A COMPREHENSIVE ANALYSIS OF THE FACTORS AFFECTING THE DEVELOPMENT OF EXPERTISE IN ATHLETES WITH IMPAIRMENTS

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Abstract

Objective: The overarching purpose of this dissertation was to provide an overview of impairment-related factors that influence Paralympic sport (PS) athletes' sporting trajectory by examining various stages of the pathway including initiation and recruitment, development, and transfer. First, a modified version of Newell's constraints-led model was introduced to collate current literature and highlight the complexity of the factors that facilitate or debilitate development. Second, the demographic and sporting characteristics of participants attending the Paralympian Search events were examined with subsequent recommendations to optimize this process. Third, a detailed overview of Australian and Canadian Paralympic sport athletes' developmental trajectories, training histories, and experience in organized sports was explored while controlling for athletes' onset of impairment. Last, factors impacting athletes' decision to retire and/or transfer between sports were identified, which led to propositions to optimize initiatives to support athletes' transfer.

Methods: This dissertation used a concurrent mixed-methods approach by using the Paralympian Search survey to collect data for study 1 (Chapter 3), a modified Developmental History of Athletes' Questionnaire (DHAQ) to collect data for study 2 (Chapters 4, 5, and 6), and semi-structured interviews to gain insight to coaches and athletes' perspective of talent transfer (study 3, Chapter 7). A descriptive analysis along parametric (ANOVAs and Bonferroni post-hoc tests) and non-parametric (Kruskal-Wallis tests with Mann-Whitney U post-hoc procedures) tests were used to examine the quantitative data while thematic analysis guided the exploration of the qualitative data.

Results: Several key findings were identified across the studies including 1) the lack of female athletes or participants from rural areas at the Search events, 2) transfer being perceived as an alternative to retirement, yet, currently only being implemented informally in ‘less than ideal’ conditions, and the 3) strong synergy between athletes’ previous (Paralympic and able-bodied) sports to their current PS. However, the most notable finding was the influence of impairment-onset on athletes’ sporting trajectories. More specifically, athletes with congenital and early-acquired impairments (pre-adolescence, adolescence) reached developmental and performance milestones at younger chronological ages than athletes with late-onset impairment (acquired during adulthood), while the latter groups ‘fast-tracked’ to achieve these milestones at an earlier point in their careers. There were no significant differences in the amount of training accumulated over athletes’ careers; however, each group demonstrated a different training profile (i.e., hours devoted to each training condition varied between groups). In addition, athletes with impairments acquired during adulthood incorporated *some* of the training conditions earlier in their careers in comparison to athletes with a congenital or early-onset impairment.

Conclusions: The collation of findings suggests different resources may be necessary for athletes at different stages of their careers depending on when the onset of impairment occurred, including more specialized pathways with access to key resources for athletes with late-onset impairments and opportunity for multi-sport programs for athletes with congenital and early-onset impairments. In addition, there is a need for initiatives to support the involvement of more female athletes, participants in rural areas, and athletes looking to transfer sports. However, the complexity and dynamics of development, including impairment-related factors, emphasize the need to consider more in-depth, individualized approaches to understanding athlete development in the Paralympic context.

Dedication

To my parents, Changez Dehghansai and Mehri Masodian, who left their home, families, friends, and childhood memories for better opportunities for me and my brother. Your selfless act of kindness and forward-thinking drives me every day to be the best I can be. I owe it to you and to myself to maximize this amazing opportunity you have given me to prosper and succeed in a country where ideologies and beliefs do not separate human beings (thanks for not going south of the border).

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Chapter One

General Introduction

General Introduction

The term athlete development has been variably used to examine athletes' progression across their sporting careers, with some scientists and practitioners focusing specifically on sporting outcomes (i.e., factors that impact sport performance, such as quantity and quality of practice, e.g., Ericsson et al.'s, 1993 'deliberate practice framework') while others have been more interested in athlete's personal development (i.e., acquired sporting skills transferable to other aspects of person's life, e.g., Wylleman et al., 2004). These factors are often conceptualized into athlete development models (ADMs), which sport organizations use as a structure to allocate resources, assign specific roles, and inform policy to optimize athletes' developmental environments. Whether rooted through empirical research (e.g., Developmental Model of Sport Participation, DMSP, Côté, 1999; Athletic Talent Development Environments, ATDE, Henriksen et al., 2010) or driven through practical application (e.g., Foundation, Talent, Elite, Mastery, FTEM, Gulbin et al., 2013; Long-Term Development in Sport and Physical Activity 3.0, Higgs et al., 2019), these models vary based on the importance given to different aspects of athletes' development including micro- (i.e., training environment, types of training, sporting opportunities), macro- (i.e., family support, social circle), and meso-level structures (i.e., policies, funding). However, despite their long history of use, these models have received scrutiny for their apparent shortcomings, including the emphasis on a specific domain (e.g., physiological outcomes), low empirical evidence to support the model's development, and the applicability of the model's tenets in practical settings (Ford et al., 2014; MacNamara & Collins, 2014). Ultimately, these shortcomings can lead to ineffective developmental environments resulting in negative athlete experiences, including athlete burnout and dropout (i.e., Isoard-Gauther et al., 2016). On the other hand, an optimal developmental environment can lead to long-term sport participation with a wide range of benefits including physical (e.g., improved health and physical fitness), psychological (e.g., increased confidence), and social (e.g., social connections) (Statistics Canada, 2011).

The Paralympic Context

Similarly, there are societal and personal benefits to sport participation for individuals with an impairment. Evidence suggests sport participation can positively reshape societal perspectives and stigmas about disability[1] and alter individuals' perception of their own abilities (World Health Organization, 2011). In addition, individuals develop a sense of accomplishment and belongingness via social networks and experience increased self-confidence, overall health, and quality of life while reducing the risk of common diseases (Brittain & Green, 2012; Caddick & Smith, 2014; Day, 2013). Above all, acquired skills learned through sport, such as leadership, may transfer to other domains, empowering and motivating individuals to pursue other life challenges such as education and/or employment (World Health Organization, 2011).

However, Paralympic sport[2] (PS) participation is relatively low (Day, 2013) and more concerning, the dropout rate among participants is very high (Sweet et al., 2012). Furthermore, the efforts of practitioners (e.g., the Canadian Paralympic Committee) in attracting participants reflects limited success in maintaining long-term participation (Foulon et al., 2010; Tomasone et al., 2014). A persisting challenge in Paralympic contexts that contributes to limited participation and high dropout rates is the availability and accessibility of programs (Jaarsma et al., 2014; Martin Ginis et al., 2016; Mulligan et al., 2012). Moreover, Radtke and Doll-Tepper (2014) identified the lack of communication between organizations, qualified coaches, and resources to

[1] In accordance with International Paralympic Committee's (2014) definitions, impairment pertains to a person's biological condition, while disability encapsulates the biopsychosocial element that creates the 'dis'able paradigm.

[2] The term Paralympic sport (PS) refers to sports that are currently or in the past a part of the Paralympics.

educate staff on impairment-related factors as contributors to negative experiences of PS athletes[3] entering existing programs. If ADMs are utilized to inform policy and structure in the Paralympic context, then PS athlete-specific needs must be considered to design optimal environments. However, most Paralympic ADMs use evidence from able-bodied (AB) contexts, with limited information on their effectiveness (Patatas et al., 2018). An impediment to a Paralympic specific ADM is the lack of literature to inform stakeholders (i.e., scientists, practitioners, sport organizations) of key factors that influence PS athletes' development.

In 2016, Hutzler and colleagues emphasized the importance of expanding the research in this area to parallel the growth of the Games in recent decades. A subsequent systematic review by Dehghansai and colleagues (2017a) demonstrated the lack of work in this area: from the 21 articles that met the inclusion criteria (from 4,156 reviewed publications), nine examined training and practice characteristics, seven implemented a short-term intervention to assess physiological changes in participants, and four studies explored long-term cognitive and physical changes caused by extensive training. However, as concluded by the authors, the systematic search found no studies examining the developmental trajectories of PS athletes, exploring such factors as sporting milestone attainments, experience in organized sports, or training histories and, perhaps more importantly, how these variables influence athletes' progression across their careers (Dehghansai et al., 2017a). As alluded to by both research teams, there are complexities associated with athletes' development which are further complicated when impairment-related nuances are introduced (Dehghansai et al., 2017a; Hutzler et al., 2016). Thus, the (already scrutinized) 'one-size-fits-all approach' borrowed from the AB context is further limited in Paralympic-specific contexts (Patatas et al., 2018).

[3] PS (i.e., Paralympic sport) athletes is used to define athletes currently in a Paralympic sport (irrespective of competitive level). Athletes with debuts at the Paralympics will be referred to as Paralympians.

While there are universal factors important for athletes' development irrespective of the context (PS or AB), such as the importance of high-quality coaching or purposeful training, other nuances including the opportunity to sample sports, quality of training environments, and the age athletes enter sport, are influenced by disability-related factors (Martin Ginis et al., 2016; Shirazipour et al. 2017). For example, coaches have reported that athletes' impairment and potential classification are key indicators to athletes' success in a particular sport (Patatas et al., 2018, 2020). In addition, the age athletes acquire their impairment will influence when and how they enter PS. Athletes with congenital or early acquired impairments may be exposed to PS through community or school programs while athletes with later acquired impairments are more likely introduced to PS through rehabilitation programs (Radtke & Doll-Tepper, 2014). Considering the lack of availability and accessibility of programs, these are additional constraints specific to PS that cannot be generalized from research from AB contexts. Moreover, athletes with congenital or early-acquired impairments may have an advantage due to more time allotted to training over their careers while athletes with impairments acquired later in their careers will understandably have less 'on task sport-specific' training hours.

A recent study of the Canadian wheelchair basketball players highlighted between-group differences as athletes with a congenital impairment reached *developmental milestones* (i.e., age at which they started PS and various training activities) at an earlier age than athletes with acquired impairments; however, athletes with acquired impairments reached key *performance milestones* (i.e., age at which they made national and international debuts) at a similar age. The authors alluded to existing AB literature and suggested athletes with acquired impairments may have either utilized different training metrics (devoted more hours to specific types of training earlier in their careers resulting in a quicker skill acquisition) or transferred skills from previous sports (i.e., experiences in AB sport) to 'fast-track' through their career and reach key performance milestones around the same age (Dehghansai et al., 2017b; Lemez et al., 2020). However, the authors were concerned about the high variability within the acquired group, suggesting future research use more specific age groupings for impairment-onset to reduce variability within groups. Finally, similar to the previous limited literature in this area of work, the authors highlighted the importance of extending this work to better understand this under-studied cohort to better encapsulate PS athletes' sporting development and thereby better inform stakeholders (i.e., practitioners, scientists, coaches, sport organizations, coaches, parents, and athletes) of the complex interaction of factors that impact PS athletes' development.

Study Rationale and Research Objectives

The purpose of this dissertation was to address some of these key gaps while providing a foundation for future work advancing the topic of athlete development in Paralympic contexts. The goal of this work was not to create another model; rather, it was to inform key stakeholders on important indicators within the complex system of PS athlete development to a) help with their decision making and b) supplement for some of the shortcomings of current ADMs. Considering the limitations in the research literature in comparison to the depth of the complexity of the problem, a working theoretical framework was necessary to collate the literature to better articulate the intricacy of the PS development and identify gaps. To this end, we modified Newell's constraints-led model (1986) as it aligned with the biopsychosocial model of disability (International Paralympic Committee, 2014). Newell's model has also been extensively used to provide structure for systematic reviews (Reinhoof et al., 2016), highlight biomechanical interactions (Keogh, 2011) and skill development (Pinder & Renshaw, 2019) in PS, and as a theoretical model to understanding athlete development (Phillips et al., 2010;

Renshaw et al., 2012; Wattie et al., 2015). In chapter 2 (Study 1), we introduced the tenets of this model (i.e., interaction between the environmental, task, and individual constraints impact learning outcomes), while proposing additional sub-categories to better contextualize the complexity of athlete development in the Paralympic contexts. In doing so, existing literature was organized within the framework and gaps in our understanding of PS athletes' development were identified.

In subsequent chapters, PS athletes' experiences within the Australian and Canadian systems were investigated to better understand key components influencing athletes' sporting trajectories. While we recognize the need to accept impairment from a holistic lens (i.e., type of impairment, impairment-onset, classification, the severity of impairment), due to the limited understanding of how these factors behave in this system, our goal was to provide an in-depth overview of PS athletes' experiences across the pathway while controlling for one impairment-variable, namely, the nature of impairment (i.e., the age an athlete acquired their impairment). Consistent with previous literature, one of the factors that influences' athletes experience in PS is the age they enter PS. As alluded to by earlier research (Dehghansai et al., 2017b), it is important to look at the acquired group in more detail, and therefore, we categorized athletes into five groups (i.e., congenital, pre-adolescence, adolescence, early-adulthood, and adulthood).

To better understand persisting challenges to recruitment (Martin Ginis et al., 2016; Radtke & Doll-Tepper, 2014), Chapter 2 explored the effectiveness of Paralympian Search events[4] by examining the demographic and characteristics of participants attending events between 2016-2018. Chapters 4-6 addressed our limited understanding of athletes currently in the pathway (Dehghansai et al., 2017b; Patatas et al., 2018) by examining PS athletes' sporting

[4] An event held four to five times a year across Canada, designed to promote PS participation and provide a platform for sports to recruit potential athletes

trajectories (i.e., milestone trajectories, training histories, and sporting experiences) in order to inform policy and guide resource allocation across the pathways to optimize developmental environments to maximize athletes' potential and reduce dropouts. Chapter 7 aimed to further enhance our understanding of athletes' experiences in the pathway and identify factors that result in athletes dropping out or transferring between sports. Collectively, these findings will help provide a) practitioners with a working theoretical framework to understand complexities associated with PS athletes' development (Chapter 1), b) an in-depth understanding of the characteristics of athletes entering PS through the Paralympian Search while identifying key gaps within the Search events (Chapter 2), c) an in-depth understanding of PS athletes' experiences across their sporting career while highlighting the impact of impairment-onset on athletes' sporting trajectories (Chapters 4-6), and d) identify key elements that contribute to dropout and/or transfer between sports (Chapter 7). The overarching objective of this dissertation was to expand and extend a significantly limited area of literature, and assist key stakeholders in guiding more appropriate policy, designing more effective initiatives, and improving the efficiency of resource allocation. Thus, Chapter 8 will provide a list of key findings of this dissertation along with practical implications, future directions, and limitations.

Chapter Two

Understanding the Development of Elite Parasport Athletes Using a Constraint-Led Approach: Considerations for Coaches and Practitioners

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******This manuscript has been presented in the formatting that has been accepted and published in the respective journal. References are included at the end of the dissertation starting on page 163-185.*

Abstract

For the past half-century, the Paralympic Games has continued to grow, evident through increased participation, media recognition, and rising research focus in Para sport. While the competitive pool of athletes has increased, athlete development models have stayed relatively the same. Currently, coaches rely mainly on experiential knowledge, informal communication with colleagues, and theory transferred from able-bodied contexts as main resources to support development for themselves and their athletes. The purpose of this paper was to introduce Newell's constraint-led model, its multidimensional spectrum and practical scope to address the complexities of athlete development. The model consists of three overarching constraint categories (i.e., individual, task, and environment) along with proposed additional sub-categories to capture nuances associated in Para sport in order to provide additional context to coaches regarding athlete development. Utilizing this theoretical framework, we present a holistic approach for coaches and practitioners to consider while addressing athletes' short- and long-term developmental plans. This approach highlights the interactions among factors from a wide range of categories that indirectly and directly impact one another and ultimately, influence athletes' developmental processes. It is important to consider the dynamic interaction of constraints over various timescales during development and identify underlying issues to improve athlete experience and maximize developmental opportunities. Coaches and practitioners can use the proposed framework as a guide to key factors to consider for their cohort of athletes. This approach provides a context-specific approach that considers unique factors associated with athletes and their environment.

Keywords: Expertise, models, theoretical framework, constraint-led approach, coach resource, athlete development, Paralympics, Para sport

Understanding the Development of Elite Para Sport Athletes Using a Constraint-Led Approach: Considerations for Coaches and Practitioners

The Paralympic Games and the Para sport community have seen tremendous growth with 2.15 million spectators watching 4,328 athletes from 159 countries compete in 22 sports in the most recent Summer Paralympics in Rio de Janeiro, Brazil (Paralympics, 2019). Parallel to this, media recognition along with research in this area, has increased in pace (Houlihan and Chapman, 2017). Given this growing popularity, contextualizing the existing research on athlete development may provide a broader understanding of the factors that influence participation, development, and expertise in Para sport. A notable issue with current models is the aim and need to generalize and condense all athletes into one developmental pathway. Such models are considered to be necessary to understanding development; they provide direction and identify specific roles for individuals within the complex sporting structure while providing a framework that organizations can utilize to evaluate and allocate resources and funding. However, the rigidness and need for a 'neat and tidy' model ignores the variability that exists in all athlete development trajectories which is exacerbated by numerous factors in Para sport, including disability-related nuances. While models have been examined and publicly scrutinized (Côté, 1999; Lloyd and Oliver, 2012), the underlying motive of these articles has usually been to promote an alternative model. However, the larger issues underlying all models are: classification of athletes into categories, the generalization of the pathway, and time-related (biologically referenced) assumptions to development (Lloyd and Oliver, 2012; MacNamara et al., 2014).

Thus, the purpose of this paper is not to suggest another model, similar to what is currently being applied across the globe (e.g., Long-Term Athlete Development model LTAD;

Bayli and Hamilton, 2004] or Foundation, Talent, Expertise, Mastery model [FTEM; Gulbin et al., 2013]), nor is it to propose specific guidelines to change policy (e.g., SPLISS [Patatas et al., 2020). The objective of this paper is to provide guidelines for coaches and practitioners to make more informed decisions by understanding the scope of variables that interact to impact athlete development at any given time. We aim to conceptualize current understanding in athletes' development and provide a better understanding of the dynamic interaction of the myriad factors influencing athletes' development. However, a limiting factor in this area is the lack of a comprehensive theoretical framework to guide research and applied work; without a theory to guide research and interpret findings, it may be difficult to understand the factors that influence processes and outcomes (Coalter, 2007). Without an overarching framework, it may also be difficult to parse existing research to generate better avenues for future research. In this paper, we demonstrate how Newell's (Newell, 1986) constraints-based model is a useful framework to i) organize current literature, ii) promote a discussion of predominant issues in the development of Para sport athletes, and iii) identify practical methods to inform coaches/practitioners of factors to consider in athletes' development. While there has been a growing body of literature in Para sport, very little of this research has considered the dynamic interaction across developmental factors and how each can directly or indirectly impact the behavior and outcome of another. More importantly, there is limited research that has considered how this dynamic interaction takes shape in an applied setting where athletes continuously interact with their environment and take on tasks that require different demands.

Newell's Constraints Model

Newell's model has been used to provide structure to systematic reviews (Rienhoff et al., 2016), highlight biomechanical interactions in Para sport (Keogh, 2011), support skill development in Para sport (Pinder and Renshaw, 2019), and more importantly, as a theoretical model to understand athlete development (Phillips et al., 2010; Renshaw et al., 2012; Wattie et al., 2015). The appeal and longevity of Newell's model is likely due to the straightforward yet multidimensional categories and the interactive nature of their relationship. Newell's theoretical framework is also attractive for our purposes because it is consistent with definitions of disability as biopsychosocial phenomena resulting from interactions between individuals and contextual-environmental factors (Leonardi et al., 2006).

This model, like many developmental systems theories (Lerner et al., 2005; Lerner, Dowling et al., 2005) emphasizes the integration and connectedness of different constraints that dynamically interact over time to affect developmental outcomes; however, it differs from other models due to its ease of practical application (see Figure 1 for depiction of the model). Often depicted as points on a triangle, Newell's framework includes task, individual (i.e., performer), and environmental constraints (Newell, 1986; 1991). Changes to any of these constraints, or the interaction between multiple constraints, will modify outcomes. In the following section, we expand on these categories and use Newell's theoretical framework in combination with the existing literature to discuss how these constraints may influence the development of Para sport athletes and identify how this framework can be utilized to help coaches shape an environment optimising athletes' development (see Table 1 for a short description of each type of constraint). The proposed additional constraint sub-categories are drawn from the authors' expertise both academically and practically working with ecological and constraint-led approaches in able-bodied and Para sport systems. This work sheds light on current gaps and limitations and we aim to address these nuances by specifying additional categories that could help coaches and practitioners better prepare for working in the Para sport context.

Performer Constraints

To better account for the different ways that individual characteristics can influence outcomes, individual constraints in Newell's model are considered relative to two sub-categories, structural and functional (Haywood and Getchell, 2009; Newell, 1986; 1991). In addition, given some aspects within each sub-category are relatively stable (e.g., height, limb length) while others are more easily changed through training (e.g., physical fitness, weight), we suggest three additional groupings within each sub-category: stable (limited to no change over time), malleable (changes over medium to long timescales), and unstable (random fluctuations over short, medium, and long timescales).

Stable structural constraints. Stable structural variables (e.g., height) affect performance through their influence on a myriad of variables that need to be optimally coordinated in order to attain a given performance outcome. Differences in height provide players with different performance/action opportunities (often referred to as affordance from an ecological dynamics perspective; Araújo et al., 2009), which may have important consequences for development (e.g., the advantage of seated height (torso length) in wheelchair basketball). In addition, physical limitations as a result of athlete impairment lead to unique action capabilities. For example, wheelchair basketball athletes with more severe impairments may compensate for limitations in trunk muscle activation by increasing the flexion of their shoulders, elbows, and wrists during free-throw shooting which causes more variability in their shot and decreases shooting percentage (Goosey-Tolfrey et al., 2002; Malone et al., 2002). Resultantly, players in different classifications are often assigned different roles to compensate for their physical function (e.g., lower-class players set picks for higher class players who have the ability to maneuver and increase speed during short-distance sprints; Sporner et al., 2009; Vanlandewijck et al., 2003; Vanlandewijck et al., 2004). Understanding stable structural constraints can provide coaches with the opportunity to adapt their game strategies to utilize each athlete in a unique way to maximize their performance and overall contribution to the team (Boyd et al., 2016; Haydon et al., 2018; Seron et al., 2019). However, stable structural constraints should not be considered as lone functioning constraints that impact athletes' performance, as they are likely interdependent on malleable structural constraints which are prone to change over time (Marszałek et al., 2018).

Malleable structural constraints. Consistent with Newell's reference of time scales for skill acquisition and development, malleable constraints are identified as body functions that adapt to the demands of the task due to extensive training or change due to natural course of progression (Newell et al., 2001; 2009; 2010). While some impairments can cause irreversible damage (e.g., nerve damage in spinal cord injuries, amputation of a limb), some bodily functions that are a symptom of the impairment (e.g., decreased cardiovascular function due to spinal cord injury [SCI] or phantom limb) can change over time (Bläsing et al., 2010). For example, Para sport athletes training long-term have been shown to exhibit superior cardiovascular performance than untrained able-bodied individuals (Huonker et al., 2003). In addition, Para sport air-pistol shooters display higher alpha level activities in the frontal, central, and temporal regions during shooting performance, highlighting the neuroplasticity of the brain and ability to recover from earlier injury to demonstrate greater attentional demand when executing a visual task (Kim and Woo, 2013). As such, it is important to consider how physical capabilities can change over time based on specific types of training and consider how this may impede or facilitate skill acquisition. The ability to differentiate athlete capabilities that are influenced by impairment versus acquired skill has been a long-standing challenge for classifiers and practitioners

(Beckman and Tweedy, 2009; Tweedy and Vanlandewijck, 2011; Vanlandewijck et al., 2011). While malleable constraints capture nuances associated with long-term change, unstable structural constraints are, as Newell and colleagues (Newell et al., 2001; 2009; 2010) suggest, 'transient,' and change more frequently in shorter periods of time.

Unstable structural constraints. Unstable structural constraints are physical and physiological factors that can vary unpredictably on a day-to-day basis. For example, while an athlete may demonstrate improvements in skill execution across multiple training sessions, there may be variability between practices that is influenced by their physical or psychological well-being. This can be due to random factors such as sickness or more systematic factors such as stiffness, soreness, and/or impairment-related complications such as day-to-day variabilities associated with conditions such as Multiple Sclerosis or Cerebral Palsy (Barkoudah and Glader, 2018; Hertel, 2002; Meberg and Broch, 2004). Therefore, it is vital for coaches to be flexible and understand the variability associated with athlete development. In particular, coaches and researchers should consider that these constraints are bidirectional and unstable, and focus should be on the long-term trajectory while negotiating minor setbacks.

Stable functional constraints. Stable functional constraints relate to internal factors such as personality traits, which are generally stable over time. Cox and Davis (1992) compared the personality traits (anxiety control, concentration, confidence, mental preparation, and motivation) of Paralympic athletes to athletes from able-bodied sport and results indicated higher positive scores for Paralympians on anxiety control, confidence, and motivation. This finding was subsequently supported by Patten, Harris, and Leatherman (Patten et al., 1994), who using a different sample found similar scores in iceberg mood profiles (i.e., T scores below the 50th percentile on Tension, Depression, Anger, Fatigue, and Confusion and above the 50th percentile on Vigor). In addition, Pensgaard, Roberts, and Ursin (1999) compared Paralympic and Olympic athletes' motivational climate under the achievement goal theory. Athlete profiles were reported to be relatively similar: ego and task orientation levels were similar, and both scored high on competitiveness; however, Paralympic athletes scored significantly higher in mastery orientation, and the authors postulated this could be the byproduct of having to negotiate and master skills in relation to their impairment (e.g., adjusting to the use of wheelchair, learning to cope with unexpected barriers such as staircases). Understanding stable functional constraints such as personality traits and tendencies could help shape skill development to push athletes to their limits while keeping athletes engaged. Furthermore, it is important to consider subtle individual differences and how each may respond differently to certain task demands (Pinder and Renshaw, 2019).

Malleable functional constraints. Internal factors including psychological qualities such as fear, mood, and self-efficacy also affect development and performance (Glazier and Robins, 2013). Many functional constraints have a rapid rate of change, which makes them more variable over time and more malleable. For example, individuals with recently acquired impairment are prone to lower self-efficacy and lower motivation to participate in sports (Greguol et al., 2015; Veldhuijzen van Zanten et al., 2015). Ironically, there are numerous reports on the benefits of sport participation on participants' self-efficacy (Martin, 2013; Perrier et al., 2015), although the dose-response relationship appears to depend on the sport (i.e., wheelchair sports with more dynamic and unpredictable movements result in higher self-efficacy than less dynamic wheelchair sports and/or non-wheelchair sports; Fliess-Douer et al., 2003). In addition, athletes with more experience in sport display a different type of anxiety profile and have less pre-competition state anxiety (Ferreira et al., 2007) as the extensive experience in competitive climates can help mitigate the initial ‘participation butterflies’ (Gioia et al., 2006). Furthermore, in an optimal participation environment, numerous benefits have been reported, such as increased sense of accomplishment, decreased anxiety and depression, enhanced mood, higher self-efficacy, better general competence, as well as enhanced object control, locomotor skills, and self-perception (Jefferies et al., 2012; Martin, 2013; Martin and Malone, 2013; Martin and Vitali, 2014). Interventions such as mindfulness have also had a positive impact on athletes’ psychological flexibility and perceived stress (Lundqvist et al., 2018).

Therefore, using the constraints-led approach to design practice sessions could maximize athletes’ current action capabilities which can improve psychological qualities such as motivation and self-esteem, which will ‘feed-forward’ into future positive behaviors. On the one hand, the ability for rapid change in malleable functional constraints makes them important for coaches, trainers, and administrators working in Para sport contexts. On the other hand, however, malleable functional constraints may limit opportunities for development/participation if an individual’s motivation to begin or maintain involvement is contingent on the availability of appropriate environments.

Unstable functional constraints. While malleable constraints are unstable and adaptable by nature, unstable functional constraints are more transient and emphasize the day-to-day variations that impact athlete training and performance. Unlike long-term psychological factors that impact and are impacted by sport participation, an athlete’s daily mood can be influenced by a wide range of factors including elements within sport (e.g., recent dialogue/interaction with coaches, other athletes) and outside of sport (e.g., family and friends, work-related factors). One’s mood and state of emotion can impact their visual perception, visual field, anticipated action, and information that can be readily and immediately used for cognitive processing (Zadra and Clore, 2011). Emotional arousal can also enhance the learning process (Hu et al., 2007; Wolfe, 2006). Thus, one's current emotion and mood may be a mediator to identifying important environmental cues in the learning and execution of tasks. Coaches and practitioners would benefit from being mindful of this variability between sessions and how it may impact athlete behavior and performance and ultimately task outcome.

Performer Constraints Summary

Given the complexity and a wide range of factors that impact an individual's system and behavior, the ability to recognize each factor and its origin is important. For example, the ability to differentiate between factors that may be malleable or unstable could influence coaching philosophy in practice. In a testing environment, malleable factors must be considered as day-to-day and controlled for variability between testing sessions. In a practice context, a coach's awareness of this may allow them to be more lenient towards negative consequences associated with malleable factors and less forgiving in situations where unstable traits are present. Therefore, a case-by-case approach is ideal as the response to each circumstance will depend on the nature of the issue and a deeper understanding of constraints behaviors can mediate how one approaches each scenario.

Task Constraints

In Newell's original model, task constraints were categorized under one category; generally, task constraints relate to the requirements of the sport such as physical demands (e.g., strength, aerobic vs. anaerobic energy systems), the rules, parameters (e.g., court dimensions, playing surface, equipment), and the different roles within the sport (e.g., positional demands). However, due to the inherent complexity of Para sport and a need for a framework that better addresses these complexities, using our expertise, we have organized the current literature in task constraints by introducing four new sub-categories ('general,' 'outcome,' 'sport-specific,' and 'skill-specific') that better contextualize the role of 'task' in this dynamic relationship.

General task constraints. Within the scope of our discussion, general tasks are the primary factors within each sport, such as the ability to push and control one's wheelchair, grab and control a racquet (e.g., table-tennis, tennis, badminton), control a stick with the mouth (i.e., boccia), sit/stand on skis, and so on. While general task constraints also constitute factors necessary to operate daily activities (e.g., going up and down a ramp, getting out of bed, cooking through manipulating a fork or spatula), it is beyond the scope of this article to cover the extensive research that has been accumulated within this topic. Nevertheless, the basic task requirements are essential for sport entry which highlights the importance of a strong foundation at the grassroots level. Athletes' mastery of general skills may be vital to remaining in sport and it is noteworthy to highlight the importance of sport and physical activity as methods for recovery and adjustment to impairment for individuals with newly acquired injuries (Bourke et al., 2015; Day, 2013; Martin-Ginis et al., 2016; Murphy, 2008).

Outcome task constraints. This sub-category of task constraint focuses on outcome measures in sport-specific contexts, measured either as the outcome of the game or specific task (e.g., rebounds, points, volleys returned). Most outcome measures are assessed in association with other constraints. For example, the relationship between outcome task constraints and structural constraints has been reported to be an important predictor for trunk stability in wheelchair basketball which in turn mediates specific roles on-court (Vanlandewijck et al., 2003). In addition, athletes' ability to cover more distance on the court in wheelchair rugby has a strong relationship with athletes' VO2 max which is moderated by the nature and severity of impairment (Goosey-Tolfrey and Leicht, 2013), which also impacts participant roles and tactics.

In team sports such as wheelchair basketball, a point system limits numbers of athletes on the court at the same time and the basis for this classification system is athletes' functional mobility. Therefore, there are possible tactical advantages if an athlete can outperform baseline expectations in their classification. Continuing to monitor and maximize the interaction among various task and outcome constraints may result in tactical advantages coaches can utilize during recruitment and development.

Sport-specific task constraints. Sport-specific constraints are rules, parameters, and equipment within the sport that provides competitive structure. This category of constraints has an important impact on Para sport athletes' development both in theory and practice. For example, the varied health experiences of these athletes underscore the challenges associated with meeting unique sport and task demands. Importantly, it may be a mischaracterization to view these constraints solely as limiting; certain task constraints may also act as 'enabling' factors to Para sport participation and performance. For example, impairment classification is a central characteristic of Para sport and presents arguably the most obvious task constraint. Classifications reflect the International Paralympic Committee's (IPC) objective "to support and co-ordinate the ongoing development of accurate, reliable, consistent and credible sport-focused classification systems and their implementation" (IPC, 2016) and there has been a surge for an evidence-based classification system considering the taxonomy, validity, reliability, and unification of testing across each sport (Beckman and Tweedy, 2009; Beckman et al., 2017; Tweedy, 2002; Tweedy et al., 2018, Vanlandewijck et al., 2011). More specifically, classification is based on an athlete's physical ability and capability to perform sporting tasks, although there is evidence suggesting that disability severity may not, in fact, be a significant indicator of potential to reach expertise (Hedrick et al., 1988). Dehghansai and colleagues supported this notion through recent examinations of Para sport athlete development, reporting that disability severity may not influence athletes' progression to elite status (Dehghansai et al., 2017a), despite an overall lack of research on sport-specific development of Para sport athletes (Dehghansai et al., 2017b). However, disability severity has the potential to negatively affect Para sport athlete selection and subsequent development (i.e., tasked to implement a set of tactical behaviors which prevents the athlete to develop a wide range of skills within the sport). As such, classifications can be viewed from both an exclusionary and inclusionary perspective. For example, as classifications are sport-specific and relative to the unique demands of each sport and a broad spectrum of individual limitations, some athletes may meet the criteria to participate in one sport, but not another (Baker et al., 2017). Furthermore, Para sport practitioners may altogether bypass individuals with specific impairments that negatively affect their ability to perform a sport-related task (perceived or actual), such severity of athlete's SCI affecting their trunk movement and ability to rebound the ball in wheelchair basketball. On the other hand, classifications may also be viewed as a means to facilitate participation in appropriate sports regardless of the athletes' intrinsic motivation for that particular sport. Therefore, a task constraint such as impairment classification may limit or help shape skill attainment (i.e., skill-specific task constraint) and development ultimately leading to a successful or failed outcome (i.e., outcome task constraint). This highlights the symbiotic nature of these sub-categories and the need to consider the dynamic interactions occurring among various factors.

