47	2.15	11
S8 The medical support on the island is not specialized enough to properly manage pitch-related injuries	1	5	3.55	1.16	1.34	11
S9 Most coaches in LLC believe that the main purpose of LLC is developing players and teaching them how to play the game	1	5	3.55	1.44	2.07	11
S10 The mentality of many coaches in LLC is to prioritize a pitcher's velocity over their mechanics (i.e., "pitching harder and faster is better")	1	5	3.36	1.49	2.23	11
S11 The mentality of many pitchers in LLC is to pitch through pain and fatigue (i.e., "I am the ace, I must complete the game")	1	5	3.09	1.16	1.36	11
S12 The mentality of some LLC parents is to prioritize pitching opportunities over the well-being of their child (i.e., pressure their child to pitch even if the child is tired)	1	5	3	1.21	1.45	11

Figure 4: Distribution of variance amongst survey items.



Discussion

Various pitch-related injury prevention strategies are documented in the literature. These strategies are primarily based on mitigating risk factors such as imposing age-specific pitch limits, controlling types of pitches, and strength training (Fleisig & Andrews, 2012; Sakata et al., 2017, 2019). Despite promising results associated with injury prevention

interventions, implementation of these strategies remains low globally (Fazarale et al., 2012; Pamiás-Velázquez et al., 2016; Yukutake et al., 2013). The literature has not addressed the key determinants of stakeholder behaviour toward pitch-related injury prevention despite calls for using qualitative methods to provide stakeholder feedback on how injury prevention implementation can be optimized (Mining et al., 2022). Thus, the present study was designed to explore coaches' attitudes, beliefs, and behaviours toward pitch-related injury prevention in Curaçao.

Little League International uses the Pitch Smart guidelines (2023) to provide membership with player safety and injury prevention information based on expert opinion and research from a predominantly American-based working group. These guidelines attempt to limit youth baseball pitching behaviours associated with overuse injuries.

However, injuries involve a complex interaction between intrinsic risk factors (i.e., gender, age, strength, flexibility, previous injury) and extrinsic factors (i.e., level of play, training load). The multidetermined factors influencing injury risk demonstrate the potential for multiple entry points to counter the injury-producing process (Emery et al., 2006). Considering that Little League is being played globally in diverse settings, a cookie-cutter approach to injury prevention is not feasible. Injury prevention programs should be flexible and accommodating to the setting-specific barriers and facilitators of implementation (Minnig et al., 2022). More importantly, addressing context-specific intrinsic and extrinsic risk factors would be more effective than a general, predetermined approach to reducing risk.

The results from the focus group discussions and the online survey indicated numerous perceived barriers and potential facilitators to implementing injury prevention strategies in LLC. Based on the findings, the researcher put forward the two recommendations to provide requisite knowledge and support based on the most significant expressed needs and preferences as communicated by participating coaches of LLC:

1. Develop a digital resource for injury prevention exercises.
2. Offer free pre-season seminars on injury prevention strategy to coaches, parents, and athletes.

Develop a Digital Resource for Injury Prevention Exercises

An age-appropriate preventative exercise program was identified as the most fundamental approach to injury prevention. “When guys are older, you can incorporate cross-training or muscle development at the proper age with the proper trainers also because not a lot of people know how to train the children properly” Focus Group 1 (FG1) Participant 1 (P1). There was a general agreement amongst participants that cross-training is an essential component of an injury prevention program, yet few coaches program cross-training into their practices. Coaches reported that the time required to do preventative exercises was the most significant barrier to implementation. One coach commented, “When our training ends, the other team is already waiting to use the field... Our time with the kids is short, so everything needs to be done quickly” FG1 P4. However, a recent pitch-related injury prevention study demonstrated that a 10-minute exercise routine performed at a minimal frequency of once a week, over the course

of a baseball season, reduced the incidence of elbow and shoulder injury by 48.5% when compared to the control group who were instructed to perform their usual stretching and training (Sakata et al., 2019). The intervention group performed the modified Yokohama Baseball-9 program consisting of static stretches for the elbow, shoulder, and hip; dynamic mobility exercises focused on scapular and thoracic function; and lower extremity balance training. The intervention groups decreased incidence of injury risk is attributed to the program’s ability to control risk factors associated with pitching injuries such as reduced humeral acetabular range of motion, deficits in hip internal rotation, and increased thoracic kyphosis angles (Sakata et al. 2017, 2019; Shanley et al. 2011).

Providing exercises and demonstrating how coaches can incorporate them into their regular warm-up routine could eliminate the initial time required for coaches to research injury prevention exercises. Coaches could offer leadership opportunities for older players on the team to lead exercises while coaches prepare for training. Research by Minnig et al. (2022) suggested that using cell phone applications to disseminate free, easy-to-follow demonstration videos could greatly expand exercise access to coaches and players, reducing barriers to time and monetary factors.