Skill-specific task constraints. Skill-specific constraints refer to the individual's ability to adopt and excel in a specific task (e.g., the forehand in wheelchair tennis). While many sport interactions consist of a dynamic interplay between two athletes, the focus of this constraint is on specific tasks within the game. More specifically, the attention is shifted to develop a better understanding of task manipulation and execution, and the underlying mechanism of how a specific skill is learnt and performed (e.g., the rolling build-up and execution of a lay-up in wheelchair basketball). From the very limited literature on this topic in Para sport, an individualized approach is suggested as each athlete approaches learning and responds to various task manipulations within practice differently (Pinder and Renshaw, 2019). The individualized approach utilizing task manipulation for acquisition and modification of specific skills has reportedly had a positive impact on athlete's ability to acquire and transfer learnt skills into different performance contexts (Pinder and Renshaw, 2019).

Task Constraints Summary

Differentiation between the type of task constraints and a deeper understanding of the fundamentals that create the dynamic complexity of a game scenario could be extremely helpful to coaches and practitioners. While it is important to understand the layers that construct the execution of a movement, a holistic approach that considers the interaction of these complex movements is equally important. As seen within this extended framework, individual constraints directly interact with task constraints and shape behavior. Therefore, when designing tasks and considering session outcomes, conceptualizing and understanding the behavior of microelements of a complex task provides a deeper perspective on the collection of behaviors that shape the performance of an athlete.

Environmental Constraints

Environmental constraints are less stable (i.e., dynamic) influences that do not change the goal of the skill and/or sport-specific task, but can influence development and performance. While the original description of this constraint in Newell's (Newell, 1986) model contained no sub-categories, we feel that it is important to provide more nuance given the complexity of athlete development in general, and particularly in Para sport. The proposed sub-categories below, natural, infrastructure, sociocultural, and interpersonal, are consistent with modern ecological systems theories (Bronfenbrenner, 2005; Bronfenbrenner and Morris, 2006; Gottlieb et al., 2006; Spencer, 2006), and emphasize the importance of incorporating different layers of the ecology into theoretical frameworks and the design of applied learning environments. This highlights the complex interaction across mutliple variables that can impact individual's development from one's immediate environment (micro) to the larger community (meso) and cultural/historical aspect of the society (Bronfenbrenner, 2005).

Natural environmental constraints. Natural environmental constraints (e.g., climate and geographic position) can influence athletes' sport selection, development, and overall performance. For example, training year-round for winter sports is extremely difficult in southern countries such as Brazil, where the climate itself can hinder/enhance athletes' development and performance. Training in cooler temperatures and competing in contrasting climates (e.g., Canadian athletes competing in the recent Rio Paralympic Games) can impact an athletes' performance. In addition, training in hotter and humid climates is difficult for athletes with impairments affecting their autonomic nervous system and thermoregulation (Mills and Krassioukov, 2011). Griggs, Leicht, Price, and Goosey-Tolfrey (2015) reported that tetraplegic athletes had a higher body temperature than paraplegic athletes during the same workouts. Therefore, it is exceedingly important to consider athletes' specific impairments and their interaction with training and competition contexts. In turn, this may mitigate negative biopsychosocial outcomes and improve athletes' training and performance (i.e., influencing skill-specific, sport-specific, and outcome task constraints).

In addition, athletes' physical location can mediate the distance travelled to practice (e.g., a country with a greater surface area such as Canada vs. smaller surface area such as Germany). Living in a country with a greater surface area can result in higher costs of transportation, difficulties in planning transportation, and longer commutes (Radtke and Doll-Tepper, 2014). The daily commute to training facilities has been one of the predominant barriers Para sport athletes face (Martin and Whalen, 2014). Due to the distance between team members, athletes and coaches rely on training camps and electronic methods of communication to build relationships and develop team chemistry (Falcão et al., 2015). Lack of teammates and support networks has been a reported issue for athletes residing in remote areas (Kean et al., 2017). Interestingly, centralized training environments have been reported to positively contribute to athletes' training quality, provide a platform for necessary feedback, and enable additional social support while providing national sporting organizations an opportunity to channel funding and evaluate program designs more effectively (Kean et al., 2017). In addition, athletes' geographic location can impact their ability for sport classification. Therefore, coaches and practitioners may turn to e-communication to compensate for time away from the team in order to maintain chemistry and if funding allows, facilitate regularly centralized camps to build rapport, provide up-to-date relevant feedback, and enhance the quality of athletes' training.

Infrastructure environmental constraints. Infrastructure environmental constraints directly hinder or facilitate development and performance through how they affect availability, accessibility, and/or affordability (Goodridge et al., 2015; Kean et al., 2017; Mwangi et al., 2009). Availability and accessibility to training facilities (e.g., curb cuts, location of change rooms/bathrooms) has been a long-standing barrier for Para sport athletes (Jaarsma et al., 2014; Martin and Whalen, 2014; Martin-Ginis et al., 2016). The limited infrastructure reduces flexibility for a number of programs available which are bound to specific times of the day and require a certain number of regular participants. Considering participation rates across communities are already reported to be low, programs with limited attendees can be eventually removed, cyclically reducing the number of programs further and negatively affecting one of the leading sport participation barriers (Martin-Ginis et al., 2016; Stephens et al., 2012). The limited opportunities within the community, in turn, negatively affect individuals' motivation to participate (i.e., a functional malleable constraint). In addition, training outdoors has its own limitations including road safety and security. Therefore, from a coaching standpoint, ensuring the facility is accessible, the training environment is barrier-free and athletes can navigate to meet task demands can be vital to athletes' attitude towards participation. From a policy standpoint, understanding these limitations can have a systematic impact on the growth of the Games: removing barriers may increase participants which in turn can contribute to the pool of athletes that compete across the pathway.

Sociocultural environmental constraints. These constraints encompass higher-order factors (i.e., policies, laws, social beliefs, and attitudes) that can indirectly impact individuals' development and their surrounding social structure. The 'Accessibility for Ontarians with Disabilities Act,' established in 2005, is an example of a Canadian government policy targeting barrier removal for individuals with impairments. The aim of this act is to ensure all facilities are accessible to individuals with impairments ("Accessibility laws", 2017). However, without agencies implementing and enforcing this Act, its existence alone does not seem to have had a comprehensive impact on the accessibility of infrastructures (Martin-Ginis et al., 2016).
Recent reports examining the distribution of funding across agencies highlights concerns associated with programs at the regional and provincial levels with the majority of funding

transmitted to the national and international level of sporting organizations (Radtke and Doll-Tepper, 2014). A recent comprehensive review exploring sport participation barriers among individuals with impairments reported that policies have had a direct impact by influencing available funding opportunities to increase program availability, transportation services, and staff education, which coincidentally are frequently reported barriers to sport participation (Martin-Ginis et al., 2016). In conjunction with unbalanced funding, the lack of communication between the hierarchies can have detrimental effects on individuals interested in participation all the way from grassroots to competitive levels.

Interpersonal environmental constraints. Interpersonal environmental constraints include the various influential agents and social support systems in a performer's life, such as coaches, teammates, doctors, parents, and friends. The importance of family and coach support (e.g., emotional, financial) in successful athlete development has been extensively investigated (Bloom, 1985; Côté, 1999), and while strong family support is common in Para sport (Medland and Ellis-Hill 2008), there is a lack of specialist coaches (Martin, 2015). Historically, coaching in Para sport has been a challenge (Townsend et al., 2015); while some athletes have learned to coach themselves, others have been coached by individuals whose primary involvement (either as a coach and/or athlete) has been in able-bodied sports (Duarte et al., 2018). Coaches also find it challenging to locate information on sport-specific training and disability (Hammond et al., 2014; Vargas et al., 2015), and some coaches seek help from parents to develop a better understanding of athlete's unique needs and action capabilities (Martin, 2014). Lack of coach development and education programs lead to coaches relying on experiential knowledge and informal communication with colleagues as means of coach development (Dehghansai et al., 2019), even reaching out to coaches from different sports (Duarte et al., 2018). In addition, recent evidence has found that Para sport coaches tend to progress through the coaching ranks to national coaching positions relatively quickly and may not be fully equipped with the necessary experience, knowledge, or resources to support their transition (Douglas et al., 2018; McMaster et al., 2012). Therefore, new coaches could benefit from networking with other coaches in Para sport (including attending conferences, workshops, etc.), while more experienced coaches can contribute to the Para sport system by serving as mentors and extending their experiential knowledge to newer coaches. It may also help coaches (especially at earlier stages of athletes' career) to maintain clear communication with parents and caregivers to better understand the unique considerations necessary for each athlete. Utilizing the extended framework as a guide and devising training sessions considering the constraint-led approach can benefit both experienced and novice coaches (see Pinder and Renshaw, 2019 for how this framework has been utilized in practice). In this, short- and long-term plans can be considered while taking into consideration the influence and support of the individuals within athletes' social system.

Environmental Constraints Summary

As highlighted previously in the literature, understanding the complex relationship between different layers of the environment requires extensive examination of the foundational elements that make up these layers. A more concerning issue is the impact indirect factors (e.g., policies, historical or societal views) can have on athletes' experience and development. Therefore, it is important to continue to develop a deeper understanding of the complex relationship between environmental factors and their influence on development and performance. The challenge for coaches becomes the interaction of the deeply rooted systematic problems (i.e., policies, infrastructure) and their impact on athletes' experience. While, in some scenarios, a coach may have the ability to influence a policy change and alteration of an infrastructural barrier, at other times, it may be just as important to be aware of these challenges to educate and inform parents, caregivers, and athletes of the nuances associated with the sporting experience.

Discussion

Newell's model and the suggested extended categories noted above reflect numerous factors that influence the development of Para athletes, highlighting the need to utilize frameworks that identify and acknowledge the complexities associated with athlete development. With this in mind, coaches can benefit from the understanding of this complex interaction between the myriad factors that influence athlete development at any given time, and this extended framework allows coaches and practitioners to consider these complexities when designing optimal performance environments. These factors should be considered across time, from micro- (immediate, on-ground daily training environments) to macro-levels (long-term training programs, policies, and resource allocation) to better organize and structure athletes' development.

It is vital to approach athletes' development from a holistic standpoint. Utilizing the three overarching constraints of Newell's theoretical framework and organizing developmental factors within each sub-category, coaches can capture and understand the dynamic and complex interaction between variables that contribute to athletes' experience and development. For example, recommendations for appropriate training and sport-specific guidelines can vary between athletes due to disability-related factors, athletes' biological age, and sport-readiness; as a result, training tasks or methodologies may work for one group of athletes but not others. In addition, there may be limited resources available to implement ideal training routines, therefore requiring further modifications for practicality reasons. Another solution may be to locate a new facility that has the necessary equipment, but coaches need to be cognizant of accessibility (infrastructure and transportation access). Therefore, in addition to considering individual-related factors (e.g., nature and severity of impairment, previous sporting experience), it is vital to consider the interaction of social factors such as family dynamics, social networks, and infrastructures and their impact on athlete development. While the constraint-led approach can provide great benefits for athletes, as it is tailored uniquely to their specific needs, it does present challenges for coaches. For instance, each athlete needs to be assessed independently which may increase the workload for coaches. In addition, first attempts can be overwhelming due to the complexity of the interactions and the multitude of factors to consider. We recommend starting with small, controllable tasks and slowly progressing to more complex environments. These smaller pieces will slowly integrate and emerge into a complete picture. This picture will evolve but through familiarity and trial and error, we believe coaches can become comfortable with the uncertainties that are presented and learn to prepare for the range of expected and unexpected events that are presented across their athletes' developments (see Pinder and Renshaw, 2019, for an application of this approach in the Para sport context).

The factors mentioned above are just a small sample of factors that interact and impact athletes' development. Therefore, devising a recommendation guideline or athlete development model for coaches is beyond the scope of this paper. Rather, our intention has been to provide a framework to guide the coaches' planning. In turn, this extended framework can help coaches devise and better plan for demands that may be present in the process of athletes' development. The preparedness can better equip coaches to deal with these events, ultimately leading to a more efficacious learning environment for the athlete.

Conclusion

Our primary goal in this discussion paper was to frame current literature using Newell's framework and provide additional categories to guide coaches' planning and preparation for their athletes' development. There are complex interactions between factors associated with athlete development and this dynamic synergy is further complicated by the unique influences of different impairments in Para sport contexts. A holistic approach that considers the interaction between an athlete's proximal environment and indirect societal factors may provide a better overview of optimal developmental trajectories. Further, sport-specific considerations must include the dynamic interplay of impairment differences among athletes within training environments. While adapted models from able-bodied sports try to compensate for the current shortcomings in the Para sport development literature, the performers and coaches who make up this population need and deserve considerations that better reflect the unique constraints affecting the development of high-performance Para sport athletes.

Author Contribution Statement

Each author was in charge of a section in the manuscript. ND was responsible to collate all the sections and prepare the manuscript for submission. ND also ensured formatting and manuscript alignment according to the journal's guidelines. Each author (in order of authorship) reviewed the manuscript and provided feedback accordingly.

Conflict of Interest Statement

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

Table 1
Description of each constraint within Newell's constraint-led model

	Constraints which govern the …	Example
Task	… parameters of an activity	
General	… process of a task	Ability to control a racquet
Outcome	… results of a specific event	Points scored in a game or outcome of the game
Sport-Specific	… operations of a sport in general	Athletes' classification
Skill-Specific	… execution of a specific skill	Performing a forehand in wheelchair tennis
	Constraints which govern individual's …	
Individual	… capacity of the performer	
Structural Stable	… body structure that are stable over time	Height, weight
Structural Malleable	… body structure that are adaptable to task demands and relatively long-term	Improved cardiovascular performance
Structural Unstable	… body structure that are transient and bidirectional in nature	Soreness, impairment-related day-to-day changes
Functional Stable	… behavior that are stable over time	Personality trait
Functional Malleable	… behavior that are adaptable to task demands	Self-efficacy
Functional Unstable	… behavior that are transient and vary on day-to-day basis	Day-to-day changes, such as mood, arousal, etc.
	Constraints which govern the …	
Environmental	… conditions of individual's surrounding	
Natural	… conditions of individual's habitat	Climate, geographical position
Infrastructure	… physical infrastructures of individual's surroundings	Accessibility to training centers
Sociocultural	… operation of social structure in individual's surroundings	Policies, social beliefs
Interpersonal	… interaction between the individual and their social environment	Coaches, teammates, parents, and friends

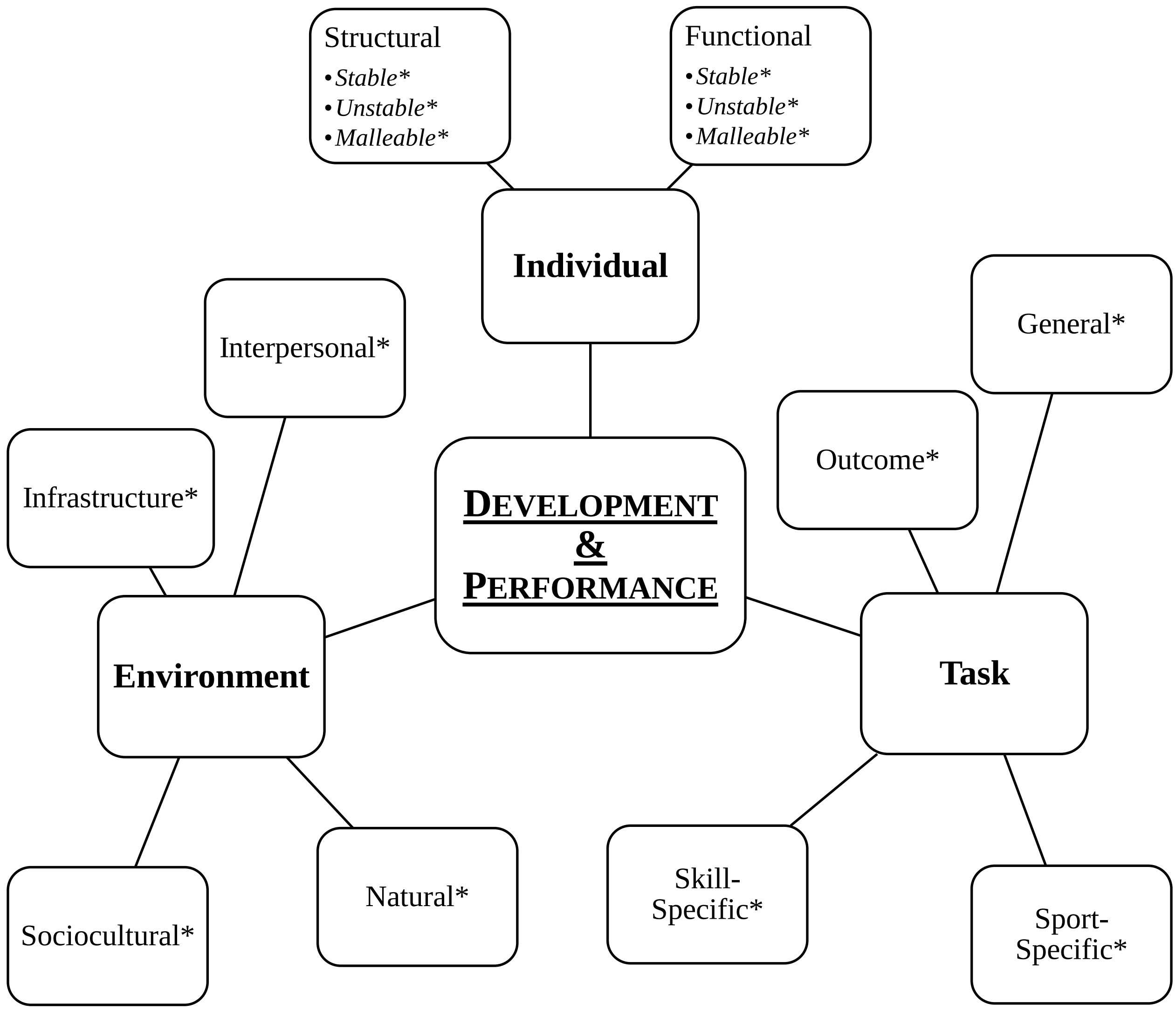

Figure 1. Depicting Newell's constraint-led model considering the addition of suggested categories.
* Indicates sub-categories that are proposed to better organize the themes under each tenet.

Chapter Three

Searching for Paralympians: Characteristics of Participants Attending ‘Search’ Events

Dehghansai, N., & Baker, J. (2020). Searching for Paralympians: Characteristics of participants attending ‘search’ events. *Adapted Physical Activity Quarterly*, *37*(1), 129-138.

***This manuscript has been presented in the formatting that has been submitted to the respective journal. References are included at the end of the dissertation starting on page 163-185.*

Abstract

Initiatives have been designed to attract novice athletes and enable transfer for experienced athletes. However, we have very little knowledge of the effectiveness of these programs. To improve our understanding, this project explored the demographic and sporting careers of 225 participants attending one of 10 Paralympian Search events held between 2016-2018. The sample consisted of participants with a wide range of impairments and sport experiential backgrounds. The majority of the participants reported having some experience in sports, suggesting either the promotions reached athletes involved in sports already, or that the advertising appealed especially to this cohort. Athletes with impairments acquired at various stages of their lives (congenital, before adolescence, adolescence, early adulthood and adulthood) displayed differences in their sporting trajectories suggesting considerations for current developmental models. Further, future events may wish to vary testing locations to increase the reach to rural areas, while also considering methods to attract novice participants.

Keywords: Para sport, athlete development, recruitment strategies, Paralympics, talent identification, sport participation

Disability[5] can constrain many aspects of an individual's life; for example, children with an impairment have a reduced network of friends (Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011), are less likely to meet education requirements (Knope, 2018), and are less likely to pursue higher-education compared to individuals without impairments (Canadian Human Rights Commission, 2012). Prior work suggests participation in Para sport contributes to an increase in self-belief and a sense of accomplishment that in turn can increase self-confidence and provide a sense of belonging via social networks (Brittain & Green, 2012). Overall, sport is suggested to have a positive impact on an individual's general health and quality of life (Day, 2013). That said, several negative consequences have been associated with sport participation in able-bodied sports, mainly regarding increased specialization in early development (i.e., dropout, burnout, concussions and injury; Baker, Cobley, & Fraser-Thomas, 2009; Patel, Parachuri, & Shettigar, 2017), and there is a need to better understand the impacts of sport participation for Para sport athletes (Bundon, 2019). Currently, the positive notion of sport participation has led to various initiatives targeting to increase sport participation for individuals with an impairment.

Recently, the Canadian Paralympic Committee (CPC) began a new initiative – *Paralympian Search* – which is held across Canada three or four times a year with the purpose of increasing awareness, attracting novice athletes and providing opportunities for experienced athletes to transfer between sports. During the event's inauguration year, a strategy was implemented to monitor event progression and inform future directions for targeting and recruitment. The purpose of this study was to a) improve our understanding on participants attending these events by exploring current trends and b) identify directions regarding how to

[5] The term 'disability' is socially constructed and does not solely encompass elements of biology (i.e., impairment)– feelings of 'disability' are often a direct reflection of social and physical barriers an individual faces on a regular basis and needs to be understood as a 'bio-psycho-social' framework (McConachie, Colver, Forsyth, Jarvis, & Parkinson, 2006).

improve future initiatives. Considering the infancy of the event and limited literature pertaining to this area of work (Dehghansai, Lemez, Wattie, & Baker, 2017a), the approach for this study was exploratory with no predetermined hypothesis. However, based on existing literature, we identified sex, competition level, and nature of athletes' impairment as controlling factors to examine group differences (Dehghansai et al., 2017b). Dehghansai and colleagues (2017b) found athletes with an acquired impairment reached the majority of milestones at a later age and suggested future research should consider the age athletes acquire their impairment as an influential factor in athletes' sporting development.

Method

Participants

A total of 225 athletes who attended one of the 10 Paralympian Search events held across Canada between 2016-2018, were included in this study. Events were advertised online through CPC's social media outlets (i.e., Instagram, Facebook, Twitter), and communicated to provincial and national sporting organizations via email by the CPC staff. Individuals interested in attending the event registered online, at which time they were informed of the research objectives and asked to voluntarily complete a survey online or in person at the event. Tablets were supplied during events for participants to complete the online survey.

Instrument

Participants completed a brief survey that collected information about demographics, school-based and outside of school sporting experiences, and training history. The demographics section included questions on participants' sex, date and place of birth, which city they have resided in most of their lives and questions regarding the nature of their impairment. The school-based sporting experience section obtained information pertaining to participants' school experience (from elementary to college/university). Participants were also asked to report the type of sport, setting (*open*: inclusive to all or *specialized*: individuals with impairments only) and experience (*none, physical education class [PE], intramural sport league [IS], extracurricular sport for fun [EF],* or *extracurricular sport to compete against other school [ES]*). Then, for their main sport, participants were asked to report the level of competition (*recreational, local, provincial, national, international)*, age they started and stopped (if applicable) participating at that level of competition, and the sport setting (*open, open with mixed athletes,* or *adapted/para only)*. Participants provided each competition level separately (e.g., provincial, national), to allow researchers to track how many years athletes spent in each level of competition and whether the sport setting changed as they move higher in their competition levels. Participants also reported any specific training performed in their main sport including the age they began training, and the hours per week they spent, or currently spend in training. The two types of trainings considered were: *unorganized involvement* (i.e., recreational, "backyard play") and *sport-specific training* (i.e., training tailored specifically to acquire skill). Finally, athletes reported any other sports they participated in, years of participation, highest level of competition (*recreational, local, provincial, national,* or *international*) and setting (*open, open with mixed athletes,* or *adapted/para only*).

Statistical Analysis

Descriptive analyses were conducted to explore the means and distribution details concerning participants' age, city of residence and nature of their impairment as well as their experiences in sports within (type of sport and sport setting) and outside school settings (number of sports, years competed and competition level). A geographical analysis (a heatmap to seek patterns and relationships) was used to locate participants' residency relative to the event location. Inferential analyses (t-tests, ANOVAs and Bonferroni post-hoc tests [selected due to its conservative approach; Field, 2009, p.373]) were used to examine between group differences using sex (male/female), nature of impairment (congenital [CI] or acquired before adolescence [BA; 1 month to 11.9 years old], adolescence [AD; 12 to 17.9 years old], early adulthood [EA; 18 to 24.9 years old], or adulthood [AH; 25 years and older]), and competition level (recreational, local, provincial, national and international) as control groups. The Levene's test provided information on equality of variance and for factors displaying unequal variance (usually driven from low and/or uneven response rates per group categories), nonparametric, Kruskal-Wallis tests with Mann Whitney U post-hoc procedures were used to confirm the findings. In addition, irrespective of athletes' grouping, Pearson's and Spearman's Rho correlations were used to explore the strength and relationship between sporting variables to better understand the complex relationship between sporting factors such as athletes' prior experience in sport and current sporting outcomes. Data were evaluated at the $p \leq .05$ level of significance with partial eta squared as the effect size measure and Cohen's (1992) guidelines for our correlation coefficient.

Results

Demographics and Impairment Characteristics

Nearly two-thirds of the sample were male (65%) with both male and female groups of similar age (males, M=24.04, SD=9.62; females, M=24.97, SD=10.59). There were more participants attending the event during the inauguration year (n=86), compared to the subsequent two years (n=75, n=55, respectively). At the same time, the average age increased each year of the event (M=22.97, SD=10.09; M=24.45, SD=9.05; M=26.40; SD=9.94, respectively). The most commonly reported impairments were spinal cord injury (n=35), amputation (n=35), paralysis (diplegia, hemiplegia, or quadriplegia, n=28), and visual impairment (*n*=26). One hundred and thirteen participants reported having a congenital impairment and 104 participants acquired their impairment after birth. The distribution among the four acquired groups was: BA (*n*=24), AD (*n*=25), EA (*n*=26) and AH (*n*=28). The most common causes of acquired impairments were accidents (*n*=43, e.g., motor vehicle, sport) and illnesses (*n*=23, e.g., cancer, musculoskeletal).

The most successful method of outreach for the event was through social media platforms (*n*=31) followed by other electronic outlets such as email (*n*=15) and professional organizations, such as the CPC (*n*=15). Finally, the heatmap (Figure 1) displayed some interesting trends. Heatmaps are color-coding systems that represent different values/behaviors and for purposes of this analysis, were used to seek patterns and relationships between two positions in the spatial data (Malik et al., 2011). We utilized the location of the events and participants' current residence to identify the reach for each event. More specifically, Toronto, Ottawa, and Montreal attracted most of its participants from the local regions. However, the Calgary event attracted participants from Edmonton while Halifax covered a wide region of Nova Scotia, some areas of New Brunswick and Prince Edward Island. There were two cities with attendees from another province: participants attending the Calgary event from Winnipeg, Manitoba, and participants attending the Halifax event from St. John's, Newfoundland.

School-Based Sporting Experiences

During elementary school, all the participants attended an open setting school, and the majority of their sporting experience was in ES (*n*=11) or PE (*n*=9) with only four participants participating in EF and two engaged in IS. A similar trend was evident for middle school settings (open=18, specialized=1) and sporting environments (ES=10, PE=8, EF=3, IS=0). While the distribution of sporting experience remained relatively the same during high school (ES=10, PE=7, EF=5, ISL=3), there were more students attending schools with a specialized setting (specialized=5, open=18). The most common sports reported throughout participants' school sport career were basketball (*n*=10) and athletics (*n*=8).

Sporting Career

Participants had a wide range of sporting experiences, with novice athletes making up the largest group. Fifty-eight athletes reported having only participated in sports in a recreational setting, 44 had some experience in local competitions, 25 participated in provincial competitions, 18 competed in national competitions and 29 had experience in international events. Participants were asked to identify their main sport (i.e., sport participated in for longest and ranked highest in competition) and 49 different sports were reported, the most common being athletics (*n*=30), Para ice hockey or ice hockey (*n*=30), wheelchair basketball or basketball (*n*=22), swimming (*n*=22), ski or snowboard (*n*=21), soccer or goalball[6] (*n*=17), cycling (*n*=11) and canoe or kayak (*n*=11). On average, athletes started participation in their main sport at the age of 12.62 years (*SD*=7.54), mostly at the recreational or local level, in an 'open' setting (setting where there were no athletes with an impairment) or 'open with mixed athletes' setting (integrated with a mix of athletes with and without disabilities). Interestingly, most athletes competed in these two settings until the national/international level of competition, during which the sport setting mostly changed to 'adapted/para only,' where all athletes have an impairment. On average, athletes spent three years transitioning from the recreational/local to international level.

Nearly 74% reported participating in 'other sports' and the highest number of sports participated in was nine, reported by four participants. The total number of sports reported was 388 (*M*=1.48, *SD*=1.68) with experiences occurring in 45 different sports. The average age

[6] A sport for individuals with a visual impairment: participants use ear-hand coordination to throw a ball that contains a bell to score on opposing team's net.

participants started other sports was 12.14 (*SD*=6.28) and on average, they spent 10.13 (*SD*=8.96) years in other sports. Competition levels were mostly recreational (*n*=62), followed by local (*n*=37), provincial (*n*=30), national (*n*=19) and international (*n*=7). Participation in open settings (*n*=51) dominated the sport setting categories, followed by open with mixed athletes (*n*=15), and adapted/para only (*n*=14). The most common other sports were wheelchair basketball or basketball (*n*=37) and ski or snowboard (*n*=37) followed by athletics (*n*=36), Para ice hockey or ice hockey (*n*=35), soccer or goalball (*n*=32), cycling (*n*=27), sit volleyball or volleyball (*n*=24) and swimming (*n*=22).

Between Group Comparisons

One-way ANOVA exploring athletes' trajectories in different impairment groups revealed group differences for the age athletes started participation in unorganized training, $F(4, 50)=16.26$, $p < 0.001$, $\eta^2=.565$. Post hoc tests revealed AH group (*M*=18.01, *SD*=10.41) started unorganized training in Para sport setting at a significantly later age than CI (*M*=13.27, *SD*=7.32, $p < .001$), BA (*M*=11.50, *SD*=4.66, $p < .001$), AD (*M*=17.50, *SD*=6.74, $p < .001$) and EA (*M*=23.06, *SD*=9.35, $p=.003$) groups. In addition, the EA group started unorganized training in Para sport at a significantly later age than the CI group ($p=.008$). Para sport-specific training was also significant, $F(4, 13)=4.03$, $p=.024$, $\eta^2=.553$, and post hoc tests indicated AH (*M*=19.39, *SD*=9.94) started Para sport-specific training at a significantly later age than the CI (*M*=17.49, *SD*=9.81, $p=.002$). The hours initially spent in unorganized training was significantly different between groups, $F(4, 50)=4.59$, $p=.003$, $\eta^2=.269$; however, post hoc analyses did not find any significant differences between groups. Last, a Kruskal-Wallis test was performed for average years the participants spent in other sports indicating a significant difference between groups, $H(4)=14.53$, $p=.006$. A pairwise comparisons suggested on average, the CI group (*M*=13.29, *SD*=7.32) spent significantly less years in other sports compared to EA (*M*=8.47, *SD*=2.97, *p*=.008) and AH (*M*=10.05, *SD*=6.22, *p*=.005) groups.

In addition, there was a significant positive correlation between athletes' current competition level and their competition level in other sport, $r_s(174)=.149$, $p=0.049$, and years competed, $r_s(174)=.182$, $p=.016$. Participants' competition level in other sports also correlated positively with number of other sports played, $r_s(225)=.285$, $p < .001$ and years competed, $r_s(225)=.435$, $p < .001$ and negatively correlated with the age the participants' started their first other sport, $r_s(225)=-.136$, $p=.042$. Furthermore, there was a significant positive correlation between the age participants engaged in other sports and total number of sports, $r(225)=.137$, $p=.041$, and years participated in other sports, $r(225)=.190$, $p=.004$. Last, there was a significant positive correlation between athletes' years of participation in other sports and number of sports they participated in, $r(225)=.478$, $p < .001$. There were no other significant group differences considering athletes' competition level and sex.

Discussion

The purpose of this study was to explore the demographics and sporting careers of participants attending Paralympian Search events held between 2016-2018 to better understand this cohort as well as identify targeting and recruitment strategies for future events. The results from this study suggests the Paralympian Search is meeting its objective of capturing athletes from a wide range of groups, with a wide range of experiences. The current findings indicate these search events attract a larger portion of participants from the recreational and local levels of expertise followed by attracting low volume but high-quality athletes from the provincial, national and international programs. The results highlighted several interesting trends. First, there was heterogeneity in participants' ages, ranging from 11-57 years, highlighting the wide scope of the program. Second, athletes appeared to mainly compete in ‘open’ settings during the early years of their career (recreational/local); however, at the national/international levels of competition, the setting was mainly exclusive to Para sport athletes. Unfortunately, due to the nature of the survey, we could not identify whether ‘open-settings’ were specific to experiences in Para sport setting only, or if it included participants’ experience as an able-bodied athlete as well. However, a closer look at the data indicated that some athletes currently continue to compete in recreational level open-settings. There is limited research on whether a more inclusive environment is more beneficial to athletes’ development (i.e., opportunity to test skills against people with various skills), or whether it is detrimental due to decreased exposure to competition against athletes with the same level of expertise/ability. In addition, very little is known of athletes’ preference regarding sport settings and whether this is the only type of setting that is available for sport participation (which may be a contributing factor to low participation and high dropout rates).

Third, the lack of between group differences for competition level, sex, and nature of impairment suggests that although athletes attending the event carry a wide range of experiences (i.e., competition levels, different sports, impairment groups), there are more similarities between groups than differences. There were significant differences between impairment groups and the age they started training in Para sport setting. As expected, athletes who acquired their impairment at a later stage in their life were more likely to start training in Para sport at a later age. Interestingly, there was little difference in trajectories of athletes with a congenital impairment and athletes whom acquired their impairment early in their life (i.e., before or during adolescence). The three groups did not significantly differ in the age they started participation in sport, and various types of training, suggesting a more similar sporting trajectory for athletes with congenital impairments and athletes whom acquire their impairment during or before adolescence. This could have implications for current developmental models and factors that are considered important for Para sport athletes' development (Hutzler, Higgs, & Legg, 2016). Further, athletes who acquired their impairment later in their life reported investing significantly more hours in unorganized/play-like settings. There is limited research exploring athletes' training histories (Dehghansai et al., 2017a, b), and very little is known regarding opportunities for Para sport athletes to participate in various types of training (unorganized, play-like vs. structured settings) or how environmental factors and resources impact training opportunities.

There were weak to moderate positive correlations between athletes' current sporting success (current level of competition) and their experience in other sports (age started, total number of sports, years involved, and level of competition). This finding suggests athletes starting involvement later in their careers tend to remain in sport longer. Further, accessibility to a sport could lead to more opportunities in other sports with experience and success in other sports positively impacting participants' main sport experience. While previous research has explored accessibility and availability of resources and programs (Goodridge et al., 2015), very little is known of the impact of participation in other sports on Para sport athletes' main sport or the degree of transferability of skills between sports (Dehghansai et al., 2017b).

Considering recent reports that highlight the lack of opportunity for sport participation amongst individuals with an impairment (Martin-Ginis, Ma, Latimer-Cheung, & Rimmer, 2016), participants' extensive experience in a wide range of sports was intriguing. This suggests events mainly attract individuals with previous sporting experience and the advertisement fails to either reach or entice participation from other groups, particularly those in remote areas. As evident from the heatmap, these events attracted individuals residing near the events. More interestingly, the three highly dense areas between the regions of Toronto, Ottawa, and Montreal appeared to attract the most of their participants from the local regions. However, the Halifax and Calgary events attracted participants from other nearby cities. One explanation for this could be that the three highly dense cities are a hub for individuals with an impairment involved in sport, while the cohort is more widespread in Calgary and Halifax. Another explanation could be that communication between Calgary and Halifax and their surrounding cities was more effective, yielding a more successful outreach advertisement. In Toronto, Ottawa, and Montreal, there may not have been an incentive to expand the advertisement beyond the local regions considering the dense population and number of programs within the cities that can effectively attend the events. Evidence from previous research and findings of this study suggest that there is a need to increase opportunities for individuals across Canada and broaden the scope of the 'search' to increase awareness and first contact in Para sport. Therefore, different strategies may be warranted including rotating the location of the events each year. On the one hand, rotating the event location (especially to fewer urban areas), introduces an uncertainty regarding participation rates. On the other hand, to consistently hold the events in the larger hubs presents the risk of saturation and attracting the same participants and organizations each year. Another option is to create a communication system between participants who are interested in the event but unable to attend and local sporting organizations. This latter option could help provide opportunities to connect individuals in less accessible areas to local clubs.

Limitations

A noteworthy limitation of this study is the ambiguity regarding participants who received the invitation but were not interested in attending the events, as well as the reasons for their absence. This is a common problem in research, as only 'successful' outcomes are reported in most cases, which creates a bias towards participants who are interested. Furthermore, the heatmap data indicate the majority of attendees lived near the events and the searches may be lacking the outreach to other areas of Canada. Therefore, data in this study are reflective of individuals in major Canadian cities, with the majority involved in sports to some degree already. While there were a few outliers reporting attendance from Winnipeg, Manitoba, and St. John's, Newfoundland, unfortunately, due to the nature of the data collection (survey), it was impossible to follow-up with the participants to confirm if they commuted specifically for this event. In addition, not all the participants completed the survey in its entirety, therefore, the missing data could have impacted the findings in ways we are unable to control for. For example, some of our findings may have been non-significant due to limited number of participants in each group contributing to a type II error; however, we monitored the effect sizes to identify any possible effects that were not noted in the significance tests. Future studies should consider other solutions such as conducting short interviews to obtain the information, although this would require more resources and time to collect the necessary data.

Conclusion

This study provides an overview of the demographics and sporting histories of participants attending Paralympian Search events from 2016-2018. While the considerable range of athletes from all competitive levels across a wide array of sports is an obvious strength of the program, we have provided several suggestions to increase opportunities for individuals to access the events or connect with local organizations in order to enhance and increase the pool of athletes that participate in Para sport. Furthermore, future research may wish to explore how athletes' experiences in different sport settings (open vs. para-only) impact skill development. Similarly, there is a need for greater understanding of how age at which athletes acquired their impairment (e.g., congenital, before adolescence, etc.) affects their long-term athletic development. Identifying factors that facilitate sport participation and development will be vital to inform more comprehensive models and more appropriate sport programming, while contributing to the removal of barriers and enhancement of environments to maximize a positive experience for participants. While this research adds to the limited literature regarding Para sport athletes' participation and development, it highlights key areas of research to address the nuances of sport participation and Para sport athletes' development.

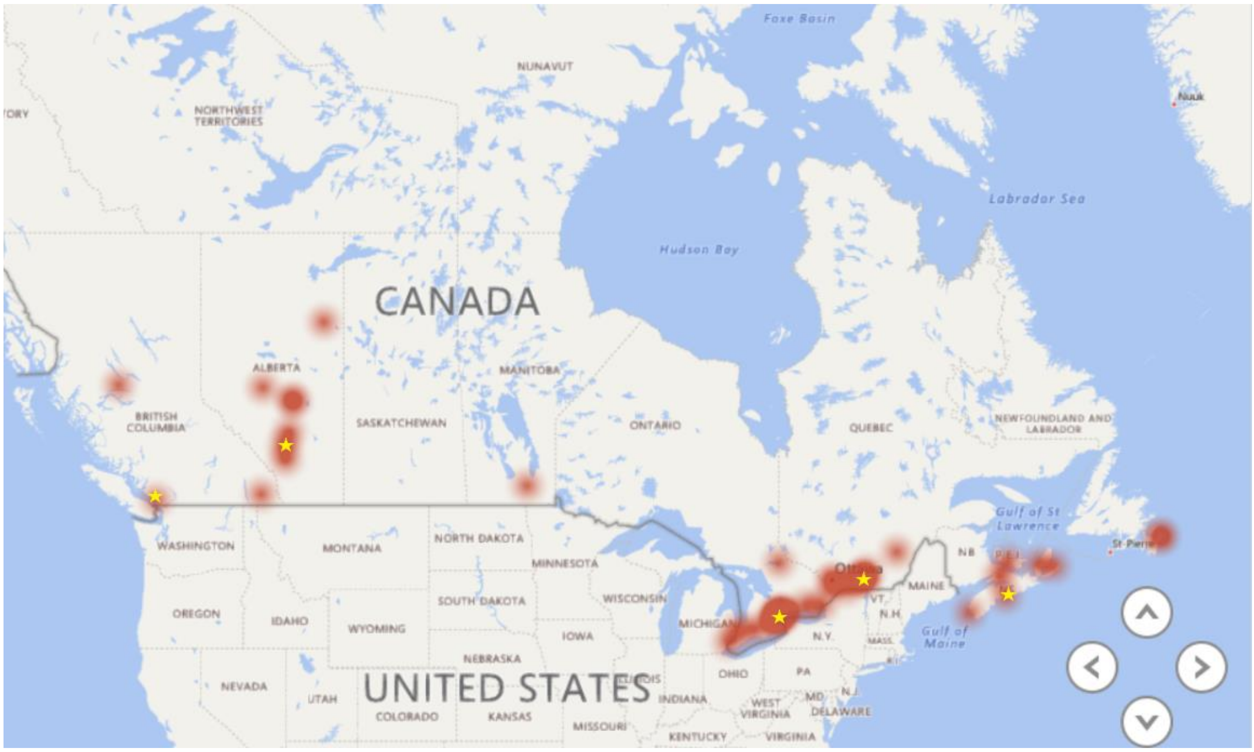

Figure 1. Heatmap displaying the distribution of participants' residing area relative to the Paralympian Search events (marked by yellow stars).

Chapter Four

The Pathway to Elite Paralympic Sport: Part I - Influence of Nature of Impairment on Athletes' Developmental Trajectories

Dehghansai, N., Pinder, R. A., & Baker, J. (In review). The pathway to elite Paralympic sport: Part 2 – Influence of nature of impairment on athletes' developmental trajectories. *Adapted Physical Activity Quarterly,* 30 pages.

******This manuscript has been presented in the formatting that has been submitted to the respective journal. References are included at the end of the dissertation starting on page 163-185.*

Abstract

There is limited understanding of the effectiveness of models of talent development in Paralympic contexts. The objective of this study was to better understand Paralympic sport athletes' developmental trajectories and how progressions of this cohort align with recommendations of published developmental models in use in Australia and Canada. Two hundred and thirteen Australian and Canadian athletes completed the Developmental Histories of Athletes' Questionnaire (DHAQ). Results suggest multiple pathways to expertise exists as athletes with early-onset impairments (i.e., congenital, pre-adolescent) reached developmental and performance milestones at a similar age, which were significantly earlier than athletes with late-onset impairments (i.e., early adulthood, adulthood). However, athletes with late-onset impairments progressed through their career at a faster pace than the other groups. Subsequent studies will investigate the underlying mechanisms that may attribute to athletes' career progression by exploring athletes' training histories and other sporting experiences to better understand factors that impact athletes' development.

Keywords: Athlete development, expertise, Paralympic sport, para sport, disability, impairment

The Pathway to Elite Paralympic Sport: Part I - Influence of Nature of Impairment on Athletes' Developmental Trajectories

Since its inception in 1960, the Paralympic Games has grown to become one of the biggest international sporting events with more than 200 National members (History of the Paralympic Movement, n.d.). To support the growth of the Games, governing bodies have embedded frameworks to appropriately allocate resources, designate roles to members, and provide opportunities for athletes to support their development (Patatas et al., 2020). Various stakeholders (e.g., national organization bodies, coaches, scientists) have turned to athlete development models (ADMs) to inform their decisions (Green, 2006). The underlying notion is that an effective ADM can result in better practices related to attracting, recruiting, identifying, and developing talented athletes (Green, 2006). However, the majority of these models have been developed and applied in able-bodied (AB) settings and only then modified to reference Paralympic contexts (Lemez et al., 2020).

The Canadian sport system, for instance, uses the Long-Term Athlete Development Model (LTAD, the current revision is re-named *Long-Term Development in Sport and Physical Activity 3.0*; Higgs et al., 2019), which includes eight developmental stages related to athletes' biological age and readiness (i.e., maturation). The model is based on sensitive periods called 'windows of opportunity' where development in specific areas is accelerated through training. Australia uses a similar stage-based model - *Foundation, Talent, Elite, Mastery (FTEM)* - comprised of 10-stages, with multiple entry and exit points. In this model, athletes enter, exit, and/or by-pass stages during their careers (Gulbin et al., 2013). In both of these models, athletes begin with broad sport exposure and the development of 'fundamental' or 'foundational' skills before moving to more advanced levels of training and competition.

Despite a long history of use, both the LTAD and FTEM have received scrutiny for their apparent shortcomings such as an emphasis on physiological development (i.e., LTAD), the low empirical validity of the notion of ‘windows of opportunity’ and ‘sensitive periods’ (i.e., LTAD), a lack of empirical evidence to support model development (i.e., FTEM), and more importantly, the applicability of the stage-based developmental sequences in a practical setting (i.e., LTAD and FTEM, Ford et al., 2014; MacNamara & Collins, 2014). While the authors of both models highlight the non-linear and dynamic process of athlete development, their stage-like approach fails to capture the complexities of development and provides vague guidelines on this dynamic process. Moreover, impairment-related factors exacerbate this complexity even further in the Paralympic contexts (Dehghansai, Lemez, et al., 2020).

Paralympic Contexts

Individuals with an acquired impairment will undoubtedly have different sporting experiences than individuals with a congenital impairment (Dehghansai et al., 2017b). Furthermore, the age at which an athlete acquires their impairment, and the type of impairment can shape their subsequent experiences in sport and their long-term development. For example, certain impairments disrupt motor learning development and delay physical literacy while other degenerative impairments can influence athletes’ abilities and/or result in de/re-classification (Hands & Larkin, 2006) making development even more nuanced and complex (Dehghansai et al., 2017b; Radtke & Doll-Tepper, 2014). However, existing models, such as the LTAD and FTEM, place more focus on the structure of stages and less on transitioning between such stages with very little consideration given to the complexity of Paralympic contexts and the wide range of variability within and between impairment groups.

Both LTAD and FTEM were designed to address the practical needs of sport stakeholders. However, the gap between the theoretical structure of these models and their practical use within Paralympic contexts is starting to emerge. For example, Athletics Canada's LTAD revisions to include Paralympic sport[7] (PS) related content highlight a lack of understanding of PS athletes' developmental trajectories suggesting the "developmental training needs of athletes with a disability are not well understood" (Athletics Canada, n.d., p. 3), later adding: "trainability of the different systems for children and youth with a disability is not well understood" (Athletics Canada, n.d., p. 6). Even within the newest Canadian framework, the authors reaffirm the "developmental training needs of athletes with a disability are not well understood" (Higgs et al., 2019, p. 14).

Paralympic Sport Athletes' Developmental Trajectories

As noted above, modifying AB models to the complex and dynamic contexts of PS is problematic. Moreover, the lack of empirical evidence to inform stakeholders' decisions further complicates this modification process (Dehghansai et al., 2017a). It is apparent that the complexity of athletes' impairment (severity, type, and/ or onset) introduces unique constraints that prevent athlete categorization into the 'neat and tidy' groups suggested by these models (Hutzler et al., 2016; Patatas et al., 2018).

For example, in a recent study, Canadian wheelchair basketball players with congenital impairments reported reaching the majority of developmental milestones (e.g., the age they start sport, various training types) at a significantly younger age than athletes with acquired impairments (Dehghansai et al., 2017b). However, athletes with acquired impairments were able to reach key performance milestones (i.e., debuts at national and international competitions) at

[7] Paralympic sport (PS) refers to any sport that is currently or in the past a part of the Paralympic Games.

similar ages, despite the later start to developmental milestones. A follow-up study revealed a similar developmental trajectory for athletes with congenital impairments to Canadian AB basketball players and similar performance milestone trajectories between the three groups (Dehghansai, Spedale, et al., 2020). In both studies, the authors noted high within-group variability for athletes with acquired impairments and recommended future studies to consider athletes' impairment onset age as a key indicator of their sporting trajectories. In a related study, Dehghansai and Baker (2019) examined the sporting background of athletes entering the Canadian Paralympic system using developmental stages to group athletes based on their impairment onset (i.e., acquired at birth, pre-adolescence, adolescence, early adulthood, or adulthood). Results indicated similarities between athletes with early-onset impairments (pre-adolescent, adolescent) and those with congenital impairments that were significantly different from athletes with later-onset impairments (early adulthood and adulthood). These recent findings suggest the timing of athletes' impairment onset influences their developmental trajectories. There is a need to better understand Paralympic cohorts to understand the implications of current ADMs' guidelines and improve resource allocation to support and optimize athletes' developmental environment.

In this series of studies, we aim to provide a comprehensive overview of Australian and Canadian PS athletes' development pathways. In Part I, our objective is to provide an overview of this large sample of athletes to better understand the influence of the onset of impairment on their development. Based on previous findings (i.e., Dehghansai et al., 2017b, Dehghansai & Baker, 2020), we hypothesized athletes with early-onset impairments (congenital, pre-adolescent, and adolescent) would reach developmental milestones at a younger chronological age than later-onset impairment athletes (early-adulthood and adulthood); however, the latter groups will reach key performance milestones (i.e., debuts at various competitive levels) at a similar age. Logically, we, therefore, hypothesized that to reach these performance milestones at a similar age, athletes with late-onset impairments would advance through milestones at a faster pace.

Method

Participants

A total of 213 Australian (n=149, 32.34 years of age [*SD*=12.46]) and Canadian (n=63, 35.47 years of age [*SD*=12.79]) athletes completed a modified version of the Developmental History of Athletes Questionnaire (DHAQ; Hopwood, 2013). In collaboration with the Canadian Paralympics Committee (CPC) and Paralympics Australia (PA), a recruitment flyer was distributed to national sporting organizations and coaches in the two countries as well as athlete longlists and recently retired athletes. Interested sports were provided further details and athletes were given a unique participant code to access the online survey.

Instrument

The DHAQ, originally validated in AB context, was modified for PS participants (i.e., wording changes and addition of sections: impairment, barriers and facilitators, and available resources) and validated in a previous study (Dehghansai et al., 2017b). The modified DHAQ is comprised of nine sections; the first four (demographics, impairment, career information, and sporting milestones) are the focus of this current study (Part I). These sections are described in more detail below.

The demographic section included information pertaining to athletes' date and place of birth, sex, education level, and sport- and impairment-related reasons for relocating homes. The impairment section obtained information on athletes' impairment, consisting of the type of impairment (i.e., musculoskeletal, neuromuscular, visual, auditory or other), impairment classification within their sport, secondary impairments, nature of impairment (congenital, pre-adolescent, adolescent, early-adulthood, and adulthood), and if the impairment was acquired, onset age and cause of injury. The career information section collected information regarding athletes' sporting careers such as the highest level of competition reached and the current competition level. The sporting milestones examined ages at which participants reached various *developmental* (e.g., age athletes started main sport, commenced various types of training, devoted leisure time to main sport) and *performance* (e.g., debuts at the national and international level competitions) milestones.

Statistical Analysis

Pre-analysis Procedures

Assumptions of normality and multicollinearity were examined before the inferential analyses. Skewness and kurtosis for all inferential tests along with homogeneity of variance for several variables and ANOVA tests were outside the normal parameters (West et al., 1995); thus, non-parametric tests were implemented to reduce the chances of type I error.

Statistical Analysis

Descriptive analyses were conducted to explore when participants reached various milestones (refer to Tables 2 and 3 for details). Kruskal-Wallis tests with Mann-Whitney U post-hoc procedures were used to examine between-group comparisons. Data was evaluated at the significance level of $p \leq .05$ performed using SPSS Version 22 (IMB Corp, 2013).

Independent Variables

The independent variable under analysis in this study was the nature of athletes' impairment. Consistent with previous literature (Dehghansai & Baker, 2020), nature of impairment was divided into the age athletes acquired their impairment: congenital (C, n=82), or acquired during: pre-adolescence (PA; 1 month to 11.9 years old, n=18), adolescence (A; 12-17.9 years old, n=33), early adulthood (EA; 18-24.9 years old, n=38), or adulthood (AD; 25 years and older, n=32).

Dependent Variables

Milestones were examined in two ways: a) the age each milestone was achieved (chronological age) and b) the absolute years that it took athletes to reach each milestone from the time they started their main sport participation (absolute years). Considering the age athletes' start in PS can vary widely due to the age they acquire their impairment, it was important to also consider the pace at which they progress in their careers relative to this starting point.

Results

Sample Demographics and Characteristics

A detailed demographic overview, including impairment-related variables, is presented in Table 1. The most commonly reported impairments (as per IPC guidelines) were ataxia (n=43), limb deficiency (n=39), impaired muscle power (n=33), impaired passive range of movement (n=19), hypertonia (n=15), and visual impairment (n=12). Additionally, other impairments reported included leg length difference (n=5), intellectual impairment (n=3), athetosis (n=2), and short stature (n=1)[8]. A total of twenty-one secondary impairments were reported (physical [n=10], neurological [n=7], visual/auditory [n=3], and intellectual/cognitive [n=1]). For athletes with acquired impairments, the average age of injury onset was 20.24 (*SD*=11.40) years old, with accidents (*M*=21.53, *SD*=8.61) and health-related (*M*=16.94, *SD*=16.24) incidents as the primary categories. The most common specific incidents reported were motor vehicle accidents (n=46),

[8] Forty-one participants either did not know their IPC impairment classification, were not IPC classified, or preferred not to report.

followed by sporting accidents (n=18), undisclosed accidents (n=13), infections (n=11), strokes (n=8), degenerative disorders (n=7), work-related injuries (n=7), cancer (n=4), and falls (n=4). Sixty-nine athletes moved locations due to either disability- (n=30, inaccessible living environments, rehabilitation program availability, or moved in/close to family for support) or sport-related reasons (n=39, venue accessibility or program/coach availability). The most common method of introduction to PS was through family, friends, and relatives (n=54) followed by rehabilitation centers/physiotherapists (n=44), talent ID programs (n=25), sport organizations (n=17), schools/teachers (n=15), online searches (n=15), and watching athletes in international competitions (n=8).

Sporting Milestones: General Trends

Chronological Age

Tables 2 and 3 present the mean and median milestone attainments. On average, athletes started organized PS around the age of eleven. Athletes did not start playing in their main sport (any format) for another nine years and about a year after, they began participating in their main sport in an organized setting (i.e., officially registered with a team that involved a coach and regular training). Around the same time, athletes started participating in various types of training: non-sport specific, unsupervised sport-specific, and supervised sport-specific. In the same year, the idea of becoming an elite athlete emerged, and quickly thereafter, athletes incorporated a year-round training routine. A little over a year later, athletes decided to become an elite athlete and thus stopped their involvement in other organized PS. This was proceeded by their debut at the state/province level, and from then onwards, there was a rapid trajectory of debuts at the national and international levels, during which they began devoting all their leisure time to their main sport. At the time of testing, on average, athletes had been competing in their main sport for 11.38 (*SD*=10.23) years.

Absolute Years

Mean and median distribution of athletes' advancements in their careers are also listed in Tables 2 and 3. The 'absolute years' analysis indicated athletes spent around 17.44 (SD=11.17) years in other sports (PS or AB sport) before they made their debut in their main PS. It took athletes around six years to start their main PS from point of injury while on average, athletes spent close to eight years in other PS before committing to their main sport (this finding suggests either some athletes participated in PS prior to their injury and/or an artifact of combining groups on these general outcomes). Less than a year after starting their main sport participation, athletes started unsupervised sport-specific training and nearly a year and a half later, they began supervised sport-specific and non-sport specific training. Roughly two and a half years later, athletes made their state/provincial debuts, proceeded by the idea of becoming an elite athlete. Three years into their main sport, athletes devoted a year-round schedule to training and were rewarded with a national debut in the same year. Around the same time, they stopped involvement in other organized sports to focus on becoming an elite athlete in their main sport. After roughly 4 years, they were devoting all leisure time to their main sport and shortly after, made their debut at the international level.

Sample Variations

An observation of the standard deviations and ranges (see Table 2 and 3) suggests considerable variation between athletes for the age they attained each milestone and the years they spent progressing through their careers. This reinforces the importance of examining group differences in an attempt to reduce the sample variation.

Sporting Milestones: Nature of Impairment

Chronological Age

Tables 2 and 3 provide the mean and median distribution for each group. Table 4 provides the statistical results and between-group differences and Figure 1 displays each group's trajectory for their main sport milestones. Kruskal-Wallis tests suggest athletes who acquired their injury later in their careers tended to reach milestones at a later age. More specifically, AD athletes reported reaching most of the milestones at a significantly older chronological age than all the other four groups (i.e., C, PE, A, and EA). This trend started early as AD athletes participated in their main sport informally and formally at a significantly older age and continued this trend across the milestones through to making their international debut. EA athletes reached earlier career milestones (i.e., starting their sport informally and formally and commencing non-sport specific training) at a significantly older age than all the early-onset impairment groups (i.e., C, PE, and A); however, as they progressed through their career, the significance of the difference between EA, PE, and A groups subsided, but EA athletes continued to reach all the milestones at a significantly older age in comparison to C athletes.

Absolute Years

Similar to chronological age, the absolute years' distributions and statistical results can be found in Tables 2, 3, and 4. Figure 2 also depicts the absolute years spent from main sport commencement to each milestone for each group. In terms of absolute years of engagement, C athletes were in their main sport for significantly longer than AD athletes. In addition, AD athletes took longer than PA, A, and EA athletes to make their main PS debut from the point of their first AB sport participation. On the contrary, PA athletes were the last group to start their main sport from the point of impairment-onset. Interestingly, while AD athletes reached milestones at a later age, they spent less time in their careers advancing through these milestones, some significantly earlier, including the years elapsed from the first participation in their main sport to milestones of starting non-sport specific training (significantly earlier than C and PA athletes), the decision to become elite (C, PA, and EA athletes), devote leisure time to their main sport (C, PA, and EA athletes), and specialize in their main sport (C athletes). Finally, AD athletes were given debuts at the state/provincial and international competition levels earlier in their careers which was significantly different from the C athletes.

Within-Group Variations

As seen in the standard deviations and ranges in Tables 2 and 3, while within-group variability remained high, in comparison to the entire sample, the variations for all the groups were reduced. Interestingly, with respect to chronological age data, there seemed to be greater variation among AD athletes relative to other groups. More specifically, the average age and range of ages that each milestone was attained varied more within the AD group. This trend was reversed for the absolute years, as AD and to a lesser extent, EA athletes displayed less variation through their careers, suggesting these two groups progressed at a similar pace (i.e., number of years spent from main sport commencement to attaining each milestone).

Discussion

There is very limited information on PS athletes' developmental trajectories (Dehghansai et al., 2017a, b). The purpose of this analysis was to gain a better understanding of these trajectories and how the nature of impairment may impact athlete development. Findings partially support our hypotheses, in that athletes with earlier onset impairments would reach developmental milestones at younger ages; however, athletes with later onset impairments did not reach performance milestones at the same age as the former group (contrary to previous findings, i.e., Dehghansai et al., 2017b, Dehghansai & Baker, 2020). Nevertheless, they did progress through most of the milestones at a faster pace than athletes with earlier onset impairments (especially in comparison to C athletes).

Nature of Impairment

The data suggest multiple developmental pathways exist, confirmed by observing athletes' careers from multiple lenses (i.e., chronological age and absolute years). From the 'chronological age' perspective, athletes with early-onset impairments (i.e., PA) had a similar trajectory to athletes born with an impairment (i.e., C). Meanwhile, the sporting trajectory of athletes with injuries acquired during adolescence had similarities to both the early- and late-acquired impairment groups. At the other end of the spectrum, athletes with late-acquired impairments (EA and AD athletes) appeared to reach milestones at later ages than other groups. Interestingly, an analysis of 'absolute years' suggests athletes with late-onset impairments progressed through the sporting milestones at a faster pace than athletes with early-onset impairments, including key career milestones such as debut at the international level highlighting a need to consider multiple pathways and different models and/or resource allocations for athletes with late-onset impairments.

One potential factor contributing to the accelerated trajectory for athletes with late-onset impairments is the number of hours devoted to training upon entering their main sport. There is extensive research that illustrates the relationship between training hours and expertise (Baker et al., 2003a, 2003b). While Dehghansai et al. (2017b) did not identify any between-group differences concerning athletes' training histories, they only examined athletes' training histories at two points of their careers (upon career commencement and during testing), with only two overarching training criteria (i.e., sport-specific and unorganized). In part II of this series, we examine training histories in-depth to better understand the association of training and athletes' development (XXXXXX, 2021b).

Another contributing factor to the late-acquired impairment group's faster career progression may be the experiences gained in other sports before acquiring their impairment, as alluded to by Dehghansai and colleagues (Dehghansai et a., 2017b; Dehghansai & Baker, 2020; Dehghansai et al., 2020). These athletes may have transferred learned skills (i.e., decision making and pattern recognition, tactical and technical skills, and high-performance habits: training routine, active recovery, and nutritional knowledge, Abernethy et al., 2005; Halson et al., 2006; Toering et al., 2009), thus requiring less time to reach similar competitive milestones in comparison to the early-acquired impairment groups. Conversely, the latter group may have required more time to adopt the fundamental movement and sport skills and gradually experience nuances associated with high-performance sports. Findings from Dehghansai and colleagues' (2017b) study suggest this as a plausible outcome as most of the wheelchair basketball players with acquired impairments reported participating in basketball prior to acquiring their impairments. In Part III of this series (XXXXXX, 2021c), we will examine athlete experiences in PS and AB sports to better understand the relationship between athletes' sporting experiences and their main sport trajectories.

ADMs

On the one hand, there was some support for the current ADMs from Canada (LTAD) and Australia (FTEM). Athletes' career progressions generally resemble the recommendations made within the LTAD and FTEM models. Athletes started by sampling a variety of sports, identified their main sport, and started to incorporate various training conditions into their regimen while reducing commitment in other sports. Upon commitment to the elite pathway, athletes devoted more resources (i.e., time, money) to their main sport and were given opportunities at more competitive levels. On the other hand, however, the recommended biological-age references from both models did not align with the average age displayed by this study's cohort. More importantly, a closer look at the data (and the high variability between and within groups) captures the complexity of PS athletes' experiences as they navigate their careers. In addition to this variability, the number of years athletes spent in each 'stage' varied significantly, as noted in the high variability in 1) length of time spent in other sports prior to 'specialization', 2) years spent in main sport 'post-specialization' before debuts at higher competitive levels, and 3) within-group comparisons, indicating the trajectory of athletes varied drastically and should be generalized with caution. Therefore, while there are some obvious links (e.g., athletes have to incorporate specific types of training to acquire the skills to be selected nationally and subsequently advance to the international level), the subtle differences in impairment onset and transition point into the pathway have larger implications that are not observable from group trends (e.g., previous sport experiences, access to resources, lack of sport knowledge, or even recruitment strategies).

Practical Implications

The findings from this study suggest 'one-size-fits-all' models do not apply to Paralympic contexts (Dehghansai et al., 2019; Dehghansai, Headrick, et al., 2019; Hutzler et al., 2016; Mann et al., 2017). While this research is in its infancy, data highlights the need to revisit current models, reconsider policies associated with this cohort (i.e., funding, programs, initiatives, and opportunities across the pathway), and re-evaluate resource distribution to PS athletes across their careers, based on the nature of athlete impairment and additional individual considerations. For example, for athletes with late-acquired impairments, it may be important to identify a key sport and ensure they are provided with appropriate resources to succeed in that particular sport (i.e., performance psychologist, physiotherapist, mechanic to adjust equipment, readily accessible high-quality equipment) because evidence suggests they can rapidly reach higher competitive levels from PS debut. On the other hand, athletes with congenital or early-acquired impairments may require opportunities to explore several sports, acquiring a broader range of fundamental and sport-specific skills before narrowing their sporting options. Thus, for athletes with early-onset impairments, multi-sport programs with cost-effective (non-customized) equipment may be the most valuable resource, where coaches facilitate activities focused on exploration and learning before presenting high-performance opportunities. Athletes at the adolescent stage may require a hybrid of the two approaches, depending on the stage of their sporting career prior to acquiring their injuries.

Limitations

Despite several intriguing findings in the current analysis, there were limitations to our investigation. Most obviously, although the DHAQ has been tested for validity and reliability, there remains the possibility of recall bias and/or inaccuracies. For example, some AD athletes with experience in other PS reported experiences before their injury. While the presence of AB athletes is common at the recreational level in some PS, there was no way of confirming this or determining whether it was a reporting error. Retrospective work of this nature will always be limited by the accuracy of memory recall over these extended periods.

In addition, Dehghansai and colleagues (2017b) alluded to the high variability between athletes with congenital and acquired impairments when examining athletes' trajectories. While we attempted to reduce within-group variability by utilizing more age-specific groups for impairment-onset, there was still a high within-group variability in our sample. This demonstrates the complexity of PS athletes' development and the need to control for numerous impairment-related factors (e.g., type of impairment, classification) to be able to reduce within-group variability.