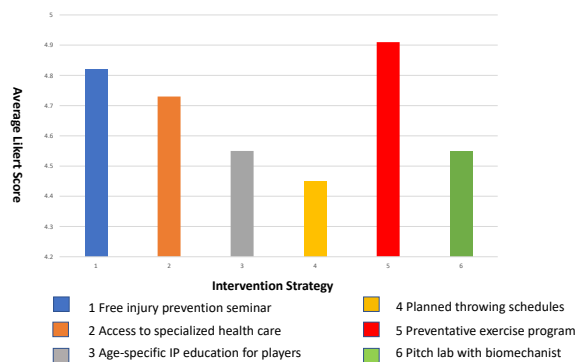
Offer Free Pre-Season Seminars to Coaches, Parents, and Athletes on Injury Prevention Strategy

LLC coaches reported low knowledge of injury prevention strategies but expressed a desire to learn. When asked how the organization supports and trains coaches to control risk factors, a coach responded, “They just count the pitches and tell you if

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a player is eligible or not to pitch the next day. They do not stress about giving the proper tools for keeping the players healthy” FG1 P3. Little knowledge of injury prevention has been identified as a substantial barrier to adopting injury prevention strategies among youth coaches (Norcross et al., 2016; Saunders et al., 2010). Focus group participants offered that creating accessible seminars for coaches, parents, and players may help increase the base level of knowledge towards injury prevention while also providing a space where questions could be put forward and strategies could be developed. The magic-wand portion of the survey supported these sentiments as coaches indicated the second highest level of agreement for free seminars to educate parents and coaches about injury prevention strategies (Figure 5). Prior research demonstrated that getting coach and player buy-in is an essential first step toward a successful injury prevention strategy (Padua et al., 2014; Root et al., 2019). Gaining buy-in could be bolstered by sharing research that links injury prevention implementation with performance benefits (Sakata et al., 2017).

Figure 5: Magic-Wand Question Results.



A recent study on youth handball players indicated that experienced and

qualified healthcare professionals should be used to deliver injury prevention training to stakeholders in youth sports. However, it is critical that these professionals are supported by the organization to optimize implementation (Ageberg et al., 2019). Unfortunately for LLC, the consensus expressed in focus group discussions and confirmed through the survey was that medical support on the island is not specialized enough to manage pitch-related injury (Figure 3, S8). One focus group participant expressed frustration, stating, “The doctor will say they can throw in 2-3 weeks, but after he returns and has thrown for six weeks, boom, the player gets injured again” FG1 P1. Although this frustration was directed towards most healthcare providers, some participants disclosed that they had found a few care providers with sports expertise whom they trust with their players over the years. Introducing these professionals to LLC coaches through presentations or workshops may help restore confidence among coaches towards the medical community and assist coaches in making recommendations so that their players can access professionals who understand the unique risk factors associated with pitching.

Considering the post-Covid climate and challenges facing coordinating coaches’ availability, it has been shown that remote presentations through free mobile applications or online databases may optimize access to resources for coaches (Minnig et al., 2022).

Support from all stakeholders (coaches, players, organizations, parents, and medical support) is essential to successful injury prevention program implementation (McGlashan et al., 2018). Regrettably, poor communication between stakeholders in LLC was a

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recurring theme throughout focus group discussions. One coach expressed, “Everybody is doing their own thing on their own island” FG2 P2. The coaches believe that lack of communication between stakeholders exposes children to overthrowing injuries as their total throwing volume is unknown before they arrive at team training. Lack of communication runs in opposition of the recent views of Møller et al. (2021) who found that a key implementation strategy to successful injury prevention programs in youth handball was a systemic approach to injury prevention that included key stakeholders. A systemic approach included coach training and education, organizational support, and coach and player understanding of injury mechanisms and prevention strategies. Moreover, approaches to injury prevention have demonstrated greater compliance and adaptation when interventions consider the unique context, facilitators, barriers, and resources available to support behavioural change (Minnig et al., 2022). Creating community and sharing expertise between LLC coaches, players, and parents through free, pre-season seminars might serve to:

- Reaffirm the objective of LLC and set expectations.
- Review of pitch-related risk factors and basic pitch-related injury management by specialized medical support personnel.
- Provide a live demonstration of the strength exercise program.
- Share strategies for managing training load led by experienced LLC coaches.
- Create a network with specialized medical support that parents, coaches, and kids are familiar with and trust.

- Establish a working group comprising volunteer coaches, players, parents, medical personnel, and LLC board members to inform future presentations on the learning needs of coaches in LLC.

While research suggests interventions targeted at preventing pitch-related injuries can reduce injury rate, a gap exists in translating this knowledge into practice. A multifactorial approach to injury prevention is needed to support the specific learning needs of coaches while addressing the location-specific barriers influencing their behaviour towards injury prevention.

Conclusion

While LLC coaches expressed a strong sense of responsibility for the safety and well-being of their players, implementation of injury prevention strategies remains minimal. Significant barriers to prevention strategies included a lack of knowledge in managing injury risk, low perceived control over what players are doing outside of time with their teams, and insufficient training and resources to support coaches. Coaches identified continued education and strength training programs as essential components of injury prevention programming.

Although this research only provides a theoretical approach to optimize injury prevention in LLC, it brings awareness to the barriers and contextual factors that impede risk reduction in a region under-represented in injury prevention literature.

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Authors' Qualifications

The authors' qualifications are as follows: Luke Cattet, MRSc, BA, CSEP High Performance Specialist; Lesley Bainbridge PhD, MEd, BSR(PT).

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