Future Directions

Throughout the discussion, a few key future directions have been offered, several of which will be addressed in subsequent analyses (see Parts II and III). In addition to this, qualitative studies may be especially helpful in furthering our understanding of these quantitative findings. For example, there may be psychological skills acquired through previous sporting experiences (i.e., self-regulation, goal-setting; Dweck, 2006; Toering et al., 2009) which may have contributed to the late-onset groups' faster progression. Identifying these beneficial factors can help create key resources to support all PS athletes. There is also the need to understand the psychological impact of entering sports at a later age and whether factors associated with different stages of life (e.g., starting PS during youth versus during late adolescence) contribute to athlete development. It is also important to consider how impairment- and classification-related factors dictate opportunity, sport selection, and sporting experiences for PS athletes. Exploring questions of this nature with key stakeholders (i.e., athletes, coaches, parents) through qualitative or mixed-methods approaches may help to expand our understanding of athlete experiences in Paralympic systems.

Conclusion

This study examined the sporting trajectories of Australian and Canadian PS athletes and results indicated that developmental pathways did not fully align with current ADM guidelines. Critical general (i.e., the variation of time athletes spent in 'pre-' and 'post-specialization') and group (i.e., differences in chronological age and absolute years between early- and late-onset impairment groups) differences highlighted concerns over the use of current ADMs which fail to capture the complexities of PS athlete development. The findings suggest there are multiple pathways to the elite level. More specifically, athletes with early acquired impairments may benefit from different types of resources and support in comparison to athletes with late-acquired impairments. In two subsequent studies (Part II and III), we expand on these initial findings and explore how athletes' training histories and experiences in other sports contribute to athletes' development and career progression and continue to shape future recommendations.

Table 1

Sample Demographics and Characteristics

Nature of Impairment	N	Age		AIA	
		M	*SD*	*M*	*SD*
Acquired	121	36.75	12.91	20.24	11.40
Congenital	82	28.49	10.38		
Pre-Adolescent	18	32.44	15.10	2.83	3.17
Adolescent	33	32.43	11.47	15.03	1.67
Early Adulthood	38	33.99	9.65	20.76	2.29
Adulthood	32	46.89	10.63	34.78	8.05
Impairment Type					
SCI	68	36.59	11.52	21.84	9.45
Other Physical Impairments	48	33.85	14.37	16.97	15.64
Amputation	43	32.03	11.20	18.19	10.74
SB/CP/ABI	37	26.67	9.89	13.23	11.75
VI	12	39.87	15.09	33.67	14.64
II	3	22.72	4.30		
Sex					
Male	143	32.76	11.24	20.19	10.89
Female	70	34.28	15.06	20.37	12.96
Country					
Australia	149	32.34	12.46	21.54	12.08
Canada	63	35.47	12.79	17.96	9.8

Notes. *AIA = acquired impairment age, SCI = spinal cord injury, SB/CP/ACI = spina bifida, cerebral palsy, acquired brain injury, VI = visual impairment, II = intellectual impairment, C = congenital, PA = pre-adolescent, A = adolescent, EA = early adulthood, AD = adulthood*

Table 2

Mean Distribution of the Age (Chronological Age) and Years Spent (Absolute Years) Reaching each Milestone by Impairment Group

Chronological Age	Total	C	PA	A	EA	AD
	M(SD)	*M(SD)*	*M(SD)*	*M(SD)*	*M(SD)*	*M(SD)*
Able-Bodied Sport	9.26(6.09)	0(0)	8(1.87)	7.25(3.7)	8.82(3.13)	10.96(9.13)
Para Sport*	11.68(7.05)	9.11(4.46)	11(7.04)	11.5(5.66)	15.5(8.46)	17(9.79)
Main Sport*	20.97(12.52)	15.68(8.97)	16.44(6.21)	19.75(7.1)	21.75(9.57)	35.74(16.35)
Organized Main Sport*	21.86(12)	15.88(8.85)	16.44(6.21)	19.75(7.1)	23.73(7.2)	41.04(9.1)
Unsupervised Practice*	23.25(11.66)	17.58(8.64)	17.43(5.6)	20.07(7.8)	23.78(6.07)	40.81(8.97)
Supervised Practice*	23.26(12)	17.29(9.13)	19.38(8.07)	21.43(7.89)	24.79(7.08)	41.67(9.19)
Non-Sport Specific*	22.19(9.68)	18.44(7.77)	19.69(5.98)	18.69(5.11)	25.15(7.22)	38.68(8.82)
Year-Round Training*	23.7(10.32)	18.89(8.09)	21.33(8.43)	21.84(6.94)	26.06(6.92)	40.09(8.46)
Ceased Involvement Other Sports*	24.6(10.3)	20.15(8.04)	22.8(8.97)	22.37(8.3)	26.7(7.62)	39.63(8.5)
Idea of Elite*	23.4(11.09)	17.51(7.81)	23.07(8.98)	21.38(8.84)	25.34(6.94)	40.83(8.88)
Decided to Become Elite*	24.47(10.36)	19.51(7.68)	21.69(7.68)	22.63(8.27)	26.87(6.83)	40.39(8.37)
Leisure Time to Main Sport*	25.56(10.54)	21.2(8.22)	22.13(8.03)	21.7(7.41)	26.69(6.18)	41.65(9.05)
State/Provincial Debut*	24.84(11.51)	19.34(8.78)	23.36(6.62)	22.14(7.91)	25.73(7.02)	42.35(9.35)
National Debut*	25.15(11.57)	19.51(8.62)	23.15(7.94)	23.1(9.2)	26.68(6.94)	42.27(9.17)
International Debut*	25.7(10.36)	20.74(8.16)	23(8.27)	24.14(8.25)	27.72(6.22)	41.24(9.03)
Absolute Years						
Able-Bodied Sport to Main Sport*	-17.44(11.17)	0(0)	-5(3.83)	-13.33(8.58)	-14.08(6.17)	-27.76(12.26)
Injury to Main Sport*	-5.91(7.56)	0(0)	-14.19(6.72)	-4.72(6.76)	-3.12(6.72)	-5.81(6.71)
Para Sport to Main Sport	-7.73(11.18)	-6.37(8.46)	-11.8(7.89)	-6.5(10.89)	-5.79(12.63)	-16.13(18.44)
Unsupervised Practice	0.76(2.81)	1.34(3.77)	0.71(1.27)	0.56(2.87)	0.61(1.61)	-0.22(1.31)
Supervised Practice	1.44(3.82)	1.4(3.4)	2.94(5.64)	2.13(6.36)	0.84(1.27)	0.63(0.84)
Non-Sport Specific	1.71(5.24)	2.91(5.52)	3.85(6.24)	-0.52(6.13)	1.84(3.07)	-1.05(2.44)
Year-Round Training*	3(4.61)	3.38(4.49)	5.33(6)	2.58(6.43)	2.74(2.91)	1.18(1.33)
Ceased Involvement Other Sports*	3.43(5.03)	4.26(4.66)	4.9(6.52)	3.05(7.92)	2.91(3.15)	1.13(1.41)
Idea of Elite*	2.78(5.19)	3.03(5.12)	7.07(8.73)	2.24(5.15)	2.45(3.51)	0.26(2.38)
Decided to Become Elite*	3.57(4.65)	4.2(4.92)	5.25(6.08)	3.33(5.17)	3.6(3.43)	0.7(1.94)
Leisure Time to Main Sport*	3.87(4.53)	4.37(4.59)	5.69(6.01)	3.75(5.53)	4.04(3.41)	1.15(1.35)
State/Provincial Debut*	2.54(4.51)	3.14(4.1)	5(6.87)	3.38(7.33)	1.15(1.76)	0.55(0.8)
National Debut	3.3(4.91)	3.66(4.47)	5.92(6.49)	4.6(8.38)	2.04(2.26)	1.1(1.14)
International Debut*	4.45(4.51)	5.15(4.73)	6.54(6.35)	4.5(4.83)	3.67(3.05)	1.75(1.61)

*****Note. *-indicates between-group significance, M=mean, SD=standard deviation, C=congenital, PA=pre-adolescence, A=adolescence, EA=early adolescence, AD=Adolescence

Table 3

Median Distribution of the Age (Chronological Age) and Years Spent (Absolute Years) Reaching each Milestone by Impairment Group

Chronological Age	Total		C		PA		A		EA		AD	
	Median	*Range*	*Median*	*Range*	*Median*	*Range*	*Median*	*Range*	*Median*	*Range*	*Median*	*Range*
Able-Bodied Sport	8.00	5-47		-	8.00	5-10	5.50	5-18	8.00	5-15	8.00	5-47
Para Sport*	10.00	5-34	7.00	5-23	10.00	5-23	10.00	5-20	13.50	6-34	14.00	5-30
Main Sport*	18.00	0-55	13.00	0-46	16.00	6-28	18.00	7-42	22.00	6-43	36.00	5-55
Organized Main Sport*	19.00	5-55	13.00	5-46	16.00	6-28	18.00	7-42	23.00	8-43	40.00	28-55
Unsupervised Practice*	20.00	5-55	16.00	5-46	16.00	10-28	18.00	8-42	23.00	15-43	39.00	29-55
Supervised Practice*	21.00	5-55	15.00	5-46	17.00	10-40	18.00	13-48	23.00	10-43	40.00	29-55
Non-Sport Specific*	19.00	9-55	16.00	9-46	19.00	10-33	17.00	12-34	24.00	16-44	36.00	28-55
Year-Round Training*	21.00	5-55	17.00	5-46	19.00	10-40	19.00	13-42	24.50	12-45	38.50	29-55
Ceased Involvement Other Sports*	21.50	5-55	18.00	5-48	19.00	12-40	20.00	14-42	25.00	19-45	36.00	29-55
Idea of Elite*	20.00	5-55	15.50	5-46	20.00	14-40	17.00	8-47	23.50	17-45	40.00	28-55
Decided to Become Elite*	21.00	8-55	17.50	9-46	19.00	14-40	20.00	8-42	25.00	20-47	40.00	29-55
Leisure Time to Main Sport*	23.00	8-55	18.00	9-46	19.00	13-40	20.00	8-42	25.00	20-47	40.50	29-55
State/Provincial Debut*	21.00	10-55	16.00	10-46	23.00	13-33	19.00	15-42	23.50	16-43	40.00	29-55
National Debut*	22.00	10-55	16.00	10-46	20.00	14-40	18.50	15-43	24.00	18-44	41.00	29-55
International Debut*	23.00	13-55	18.00	13-47	19.00	14-40	21.00	16-48	26.00	20-46	39.00	29-55
Absolute Years												
Able-Bodied Sport to Main Sport*	-15.00	-48-1			-6.00	-8-0	-12.00	-37-1	-14.50	-30-0	-30.00	-48--2
Injury to Main Sport*	-3.00	-28-10			-13.80	-26.6--4.7	-2.50	-26-6	-1.00	-23-10	-4.00	-28-2
Para Sport to Main Sport	-6.00	-39-14	-6.00	-34-10	-11.00	-20-0	-1.00	-27-3	-9.50	-28-14	-13.00	-39-8
Unsupervised Practice	0.00	-6-22	0.00	-6-22	0.00	0-3	0.00	-6-10	0.00	0-8	0.00	-5-1
Supervised Practice	0.00	-2-34	0.00	-2-17	0.00	0-20	0.00	0-34	0.00	-1-5	0.00	-1-2
Non-Sport Specific	1.00	-26-21	3.00	-11-19	3.00	-3-21	0.00	-26-8	1.00	-2-11	0.00	-8-2
Year-Round Training*	2.00	-5-34	2.00	-4-20	3.00	0-20	1.00	-5-34	2.00	-1-11	1.00	0-6
Ceased Involvement Other Sports*	2.00	-4-34	3.00	-2-18	2.50	0-20	0.00	-4-34	2.00	-2-11	1.00	0-5
Idea of Elite*	2.00	-14-30	3.00	-14-17	4.00	-1-30	1.00	-7-21	1.00	-4-11	0.00	-8-4
Decided to Become Elite*	2.00	-14-21	4.00	-14-17	3.00	-3-21	1.00	-4-21	2.50	0-12	0.00	-6-4
Leisure Time to Main Sport*	2.00	-4-22	3.50	-2-19	3.50	0-22	1.00	-4-21	3.00	0-12	1.00	-1-4
State/Provincial Debut*	1.00	-1-34	1.50	0-21	2.00	0-21	1.00	0-34	1.00	0-8	0.00	-1-2
National Debut	2.00	0-34	2.00	0-21	2.00	0-21	1.50	0-34	1.00	0-10	1.00	0-4
International Debut*	3.00	0-23	3.00	0-23	4.00	0-22	2.50	0-21	3.00	0-12	2.00	0-6

*****Note.*-indicates between-group significance, Md=median, C=congenital, PA=pre-adolescence, A=adolescence, EA=early adolescence, AD=Adolescence

Table 4
Significant KW Results for Milestones Attainment Between Nature of Impairment Groups pertaining to Chronological Age and Absolute Years Analysis

Milestones (Chronological Age)	*Kruskal-Wallis Test*	Between-Group Significance (*p* <.05)
Started Main Sport (any format)	H(4)=53.75, *p*<.001	AD-C, AD-PA, AD-A EA-C
Started Main Sport (formal)	H(4)=83.96, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C, EA-PA
Non-Sport Specific Training	H(4)=66.38, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C, EA-A
Unsupervised Training	H(4)=74.66, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C, EA-PA
Supervised Training	H(4)=78.78, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C
Idea of Becoming Elite	H(4)=7.00, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C
Decision to Become Elite	H(4)=69.16, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C
Year-Round Training	H(4)=68.13, *p*<.001	AD-C, AD-A, AD-EA EA-C
Devoted Leisure Time to Main Sport	H(4)=52.93, *p*<.001	AD-C, AD-PA, AD-A, AD-EA EA-C
Committed to their Main Sport	H(4)=43.37, *p*<.001	AD-C, AD-PA, AD-A EA-C
State/Provincial Debut	H(4)=63.36, *p*<.001	AD-C, AD-A, AD-PA, AD-EA EA-C
National Debut	H(4)=63.85, *p*<.001	AD-C, AD-A, AD-PA, AD-EA EA-C
International Debut	H(4)=53.09, *p*<.001	AD-C, AD-PA, AD-A EA-C
Milestones (Absolute Years)	*Kruskal-Wallis Test*	Between-Group Significance (*p* <.05)
Time in Main Sport	H(4)=12.27, *p*<.05	AD-C
AB-Main Sport Debut	H(3)=25.83, *p*<.001	AD-PA, AD-A, AD-EA
Injury to Main Sport	H(3)=7.10, *p*<.001	PA-A, PA-EA, PA-AD
Non-Sport Specific Training	H(4)=21.66, *p*<.001	AD-C, AD-PA
Idea of Becoming Elite	H(4)=14.11, *p*<.05	AD-C, AD-PA
Decision to Become Elite	H(4)=18.90, *p*<.001	AD-C, AD-PA, AD-EA
Leisure time to Main Sport	H(4)=12.33, *p*<.05	AD-C, AD-PA, AD-EA
Committed to their Main Sport	H(4)=11.97, *p*<.05	AD-C
State/Provincial Debut	H(4)=14.83, *p*<.05	AD-C
International Debut	H(4)=10.90, *p*<.05	AD-C

**Note*. C=congenital, PA=pre-adolescence, A=adolescence, EA=early adolescence, AD=Adolescence, AB=able-bodied

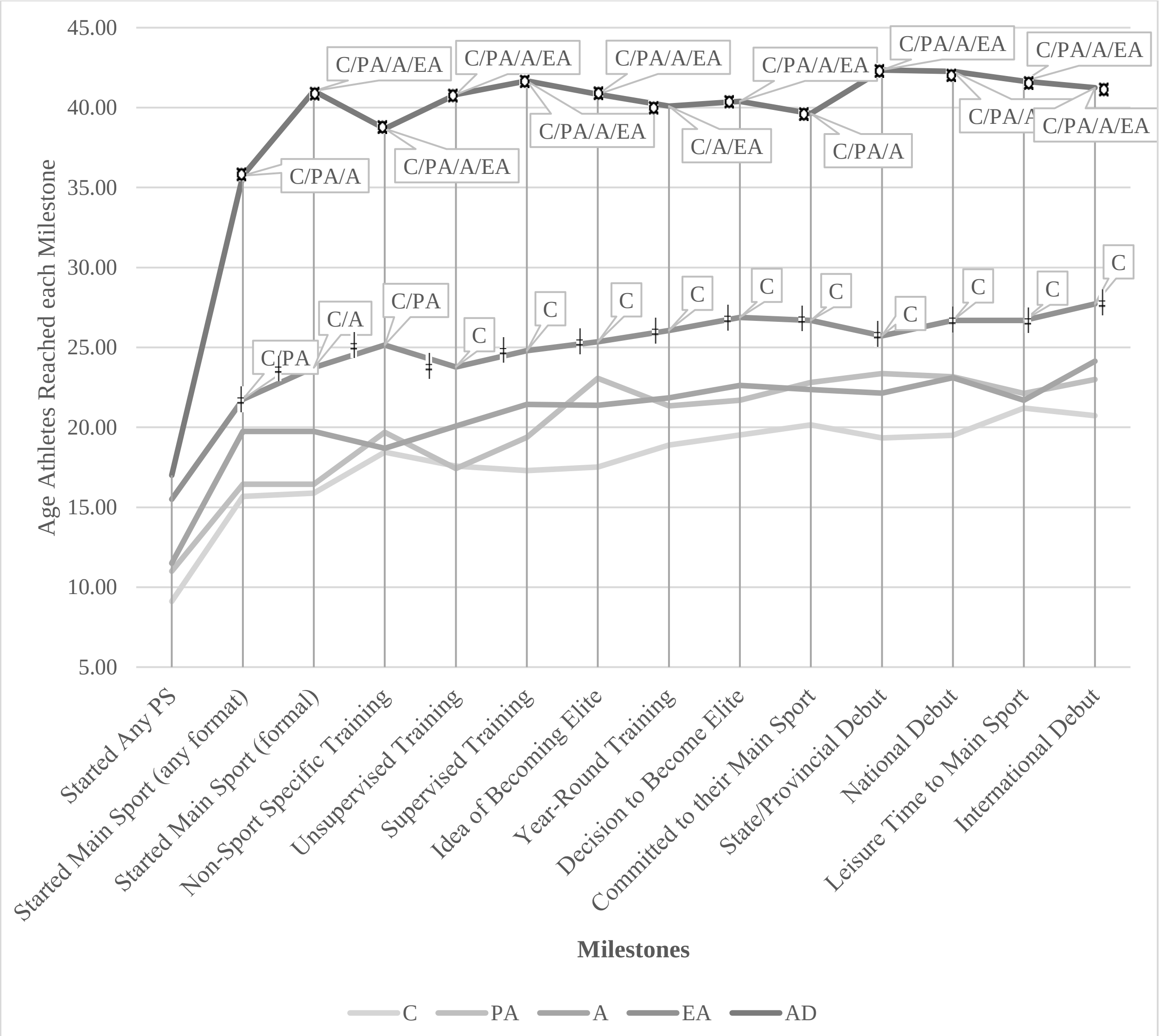

Figure 1. The Average Age Athletes in each Impairment Group Reached Developmental and Performance Milestones.

Note. ¤ = indicates AD group reached milestone at an older age in comparison to one or more group(s). ǂ = similarly, but for EA group, *p* <.05.

The comment box lists the groups that these milestones were significantly different to.

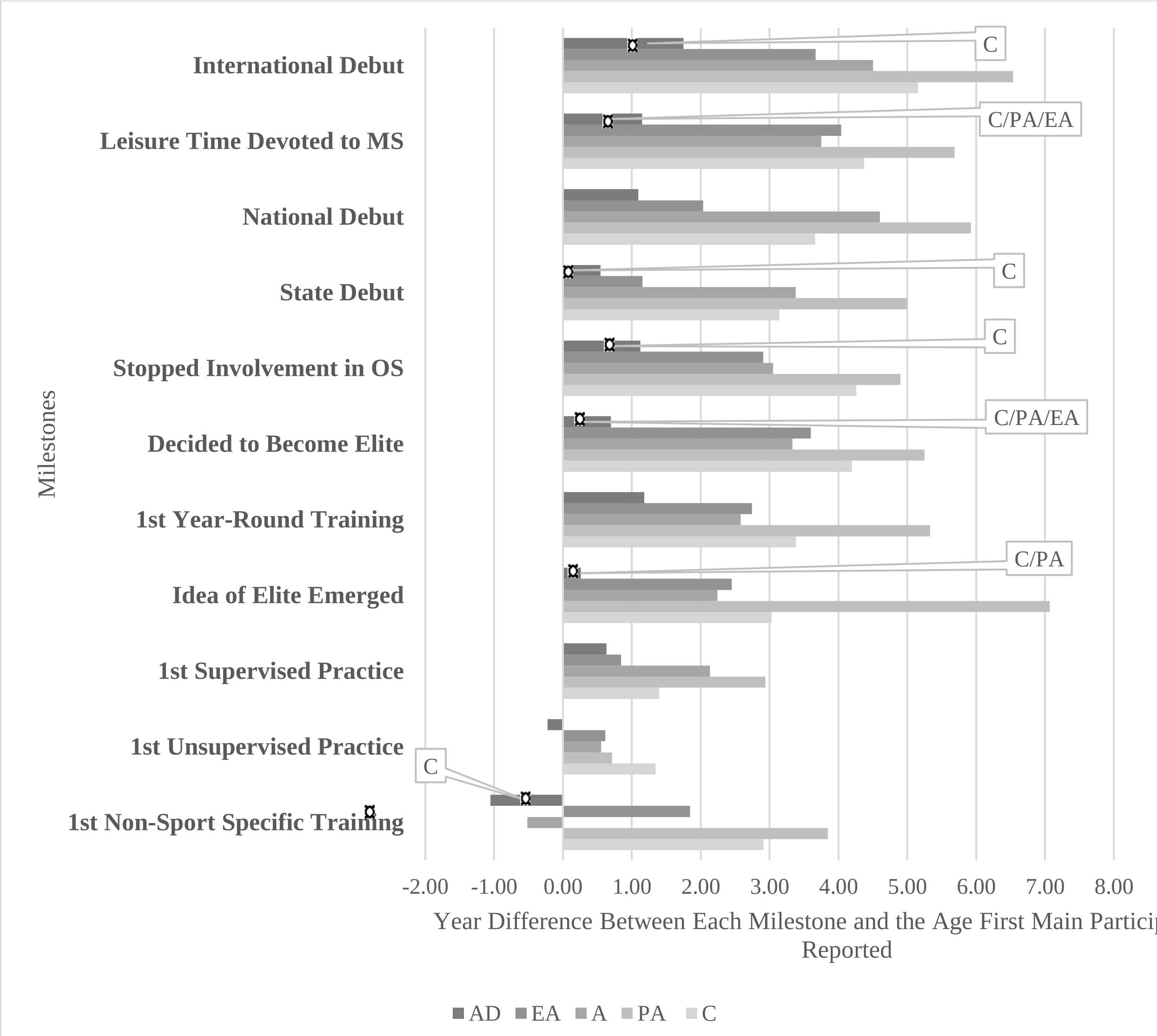

Figure 2. Years until Each Milestone was Attained from the Point of Main Sport Entry for each Impairment Group.

Note. ¤ = indicates AD group attained milestone at a faster pace in comparison to one or more group(s). The comment box lists the groups that these milestones were significantly different to.

Chapter Five

The Pathway to Elite in Paralympic Sport: Part II – In-Depth Analysis of Athletes' Training Histories

Dehghansai, N., Pinder, R. A., & Baker, J. (In review). The pathway to elite Paralympic sport: Part 2 – In-depth analysis of athletes' training histories. *Adapted Physical Activity Quarterly*, 30 pages.

***This manuscript has been presented in the formatting that has been submitted to the respective journal. References are included at the end of the dissertation starting on page 163-185.*

Abstract

Recent findings suggest different developmental trajectories for athletes with early- and late-onset impairments. In this study, 213 Australian and Canadian athletes from 18 Paralympic sports reported the hours and years devoted to various training types across numerous conditions. While athletes with early-onset impairment started most training conditions at a younger age, athletes with late-onset impairments incorporated some of these conditions into their training earlier in their careers. Impairment groups exhibited different training profiles with preferences for certain conditions within each training type. The accumulated training hours did not differ between groups; however, the proportion of hours devoted to each condition varied across athletes' careers. Athletes with late-onset impairments' expanded training profile early in their careers could be due to experiences in sports before acquiring their impairment. Future studies should explore athletes' experiences in other able-bodied and Paralympic sports to understand the impact of other sporting experiences on athletes' careers.

Keywords: Paralympics, athletes with impairments, Para sport, training, athlete development, expertise

The Pathway to Elite in Paralympic Sport: Part II – In-Depth Analysis of Athletes' Training Histories

There is very limited information pertaining to Paralympic sport[9] (PS) athletes' sporting trajectories and factors that impact development across their careers (Dehghansai et al., 2017a). Results from recent studies suggest athletes whose impairments occur early in development (i.e., congenital, acquired in pre-adolescence, adolescence) reach developmental milestones (e.g., starting sport, incorporating various training conditions) at younger ages than athletes with late-onset impairments (i.e., acquired in early-adulthood, adulthood). However, athletes with late-onset impairments seem able to reach key performance milestones (i.e., debuts at national and international level) at a similar age (Dehghansai & Baker, 2020; Dehghansai et al., 2017b, Dehghansai, Spedale, et al., 2020). In Part I of this series (XXXXXX, 2021a) we examined a large sample of athletes from the Australian and Canadian Paralympic systems, with similar results to those noted above. Further exploration is necessary to understand the underlying mechanisms that allow athletes with late-onset impairments to 'fast-track' through key development and performance milestones across their PS careers. One possibility is that the late-onset group devoted greater hours to sport-specific training which accelerated their skill acquisition (Baker & Young, 2014; Starkes, 2000). While the impact of different types of training on expertise has been examined in the able-bodied (AB) literature (see Baker & Young, 2014 for a review), less is known about the relationship within Paralympic contexts.

Moreover, there is limited information regarding PS athletes' training histories, and how the evolution of training across athletes' careers might provide insight into their development. In a recent systematic review, Dehghansai and colleagues (2017a) found only 21 articles that

[9] Paralympic sport (PS) refers to any sport that is currently or in the past a part of the Paralympic Games.

examined factors influencing PS athletes' development, nine of which explored the influence of training profiles on athletes' performance. The results highlighted the high variability among athletes' training regimens (Bednarczuk et al., 2013), the lack of sport-specific training programs (Liow & Hopkins, 1996; Watanabe et al., 1992), negative impacts of training without a coach (Davis et al. 1993; Fulton et al., 2010; Hedrick et al., 1988), and positive correlation between training and performance (Fay et al., 2013; Ferrara et al., 1992; van der Woude et al., 1998). More recently, Kennedy and Fairbrother (2019) examined the training profiles of wheelchair rugby players across their careers, suggesting similar training profiles to studies examining AB professional athletes. More specifically, athletes focused mainly on sport-specific and cardiovascular training with teammates, under the supervision of a coach. However, a limitation expressed by the authors was the lack of control over impairment-related factors due to the small sample size.

To date, our understanding of PS athletes' training profiles and the impact of impairment-related factors on athletes' training is scant. Thus, the purpose of this study (Part II of this series) was to explore the impact of impairment onset on athletes' training histories. In addition, due to the limited literature in this field, we provide a comprehensive overview of training profiles for our large cohort of Australian and Canadian athletes. Based on previous literature (Kennedy & Fairbrother, 2019), we hypothesized athletes would invest significantly more hours in sport-specific training, with teammates under the supervision of a coach. Furthermore, due to the previous 'fast-tracking' for athletes with late-onset impairments (see Part I), we hypothesized this group would devote significantly more hours to sport-specific training in a shorter period of time (i.e., first seven years of their career) in comparison to athletes with early-onset impairments. However, the longer career span combined with more training opportunities for athletes with early-impairment onset (XXXXXX, 2021a) would offset the condensed hours athletes with late-onset impairments acquired over the shorter period of time, yielding no significant difference between groups for total accumulated hours of training.

Method

Participants

A total of 213 Australian (n=149, 32.34 years of age [*SD*=12.46]) and Canadian (n=63, 35.47 years of age [*SD*=12.79]) athletes from 18 different sports completed a modified version of the Developmental History of Athletes Questionnaire. For details pertaining to recruitment methods and sample description, please refer to Part I of this series of studies.

Instrument

The modified DHAQ is comprised of nine sections, two of which were the focus for this study (Part II): impairment and training histories. The impairment section captured information regarding the type of impairment (i.e., musculoskeletal, neuromuscular, visual, auditory, or other), impairment classification, secondary impairments, nature of impairment (congenital, pre-adolescent, adolescent, early adulthood, adulthood), and, if the impairment was acquired, onset and cause of injury. Participants also provided information on five types of practice, which consisted of *sport-specific* (SS) - activities directly resembling the technical and/or tactical demands associated with athletes' main sport, *physical preparation* (PP) - activities aimed at improving physiological and muscular capacities such as strength, power, endurance, and flexibility (i.e., weight training, yoga), *mental preparation* (MP) - activities aimed at improving knowledge of the sport, teammates, and/or opponents (working with a psychologist, video analysis), *informal play* (P) - activities that resemble the skills and goals of the sport but involve modified rules and/or equipment (i.e., backyard play, pick-up games), and *training camps* (TC) -

intensive training periods aimed at improving squad cohesion and targeted athlete development. Sport-specific, physical preparation, and mental preparation activities were each measured under four different conditions: ‘a coach is present, one-on-one training’ (Individually-Supervised: IS), ‘a coach is present, you and 1 or more other athletes are practicing’ (Group-Supervised: GS), ‘no coach present, you and 1 or more other athletes are practicing’ (Group-Unsupervised: GU), and ‘no coach present, you are practicing on your own’ (Individually-Unsupervised: IU). On the other hand, play was measured under two conditions: Individually (I) or in groups-with one or more persons (Groups: G). In tables and figures, training type acronyms are combined with condition acronyms for simplicity of report (i.e., sport-specific (SS) and group-supervised (GS) would have the acronym of SSGS).

Statistical Analysis and Variables

Assumptions of normality were violated for most of the outcomes and therefore, non-parametric tests were implemented (West et al., 1995). Descriptive analyses were conducted to explore the mean (Table 1a) and median (Table 1b) distribution of the groups for each observable training variable. Kruskal-Wallis tests with Mann-Whitney U post-hoc procedures were used to examine between-group comparisons. Data was evaluated at the significance level of $p \leq .05$ performed using SPSS Version 22 (IMB Corp, 2013).

The independent variable was the age athletes acquired their impairment: congenital (C) or acquired during pre-adolescence (PA; 1 month to 11.9-year-olds), adolescence (A; 12- to 17.9-year-olds), early adulthood (EA; 18- to 24.9-year-olds), or adulthood (AD; 25 years and older). Meanwhile, the outcome variables were training-related factors. Training commencement was examined in two ways: a) the age each training condition was incorporated into athletes’ regimen (chronological age), and b) the years it took athletes to incorporate each training condition into their training regimen from the point they started their main sport participation (absolute years). The number of years trained, accumulated training hours, and hours devoted yearly across athletes' careers for each condition were also examined.

Results

Training History Trends – Overall Group

Years Trained in each Condition

Refer to Tables 1a and 1b for specific mean and median distributions. Unsurprisingly, athletes spent the most time in sport-specific training supervised as part of a group (around eight years), followed by roughly five years in each of sport-specific group and individual training without supervision, play in groups, and attending training camps. Around four years were invested in individual sport-specific training under the supervision of a coach, physical preparation individually unsupervised and with a group (supervised and unsupervised), unsupervised mental preparation both with a group and individually, and play individually. The lowest amount of time (around three years) was spent in supervised mental preparation training both with a group and individually and unsupervised physical preparation training with a group.

Accumulated Training Hours

The highest accumulated training hours was in sport-specific training supervised in groups and this trend continued for other sport-specific conditions (supervised-individually and unsupervised-individually and in groups). Physical preparation conditions (supervised-in groups, and unsupervised-individually and in groups) averaged the next highest training hours followed by play (in groups), mental preparation individually-unsupervised, physical preparation individually-supervised, and play (individually). The remaining mental preparation conditions (in groups both supervised and unsupervised and individually-supervised) and training camp had the lowest accumulated training hours. Therefore, certain conditions were more common for each training type. For example, sport-specific training was more commonly completed in group situations, and under supervision, while mental preparation was largely completed individually and unsupervised.

Yearly Training Progression

Total yearly hours for each training type were analysed across the first seven years (analysis was terminated beyond year seven due to smaller sample size). As depicted in Figure 1, athletes appeared to maintain or slightly increase their yearly contribution to each training condition, with significant increases in training hours in sport-specific training and training camps. Relative to year one, by the seventh year, athletes increased their sport-specific training by 45.00% and training camps by 68.86%. With respect to the proportion of time devoted to each type of training (see Figure 1), a higher proportion of athletes' time was invested in sport-specific training (36.18% in year one) and this gradually increased over the years (48.44% in year seven), while other training types (physical preparation [24.58% year one to 20.13% in year seven], mental preparation [18.67% to 14.15%], and play [18.85% to 13.23%]) decreased over the same seven-year span.

The Relevance of Training Conditions

To capture the relevance of the conditions used within each training type, frequency of participants incorporating each condition was examined. Athletes spent most of their training either in groups under the supervision of a coach or individually unsupervised. Sport-specific training was the most commonly reported type (in groups: supervised= reported by 172 athletes, unsupervised=111, individually: supervised=119, unsupervised=104) with physical preparation the next most frequent (in groups: supervised=111, unsupervised=43, individually:

supervised=67, unsupervised=102) and least frequent was mental preparation (in groups: supervised=76, unsupervised=29, individually: supervised=65, unsupervised=86).

Nature of Impairment

Chronological Age

Table 2 provides a list of Kruskal Wallis results for significant differences between the age athletes in each group started various training conditions. While the list of significant results is too extensive to report here, similar to findings from Part I of this series of investigation, AD and EA athletes started most training conditions at a significantly later age than C athletes. In addition, AD athletes started these training conditions at an older age than PA and A athletes.

Absolute Years

While athletes with late-onset impairments started various training conditions at an older age, they incorporated some of these conditions into their careers earlier, with two being statistically significant between groups. AD athletes (M=1.55, SD=2.63, M=0.85, SD=1.57, respectively) started both individually unsupervised sport-specific ($H(4)=16.359$, $p<.05$) and physical preparation ($H(4)=13.288$, $p<.05$) trainings at a significantly earlier point in their careers than C (M=4.85, SD=5.82, M=6.11, SD=6.83) and PA athletes (M=14.86, SD=12.65, M=7.44, SD=6.23).

Yearly Training Progression

The hours devoted to different training types fluctuated for each group over the first seven years. Interestingly, AD athletes committed more hours to sport-specific training in year 1 (M=763.71, SD=1764.77) in comparison to C (M=346.04, SD=393.43), PA (M=192.00, SD=216.17), A (M=221.07, SD=196.01), and EA athletes (M=167.75, SD=185.96). AD athletes continued to commit more hours to sport-specific training by year 7 (M=848.67, SD=545.48);

however, the increase in proportion of hours was lower (10.10%) in comparison to C (*M*=680.69, *SD*=647.59, 49.16%), PA (*M*=467.20, *SD*=185.01, 58.90%), A (*M*=607.25, *SD*=570.37, 63.60%), and EA (*M*=562.67, *SD*=675.43, 70.19%). Across this seven-year period, C and A athletes reduced total hours committed to physical preparation by 11.58% (*M*=201.43, *SD*=124.19 to *M*=180.52, *SD*=138.22) and 2.28% (*M*=250.80, *SD*=206.77 to *M*=245.20, *SD*=217.89), respectively, while PA, EA, and AD athletes increased their commitment by 15.15% (*M*=224.00, *SD*=178.17 to *M*=264.00, *SD*=124.71), 18.84% (*M*=291.00, *SD*=220.17 to *M*=358.57, *SD*=292.97), and 40.81% (*M*=241.50, *SD*=133.04 to *M*=408.00, *SD*=377.65), respectively. Similar trend was observed for mental preparation as C and A athletes reduced their committed hours by 16.80% (*M*=429.71, *SD*=559.75 to *M*=367.60, *SD*=535.86) and 178.94% (*M*=160.67, *SD*=115.75 to *M*=57.60, *SD*=43.14), respectively, while PA, EA, and AD athletes increased hours committed to mental preparation by 43.14% (*M*=77.33, *SD*=28.10 to *M*=136.32, *SD*=89.56), 71.04% (*M*=30.00, *SD*=25.46 to *M*=103.60, *SD*=94.53), and 29.39% (*M*=81.20, *SD*=72.96 to *M*=115.00, *SD*=121.74). In addition, while C (*M*=7.86, *SD*=8.61 to *M*=50.59, *SD*=119.89, 84.47%), A (*M*=18.00, *SD*=18.37 to *M*=23.78, *SD*=16.93, 24.30%), EA (*M*=23.80, *SD*=23.75 to *M*=93.42, *SD*=16.93, 74.52%), and AD (*M*=8.25, *SD*=7.09 to *M*=36.00, *SD*=24.56, 77.08%) increased the hours committed to TC over the seven-year span, PA athletes reported a reduction of 85.11% (*M*=29.00, *SD*=19.95 to *M*=15.67, *SD*=7.64) by year seven.

All but AD athletes (64.06% to 57.36%) increased the proportion of their training hours devoted to sport-specific training from year 1 to year 7 (C [25.90% to 42.70%], PA [30.65% to 52.92%], A [27.39% to 61.25%], and EA [29.93% to 45.87%]). Conversely, AD athletes (20.26% to 27.57%) were the only group to increase their proportion of time in physical preparation activities from year 1 to 7 (C [15.07% to 11.32%], PA [35.75% to 29.90%], A

[31.07% to 24.73%], and EA [51.951% to 29.23%]). The allocation of time to mental preparation activities across the seven years varied as C (32.16% to 23.06%) and A athletes (19.91% to 5.81%) decreased their proportion of training to mental preparation while PA (12.35% to 15.40%), EA (5.35% to 8.45%), and AD athletes (6.81% to 7.77%) increased their relative involvement. Finally, EA (year 1, 8.56%, year 7, 8.83%) and AD (8.19%, 4.87%) athletes committed a smaller portion of their training to play across the seven years in comparison to C (26.28%, 19.74%). Meanwhile, PA (16.60%) and A (19.40%) athletes drastically reduced the proportion of hours devoted to play by year 7 (0.00% and 5.81%, respectively).

Years Trained in each Condition

Descriptive observations suggest athletes with early-onset impairments (i.e., C and A athletes, see Table 1) trained for longer; however, there was only one between-group significant difference. AD athletes (M=4.33, SD=2.90) spent significantly fewer years in sport-specific training in groups under supervision compared to C (M=8.83, SD=7.45) and A athletes (M=6.21, SD=4.49, $H(4)=11.674$, $p<.05$).

Accumulated Hours of Training and Condition Preferences within Training Profiles

Each group had a unique training profile, with different training volumes (total number of hours per year) per each condition. Figure 2 depicts the percentage of athletes' overall training hours devoted to each condition. AD athletes tended to spend more time in sport-specific training while other groups had a reduction of hours in physical preparation training and an increase in mental preparation training. All impairment groups, except AD athletes (28.82%), invested at least 50.00% of their sport-specific training in groups under the supervision of a coach, while AD athletes relied on individual-unsupervised settings for most of their sport-specific training (51.94%). This difference was significant as AD athletes (M=1085.04, SD=1527.75) accumulated fewer hours than C (*M*=3207.33, *SD*=4536.88) and A athletes (*M*=3441.24, *SD*=3892.35) training in supervised groups (H(4)=11.012, $p<.05$). For PA athletes (*M*=298.40, *SD*=287.42), time devoted to physical preparation in groups under the supervision of a coach (H(4)=19.997, $p<.05$) was significantly less than C (*M*=702.84, *SD*=287.42), A (*M*=976.95, *SD*=1194.50), and EA athletes (*M*=626.12, *SD*=575.62). Meanwhile, EA athletes (*M*=1352.73, *SD*=1471.14) devoted significantly more hours than C athletes (*M*=502.49, *SD*=657.05) to individual-unsupervised physical preparation (H(4)=10.816, $p<.05$).

The combined data for conditions (i.e., supervised-in groups, supervised-individually, unsupervised-in groups or unsupervised-individually) across training types (see Figure 3) highlights different volumes of training types for particular conditions for each impairment group. For example, more than 50.00% of AD athletes' training took place in individual-unsupervised settings and while spending less than 30.00% of their training in groups under supervision. Meanwhile other groups spent at least 40.00% of their time training in groups-supervised, and this was significantly different between AD (*M*=1770.78, *SD*=2277.80, 28.73%) and C groups (*M*=4146.61, *SD*=5846.83, 39.02%, H(4)=10.826, $p<.05$).

In addition, in the individual condition comparisons (supervised vs. unsupervised or group vs. individual), AD athletes spent the majority of their training in individual settings (59.27% versus 40.73% in group settings) and unsupervised (62.01% versus 37.99% in supervised settings). These differences were significant with AD (*M*=2510.25, *SD*=3004.51, *M*=2341.48, *SD*=2814.92) athletes spending significantly fewer hours in group settings (H(4)=11.315, $p<.05$) compared to PA athletes (*M*=3398.50, *SD*=3510.04) and in supervised conditions (H(4)=10.866, $p<.05$) compared to C athletes (*M*=5748.14, *SD*=8424.42). In addition, EA (*M*=4521.50, *SD*=5674.86) and AD athletes (*M*=3821.63, *SD*=6790.61) spent significantly more hours in unsupervised settings (H(4)=18.450, p<.05) compared to C athletes (*M*=4879.78, *SD*=9801.43).

Between and Within Group Variability

It is important to highlight the high variability both between and within groups. This suggests that even within each group, the age athletes adopt various training conditions, the number of years they train and the hours they accumulate for each condition varies considerably.

Discussion

The purpose of this study was to provide a comprehensive overview of Paralympic sport athletes' training histories and build on the results from Part I in this series to better understand the influence of athletes' impairment onset on training-related factors. The hypotheses in this study were partially supported. First, regardless of group, athletes spent more hours training in sport-specific conditions in comparison to other training conditions. Second, like milestone progressions (Part I of this series), upon starting their main sport, athletes with late-onset impairments incorporated some (but not all) training conditions earlier than athletes with early-onset impairments. While each group exhibited a preference for a set of conditions (e.g., AD athletes' preference to individual-unsupervised settings for sport-specific training), there were no significant differences to draw conclusive assumptions on training advantages for a particular group. Nevertheless, there were noteworthy overall trends and group-specific preferences worth discussing.

Training History Trends – Overall Group

Sport-specific training, and to a lesser extent physical preparation, were the most common training types across athlete training histories; however, similar to reports from the existing literature groups (Baker et al., 2005; Hopwood et al., 2015; Kennedy & Fairbrother, 2019), there was a high variability within and between groups. While the commitment to sport-specific training and physical preparation remained relatively stable across the first seven years of training histories in athletes main sport, play was initially incorporated and as athletes advanced in their careers, play conditions were excluded or reduced in hours committed. This was also around the same time mental preparation training was incorporated. The progression is likely due to the finite resources (e.g., time, energy) to meet the demands at the high-performance levels, adjusting to more structured environments and the associated stressors (e.g., increased expectations, media exposure, roster competition), which can impact athletes' physical and psychological well-being (Bruner et al., 2008; Foskett & Longstaff, 2018). Athletes perhaps incorporated mental preparation activities such as self-regulation strategies and video analyses to alleviate some of the associated stresses (Bertollo et al., 2009; Martin, 2012). Most of the mental preparation training took place in an individual-unsupervised setting. While the specificity of mental training (different needs, skills, etc.) may not be optimal for group-like activities, it is unclear whether athletes received formal training (e.g., psychological skill training) from coaches or sport psychologists and applied these strategies in an unsupervised setting or this was an independent, athlete-led initiative (Martin, 2012).

Group-supervised training was also common, mainly incorporated within sport-specific training reflecting coaches' roles in training environments and the evolution of Paralympic sport in recent decades. Findings from the late 1980s and early 1990s indicated the lack of coaches led to limited feedback and inconsistencies in training (Hedrick et al., 1988), overtraining and increased injuries (Ferrara et al., 1992; Liow & Hopkins, 1996; Watanabe et al., 1992) and less success in major competitions (David et al., 1993). However, more recent research has alluded to the coaches' role in facilitating quality training environments (Kean et al., 2017; Kennedy &

Fairbrother, 2019). Interestingly, AD athletes were the only group to report more sport-specific training in individual-unsupervised settings and, therefore, less under a coach's supervision. Future research is necessary to unpack this trend. It is possible athletes with late-onset impairment have competing life commitments (e.g., career, families), less time to devote to structured (supervised) training and have to be creative with when and how they train. In addition, AD athletes may be able to draw from their AB sport knowledge and facilitate their own training with less dependency on feedback and/or motivation from coaches.

Nature of Impairment

Unlike other groups, which invested most of their sport-specific and physical preparation training hours in supervised group settings, AD athletes reported investing more hours training individually and unsupervised. They also spent more time in sport-specific training, and less in play, physical, and mental preparation. In addition, like the milestone attainments reported in Part I (XXXXXX, 2021a), AD athletes started training for their main sport at an older chronological age but adopted some of the conditions earlier in their careers (i.e., individually unsupervised sport-specific and physical preparation trainings). However, neither the accumulated nor yearly hours of training differed between groups. This suggests AD athletes could be entering their sport at a different phase of their sporting careers. While these early years may capture a period when athletes with early-onset impairments are exploring multiple sports and acquiring fundamental movement and sport-specific skills before entering the competitive stream, athletes with late-onset impairments may be directly entering the competitive stream of PS. Previous AB sport experiences may help explain this, enabling athletes to incorporate more hours, and more complex training earlier in their main PS careers, resulting in a 'fast-paced' trajectory for milestone attainment (XXXXXX, 2021a) and training progression. However, it is important to examine athletes' experiences in sports prior to their injury to better understand whether athletes utilize experiences pre-injury to advance their careers in PS (see Part III in this series, XXXXXX, 2021c). Athletes with late-acquired impairment also adopted play in groups and physical preparation in unsupervised groups, almost immediately upon entering PS. The unsupervised parameters within these two settings may have allowed for the opportunity to extract valuable impairment- and sport-related strategies from more experienced teammates to help adjust to the new sporting environments (Kean et al., 2017).

Practical Implications

In general, impairment groups demonstrated different paces at which they incorporated various training conditions, had preferences for specific conditions within each training type, and devoted proportionately different hours to various training conditions. This highlights the importance of approaching each athlete's training plan uniquely based on their impairment, previous sporting experiences, and overall readiness for various training conditions and competition (Dehghansai, Lemez, et al., 2020; Lemez et al., 2020), which could imply different support and resource needs for each athlete during key development periods (including resources for self-directed learning). This is noteworthy for coaches and practitioners to consider when designing training sessions according to athletes' responsiveness to the conditions. Aligning the training demands and environment to athletes' preference (including considerations for athletes' impairments) may result in more engagement, motivation, and learning (Kean et al., 2017). In addition, athletes spent significant time training individually unsupervised (e.g., mental preparation) and there are potential benefits to exploring opportunities to improve and support athletes' training in these areas. Similarly, AD athletes invested most of their training time in individual-unsupervised conditions, and it is worth considering whether this is athlete preference or lack of opportunities within other conditions. If it is lack of opportunities, it is important to engage athletes by providing more opportunities through initiatives and supporting staff development and in remote areas with lack of resources, utilizing emerging technologies to observe, coach, and monitor athletes whom have limited access to coach-directed environments. If athletes with late-onset impairments are attracted to unsupervised training environments early in their sporting careers, coaches and practitioners could create environments to optimize this. Which might facilitate informal conversations for newer athletes entering the sport to acquire knowledge about day-to-day aspects of training from more experienced athletes.

Limitations

While the DHAQ is a reliable and valid instrument, retrospective studies are always prone to recall bias. Ultimately, longitudinal tracking is necessary to verify the trends noted here and their relevance for athletes' training in current systems. Optimistically, new technological advancements such as the development of applications that more easily record and store training information could prove highly beneficial for detailing athletes' training. It is also important to consider the variability within and between groups and the non-significance in most training conditions, suggesting training profiles are more nuanced than group-based analyses can determine. This study examined 18 different sports and the unique classification systems in each sport may attract or limit opportunities for athletes, influencing their training, thus confounding our analysis. In addition, the demands of each sport require different training profiles which necessitate sport-specific or at least sport-type specific analysis.

Future Directions

Results from this study provide insight into a large sample of PS training histories of Australian and Canadian athletes. As alluded to, athletes with late-onset impairments may be able to utilize their experiences in AB sport to ‘fast-track’ through early years of their PS careers. Research from AB literature suggests possibility of transferring skills between sports with similar physiological or cognitive demands (Abernethy et al., 2005; Halson et al., 2006). Therefore, Part III of this series will build on these findings to examine the role of other sports in athletes’ career development. In addition to these quantitative approaches, qualitative studies may be necessary to understand the impact and relevance of other factors throughout the developmental pathway (e.g., access to coaches, teammates, and resources or whether their training was shaped based on personal, financial, and/or disability-related constraints). Due to the limited literature in this area, the group-based overview of a wide range of sports in two countries was a necessary initial step; however, future research should aim to examine these nuanced factors in more specific controlled environments to maximize practical insight and key directions for training-specific related outcomes.

Conclusion

The purpose of this study was to provide a comprehensive overview of Australian and Canadian Paralympic sport athletes’ training profiles while examining the influence of impairment onset. Regardless of grouping, athletes tended to invest more hours into sport-specific and to a lesser extent, physical preparation trainings. While AD athletes started training conditions at an older age, they incorporated some of these conditions earlier in their careers upon entering their sports. The analysis here was not able to tease apart differences, likely due to high within and between variability even at a smaller group level. Nevertheless, data suggest different training profiles with unique preferences exist for each group. Part III will build on current findings to understand the role of other sports in athletes’ sporting development.

Table 1a

Mean distribution of athletes training histories

Chronological Age	Total *M(Sd)*	C *M(Sd)*	PA *M(Sd)*	A *M(Sd)*	EA *M(Sd)*	AD *M(Sd)*
MPGS*	27.13(10.88)	19.93(7.17)	29.33(12.22)	25.50(6.91)	28.13(6.75)	44.63(10.14)
MPGU*	27.72(10.41)	21.00(7.89)	41.00(0)	24.67(5.51)	25.69(3.79)	48.33(11.55)
MPIS*	28.02(11.24)	21.70(7.34)	24.8(9.2)	26.09(6.95)	30.42(7.44)	45.25(10.15)
MPIU*	30.05(11.7)	23.48(10.17)	27.38(11.01)	26.07(8.86)	28.38(7.59)	44.22(8.28)
MP Total*	28.67(14.36)	21.80(9.12)	24.44(8.14)	24.58(8.48)	31.15(19.46)	43.74(8.37)
PPGS*	26.02(10.47)	20.04(6.97)	25.90(8.58)	24.52(9.08)	26.47(3.14)	42.29(7.87)
PPGU*	24.98(9.21)	21.29(8.12)	23.33(1.53)	22.9(3.28)	23.91(4.55)	42.75(13.6)
PPIS	25.55(10.07)	18.79(4.25)	27.00(9.49)	25.93(9.14)	31.25(8.83)	40.13(8.82)
PPIU*	26.48(9.97)	22.57(8.69)	23.67(7.66)	25.47(9.43)	25.77(7.02)	38.19(9.28)
PP Total*	25.21(10.33)	20.21(7.84)	24.54(8.36)	22.96(8.98)	26.38(7.18)	39.43(9.14)
PI*	32.23(14.53)	21.25(13.4)	26.00(12.77)	25.75(12.31)	29.17(5.6)	46.44(7.89)
PG*	25.59(13.42)	16.59(9.47)	23.86(5.58)	24.8(14.09)	26.11(8.69)	42.92(8.91)
P Total*	27.21(11.72)	20.31(8.36)	23.44(9.36)	24.79(8.7)	27.59(6.94)	44.10(7.77)
SSGS*	23.01(11.35)	18.13(9.07)	21.79(8.19)	20.1(8.03)	25.09(7.46)	37.57(12.42)
SSGU*	26.14(10.88)	21.42(7.61)	21.50(6.53)	24.1(10.61)	25.88(6.66)	41.73(9.51)
SSIS*	25.84(11.3)	20.58(7.92)	25.00(7.96)	25.81(10.26)	29.50(9.08)	43.50(9.49)
SSIU*	27.38(11.81)	21.98(8.48)	32.00(12.78)	24.47(10.61)	26.67(7.43)	39.95(10.76)
SS Total*	22.64(11.43)	17.80(8.7)	21.57(8.22)	19.73(7.9)	24.29(7.15)	38.04(12.88)
TC*	25.21(10.37)	20.56(8.41)	25.73(9.37)	23(7.38)	34.38(40.42)	42.36(9.79)
Total Practice*	22.31(11.45)	17.20(8.76)	21.60(7.94)	19.19(7.73)	23.56(7.25)	37.96(11.73)
Absolute Years						
MPGS	5.11(5.33)	5.78(5.58)	10.67(10.07)	5.08(7.04)	4.83(3.46)	2.75(3.58)
MPGU	4.89(4.32)	4.00(4.87)	12.00(0)	7.00(5.00)	4.83(3.83)	4.67(4.04)
MPIS	6.29(6.87)	7.59(6.82)	7.00(5.92)	7.18(11.06)	5.75(3.72)	2.63(2.62)
MPIU	4.88(6.75)	4.95(5.67)	8.5(11.95)	6.27(9.16)	4.95(4.15)	1.88(3.72)
MP Total*	4.36(5.61)	5.36(4.92)	5.78(7.34)	5.21(8.62)	4.15(3.97)	1.39(3.24)
PPGS	4.10(5.88)	4.18(4.81)	6.22(6.92)	5.05(9.82)	3.63(2.78)	1.93(2.87)
PPGU	4.10(4.33)	5.36(6.18)	4.00(4.36)	5.20(2.35)	2.45(2.73)	1.67(2.89)
PPIS*	5.12(6.09)	5.46(4.95)	7.50(5.26)	7.36(9.66)	3.75(3.98)	0.88(1.36)
PPIU*	4.79(6.41)	6.11(6.83)	7.44(6.23)	6.06(8.98)	2.95(3.37)	0.85(1.57)
PP Total*	3.65(5.58)	4.41(5.07)	6.62(6.92)	3.42(8.65)	2.64(3.21)	1.22(1.59)
PI	3.44(7.74)	3.75(2.92)	5.00(6.24)	6.00(20.2)	2.50(2.89)	2.00(4.20)
PG	2.69(6.58)	2.90(6.07)	6.71(7.97)	5.10(12.53)	1.29(2.71)	0.25(2.30)
P Total	4.51(6.50)	4.87(5.45)	6.67(7.50)	4.84(9.25)	4.20(4.02)	3.11(8.14)
SSGS	2.05(4.64)	2.06(4.31)	5.21(6.18)	2.11(7.30)	1.42(2.11)	0.95(1.53)
SSGU	3.95(6.22)	4.74(5.8)	7.83(7.86)	5.90(9.78)	1.75(2.95)	1.60(1.96)
SSIS	4.66(6.34)	4.63(5.95)	8.63(7.11)	5.06(9.43)	4.69(4.51)	1.56(2.35)
SSIU*	4.71(7.00)	4.85(5.82)	14.86(12.65)	5.76(9.52)	3.86(4.74)	1.55(2.63)
SS Total*	1.77(4.75)	2.05(4.29)	5.21(6.00)	1.18(7.64)	1.29(2.4)	0.5(1.01)
TC	4.69(5.52)	6.04(6.20)	7.09(8.43)	3.44(5.24)	3.45(2.9)	2.5(2.68)
Total Practice*	0.87(4.65)	1.04(3.82)	4.80(6.10)	0.14(7.38)	0.55(2.34)	-0.59(2.38)
Years Trained in each Condition						
MPGS	4.08(3.35)	4.30(3.60)	5.00(5.29)	4.42(3.34)	4.26(3.47)	2.63(1.41)
MPGU	4.32(5.04)	4.38(4.66)	1.00(0)	7.00(8.72)	4.08(4.83)	1.00(0)
MPIS	3.25(2.82)	3.63(2.82)	2.80(1.3)	3.00(2.32)	3.50(4.32)	2.50(1.69)
MPIU	4.49(4.86)	4.68(4.63)	5.13(3.87)	5.47(6.82)	4.75(5.43)	2.75(2.27)
MP Total	5.00(5.18)	4.73(3.78)	6.67(8.92)	6.95(7.34)	5.00(4.86)	3.06(2.18)
PPGS	4.69(3.85)	4.89(3.71)	3.44(2.07)	5.75(4.91)	4.94(4.40)	3.21(2.39)
PPGU	4.07(5.32)	5.14(7.94)	2.00(0)	3.60(2.76)	4.45(4.68)	2.00(1.00)
PPIS	4.38(3.51)	4.71(3.81)	3.25(1.71)	3.29(2.55)	5.75(4.59)	3.63(2.07)
PPIU	4.62(3.85)	4.14(3.62)	3.89(2.85)	4.41(3.36)	6.52(4.84)	3.85(3.53)
PP Total	5.22(5.32)	4.96(4.52)	6.67(8.92)	7.21(7.28)	5.24(4.84)	3.39(2.15)
PI	4.26(4.15)	4.63(4.27)	3.00(2.65)	4.75(3.30)	8.00(7.16)	2.43(1.90)
PG	5.96(5.33)	6.24(5.64)	5.29(5.09)	4.00(3.30)	8.24(6.69)	4.75(3.31)
P Total	5.92(4.62)	6.14(5.01)	4.92(2.84)	7.13(5.11)	6.25(4.71)	4.06(3.04)
SSGS*	7.99(6.82)	8.83(7.45)	6.21(4.49)	9.78(6.90)	8.16(7.25)	4.33(2.90)
SSGU	5.58(4.35)	5.67(4.75)	7.00(3.35)	5.70(5.09)	6.46(3.80)	3.67(2.92)
SSIS	4.72(4.44)	4.75(3.65)	3.13(2.64)	7.50(7.81)	4.00(2.85)	3.11(2.20)
SSIU	5.02(4.14)	5.00(3.97)	3.14(2.12)	5.59(5.00)	6.52(4.84)	3.60(2.74)
SS Total*	8.42(6.59)	9.41(7.43)	6.36(4.70)	10.46(6.89)	8.42(5.63)	4.23(2.69)
TC	5.32(4.37)	6.00(4.83)	4.91(3.53)	5.60(4.32)	5.10(4.47)	3.08(1.88)
Total Practice*	8.80(6.49)	10.11(7.45)	6.33(4.47)	10.14(6.08)	8.97(5.77)	4.59(2.77)
Accumulated Hours of Training						
MPGS	210.42(308.13)	236.44(350.31)	210.67(351.05)	244.33(355.9)	207.67(299.77)	129.50(92.7)
MPGU	213.38(331.14)	237.00(290.55)	8.00(0)	454.67(735.76)	208.00(298.94)	45.33(4.62)
MPIS	130.65(144.11)	175.41(149.31)	164.00(232.74)	121.09(142.71)	78.00(112.36)	80.00(83.22)
MPIU	531.63(1431.54)	1093.74(2577.32)	261.00(203.7)	662.93(965.5)	276.00(320.46)	128.00(117.03)
MP Total	664.28(1534.09)	954.30(2335.9)	394.22(422.7)	819.58(1265.08)	554.62(793.19)	216.63(164.59)
PPGS*	678.59(884.24)	702.84(959.74)	298.40(287.42)	976.95(1194.5)	626.12(575.62)	556.24(657.35)
PPGU	606.98(1722.25)	1036.57(2913.42)	197.33(152.07)	318.80(320.58)	626.91(916.67)	204.00(96.99)
PPIS	399.70(454.74)	484.41(411.7)	239.00(284.58)	253.71(286.02)	515.00(761.78)	255.50(198.9)
PPIU*	853.25(1088.88)	502.49(657.05)	869.78(929.12)	869.65(947.28)	1352.73(1471.14)	997.25(1330.88)
PP Total	1474.22(1735.46)	1382.11(1740.03)	950.77(969.28)	1681.60(1575.14)	1844.14(2305.55)	1346.29(1354.72)
PI	325.94(432.33)	374.50(616.09)	221.33(234.11)	311.00(354.75)	331.33(309.41)	355.11(478.02)
PG	538.50(996.57)	484.83(809.51)	1198.86(2441.54)	424.80(457.97)	626.32(931.63)	332.62(451.41)
P Total	708.98(1514.25)	914.84(2213.32)	468.00(457.61)	885.05(1288.13)	607.70(912.23)	365.60(368.63)
SSGS*	2672.98(3766.65)	3207.33(4536.88)	1925.43(2234.44)	3441.24(3892.35)	2394(3143.86)	1085.04(1527.75)
SSGU	908.61(1387.37)	1034.88(1817.41)	758.67(485.05)	1186.4(1619.32)	791.2(660.09)	490.13(625.1)
SSIS*	751.46(1540.32)	941.69(2016.48)	477.50(404.68)	1043(1189.12)	392(543.38)	235.2(255)
SSIU	1159.46(2431.93)	975.10(1545.68)	343.43(567.2)	967.53(1380.09)	1266.67(2007.55)	1956.91(4615.99)
SS Total	4339.31(5431.69)	5029.41(6545.62)	2695.14(2436.39)	5222(4722.69)	3801.76(4716.9)	3238(4643.51)
TC	128.26(248.79)	134.96(281.79)	94.91(98.2)	103.38(128.88)	181.97(336.98)	60.71(76.44)
Total Practice	6406.05(7398.53)	7261.04(8491.85)	3926.40(3066.58)	7541.16(6834.86)	6452.68(7800.14)	4548.54(5671.79)

Table 1b

Median distribution of athletes training histories

	Total Md	Total Range	C Md	C Range	PA Md	PA Range	A Md	A Range	EA Md	EA Range	AD Md	AD Range
Chronological Age												
MPGS*	25.00	12-55	20.00	12-40	32.00	16-40	25.50	16-42	26.00	21-49	48	30-55
MPGU*	25.00	12-55	20.50	12-37	41.00	41-41	25.00	19-30	25.00	20-32	55	35-55
MPIS*	25.00	12-55	20.00	12-43	20.00	18-40	27.00	16-41	29.50	24-52	48	29-55
MPIU*	27.50	12-55	21.00	12-47	25.50	15-45	25.00	16-48	26.00	20-51	44.5	32-55
MP T*	25.00	12-121	20.00	12-47	23.00	15-40	21.00	16-48	26.00	20-121	45	30-55
PPGS*	24.00	9-55	19.00	9-42	24.50	15-41	23.00	15-47	26.00	21-32	40	31-55
PPGU*	23.00	12-55	20.50	12-39	23.00	22-25	22.50	18-28	24.00	16-32	43	30-55
PPIS	23.00	9-55	19.00	9-26	23.50	20-41	23.00	16-42	28.50	23-47	38	30-55
PPIU*	24.00	9-55	21.00	9-47	20.00	17-40	23.00	16-48	25.00	16-45	35.5	22-55
PP T*	22.00	9-55	18.00	9-47	22.00	15-41	19.00	15-47	25.00	16-44	38	22-55
PI*	29.00	5-55	17.50	5-47	23.00	15-40	25.00	12-41	28.00	24-40	45	33-55
PG*	23.00	5-55	14.00	5-40	23.00	16-31	19.50	9-55	26.00	8-44	43	29-55
P T*	24.50	5-55	19.00	5-47	23.00	10-40	25.00	12-48	26.00	20-49	45	30-55
SSGS*	21.00	5-55	16.00	5-46	18.00	13-40	18.00	5-41	24.00	8-43	36	8-55
SSGU*	23.00	9-55	21.00	9-46	18.50	16-32	20.00	12-55	24.00	20-50	42	29-55
SSIS*	22.50	6-55	19.50	6-46	22.00	16-40	23.50	15-47	27.00	20-53	44	31-55
SSIU*	25.00	5-55	19.00	9-47	31.00	19-52	19.00	15-55	26.00	16-51	40	12-55
SS T*	21.00	5-66	16.00	5-47	18.00	13-40	18.00	5-41	23.00	8-43	37	8-66
TC*	23.00	10-55	18.00	10-46	23.00	16-44	19.50	17-42	25.00	14-252	40.5	30-55
Absolute Years												
MPGS	3.00	-5-22	4.00	0-22	12.00	0-20	3.00	-5-21	4.00	1-14	1.5	0-10
MPGU	4.00	0-14	2.00	0-14	12.00	12-12	7.00	2-12	4.50	1-13	7	0-7
MPIS	5.00	-7-36	6.00	0-25	6.00	0-14	3.00	-7-36	6.00	1-12	2.5	0-7
MPIU	3.00	-7-33	2.50	0-20	2.00	0-32	5.00	-7-33	4.00	-2-13	1	-6-10
MP T*	3.00	-6-34	4.00	0-20	3.00	0-20	3.00	-6-34	3.00	-2-13	0	-6-10
PPGS	2.00	-9-36	2.00	0-16	3.00	0-18	3.50	-9-36	3.50	0-9	1	0-10
PPGU	3.00	-1-21	3.50	0-21	6.00	-1-7	5.50	2-8	1.00	0-8	0	0-5
PPIS*	3.00	-1-35	4.00	0-15	9.00	0-12	3.50	0-35	3.00	0-12	0.5	-1-3
PPIU*	3.00	-2-36	4.00	-1-29	6.00	0-19	4.00	0-36	3.00	-2-12	0	0-5
PP T*	2.00	-9-34	3.00	-1-21	4.00	-1-19	1.00	-9-34	2.00	-2-12	1	0-6
PI	1.00	-6-36	3.50	0-9	3.00	0-12	-3.00	-6-36	2.50	0-5	0	-2-9
PG	0.00	-9-34	1.00	-6-22	4.00	0-19	0.00	-9-34	0.00	-2-10	0	-6-4
P T	3.00	-7-36	3.00	-5-22	3.00	0-20	3.00	-7-36	3.00	-2-14	0	-6-33
SSGS	0.00	-10-34	0.00	-1-18	2.50	0-20	1.00	-10-34	0.00	0-7	0	-1-6
SSGU	2.00	-6-36	2.00	0-20	6.00	0-20	2.00	-6-36	0.50	-4-9	1	0-7
SSIS	2.00	-9-32	1.00	-1-19	9.00	0-21	3.00	-9-32	2.00	-1-12	0	0-7
SSIU*	2.00	-3-39	2.50	-3-22	12.00	0-39	2.00	-3-36	2.00	-1-17	1	-1-10
SS T*	0.00	-10-36	0.00	-2-17	3.50	0-19	0.00	-10-36	0.00	0-11	0	-1-3
TC	3.00	-5-29	4.00	0-29	4.00	0-21	2.00	-5-21	3.00	0-11	2	0-8
Years Trained in each Condition												
MPGS	3.00	1-16	3.00	1-15	3.00	1-11	3.00	1-13	4.00	1-16	2.5	1-5
MPGU	2.00	1-18	2.50	1-15	1.00	1-1	3.00	1-17	2.00	1-18	1	1-1
MPIS	3.00	1-15	3.00	1-15	3.00	1-4	2.00	1-8	2.00	1-15	2	1-5
MPIU	3.00	1-28	2.50	1-18	3.50	2-11	3.00	1-28	2.50	1-20	2	1-8
MP T	3.00	1-29	3.00	1-15	3.00	1-29	5.00	1-28	4.00	1-20	2.5	1-8
PPGS	3.00	1-19	4.00	1-16	3.00	1-7	4.50	1-19	3.50	1-18	2.5	1-8
PPGU	2.00	1-31	3.00	1-31	2.00	2-2	3.00	1-9	2.00	1-14	2	1-3
PPIS	3.00	1-15	3.00	1-15	3.50	1-5	2.50	1-9	5.00	1-15	3.5	1-7
PPIU	3.00	1-19	3.00	1-15	3.00	1-11	4.00	1-13	5.00	1-19	3	1-13
PP T	5.00	1-31	5.00	1-31	4.00	1-11	6.50	1-19	5.00	1-19	3.5	1-13

PI	2.00	1-18	3.00	1-14	2.00	1-6	5.00	1-8	6.50	1-18	2	1-6
PG	4.00	1-24	4.00	1-19	3.00	1-14	3.00	1-12	5.00	1-24	3.5	1-12
P T	3.00	1-29	3.00	1-19	3.00	1-29	5.00	1-28	4.00	1-20	3	1-8
SSGS*	6.00	1-37	7.00	1-37	4.00	1-16	10.00	1-30	7.00	1-32	4	1-12
SSGU	4.00	1-18	5.00	1-18	6.50	4-11	3.50	1-18	6.00	2-14	3	1-9
SSIS	3.00	1-30	4.50	1-14	2.00	1-9	4.00	1-30	3.00	1-8	3	1-8
SSIU	4.00	1-19	4.00	1-17	3.00	1-7	4.00	1-19	5.00	2-17	3	1-10
SS T*	7.00	1-37	7.00	1-37	4.00	1-17	10.00	1-30	8.00	2-23	3.5	1-10
TC	4.00	1-20	5.00	1-20	4.00	1-11	5.00	1-15	4.00	1-19	3	1-6
Accumulated Hours of Training												
MPGS	76.00	4-1660	96.00	4-1660	12.00	4-616	66.00	12-1120	48.00	4-1024	120	12-240
MPGU	48.00	8-1304	82.00	16-720	8.00	8-8	48.00	12-1304	72.00	8-1024	48	40-48
MPIS	88.00	4-660	144.00	4-660	60.00	32-576	64.00	8-396	32.00	4-384	64	4-208
MPIU	144.00	4-11520	144.00	4-11520	282.00	12-528	272.00	4-3256	144.00	12-1176	96	12-464
MP T	240.00	4-13488	254.00	8-13488	180.00	24-1104	360.00	16-4688	164.00	4-3280	200	8-488
PPGS*	368.00	8-5328	384.00	16-5328	288.00	8-960	400.00	12-4096	512.00	20-2224	240	8-2400
PPGU	192.00	4-11136	216.00	4-11136	192.00	48-352	168.00	52-960	256.00	24-2880	228	72-288
PPIS	256.00	12-2796	432.00	20-1604	152.00	12-640	120.00	32-1000	276.00	48-2796	232	24-576
PPIU*	384.00	12-6060	240.00	12-2576	384.00	60-2512	432.00	80-3360	680.00	80-6060	304	48-4512
PP T	892.00	8-11136	880.00	20-11136	480.00	80-3248	1520	140-6248	952.00	24-11080	1008	8-4764
PI	104.00	4-1680	100.00	4-1680	160.00	24-480	206.00	16-816	304.00	8-684	96	32-1440
PG	196.00	4-6720	176.00	4-3120	240.00	48-6720	264.00	12-1200	228.00	24-3840	144	4-1680
P T	256.00	4-13488	252.00	4-13488	256.00	24-1104	360.00	32-4688	240.00	4-3964	242	8-1440
SSGS*	1082	8-25136	1456	32-25136	1364	96-8832	1728.00	176-12432	822.00	32-10320	576	8-6672
SSGU	384.00	16-8876	448.00	16-8876	828.00	32-1248	320.00	40-4992	600.00	24-2160	320	20-2380
SSIS*	300.00	4-14100	404.00	4-14100	272.00	96-1152	392.00	88-4040	152.00	16-1920	78	4-664
SSIU	432.00	8-21600	432.00	8-7216	64.00	12-1536	200.00	48-4400	456.00	40-8192	528	12-21600
SS T	2156	28-44860	3028	48-44860	2112	216-9836	3504	428-13772	1632	116-17792	1610	28-22064
TC	55.00	3-1596	54.00	3-1498	48.00	6-252	56.50	3-511	61.50	3-1596	24.5	3-248

*Note. *indicates significant between group difference, $p < .05$, MP=mental practice, PP=physical preparation, P=play, SS=sport-specific, TC=training camp, TP=total practice, GS=group, supervised, GU=group, unsupervised, IS=individually, supervised, IU=individually, unsupervised, PG=play with others, I=play, individually, T=total, Md=median, M=mean, SD=standard deviation, C=congenital, PA=pre-adolescence, A=adolescence, EA=early adulthood, AD=adulthood

Table 2

Kruskal Wallis Results from Between Group Comparisons per Nature of Impairment

Chronological Age	Kruskal Wallis	p<.05
MPGS	H(4)=34.193, p<.05	AD-C, AD-A, EA-C
MPGU	H(4)=12.389, p<.05	AD-C
MPIS	H(4)=27.798, p<.05	AD-C, AD-PA, EA-C
MPIU	H(4)=33.926, p<.05	AD-C, AD-PA, AD-A, AD-EA
PPGS	H(4)=49.915, p<.05	AD-C, AD-PA, AD-A, AD-EA, EA-C
PPGU	H(4)=11.507, p<.05	AD-C
PPIU	H(4)=27.652, p<.05	AD-C, AD-PA, AD-A, AD-EA
PI	H(4)=36.062, p<.05	AD-C
PG	H(4)=36.062, p<.05	AD-C, AD-A, AD-EA, EA-C
SSGS	H(4)=49.026, p<.05	AD-C, AD-PA, AD-A, EA-C
SSGU	H(4)=37.690, p<.05	AD-C, AD-PA, AD-A
SSIS	H(4)=37.862, p<.05	AD-C, AD-A, EA-C
SSIU	H(4)=37.862, p<.05	AD-C, AD-PA, AD-A, AD-EA
TC	H(4)=45.549, p<.05	AD-C, AD-C, AD-A, EA-C

*Note. The group before the '-' is the group with the larger mean average

MP=mental practice, PP=physical preparation, P=play, SS=sport-specific, TC=training camp, TP=total practice, GS=group, supervised, GU=group, unsupervised, IS=individually, supervised, IU=individually, unsupervised, PG=play with others, I=play, individually, T=total, Md=median, C=congenital, PA=pre-adolescence, A=adolescence, EA=early adulthood, AD=adulthood

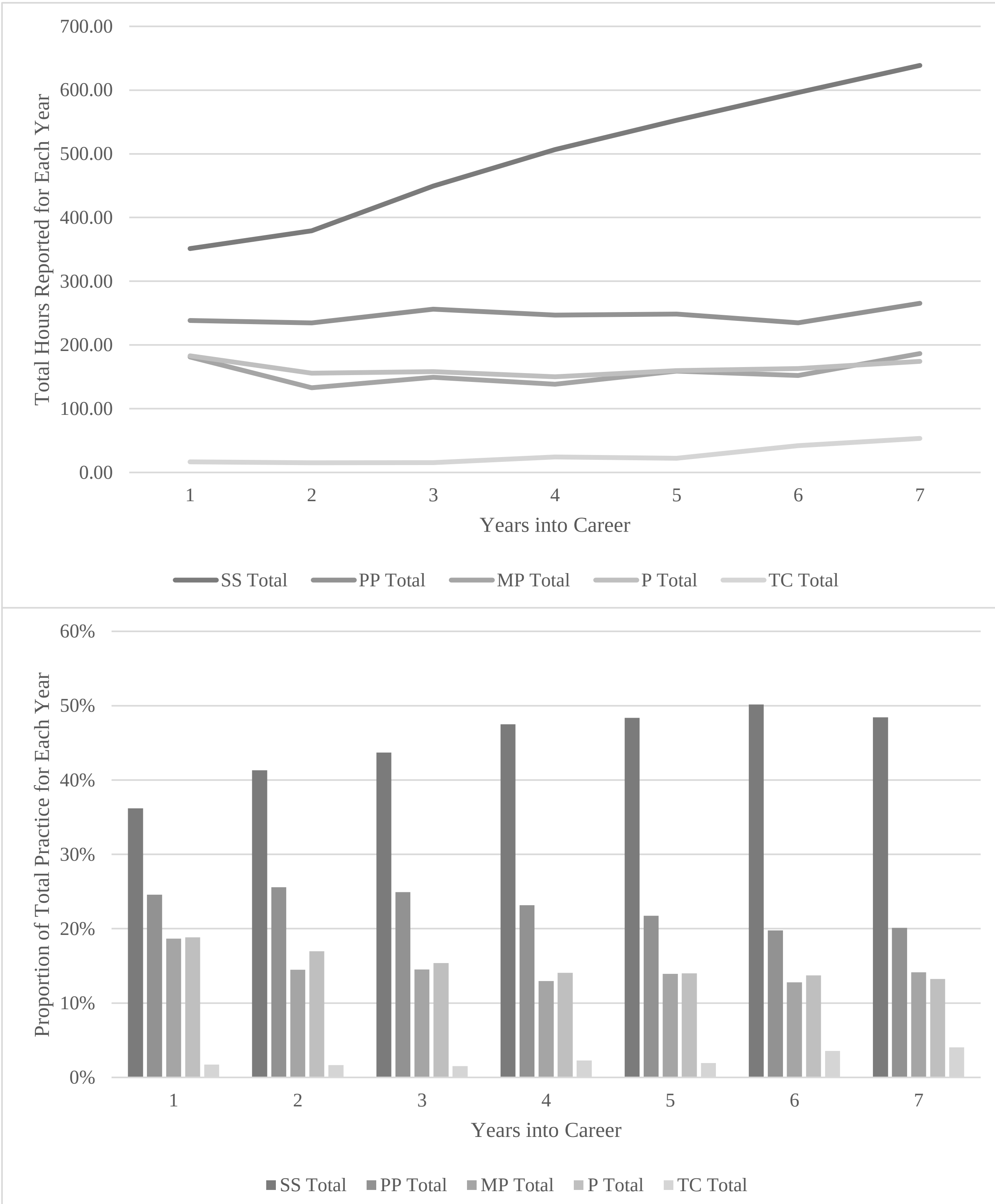

Figure 1. The total hours devoted to each training type across the first seven years of athletes' career (above) and the proportion of hours devoted to each training type for each year (below).

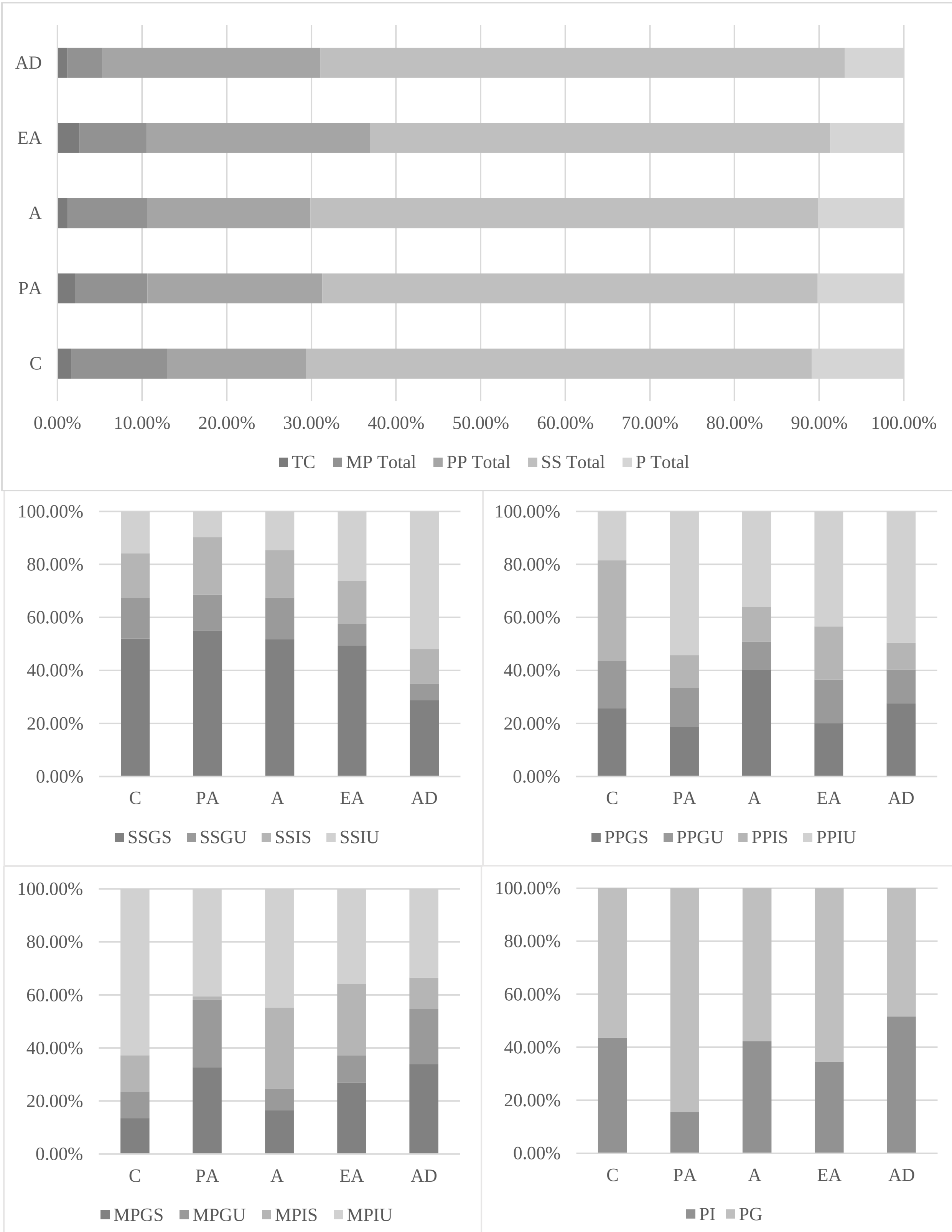

Figure 2. The proportion of total accumulated hours devoted to each training type (above) and each condition within the training types.

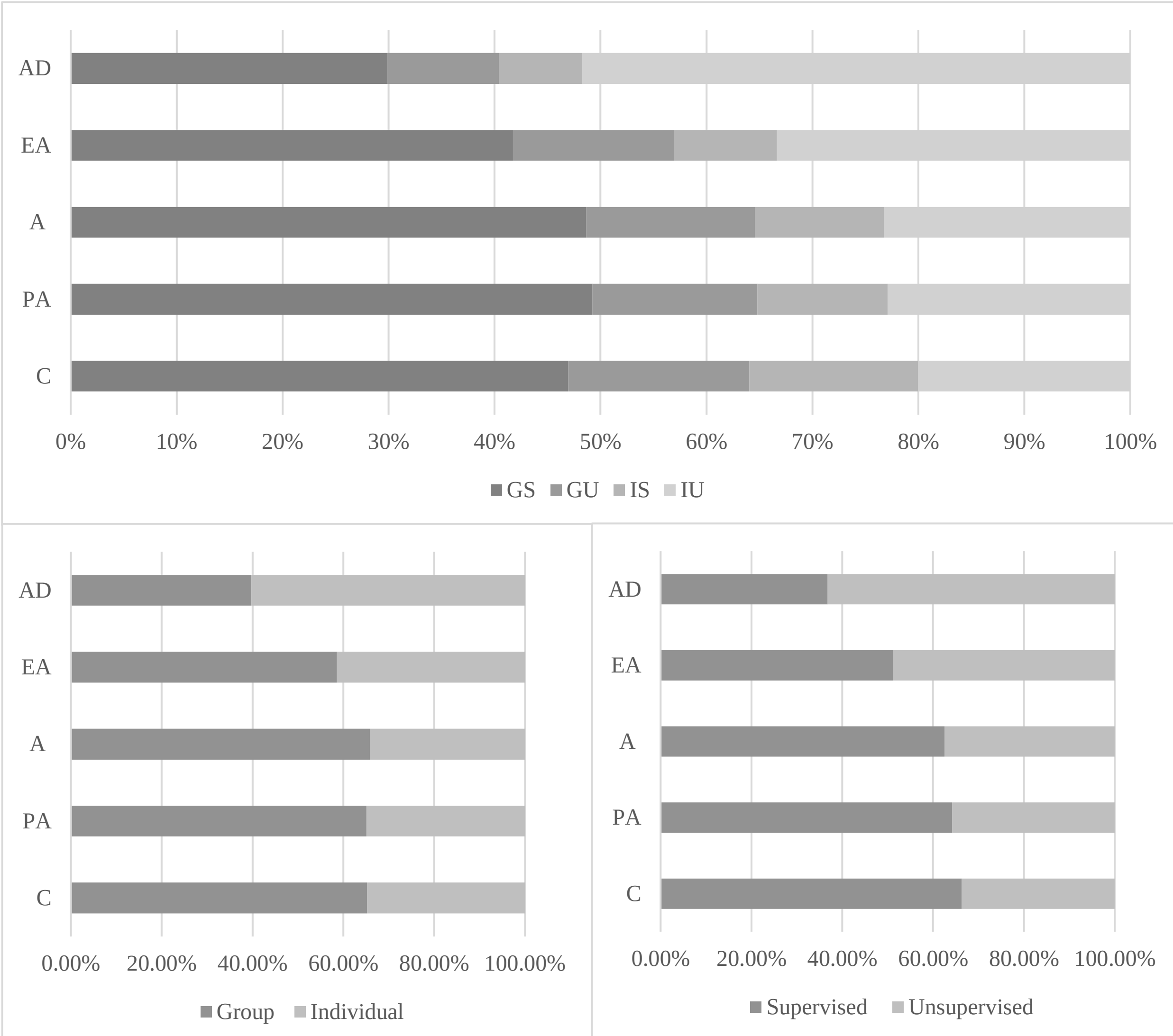

Figure 3. The proportion of training distribution within the four conditions combined (above) and separate (below).

Chapter Six

The Pathway to Elite Paralympic Sport: Part III – The Role of Experience in Other Sports

Dehghansai, N., Pinder, R. A., & Baker, J. (In review). The pathway to elite Paralympic sport: Part 3 – The role of organized sports. *Adapted Physical Activity Quarterly*, 28 pages.

This manuscript has been presented in the formatting that has been submitted to the respective journal. References are included at the end of the dissertation starting on page 163-185.

Abstract

The lack of understanding of how previous sporting experiences influence the development of athletes in Paralympic sport (PS) limits insight to appropriate evidence-based policy. Two hundred thirteen Australian and Canadian athletes detailed their sporting involvement in PS and able-bodied (AB) contexts. More than eighty percent (81.82%) of athletes with acquired impairments reported involvement in AB sports before the onset of their impairment with 69.5% noting involvement in sports similar to their current PS. Only 37.56% participated in other PS, with a large portion of experiences within local or state/provincial levels (79.17%), alongside AB athletes (with no sport-modifications, 46.84%), in a club setting (61.36%) and in sports similar to their current one (52.50%). The commonality of previous experiences with athletes' current sport suggests benefits to cross-training and a need for more cross-pathway opportunities for athletes to engage in multiple sports early in their careers before committing to a single sport.

Keywords: able-bodied, athletes with impairment, diversification, disability sport, Para sport, organized sports, sporting history

The Pathway to Elite Paralympic Sport: Part III – The Role of Experience in Other Sports

Given the relative immaturity of research programs in Paralympic sport (PS) compared to able-bodied (AB) sports (Dehghansai et al., 2017a), it is not surprising that many athlete development models (ADMs) are built on evidence from AB cohorts. However, considering the complexities associated with PS, it is unclear whether recommendations from existing literature can apply to PS athletes. For instance, impairment-related factors (i.e., impairment-onset, impairment type, and sporting experiences prior to impairment-onset) impact athletes' introduction to PS, *and* their subsequent developmental trajectories. There are also additional challenges in PS that limit sporting opportunities such as the lack of sport programs, inaccessible facilities, and volunteer staff with limited impairment-specific knowledge (Martin-Ginis et al., 2016).

In a recent study, less than half of the Canadian wheelchair basketball players reported having experience in other PS, with involvement in AB sport prior to impairment-onset a more common pathway (Lemez et al., 2020). Moreover, while Dehghansai and Baker (2020) found 74% of Paralympic Search event[10] attendees were involved in sports post-impairment-onset, the majority of these experiences took place either in 'open' (i.e., no other athletes with impairments were involved) or 'open with mixed athletes' settings (i.e., integrated with a mix of athletes with and without impairments). Therefore, the question remains as to whether athletes have similar opportunities to sample sports early in their PS careers as alluded to by popular ADMs (e.g., *Long-Term Development in Sport and Physical Activity 3.0*; Higgs et al., 2019), and whether these settings are optimal for athletes' development.

[10] The Paralympian Search, organized and facilitated by the Canadian Paralympic Committee, are one-day athlete identification events designed to test aptitudes of persons with impairments exploring opportunities to engage in Paralympic sports.

What has been reported to date on PS athletes' development is that a) athletes with congenital and early acquired impairments (i.e., acquired pre-adolescence) have a different sporting trajectory to those with later-onset impairments (i.e., early adulthood/adulthood, Dehghansai & Baker, 2020; Dehghansai et al., 2017b; Dehghansai, Spedale, et al., 2020), b) the majority of athletes with acquired impairments have AB sporting experience prior to entering PS (Lemez et al., 2020), c) athletes' early PS experiences are mainly in open settings (Dehghansai & Baker, 2020), d) impairment-related factors play a vital role in PS athlete selection and development (Dehghansai, Lemez, et al., 2020; Mann et al., 2017; Patatas et al., 2020), and e) the complexities and nuances associated with disability[11]-related factors make PS athletes' development difficult to capture in a 'one-size-fits-all' approach (Dehghansai & Baker, 2020; Dehghansai et al., 2017b; Dehghansai, Lemez, et al., 2020; Hutzler et al., 2016; Mann et al., 2017; Patatas et al., 2018; 2020; Radtke & Doll-Tepper, 2014). The main conclusion emerging from this body of research has been a call to extend these initial findings to better capture nuances associated with PS athletes' development to a) better educate stakeholders (i.e., coaches, athletes, parents), b) inform policies, and, c) allocate appropriate resources to optimize sporting environments to maximize support for PS athletes' development.

In Part I of this series of investigations, findings suggested athletes with early impairment-onset (congenital or acquired during pre-adolescence) reached the majority of milestones at a younger age than athletes with impairments acquired in early-adulthood or adulthood (XXXXXX, 2021a). However, athletes with later-onset impairments were able to progress and attain various milestones within a shorter period of time. In Part II, results indicated

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[11] Per International Paralympic Committee's (2014) guidelines, disability is used to refer to the biopsychosocial interaction of persons' biological impairment with their environment which creates the 'dis'abled context. Impairment is used to refer to persons' biological conditions.

there were different training profiles for athlete groupings who aquired their impairments during different phases of their lives (i.e., congenital, pre-adolescence, adolescence, early adulthood, and adulthood). While attaining statistical significance between groups was not possible given the high within and between variability, athletes with late-onset impairments showed readiness to incorporate *some* of the training conditions earlier into their training program (XXXXXX, 2021b). Based on previous assumptions (Dehghansai et al., 2017b), we proposed athletes with late-onset impairments may be benefiting from AB experiences to attain milestones quicker and incorporate training conditions earlier in their careers.

Research in AB sport has repeatedly demonstrated elite athletes to have superior perceptual-cognitive skills including pattern recognition, anticipation, and decision-making compared to lower skilled performers (Abernethy et al., 2005; Baker et al., 2003a), while requiring less sport-specific training due to additional non-sport specific activities undertaken during their development (i.e., demonstrating a possible transference of acquired skills between activities, Baker et al., 2003b). Drawing on the the very limited PS research suggests this may be similar for PS cohorts. For example, a recent gaze analysis study with wheelchair tennis players revealed differences in gaze patterns, fixation locations, and fixation durations for athletes with previous experience in biped tennis (Hunfalvay & Murray, 2017). Thus, PS athletes with late-onset impairments *and* previous sporting experiences may be able to transfer learned skills from previous AB sport experiences, especially if performance demands in their current sport more closely resemble those of the previous sport (e.g., transition from basketball to wheelchair basketball). Besides perceptual and cognitive skill advantages, there are likely other beneficial factors from previous sport experiences, including, competition experience, exposure to the coach-athlete relationship, the understanding of nutritional guidelines, and familiarity with self-regulation practices including goal-setting, and monitoring of training and recovery strategies (Dweck, 2006; Halson et al., 2006; Toering et al., 2009). In order to parse out these factors' contribution to athletes' PS development, it is important to have an in-depth understanding of PS athletes' sporting histories.

Therefore, the purpose of this study was to provide a comprehensive review of PS athletes' experiences in PS and AB sports and build on the findings from Parts I and II to explore differences between athletes with impairments acquired at different stages of their careers. Based on prior work (Dehghansai et al., 2017b), we hypothesized that most athletes with late-onset impairments would have participated in AB sports prior to acquiring their impairment with experiences, and they would be in sports that were similar to their current PS. Furthermore, we hypothesized that involvement in PS would be less common, with any additional PS experiences occurring predominately in open settings (Dehghansai & Baker, 2020).

Method

Participants

A total of 213 Australian (n=149, *M*=32.34 years of age [*SD*=12.46]) and Canadian (n=63, *M*=35.47 years of age [*SD*=12.79]) athletes completed a modified version of the Developmental History of Athletes Questionnaire (DHAQ; Hopwood, 2013). For details pertaining to recruitment methods, refer to Part I (XXXXXX, 2021a).

Instrument

Two sections of the modified DHAQ were the focus of this study: impairment and other organized sports. The impairment section obtained information on athletes' impairment type (i.e., musculoskeletal, neuromuscular, visual, auditory or other), sport classification, secondary impairments, nature of impairment (congenital, pre-adolescent, adolescent, early-adulthood, adulthood), and, if the impairment was acquired, onset age and cause of impairment.

Other organized sports were captured in both AB and PS settings. For each AB sport, athletes reported the age they started participating, their total career length, and the highest level of competition achieved. Athletes reported the same information for PS along with rating the impact of their experience in each PS on their current main sport development (1-10, 10 being most impactful), the setting in which their PS experience took place, and the delivery method for each PS. The five sport settings were: *school* (i.e., competition between students within the same school), *inter-school* (i.e., competition against individuals or teams from different schools), *university* (i.e., competitions occurring in a university setting, usually against other universities), *community/recreational* (i.e., community sport programs with no ties to the schooling system, usually promoting a recreational and non-competitive environment), and c*lub/inter-club* (i.e., sporting organizations, usually promoting competitive environments with competition between clubs). Sport delivery was captured in one of four methods: *PS-Dominant* - training and competing against other PS athletes (e.g., exclusive to PS athletes), *Adapted-Training* - training with PS and AB athletes, but, competing against PS athletes only, *Adapted-Competition* - training and competing with PS and AB athletes, with modifications to competition rules to adapt to all abilities, and *AB-Dominant* - training and competing in AB sports without any modifications to the competition.

Statistical Analysis and Variables

Descriptive analyses of the sample along with the PS and AB sports in which athletes participated in are provided in Tables 1a and 1b. Due to violations of normality, non-parametric tests were implemented (West et al., 1995). Kruskal-Wallis tests with Mann-Whitney U post hoc procedures were used to examine between-group comparisons along with Spearman's ρ correlations to explore the strength and relationship between sporting variables. Data was evaluated at the significance level of $p \leq .05$ performed using SPSS Version 22 (IMB Corp, 2013)

The independent variable was the age athletes acquired their impairment: congenital (C, n=82), acquired during: pre-adolescence (PA; 1 month to 11.9-year-olds, n=18), adolescence (A; 12- to 17.9-year-olds, n=33), early adulthood (EA; 18- to 24.9-year-olds, n=33), and adulthood (AD; 25 years and older, n=32). Athletes' current competitive levels were organized into eminent (n=61, multiple Paralympics/World Championship medalists), elite (n=91, competed at the Paralympics/World Championships), pre-elite (n=29, senior national athletes), non-elite (n=other competitive levels) to compare success between their current PS and other sports (Baker et al., 2019).

Outcome variables related to athletes' sporting history including the number and type of sports, level of competition, setting (PS only), and delivery method (PS only) were examined. Athletes' competition level was organized into the elite (senior international level), pre-elite (senior national or junior international level), and non-elite categories (other competitive levels) (Hopwood et al., 2015). Athletes' experiences in other sports were categorized into five categories for comparisons of similarity to athletes' current PS: *single similar* (played in one sport that was similar to their current sport), *multiple similar* (played multiple sports that were similar to their current sport), *single different* (played in one sport that was in a different category to their current sport), *multiple different* (played in multiple sports that were in categories different to their current sport), and *mixed* (played multiple sports including a sport that was similar to their current sport). Two different analyses (*Simple Sport Types* and *Expanded Sport*

Types) measured the similarity between athletes' current sport to that of previous sports. *Simple Sport Types* was a simple two-category split between *Team* (n=63) and *Individual* (n=149) sports, defined under the parameters of athletes' main competition event. More specifically, athletes competing as an individual in their main event were placed in an individual category (e.g., track and field, wheelchair tennis), while team sports required the participation of two or more athletes in the main events (e.g., wheelchair basketball, wheelchair rugby). The second analysis, *Expanded Sport Types* was based on previous recommendations (see Mandigo et al., 2007, for more information) and groups consisted of *Target* (e.g., boccia, Para archery, wheelchair curling, n=22), *Invasion* (e.g., wheelchair basketball, wheelchair rugby, n=50), *Net/Wall* (e.g., Para badminton, Para table-tennis, Sitting volleyball, n=65), and *Centimeters, Grams, Seconds* (e.g., Para athletics, Para cycling, Para swimming, n=73). *Artistic* (e.g., Para equestrian, n=1) and *Combat* (e.g., Para Judo, Para Taekwondo, n=2) categories were excluded from between-group comparisons due to a limited number of participants who reported these types of sport as their main PS. In addition, seven other samples were removed from between-group comparisons due to incomplete data in specific sections relevant to these analyses, leading to a total of 203 participants for the group analyses. However, due to limited research to date, all cases were kept for analyses overviewing general trends.

Results

Able-Bodied Sport Experiences

Ninety-nine (out of 121, 81.82%) athletes with an acquired impairment reported participating in 40 different AB sports prior to impairment-onset (see Table 2 for full sports list) with an average of 3.20 sports (*SD*=2.00, *Md*=3.00, *R*=1-9) per athlete. On average, athletes started their first sport at around the age of nine (*M*=9.26, *SD*=6.09) and competed for an average of nine and half years (*M*=9.48, *SD*=7.78) with experiences ranging across non-elite (*M*=2.71, *SD*=1.48, *Md*=2.00, *R*=1-9), pre-elite (*M*=1.08, *SD*=.03, *Md*=1.00, *R*=1-2) and elite settings (*M*=1.45, *SD*=.69, *Md*=1.00, *R*=1-3). The most commonly reported sports were basketball (n=28), athletics (n=17), swimming (n=17), and tennis (n=16).

There were no significant between-group differences for the number of sports played, career length, or competition level attained. However, nearly all the AD athletes (31/32, 96.88%) and the majority of A (31/33, 93.94%) and EA (32/38, 84.21%) athletes reported participating in AB sports prior to acquiring their impairment while only five (out of 18, 28%) PA athletes reported sampling AB sports. This is likely due to the age of impairment onset, as PA athletes with AB sport experiences acquired their impairment around the age of four and half years old (*M*=4.42, *SD*=3.48) while athletes with no AB sport experiences reported an impairment-onset age of roughly 2 years old (*M*=2.22, *SD*=2.97).

Simple and Expanded Sport Types

Athletes' AB sports were organized into the simple and expanded sport types categories (see Table 3 for the distribution and Table 4 and Figure 1 for similarities between athletes' previous AB sports to their current PS). In a simple sport type comparison, more than half of the athletes participated in both individual and team sports, and eighty-five percent 85.26% (81/95) of the sample was involved in an AB sport that was similar to their current PS. In the expanded sport types analysis, 69.50% (66/95) athletes played a sport that was similar to their current PS.

Highest Competition Level Attained

The majority of athletes' involvement in AB sport took place at the local and state/provincial level (79.17%). Eleven athletes reported competing in an elite-level sport that was either the same sport (n=4, e.g., AB basketball vs. wheelchair basketball), similar type (n=3), or different (n=4) to their current PS. Athletes with similar experiences were currently either eminent (n=4, multiple Paralympics/World Championship medalists) or elite (n=3, competed at the Paralympics/World Championships), while athletes with different types of sporting experiences included a range, from eminent (n=2), to pre-elite (n=1, national level), or non-elite (n=1, state/provincial or below). Athletes' sporting success was not indicative of the nature of their impairment as there was an even distribution across the four impairment groups (PA [n=2], A [n=4], EA [n=2], and AD [n=3]). However, there were more AD (n=6) and EA (n=3) athletes with pre-elite sporting experiences in comparison to PA (n=1) and A (n=1) athletes.

Correlations

Spearman's correlation analysis highlighted positive associations across the AB sports. The age for first AB sport participation correlated with the age they started other AB sports ($r=.760$, $p<.001$), average AB sport career length ($r=.241$, $p<.05$), and average competition level achieved in AB sports ($r=.241$, $p<.001$). The age athletes began first AB sport was negatively correlated with the number of sports involved ($r=-.348$, $p<.001$). Furthermore, number of sports was negatively correlated with the average competition level ($r=-.262$, $p<.05$). Athletes' career lengths in each sport was positively correlated with the corresponding competition levels achieved ($r=.440$, $p<.001$).

Paralympic Sport Experiences

Eighty athletes (out of 213, 37.56%) reported participating in other organized PS with an average starting age of 11.68 years old (*SD*=7.05, *Md*=10, *R*=5-34) and an average career length of roughly eight years (*M*=7.79, *SD*=5.05, *Md*=6.34, *R*=1-22). Thirty-eight of 82 (46.34%) C athletes reported other PS experiences. In comparison to AB sports involvement, only PA athletes reported a similar participation rate (5/18, 27.78%), while fewer of A (10/33, 30.30%), EA (16/38, 42.11%), and AD (10/32, 31.25%) athletes reported PS experiences. The most commonly reported sports were wheelchair basketball (n=28), Para athletics (n=17), and Para swimming (n=17), with a total of 32 sports reported (refer to Table 2 for a full list of sports).

Simple and Expanded Sport Types

Refer to Table 3 for sport types distribution and Table 4 and Figure 1 for similarities between previous and current PS. The majority of the athletes were involved in a PS (individual vs. team) that was similar to their main PS (59/80, 73.75%). However, between sport similarities were reduced during expanded sport types analysis (42/80, 52.50%).

Competition Level x Method x Setting Interactions

The majority of athletes reported other PS experiences were at the non-elite level (n=73) with only five at the pre-elite and two at the elite levels. The seven athletes with experiences at a competitive level (two elite- and five pre-elite levels) were involved in sports similar to their current PS. The two athletes with elite-level experiences had an impairment that was congenital or acquired in early-adulthood while pre-elite experiences were reported by C (n=3), PA (n=1), and A (n=1) athletes. AD athletes did not report pre-elite or elite level PS experiences outside of their main PS. The most common method of delivery was in AB-dominant formats (n=37), followed by PS-dominant (n=17), adapted-competition (n=13), and adapted-training (n=12). A large portion of participants' experiences were at the club setting (n=54) followed by community (n=17), inter-school (n=9), and school (n=8).

Interaction. In the community setting, the majority of athletes' experiences were at the recreational level (n=13), followed by local (n=2), state (n=1), and national (n=1) levels. The setting here was mostly coupled with AB-dominant delivery (n=9) with limited alternative delivery methods (n=3 for each of the other three methods). Similarly, experiences in the inter-school environments were at the recreational (n=8), local (n=3), or province/state (n=1) levels, with AB-dominant (n=7) again the most common delivery method, followed by adapted-competitions (n=3), and one experience for each PS-dominant and adapted-training. This trend continued for the school setting, with four athletes having experience at the recreational and five at the local, and only one at the national level. Again, the majority played in AB-dominant format (n=7), two in adapted-competition, and one in PS-dominant delivery methods. Trends were slightly different at the club level, as 13 experiences were at the recreational, 24 at the local, 17 at the state/provincial, seven at national, and one at the international levels. However, the most common delivery method was still AB-dominant (n=33) with an even distribution among the other three methods (PS-dominant=11, adapted-training=9, and adapted-competition=9).

While C athletes and to an extent, A and EA athletes' experiences were evenly spread across competitive levels, methods, and settings, PA and AD athletes did not report experiences in school settings and, relative to other groups, had a greater proportion of their experiences in AB-dominant formats. AD athletes' lack of school experiences could be explained (i.e., they acquired their impairment at an older age); however, there are complex interaction of factors that contribute to PA athletes' lack of sport participation in a school setting.

Correlations

Spearman's correlation revealed a negative relationship between the age athletes started their first PS and the total number of PS played ($r=-.347$, $p<.001$) and total career length ($r=-.466$, $p<.001$). Interestingly, athletes' career lengths were also positively correlated with the impact rating of experiences in other PS on their main sport success (i.e., athletes who spent longer in other PS sports reported a higher rating for that particular sport's influence on their current PS development, r=.553, $p<.001$).

Discussion

The limited research in the PS contexts yield to adoption of evidence from AB cohorts to build PS ADMs. However, given the complexities associated with PS, these recommendations may not be applicable to PS athletes. The main objective of this study was to provide a broad overview of PS athletes' sporting experiences in Paralympic and AB contexts. Our hypotheses about the role of impairment-related factors were supported. First, an overwhelming number of athlete experiences in the PS contexts occurred in recreational settings in an open environment with PS and AB athletes. Second, the majority of athletes with an acquired impairment had experiences in AB sport, while involvement in other PS was reported by less than half of the entire sample. Last, the majority of athletes' AB involvement was in sports similar to their current PS.

Experiences in AB Sports and its Relationship to Athletes' PS Success

The latter two hypotheses (i.e., overwhelming AB experience in sports similar to current PS) corroborate assumptions from previous literature (Dehghansai et al., 2017b; Dehghansai & Baker, 2020) and Parts I and II of this series (2020a, 2020b), that athletes with late-acquired impairments may have transferred specific skills acquired in AB sport to adapt to PS demands. Athletes with pre-existing physical and perceptual-cognitive training may have an advantage in sports that share physiological, technical, or tactical demands (Abernethy et al., 2005; Halson et al., 2006). There are also lifestyle components (e.g., nutritional awareness, exposure to robust training and competition, self-regulation and goal-setting techniques) that may be transferred to their new sporting environment (Dweck, 2006; Halson et al., 2006; Toering et al., 2009).

Athletes with elite AB sporting experiences also achieved eminent or elite PS success, suggesting some athletes utilize a combination of physical and/or psychological skills that contributes to their success, irrespective of the setting (Paralympic or AB).

It seems plausible from these findings that athletes gravitate to similar sporting environments due to the inherent intrinsic motivation and competence in familiar settings (Côté, 1999). The overwhelming number of athletes with experience prior to the onset of their impairment illuminates the type of persons who are either attracted to, or recruited into PS. Similar to previous findings, a very limited number of athletes had no experience in AB sports (Dehghansai & Baker, 2020), which suggests three possibilities: a) athletes with previous AB sporting experience are attracted to PS, b) current advertising and recruitment strategies target athletes with previous sporting experiences, and/or c) current environments are designed to retain athletes with specific set of characteristics (i.e., deterrent to athletes with limited sporting experiences, females athletes, etc., Dehghansai & Baker, 2020). Future research is needed to identify the specific contributing factors that attract athletes to PS post-impairment-onset and AB sporting experiences that athletes utilize to adjust to the Paralympic context.

In sum, considering the positive correlation between PS and AB sport success, along with the overwhelming similarity between sports in the two contexts, better frameworks to support collaborations between similar types of PS and AB sports may facilitate dynamic training environments that benefit both sporting environments, optimize resource expenditure, and provide transfer opportunities for athletes who acquire their impairment during their AB sporting careers.

Experiences in Other Paralympic Sports

Similar to previous literature (Dehghansai & Baker, 2020; Lemez et al., 2020), less than half of the sample participated in other PS and these experiences mainly occurred at the recreational level, in clubs (and to a lesser extent in communities), predominantly delivered in AB-dominant methods. It is unclear whether athletes prefer these settings and delivery methods or there are limited opportunities for PS involvement in other conditions (Martin-Ginis et al., 2016). While reverse integration (AB persons playing adaptive sports, e.g., wheelchair basketball) has been examined in physical education and sport settings with reported benefits of increased impairment-awareness, exposure to adaptive sports, and opportunity for family and friends to participate in sports, less is known of athletes' experiences in open settings playing AB sports (Haegele et al., 2018; Maher, 2018; Verdonck et al., 2020). It is imperative to continue to examine the availability and quality of opportunities in these 'open' settings (Shirazipour et al., 2017). On the one hand, exposure to different environmental conditions (e.g., various competition constraints [rules, game structure], athletes with different abilities) may enhance athletes' anticipation and decision-making skills while creating an inclusive environment (Travassos et al., 2018). On the other hand, there are benefits of training specificity for skill acquisition and skill mastery (Farrow & Robertson, 2017). Therefore, research is required to identify experiential (e.g., intrinsic motivation, sense of belonging) and skill acquisition benefits to sport participation in these environments but equally important to examine whether these environments deter others from participating (e.g., lack of female athletes creating an unwelcoming environment for female athletes entering the system, Dehghansai & Baker, 2020). With less than half of the sample participating in other PS, there is a possibility of a) lack of alignment of current programs with athlete needs, b) limited availability of coaches/programs, and/or c) inaccessible programs/facilities (Goodridge et al., 2015). Without an understanding of athletes' experiences and needs, it is difficult to design optimal programs in accessible environments with delivery methods that are tailored to athletes' needs (Goodridge et al., 2015). As seen here and elsewhere (e.g., Dehghansai, Lemez, et al., 2020), impairment-related nuances (i.e., impairment-onset, type of impairment) introduce a complexity that is critical for consideration when designing these programs, including the limitations set by sport classifications in providing opportunity for athletes with a wide range of impairments. In this study, trends were observed within the PA and AD groups that highlighted this complexity.

Athletes with Impairments Acquired during Pre-Adolescence

PA athletes reported limited participation in other organized sports (both PS and AB), with no experiences in school-settings. This is an interesting observation since they also reported starting sports and various types of training later in their careers and accumulated fewer training hours in various conditions in comparison to the other groups (see Part II). Yet, the majority were eminent or elite athletes and their milestone trajectories resembled that of C athletes (See Part I). Moreover, the PA sample was distributed evenly across sport-types. One notable difference was that most athletes in this group had a visual impairment, which suggests this cohort experiences sports differently to athletes with other types of impairment (e.g., spinal cord injury, spina bifida, amputation, etc.). Buckley and colleagues (2020) recently reported female athletes with visual impairments' negative experiences during physical education courses including lack of engagement from the teachers with limited efforts to adapt programs to meet the needs of this cohort. Parental support to reinforce sport participation outside of school was vital for the development of athletic identity which mitigated their negative experiences in school. This may explain the lack of participation in physical education classes for athletes with visual impairments in the current sample. While we have recommended here and elsewhere for sport-specific studies to better understand athlete development, findings of this nature would confound results in sports that include a wide range of impairment categories (which many do). Therefore, future studies should not only consider sport-specific environments but also be vigilant regarding the nature and type of impairments (and subsequent sport classification) in PS athletes' development (Radtke & Doll-Tepper, 2014).

Athletes with Impairments Acquired during Adulthood

Nearly all AD athletes had AB sports experience, with some at the pre-elite and elite levels. However, even though their PS participation rate and career lengths were similar to the other groups, none reported pre-elite or elite level success in other PS. This finding may be connected to AD athletes' quicker milestone attainment and training adoption (see Parts I and II in this series), where they invest the limited resources (e.g., time, energy, finance) in advancing their main PS career. AD athletes also reported investing more hours into sport-specific training during the first seven years of their careers in their current PS. Qualitative work is required to capture AD athletes' experiences during the PS transition period to explore athletes' motivation of joining PS (e.g., strive to become elite, to socialize, for enjoyment), the reasoning behind selecting a specific PS (e.g., opportunity, impairment/classification constraints, intrinsic interest), and how these experiences along with their AB sports involvement contributed to their development in PS.

Practical Implications

As alluded to above, a large number of athletes had experiences in PS and AB sport that were similar to their current main PS. As such, stronger cross-pathway communication and partnership with a shared resource model between PS and AB sports of a similar type may have benefits for all stakeholders (e.g., access to expertise, equipment, facilities, and skilled staff).

Within the PS context, a multisport approach can benefit athletes (e.g., sampling variety of sports, cross-training, sense of independence, sense of belongingness, intrinsic motivation, Arede et al., 2019; Côté, 1999; Shirazipour et al., 2017), coaches (i.e., informal and formal coach development opportunities, McMaster et al., 2012), and sport organizations (shared resource including experts (i.e., sport scientists, practitioners), equipment, and facilities). A multisport approach may also mitigate previously reported challenges to recruitment (i.e., lack of exposure, advertisement messaging, infrastructure accessibility, and program availability; Radtke & Doll-Tepper, 2014).

Limitations and Future Directions

The findings of this study further emphasize the complexity of PS athletes' development. Due to the limited literature in this area, this study (and the series) was intended as a comprehensive overview of a large sample compared to any previous work, and therefore, limited in its ability to be generalized given the high within and between variability seen throughout. However, in the process, we parsed out one of the key indicating factors that influence development, namely, the nature of athletes' impairments. Throughout, it could be argued that we have now raised more questions than we have answered. PS athletes' development is much more complex given the dynamic interaction of constraints on their development including impairment-related factors, and therefore, these nuances need to be further examined to better understand the complexity of this network system, which highlights the importance of future research to extend current findings. For example, it is vital to consider athletes' impairment type (e.g., spinal cord injury, visual impairment, amputation, etc.) and how this factors in with results from this study. Furthermore, a sport- and classification-specific analysis would better inform coaches, athletes, and key stakeholders on unique factors that apply to their specific environments. There is also a need for competition-level analysis to better understand resource needs across the pathway and a sex-specific analysis to better understand the experience of males and females in the current PS systems.

Conclusion

This project aimed to capture the sporting experience of Canadian and Australian Paralympic sport athletes and build on findings from Parts I and II of this series of investigations. The majority of the athletes with acquired impairments from adolescence onwards had experience in AB sports prior to acquiring their impairment and tended to select Paralympic sports that were similar to their previous sporting experiences. However, less than half of the sample reported participating in other organized PS, with the majority of these experiences taking place in club settings, recreationally, and in AB-dominant delivery formats. Findings from this study, in conjunction with Parts I and II, highlight the enormous complexity of PS athletes' development, further solidifying the need to reconsider the structure of current supporting mechanisms (i.e., 'one-size-fits-all' models). More extensive mixed methods research involving complex analyses is needed to describe the variables that impact athletes' development to provide appropriate resources and optimize environments to maximize Paralympic sport athletes' development.

Table 1a

Sport Types and Impairment Distribution

Variable	N	Age	SD	AIA	SD	Variable	N	Age	SD	AIA	SD
Sport Types						Nature of Impairment					
Individual Sports	149	34.58	14.00	22.09	13.24	Acquired	121	36.75	12.91	20.24	11.40
Team Sports	63	29.89	7.50	17.76	7.71	Congenital	82	28.49	10.38		
Target	22	45.06	14.85	33.46	11.72	Pre-Adolescent	18	32.44	15.10	2.83	3.17
Invasion	50	30.46	7.82	17.99	7.60	Adolescent	33	32.43	11.47	15.03	1.67
Net/Wall	65	30.40	11.40	16.83	11.25	Early Adulthood	38	33.99	9.65	20.76	2.29
CGS	73	33.90	13.53	21.92	11.81	Adulthood	32	46.89	10.63	34.78	8.05

Table 1b

Distribution of Impairment per Sport

Sport	N	Age	SD	AIA	SD	Nature of Impairment					Impairment Type				
						C	PA	A	EA	AD	VI	SCI	SB/CP/ABI	Amputee	Other
Boccia	3	28.10	15.73			2							1		2
Para Archery	11	44.53	15.06	38.5	12.77	4			1	5	1	3	2	1	4
Para Athletics	22	31.78	12.77	17.71	11.28	10	2	4	1	3		3	7	6	5
Para Badminton	13	31.88	16.13	25.17	18.72	5	2		1	3		5	2	1	4
Para Equestrian	1	21.83				1							1		
Para Judo	1	44.65				1					1				
Para Cycling	33	34.22	12.15	27.38	9.4	15		4	3	9	6	7	9	3	6
Para Nordic	2	38.94		18		1			1		2				
Para Table Tennis	28	29.96	12.19	14.94	10.07	14	3	8	1	2		8	8	4	8
Para Triathlon	1	35.99				1					1				
Para Ice Hockey	4	27.35	7.30	19.67	2.08	1			3			1		2	1
Para Snowboard	1	27.64		23					1					1	
Para Swimming	14	36.40	18.79	19.67	2.08	12	2				1		3	5	5
Sitting Volleyball	12	28.79	4.79	16.92	8.39	1	2	4	3	2				12	
Wheelchair Basketball	10	30.57	11.70	17.75	13.23	6	1	1	1	1		3	2	1	4
Wheelchair Curling	8	52.15	9.26	29.14	9.56				3	4		6		1	1
Wheelchair Rugby	36	30.79	6.83	17.87	7.31	4	4	8	17	3		27		6	3
Wheelchair Tennis	12	31.56	9.46	13.34	7.69	4	2	3	2			5	2		4

Note. AAI=age injury acquired, C=congenital, PA=pre-adolescent, A=adolescence, EA=early-adulthood, AD=adulthood, VI=visual impairment, SCI=spinal cord injury, SB/CP/ABI=spina bifida/cerebral palsy/acquired brain injury, Other=other physical impairment

Table 2

Frequency of Paralympic sport and able-bodied sport experiences reported by participants

Able-Bodied Sports	N	Paralympic Sports	N
Football (Soccer)	32	(Wheelchair) Basketball	28
Basketball	28	(Para) Athletics	17
Athletics	23	(Para) Swimming	17
Volleyball	19	(Wheelchair) Tennis	16
Swimming	17	(Soccer) Football	14
Rugby	17	Cricket	11
Cycling (BMX, Mountain, Track, Road)	17	Baseball	8
Tennis	15	Equestrian (Dressage, Eventing, Jumping)	8
Cricket	15	(Wheelchair) Rugby	5
Ice Chokey	14	Golf	4
Baseball	12	(Para) Ice Hockey	4
Golf	8	(Para) Rowing	4
Equestrian (Dressage, Eventing, Jumping)	8	(Sit) Volleyball	3
Triathlon	7	Alpine Skiing	2
Skiing (cross-country, alpine, etc.)	7	Badminton	2
Badminton	7	(Wheelchair) Curling	2
Squad	6	(Para) Cycling (Mountain, BMX, Road)	2
Table-Tennis	5	Dancing (Ballroom, Ballet, Etc.)	2
Archery	5	Diving	2
Taekwondo	4	Football (American)	2
Softball	4	Gymnastics Artistic	2
Snowboard	4	Squash	2
Rowing	4	Beach Volleyball	1
Football (American)	4	Boccia	1
Gymnastics	3	Cross Country Skiing	1
Dancing (Ballroom, Ballet, etc.)	3	Shooting	1
Curling	3	Snowboard	1
Weightlifting	2	Softball	1
Water Polo	2	Table Tennis	1
Karate	2	Taekwondo	1
Beach Volleyball	2	Triathlon	1
Wrestling	1	Wrestling Freestyle	1
Sailing	1		
MMA	1		
Judo	1		
Handball	1		
Figure Skating	1		
Diving	1		
Canoe	1		
Boxing	1		

Note. Words in parentheses indicate athletes reported either the Paralympic or able-bodied sport.

Table 3

Distribution of athletes' Paralympic and able-bodied sport experiences within the sport types categories

Simple Sport Types (AB)	Category	n	% of sample
Individual (n*=132)	Single	9	9.47%
	Multiple	8	8.42%
Team (n=135)	Single	14	14.74%
	Multiple	12	12.63%
Mix		52	54.74%
Expanded Sport Types (AB)			
Artistic (n=16)	Single	1	1.05%
	Multiple	1	1.05%
CGS (n=84)	Single	7	7.37%
	Multiple	2	2.11%
Invasion (n=98)	Single	8	8.42%
	Multiple	2	2.11%
Mix		66	69.47%
Net/Wall (n=54)	Single	3	3.16%
Combat (n=40)	Single	3	3.16%
	Multiple	1	1.05%
Target (n=12)	Single	1	1.05%
Simple Sport Types (PS)			
Individual (*n=90)	Single	23	28.75%
	Multiple	6	7.50%
Team (n=79)	Single	12	15.00%
	Multiple	9	11.25%
Mix		30	37.50%
Expanded Sport Types (PS)			
Artistic (n=12)			
CGS (n=45)	Single	18	22.50%
	Multiple	2	2.50%
Invasion (n=55)	Single	12	15.00%
	Multiple	2	2.50%
Mix		41	51.25%
Net/Wall (n=26)	Single	5	6.25%
Combat (n=21)			
Target (n=12)			

Note. *Sport Types column (n) indicates totals for each specific sport type reported. This differs from (n) in column totals, because each athlete response counted as one for grouping purposes.

Table 4

The similarity of athletes’ Paralympic and able-bodied sport experiences to their current Paralympic sport

Similarity	Category	n	% of sample
Simple Sport Types (AB)			
Similar	Single	12	12.63%
	Multiple	17	17.89%
Different	Single	4	4.21%
	Multiple	10	10.53%
Mix		52	54.74%
Expanded Sport Types (AB)			
Similar	Single	10	10.53%
	Multiple	4	4.21%
Different	Single	13	13.68%
	Multiple	16	16.84%
Mix		52	54.74%
Simple Sport Types (PS)			
Similar	Single	23	28.75%
	Multiple	6	7.50%
Different	Single	12	15.00%
	Multiple	9	11.25%
Mixed		30	37.50%
Expanded Sport Types (PS)			
Similar	Single	17	21.25%
	Multiple	3	3.75%
Different	Single	16	20.00%
	Multiple	22	27.50%
Mixed		22	27.50%

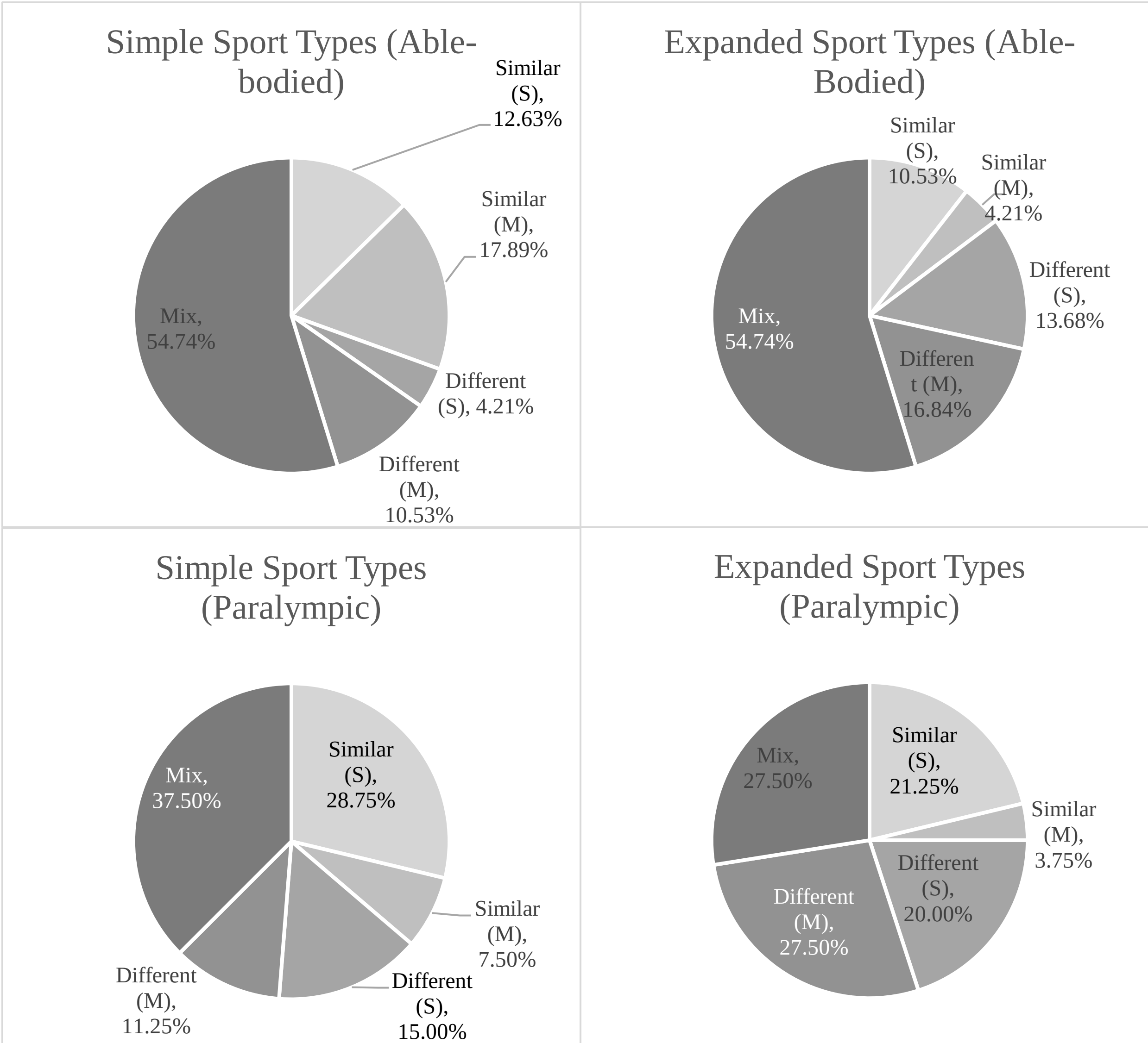

Figure 1. The percentage of athletes' Paralympic and able-bodied sports that were similar or different to their current Paralympic sport.

Note. (S)=single sport, (M)=multiple sports, Mix=athletes were involved in two or more sports that were in the similar and different categories.

Chapter Seven

Coach and Athlete Perspectives on Talent Transfer in Paralympic Sport

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This manuscript has been presented in the formatting that has been submitted to the respective journal. References are included at the end of the dissertation starting on page 163-185.

Abstract

Current literature pertaining to athletes' transfer between sports is very scant with very little understanding of athletes' experiences throughout the transfer process. The purpose of this study was to address this gap by conducting semi-structured interviews with 47 Canadian Paralympic coaches (n=35) and athletes (n=12). Three higher order themes of 'alternative to retirement,' 'career extension,' and 'compatibility' were identified. The sub-themes of alternative to retirement highlighted the 'psycho-behavioral' and 'physical and physiological' reasons that athletes consider transfer which are similar to reported reasons for retirement (e.g., classified-out/re-classification, waned motivation, achieved goals, age-related performance drop off, etc.). The sub-themes of career extension; 'better opportunities' and 'beneficial outcomes' shed light on factors that contributed to withdrawal of negative experiences and reinforcement of positive outcomes associated with transferring sports. Last, compatibility had three sub-themes of 'resources,' sport-specific,' and 'communication' which encapsulated factors athletes should consider prior to their transfer to have a better understanding and preparation for challenges during the TT process. In conclusion, the participants highlighted the importance of transparent and effective communication between athletes and sports in order to align and establish realistic expectations for everyone involved. More importantly, transfer initiatives and decisions should be made with the athletes' best interests at the front and center of the program.

Coach and Athlete Perspectives on Talent Transfer in Paralympic Sport

Talent transfer (TT) is a formalized process designed to facilitate the movement of skilled athletes from one sport to another (Collins, Collins, MacNamara, & Jones, 2014). The benefits of TT can be captured from two perspectives: the athlete and the sport. For instance, it is common for transfer athletes to have been contemplating retirement in their primary sport (Collins et al., 2014; MacNamara & Collins, 2015), either due to natural career progressions (e.g., contentment with achievements, decline in performance) or sudden and unexpected events (e.g., injury; Fortunato & Marchant, 1999; Lavallee, Grove, & Gordon, 1997). While TT is not the solution to all retirement-related issues, it may benefit athletes who are eager to continue their high-performance journey (Collins et al., 2014; MacNamara & Collins, 2015). In addition, the recipient sport (i.e., the sport the athlete transfers to) gains a high-performance (or close to high performance) athlete with competition experience, exposure to training programs, familiarity with nutritional guidelines, and other elements of elite athlete development. These foundational components can contribute to the fast-tracking of athletes in the pathway (Halson, Martin, Gardner, Fallon, & Gulbin, 2006).

Unfortunately, there are few known TT initiatives that systematically support athletes' transition from one sport to another, with very little information on the efficacy of such programs (Collins et al., 2014). In addition to the scarcity of knowledge in this area, the majority of studies on this topic have focused on podium outcomes (i.e., medals produced in a new sport; Bullock et al., 2008) with less attention on the transfer process, such as how to help athletes develop strategies to cope with career-changing events (Bullock et al., 2008; Collins et al., 2014; MacNamara & Collins, 2015). One of the few studies that focused on athletes' TT experiences examined athletes' physiological responses to training in their new sport, indicating the extensive training contributed to persistent fatigue which required a recovery intervention (Halson et al., 2006). In another study, MacNamara and Collins (2015) identified a range of individual (i.e., previous sporting experiences, physical and physiological characteristics, and psycho-behavioral factors) and environmental (i.e., positive learning environment and time frame of TT process) factors vital to a successful TT outcome. Although the research in this area is limited, the existing findings highlight the importance of understanding the nuances associated with TT to better equip athletes and sports for the transfer process. Currently, athletes and sport organizations lack evidence-based resources that can inform them of their decision and its implications (Abbott & Collins, 2004; Collins et al., 2014; MacNamara & Collins, 2015; Phillips, Davids, Renshaw, & Portus, 2010).

In addition, to our knowledge, there has yet to be a study that examines the TT experiences of Paralympic athletes, a context that exacerbates the importance of understanding how to do this process effectively for several reasons. First, there is a limited pool of athletes within the Paralympic system, thus, a successful TT program can retain athletes, maximize resources, and increase the pool of athletes (Gulbin & Ackland, 2009; Halson et al., 2006). Second, the competitive level between sports varies, providing more opportunities for athletes to transfer to sports that may be less demanding (Bullock et al., 2008). Third, there are important nuances associated with disability-related factors (i.e., classification, specialized equipment, venue accessibility, impairment and athletic identity to name a few) that likely affect the impact of these complexities on Paralympic athletes' TT experience (Martin, 1996; 1999; 2000; 2017). Within the Canadian sporting system, the Long-Term Development (LTD) in Sport and Physical Activity model is utilized for policy development and resource allocation to support Paralympic athletes' development. This framework contains information pertaining to athletes' transfer between sports as an alternative to retirement (Balyi & Hamilton, 2004; Higgs, Way, & Harber, 2019); however, there are no official[12] TT programs designed to support this process in the Canadian Paralympic system. A deeper look may result in the identification of gaps and the development of strategies to prevent or reduce the challenges Paralympic athletes face in the process of TT.

To this end, the purpose of this project was to interview Canadian Paralympic coaches and athletes to better understand the factors vital to athletes' experiences in the TT process. In addition, a secondary purpose was to explore the 'factors athletes should consider prior to transfer,' 'challenges and benefits to transferring between sports,' and 'reasons for the transfer.' Considering the gap in the literature (in both able-bodied and Para sport contexts) and the importance of developing resources to support athletes' transfer between sports is vital.

Method

Participants

Recruitment. Institutional approval was obtained from a university ethics committee and participants read and provided informed consent prior to study commencement. Nineteen sport leads (i.e., the sport person in charge of communication line for organization members and research groups, most often the sport director) were contacted by the members of the Canadian Paralympic Committee (CPC). Seventeen sports agreed to participate and collaborated with the CPC members to draft a list of potential participants (i.e., coaches and athletes who had either experience in the transfer process, or their expertise and insights could be of value to better understand athletes' experiences within the Paralympic system). A total of eighty-five

[12] An official TT program is as an initiative that creates a communication line between the donor and recipient sport with varying resources to support the athletes and sports while the process is monitored and evaluated.

participants were identified and contacted by the lead author, 45 responded to the initial email (containing a recruitment letter with the project details), and 43 participated in interviews recorded through the software platform Go2Meeting. Due to the project's underlying practical implications as well as nuances between Paralympic sports, we focused on capturing the experiences of athletes and coaches in the majority of Paralympic sports rather than exploring saturation. As a result, a study rich in content and rigorous in method was conducted.

Background. Seventeen of the 35 coaches and all 12 athletes from 16 Canadian Para sports reported involvement in a transfer process, although all were unofficial. All athletes competed internationally in at least one of their sports while coaches reported national or international experience with tenure in their current role ranging from one to 21 years. Table 1 details athletes' and coaches' sporting careers and Table 2 provides a list of sports involved.

Methodology

The purpose of this project was to capture the experiences and perspectives of coaches and athletes who had been involved in the TT process or could provide insight into athletes' experiences in the current Canadian Paralympic system. Similar to other literature examining coaches' and athletes' experiences and relationships in sport environments (Cooper & Ewing, 2019), semi-structured interviews were selected as the optimal data collection approach. This allowed for a deeper understanding of how athletes and coaches conceptualized the process of transfer within their sporting environments.

Philosophical assumption. This study was grounded ontologically and epistemologically in critical realism (CR, i.e., a reality exists which is experienced by individuals through a world that is constructed by social discourse, Fletcher, 2017). The TT process evolves through the interaction between the athlete and their sports, thus this approach allowed for a search of underlying casual relationships in a world that is subjective and often unmeasurable. Therefore, it was important to understand multiple perspectives and draw meaning from participants' experiences (Cooper & Ewing, 2019; Creswell, 2014; Smith, 2015). Understanding these experiences across multiple Paralympic environments from participants in various roles highlighted the larger structure of TT within the Canadian Paralympic context (Smith et al., 2016; Wiggins & Potter, 2008).

Methodological rigor. A guiding list of criteria was set out to establish the rigor of this study design (Smith & McGannon, 2017; Sparkes & Smith, 2014; Tracy, 2010). To our knowledge, there is limited literature exploring athletes' experiences transferring between Para sports and this study contributes to the existing gap highlighting the *worthiness of topic*, *significant contribution*, and *practicality*. The methods within this study align with previous literature and are appropriate for our objectives, consistent with the requirements of *rich rigor*. We achieved *credibility* by capturing the opinion of a wide range of participants from various Paralympic sports, both from coach and athlete lenses. *Ethical considerations* were taken to retain participant anonymity in this small community by using pseudonyms and concealing any participant information that jeopardized their anonymity. While *relational ethics* contributed to the shaping of the interviews (i.e., the role of CPC in recruitment and the existing mutual respect and interpersonal relationship between the sports, participants, and CPC; Bergum & Dossetor, 2005), the lead author, who had no prior relationship with the coaches and athletes, conducted the interviews to ensure this connection did not directly impact the interview process (Evans, Bergum, Bamforth, & MacPhail, 2004; Pollard, 2015; Upasen, 2017). The authors reiterated to participants that their noncommittal to this project would not impact their relationship with the authors or the CPC in any shape or form. In addition, a report was shared with all participants, allowing coaches and athletes to retract or clarify statements. The validation process did not yield any objections or corrections. Finally, the lead author utilized the technique of *critical friend* with the support of the co-author, using each other as 'theoretical sounding boards' when evaluating, interpreting, and developing themes throughout the project (Burke, 2016; Smith & Sparkes, 2012). In addition, the second author continued to probe and test the lead author's biases and personal perspective to ensure that exploration was true to the content.

Procedure and Interview Guide

Following a series of discussions between the authors and CPC staff, general topics were agreed upon and probe-questions were generated to elicit open discussion and maintain a consistent course of discussion throughout the interviews (Patton, 2002). The interview guide was piloted among the CPC staff who have extensive knowledge in Para sport and TT. The coaches' interview guideline was organized into four main sections: 1) introduction and insight to coaches' experiences in sports, 2) details pertaining to the system of their affiliated sport (i.e., recruitment strategies and current gaps), 3) coaches' perspectives of TT, and 4) closing questions including reflection opportunities. Similarly, the four main sections for the athletes' guideline consisted of: 1) introduction, and athletes' past experiences and accomplishments in sports, 2) the process of transition between the two sports, reasons for their transfer and experiences pre-, during, and post-transfer, 3) athletes' perspectives of TT in general and 4) closing questions with reflection opportunities. The semi-structured interviews ranged from 25-60 minutes in duration.

Data Analysis

The interviews lasted an average of 35 minutes for the coaches and 27 minutes for the athletes. The interview audio recordings were transcribed verbatim and the steps of thematic analysis guided the data exploration (Braun, Clarke, & Weate, 2016). Using the six-phased inductive thematic analysis, commonalities between athletes' and coaches' responses were explored (Braun et al., 2016). The lead author continuously reviewed the transcripts, using NVivo (NVivo qualitative analysis software: Version 12) to note significant thoughts and patterns. These codes were refined and grouped into four higher-themes and 12 sub-themes. Upon re-evaluation and re-organization, overlapping themes were merged into two overarching themes with four sub-themes. Upon further discussion and reflection with the co-author, three higher-order and seven lower-order themes emerged. The higher-order themes of 'alternative to retirement' and 'career extension' each had two lower-level themes ('psycho-behavioral' and 'physical and physiological' for the former and 'better opportunities' and 'beneficial outcomes' for the latter). Last, 'compatibility' had the three sub-themes of 'resources,' 'sport-specific,' and 'communication.' The second author reviewed the development of the themes and acted as a 'critical friend,' questioning the assumptions of the lead author to prevent bias and ensure reflection was true to the interview content (Sparkes & Smith, 2014). Emerging themes, reports, and all discussions were consistently assessed for alignment with the full dataset to ensure themes were reflective of the individual transcripts and the entire dataset.

Results and Discussion

Coaches' and athletes' perspective of TT was organized into seven sub-themes within three overarching themes of 'alternative to retirement,' 'career extension,' and 'compatibility.' Each theme along with sub-themes are discussed below.

Alternative to Retirement

The amalgamation of the sub-themes encapsulated the underlying reasons athletes' transfer between sports. More specifically, participants reflected on reasons that may attribute to athletes' transfer considerations. Athletes with transfer experience also shared their personal experiences that led to a transfer. Interestingly, these were parallel to the most common reasons reported for sport retirement (e.g., sport-related injury, performance drop-off, waning motivation; Bundon, Ashfield, Smith, & Goosey-Tolfrey, 2018); thus, they were perceived as the 'alternative to retirement.' These events were organized into two broader streams of: a) psycho-behavioral factors: lack of motivation stemming from a variety of circumstances (i.e., peaked careers, burnout, or lack of enjoyment), or b) physical- and physiological-related factors, including classed-out/reclassification in their sport, decrease in sport-specific performance, or a major injury.

Psycho-behavioral. Coaches and athletes highlighted 'lack of motivation' as one of the underlying indicators attributed to career considerations. The source of this was either, a) having reached the peak of their career and/or accomplished their targeted goals, b) a lack of mental resources to sustain intensive training, or c) a lack of enjoyment in their current sport. As one of the coaches (Louis) highlighted:

> "If they've reached the point in time where they've lost interest or realized that they've probably climbed as high as they're going to in that sport, and still have a passion to try to be world best in another sport. That's a good time to transfer."

Another participant, an athlete (John) echoed a similar thought:

> "I'd say when you don't feel passionate about what you're doing. Or it's pretty harsh to say, but I think if you're not as successful athlete doing what you're doing, maybe either re-evaluate if you are actually an athlete or if you're playing the right sport."

The lack of motivation can contribute to decreased levels of training, lack of enjoyment, increased feelings of burnout and chances of dropout (Calvo, Cervelló, Jiménez, Iglesias, & Murcia, 2010; Fraser-Thomas, Côté, & Deakin, 2008), as well as lower levels of commitment (Guzmán & Kingston, 2011). For some athletes, a change of environment (i.e., a new sport) might mitigate some of the negative psychological factors associated with their current experience and prevent dropout by presenting an alternative solution. The new sport allows for new opportunities and challenges that can increase athlete's commitment, a sentiment expressed by participants, including Paige:

> "I think sometimes people just need a new outlook, or a new challenge, or a new environment even, to spend their time in. And so that can be a time in which it's a good opportunity to look outside of what they've currently been in."

Athletes with transfer experience have reported an increase in their commitment and motivation levels post-transfer (MacNamara & Collins, 2015). Thus, for athletes with aspirations to remain competitive but little motivation to do so in their current sport, TT offers an enticing alternative. From the sport's perspective, this allows retention of high-performance athletes within the Paralympic system. In addition to psycho-behavioral factors, there were physical and physiological experiences that contributed to thoughts of transfer between sports.

Physical and physiological. This theme captured athletes' physical and physiological experiences that led to TT considerations, and reflections were organized into three categories: unexpected injuries, classed-out or reclassification or physical demands of high-performance training. The high-performance environment is results-driven and inability to keep with demands is realized through competition results and physiological responses to training, as highlighted by Jackson:

> "Either at the natural end to their effectiveness in a sport, which typically correlates with age, but ultimately I would suggest it becomes when they no longer are effective or play a prominent role with a particular sport. You know, a player could be a depth player and still considered a meaningful member of the program, but if somebody was on the bubble

> or having difficulty maintaining their role within a team or their spot on the team then perhaps that's the right time. If they no longer have a passion for the sport and what the standards and expectations are of being a high-performance athlete in that sport, if it doesn't fit anymore, and they have trouble living up to that, perhaps there is another sport that they would be a better fit for."

Similarly, from the athletes' perspectives, Paul explained the psychological and physical aspects of sport commitment and purpose for transferring:

> "When they're fed up of their sport, when they're bored or when they don't have fun doing it anymore. That's one thing. The other thing is sometime the age, so depending on the sport, something that's more of an aerobic or a really focused on sprint versus something that's more on distance could be something to consider at one point in your career. Whether it's a plateau, you don't improve any more or even you're more on the descent of your physical abilities. So that's something I think could be a good time to consider a different sport that uses different physical abilities."

A similar notion was echoed by another athlete (Paige), though, some athletes' experiences were more non-normative and had a sudden impact on their sporting career. As Paige highlighted, an injury could abruptly derail sporting plans:

> "I was training to go to world championships, and I developed [my injury]. … And got dropped from the national team, so I actually wasn't wanting a new sport, but I am happiest when I am physically active. And so, I needed something else most, at the point it was mostly for my mental health."

As indicated by this athlete, one of many benefits of sport participation is enhanced quality of life and mental health (Eime, Young, Harvey, Charity, & Payne, 2013).

Another non-normative transition and experience specific to Paralympic sport is the process of ‘classed-out’ or ‘reclassification.’ This occurs when athletes’ abilities do not align with their current sport-specific classification criteria and alternatives are, a) reclassification into another category, or b) no categories are offered for athlete’s abilities and thus, the athlete is declassified. Aside from the common reasons athletes retire (similar both in able-bodied and Para sport), classed-out is a unique but common factor leading to retirement in Paralympic sport. Reclassification can also pose problems for athletes, pending on the category they are classified into, which can be perceived as a disadvantage due to function-related (i.e., competing against athletes with greater function) or competition related factors (i.e., athlete pool contains more depth) or as an advantage due to moving into a category with very little competition, however, also with fewer opportunities to compete (Bundon et al., 2018; Van Dornick & Spencer, 2019). One of the coaches, Bob, shared an experience of someone classified into a disadvantaged category:

> “Whereas our sport has a very, very robust classification system, which helps for some individuals to get into a sport where they're actually able to compete at their level. But for some athletes, … their classification puts them at the very bottom of their classification category. To get above that, it's going to be very, very difficult.”

Thus, whether it is psycho-behavioral (e.g., lack of motivation or enjoyment, accomplished goals) or physical/physiological (e.g., unexpected injuries, classed-out or reclassification or physical demands of training and competition) factors, normative and non-normative scenarios challenge athletes across their career and at times, they are at a ‘fork in the road’ between retirement or transfer.

Career Extensions

The participants' narratives indicated many saw TT as an alternative to retirement, allowing athletes to extend their careers. The items that emerged within this theme are grouped into two sub-themes of 'better opportunities' and 'beneficial outcomes.' First, TT was portrayed as an opportunity for athletes to remove themselves from the more negative environments occurring during the latter years of their careers. With the emergence of the new sport, new opportunities emerged, and participants perceived these experiences positively, as ways to address limitations they experienced in their previous sports. The second theme: beneficial outcomes stemmed from transfer opportunities. For athletes, the new sporting opportunity provided a new physical and psychological challenge. The recipient sport welcomed experienced athletes to their program while athlete departure from the sport was perceived as opportunity for other athletes in the system. These transfer impacts on the athlete, the recipient and donor sports are explored further in each of these sub-themes.

Better Opportunities. These opportunities consisted of a wide range of factors that athletes considered including classification eligibility and depth of competition in another sport, funding opportunities, and/or available resources such as facilities and coaching support. Transfer considerations may also stem from lack of opportunities in their current sport. Paul expressed the experience that resulted in their transfer and how the new sport presented more opportunities:

> "The staff [are] already there, the structure is already there. So it is quite easier in regards to logistics or whether to organize a camp or going to world cups. Usually I was booking everything on my own. So booking and car rental, you know, get your name into the race list and stuff like that. So in regards of logistics, it is quite easier as well. And then the other thing is we did a lot of, in preparation for Rio, we did lots of research and

> development, but we had some expertise to optimize our set for races. And so this is something that I could not have hope in [my previous sport]. So that's something that's another benefit from switching sport."

The lack of resources for Paralympic athletes is a challenge commonly reported in the literature (Radtke & Doll-Tepper, 2014; Mann, Dehghansai, & Baker, 2017) and thus, better funding and/or availability of resources could be attractive for an athlete reconsidering their position in their primary sport. However, as Lewis emphasized, a transfer is not always in an upward trajectory: "it depends on what sport they come from? Because that sport might have had a lot more resources to offer them than we do. So there are some unique challenges that are probably associated to that too." Therefore, other incentives may attract athletes to another sport including change of environment or the love for the sport and Damian reiterated this notion:

> "why would they go from something that they believe is a professionally run organization into something that's unprofessional? The only reason they would want to do that is because they absolutely adore, love the other sport."

An athlete, Brittney confirmed this as her reason for transferring between sports: "So with winter, it was like oh gosh, this is definitely what I enjoy, and so I would definitely say the transfer was because of the experiences that I enjoyed prior to my accident." Thus, while the definition of better opportunities may vary between athletes (e.g., separation from a negative environment, lack of opportunities in their previous sport, or love for the new sport), there are beneficial outcomes stemming from the transfer that emerged from both athletes' and sports' perspectives.

Beneficial outcomes. The main overarching benefit of TT is the extension of athletes' careers, which has a wide range of psychological (e.g., mental health), social (e.g., sense of belongingness) and physical benefits (e.g., physical fitness and reduced risk of diseases; Murphy, Carbone, & the Council on Children with Disabilities, 2008). Sports also benefit from this process as highlighted by Alex: “it's obvious that they can hopefully be recruiting or pulling into their program an athlete that has already learned a set of skills that will transfer quickly into performance into your sport.” An athlete with previous high-performance (or close to) experience requires less training on foundational pieces including understanding of training programs, adhering to dietary and nutritional guidelines, managing their schedule and familiarity with training and competition intensity (Gulbin & Ackland, 2009; Halson et al., 2006). As Eric explained, there are numerous benefits to receiving an athlete with prior high-performance experience:

> “The advantages is obvious. You have some modicum of training experience, coach-ability experience, so you're not taking somebody raw off the street. They had been working the program before. They understand the nature of following a plan, reporting in, buildups for training camps, competitions, that kind of stuff. So they have some experience with that, so it's not a whole new world for them. Their worlds are not the same, but they're parallel.”

Another coach (Louis) expressed the importance of collaborations between sports to maximize resources but emphasized the financial and resource benefits should be coupled with fulfilling athletes’ needs:

> “It’s making sure if we invest in them in one sport, that investment doesn't go to waste. And that even if they're not successful in that sport, there's a way for us to take advantage of the investment we've made in that athlete and do what's best for them.”

While coaches were cognizant of the impact losing an athlete could have on their ‘limited’ pool of athletes, their satisfaction in another sport was preferred to their lack of commitment in their current sport. As Tiffany highlighted: “it has to be more than just being on a podium to get the athlete to commit” and this was reiterated by Richard:

> “If you have to sell an athlete on a particular sport, that's another red flag, the sport which should be able to sell itself and that goes back to passion. A passion for the sport will sell itself, and then the athlete will be with it for further life and not just the duration of their high-performance career. It is, 100%, it has to be the athlete’s choice.”

At the same time, an athlete’s departure was perceived as an opportunity for other developing athletes in the pathway, as Barbara highlighted: “An athlete leaving and then there would be a spot for new up and coming athlete, so that kind of turnover and development of a program.”

However, this was not always the case, as certain programs relied on every single athlete and the departure of one athlete could destabilize the entire local program, an issue that is exacerbated in Paralympic contexts. Bob noted the impact of limited participant pool for a program they had monitored:

> “It has system ramifications. Like when [an athlete] left, the program in his province suffered greatly because he came from a small province. So, all of a sudden, they almost didn't have enough players to play because he left. So, those kinds of things can happen.”

Understandably, coaches’ reflections accentuated transfer implications on their programs, while athletes were more focused on athletes’ experiences and well-being throughout the transfer process. However, both coaches and athletes agreed that athletes’ well-being and positive experiences should be prioritized over the outcome implications for sports. This was captured in the conversation with Corey:

"The challenge is always someone who's at the top of their game, leaving your sport to go elsewhere. When you look at how funding works, the more people we put on a podium, the more funding we get as a sport. So there's a challenge there if we have an athlete that leaves us. I think, there's many, many benefits to it. I think the benefits for the individuals outweigh kind of anything that it would take away from the sport."

This sentiment was echoed by other coaches, who agreed that any negative consequences of TT on their program were worthwhile as long as the TT resulted in positive outcomes for the athletes. Thus, it is important to consider and anticipate some of the challenges athletes may face and explore ways to prevent these shortcomings to ensure positive experiential outcomes for athletes. We explore many of the issues and solutions to consider in the next section.

Compatibility

As the narratives evolved, it became evident that athlete-sport compatibility was vital to athletes' positive experience and ultimately, a successful transfer outcome - success being measured by athletes' perceived well-being in their new sports, contrary to previous literature which focused on podium results as the measuring stick for successful transfer (MacNamara & Collins, 2015; Collins et al., 2014). The emerging themes that cultivated compatibility were 'resources,' 'sport-specific,' and 'communication.' Thus, athletes exploring TT opportunities would benefit from considering factors that emanate from the three themes presented below.

Resources. Previously, resources (or lack thereof) were captured as a reason athletes may consider transferring sports, thus unsurprisingly, it was also noted as a factor to consider for athletes transferring to a new sport. More specifically, coaches and athletes stressed the importance of exploring the availability and accessibility of nearby coaches and facilities, adaptable training programs and funding to support the transition process. As Chris highlighted:

“You need access to resources. That's probably a number one fundamental barrier” and Henry concurred: “Location. Availability of training facilities and people to support them. Or their willingness to move to those locations.” Alois highlighted the limitation of accessible venues and the impact of this on opportunities for athletes:

> “I think that is the ability for, in our country, the number of accessible venues. It's scary. In this city, we have two hundred and fifty thousand people. We have two rinks, or three rinks. One is not accessible, and the other has one accessible bathroom, and no elevator to get them to it. I think the challenges are the accessibility of the facilities for these athletes to compete in.”

The lack of accessible programs, facilities, and knowledgeable staff has been a common challenge for individuals with an impairment looking to participate in sport (Martin Ginis, Ma, Latimer-Cheung, & Rimmer, 2016) and evidently, was also a key factor that athletes should consider before making a transition to another sport. Another key consideration was sporting equipment, as highlighted by Chris: “It's tough, I mean we haven't even gone into the barriers of just financial resources in general for things like equipment, obviously any para sport you're required to have specific equipment that obviously costs a lot of money.” Rick reiterated the importance of identifying a support network in the new sport to help with some of the challenges:

> “I'd say just financially it would be nice to have a little resource or at least like information on who to contact to help get the right equipment that you need going into different sports. Because all of these sports require adaptive equipment. They're all different, so that's pretty tough.”

In addition, some athletes require specialized equipment tailored to their impairment and this is an additional cost. It also takes time to adjust to the equipment and this can be a frustrating process. Elite Paralympic athletes regularly struggle to find tailor-fit equipment and resort to custom made pieces, although, not always successfully tailored (Hambrick, Hums, Bower, & Wolff, 2013). However, athletes remain positive that innovations in their equipment can lead to an advantage against their competition (Hambrick et al., 2013). Therefore, it is important for athletes exploring transfer options to understand the availability of resources (accessible training venues, training programs, coaches, funding) and be aware of the limitations and challenges when making their decision. There are also factors within the training and competition environment that should be considered prior to transfer (e.g., differences in training structure and sport cultures) which are discussed in the next section.

Sport-specific. The second theme that emerged through participants' narratives is the compatibility of the athlete and the new sport. More specifically, athlete's adjustability to the new sport-culture constituting of training demands, learning of new techniques and tactics and adapting to variations in competitive environments. For example, Emily highlighted her experience switching sports and the impact it had on her physically and socially:

> "Well, definitely see if your body can take it, like can take the load, first of all. If you had many injuries in your sport career, it might be not the smartest thing. … It's just if your body can take the load and then if your schedule can take the load, because it takes on ... you might not have much of a social life."

Another coach, Alexandra, echoed this sentiment from the sport's perspective, highlighting the importance of understanding the athlete's background and how they fit within the sport:

> “I think it would be very important for there to be a high level of collaboration before the actual transition took place. And taking a proactive approach and ensuring that we knew what their sport experience was, their kind of motivation to do that so we can better support them on this end. And it's about building a good plan. And the only way that we can really do that is understanding the individual, their sport history, where they're currently at, so that we can build a better plan for them. So I think the more proactive that we can be in ensuring we have good information to work on, I think that's probably the best route.”

These data suggest it is important that athletes understand sport-specific nuances such as differences in training demands, program outlines, sporting culture (training and competition), expectations (of the sport and the athlete), coaching techniques, and technical/tactical details. Another athlete, Paige, emphasized the importance of considering the cultural shift between the two sports (especially transferring between individual and team sports), which may take some time to adjust to:

> “Probably I would say that whole team interaction interpersonal skills, I probably would say it took a couple of years to really get comfortable in that environment… Because the sports are so different, I mean there's the interpersonal challenges, going from an individual sport to a team sport. I definitely struggled with that whole aspect quite a bit.”

Bob had a similar experience with athletes coming into their program from different types of sports:

> “Sport mentality around team sports or individual sports. There's a very different mentality around those two. So, we've had a number of players that come to [our sport], and decide, "Nah. This is not for me. I'm going to go play [another sport, a different type

> of sport]." We got one playing [another sport] right now that used to play [our sport] and we've had two go to [another sport] and become international."

Barbara expressed similar concerns regarding athletes' ability to cope with the challenges of acquiring and developing new skills and assuming new and unfamiliar roles:

> "The fact they would be maybe not the top athlete within that new group, so now they're having to learn new skills within the sport and not being a similar role that they would have maybe been in their sport, I think it's very different, if it's individual vs team sport but as far as us for a team sport they may not be on the starting lineup and they were used to that in the past and I think that could be a challenge for athletes and I think just getting use to the new sport in general because every sport has a different atmosphere when competing and I think that could be overwhelming cause you can be at the top of the game in one area and then come to [our sport] for example, it's completely different when your competing internationally."

Other sport-specific nuances were so subtle that athletes failed to anticipate and thus, were more challenging to deal with including sport-specific terminologies and differences in preparation leading up to competitive events. Acclimation to the demands of their new environment occurred through subsequent exposures. Whilst difficult to override old patterns of behavior, a blank slate mentality with limited expectations contributed to athletes' acclimation process. As highlighted by Alex, differences in technical and tactical demands between sports may force athletes into a 'learning phase' that they may be unfamiliar with. Therefore, expectations need to be tailored to their new sport:

> "I think some understanding of the culture of what the athletes' expectations. You're going from a national team athlete on one sport and then putting him into a development

> level in terms of funding or resources that we're going to be able to spend on them. Having really clear framework that way and helping them understand that, that you might be coming from the top end where we're able to support you fully in X sport and you're dropping into another one where there's not necessarily that same level of support."

Barbara and Corey both expressed similar concerns regarding athletes' expectations: "Just the fact that athletes could be frustrated and that it could be difficult to try to and or learn a new sport when you are used to being comfortable within what maybe you've done before" (Barbara), "I mean, I think learning a new sport for anyone, right? The learning curve will be the challenge, and to figure out where you sit sort of on that curve" (Corey).

Therefore, a deeper understanding of sport-specific nuances can help athletes better align their expectations during the acclimation period of transfer. For this, transparent communication between the coaches and the athletes is integral to highlight details about sporting demands, available resources, expected challenges, and preparation strategies.

Communication. In order to establish a constructive expectation and develop a deep understanding of the circumstances that an athlete will be exposed to, it is important to have clear and transparent communication with the coaches from the new sport. Charles stressed the importance of transparency in preparation for athlete's transfer:

> "Afterwards is to be really transparent with the athletes with transferring on all of the requirements of this sport or everything that is applied by doing this new sport. So being able to have clear and precise conversations that might scare the person away, but will actually give them the whole spectrum of what is required to be a top [athlete in this sport], if you're hiding information from the athlete hoping that they will transfer, this is where you lose the relationship."

Another coach (Barbara) also highlighted the importance of supporting athletes' physical and psychological needs, in case the sport was not what the athlete envisioned it to be:

> "I think for us, we have a lot of newer athletes to begin with in our sport so just making them comfortable within our sport and the environment to be able to learn and I think that's important because athletes can come from being talked out of another sport or something that they were more comfortable in and now that they're into something brand new, it could be quite frustrating and I think support on the mental performance side of that is very important as well as the physical side."

Alex had a similar sentiment which was shared by most of the coaches:

> "The biggest challenge probably is just having a clear communication or a clear understanding of where the priority is, maybe, for that athlete, being able to have a three way conversation between two coaches of two different sports and an athlete and being able to do fairly openly and honestly. … At a certain point in time, they really do need to make a commitment in one direction or the other."

The level of commitment and decision to transfer was reiterated by the athletes. As Rick emphasized: "I'd say make sure you're serious about it because I think if you're gonna up and leave what you're doing." and Paige supported: "you need to think about what it is exactly you want out of your sporting career. … You should be reflective, I guess, on your previous sport that you're in and why it is that you feel the need that to now switch. Make sure you're doing it because you want to." Similarly, Charles expressed his responsibility in this process as a coach: "my biggest task is to try and find another sport for that person to be more competitive or have more fun." A thorough understanding of the process, sport expectations and new sport demands can support athletes' decision making and prepare them for the transfer. However, the most important factor appeared to be athlete’s independence in making the decision to transfer between sports.

Conclusion

As highlighted by MacNamara and Collins (2015), most of TT literature has examined physical, physiological, and anthropometric results’ impact on podium success with very limited observation holistically examining athletes’ experiences in the TT process. To our knowledge, no previous study has examined athletes’ experiences in the Paralympic context. This project explored this gap and captured the perspective of the coaches and athletes about athletes’ experience transferring between Paralympic sports. The themes that emerged from this study highlighted the perspectives of the athletes and coaches and these concepts were conceptualized into three higher-order themes of ‘alternative to retirement,’ ‘career extension,’ and ‘compatibility.’ The alternative to retirement was supported by two sub-themes of ‘psycho-behavioral’ and ‘physical and physiological’ while career extension was conceptualized into two sub-themes of ‘opportunities’ and ‘beneficial outcomes’ and compatibility constituted of ‘resources,’ ‘sport-specific,’ and ‘communication.’

Coaches’ and athletes’ narratives were parallel to the previous literature highlighting some of the reasons athletes consider retirement (Bundon et al., 2018; Eim et al., 2013; Guzmán & Kingston, 2011), including but not limited to psychological withdrawal from sport (e.g., lack of motivation, toxic environment), physical exhaustion (e.g., burnout, injury), or lack of opportunities (e.g., classed-out). However, transfer to another sport can provide opportunities for athletes to extend their careers and maintain the benefits of sport participation (Collins et al., 2014). The athlete and coach narratives emphasized transparent and effective communication as integral for both the sport and the athlete in order to better understand each other, be informed of the available resources, set appropriate expectations and remove or reduce some of the anticipated challenges. Ultimately, TT initiatives should be designed athlete-centered with their decision at the forefront of any TT process.

Acknowledgment

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Table 1

Details for each participant in the interview

Coaches	Sex	Years in Current Role	Coaches	Years in Current Role	Athletes	Sex	Highest competitive accomplishment
C1	M	2	M	20	A1	M	Paralympian
C2	F	1	M	3	A2	M	Nationals
C3	M	4	M	5	A3	M	International
C4	M	N/A	F	N/A	A4	M	Multiple Paralympian
C5	M	4	M	N/A	A5	M	Paralympian
C6	F	13	M	N/A	A6	M	Multiple Paralympian
C7	F	13	M	2	A7	M	Paralympian
C8	M	2	M	20	A8	F	Multiple Paralympian
C9	M	21	M	2	A9	F	Multiple Paralympian
C10	F	4	F	N/A	A10	F	Multiple Paralympian
C11	F	12	F	N/A	A11	F	Multiple Paralympian
C12	M	3	F	1	A12	F	Multiple Paralympian
C13	M	8	M	3			
C14	F	20	M	N/A			
C15	M	N/A	M	5			
C16	M	N/A	M	N/A			
C17	F	2	M	5			
C18	F	N/A					

**Note*. Due to the confidentiality of the participants and the small community of Canadian Para sport (and transferred athletes), only limited information pertaining to participants can be provided without compromising participants' identification.
'N/A' is associated for coaches that were not explicit in the years they have worked in their current role.

Table 2

List of Sports Involved in the Interview Process.

Sports
Para Alpine
Para Athletics
Para Badminton
Para Canoe
Para Cycling
Para Hockey
Para Judo
Para Nordic
Para Shooting
Para Snowboard
Para Swimming
Sit Volleyball
Wheelchair Basketball
Wheelchair Curling
Wheelchair Rugby
Wheelchair Tennis

Chapter Eight

General Discussion

The overarching purpose of this dissertation was to provide a deeper understanding of the Paralympic pathways (i.e., initiation, recruitment, development, transfer) and impairment-related factors that impact athletes' experience in these systems. In Chapter Two, Newell's constraints-led model was modified to use as a theoretical framework to organize existing literature and identify research gaps. The collation illuminated the myriad variables that interact to influence athlete development and the additional complexity introduced when considering impairment-related nuances. Chapter Three explored the effectiveness of Paralympian Search events in attracting and initiating participants into the system by tracking participant demographics and sporting characteristics over a three-year span (2016-2018). Chapters Four, Five, and Six explored Australian and Canadian Paralympic sport (PS) athletes' developmental trajectories while controlling for the onset of impairment. Last, Chapter Seven examined factors that impact athletes' decision to consider retirement or transfer between sports. The five studies in this dissertation provide a comprehensive overview of a wide range of factors that impact PS athletes' development across their careers. Findings inform key stakeholders (directors, coaches, practitioners) of possible ways to optimize the environment for athletes' development and highlight gaps to guide future research.

Key Findings

Chapter Two

The introduction of additional categories within Newell's (1986) framework enabled a clearer depiction of the complex interaction of factors that influence PS athletes' development. This framework provided a holistic (i.e., micro, macro, and meso levels) overview of the inter-connection between different constraints over time, including the role of impairment (and variability of impairment-related factors between athletes) in the training environment, emphasizing the need for a more individual approach to development (Patatas et al., 2018, 2020).

Chapter Three

An examination of the demographics and characteristics of participants attending Paralympian Search events indicated fewer females than males attended the events, while a heatmap analysis demonstrated the centrality of the events (i.e., very few athletes were drawn from rural areas). Both of these results reflect longstanding challenges to participation in PS with environmental and social factors contributing to the limited number of female athletes (Buckley et al., 2020), and the inadequate availability and accessibility of programs attributing to the lack of participants in rural regions (Goodridge et al., 2015). Furthermore, participants with varying degrees of expertise (from novice to national level athletes) from numerous sports attended the events. The majority of athletes' prior experiences in sports took place in open-settings (with able-bodied persons and no modifications to sporting activities). An impairment-onset analysis highlighted differences among athletes with congenital and early-onset impairments and those with impairments acquired later in life (early adulthood and adulthood) demonstrating the importance to consider the age of impairment onset when examining athletes' sporting careers.

Chapter Four

The first of this three-part series exploring the sporting careers of Australian and Canadian Paralympic athletes examined the influence of impairment-onset on the age athletes attained various developmental (i.e., started sport, different types of training, etc.) and performance milestones (i.e., debuts at national or international competitions). Results corroborated those previously reported in the literature (Dehghansai et al., 2017b). More specifically, athletes with congenital or early-onset impairments reached the majority of the milestones (both developmental and performance) at a younger age than athletes with late-onset impairments. However, the latter group progressed through their careers and reached most of the milestones at a faster pace, suggesting the possibility of underlying mechanisms that contributed to the latter group's capacity to 'fast-track' through their sporting careers.

Chapter Five

One assumption for the 'fast-tracked' trajectory was the time athletes devoted to training upon entering PS. There is extensive research in able-bodied contexts that suggests sport-specific training results in skill acquisition and mastery (Baker & Young, 2014; Starkes, 2000). Part II examined this assumption and while athletes with late-onset impairments incorporated *some* of the training conditions into their programs earlier in their careers, there were no significant differences for yearly or accumulated hours of training between groups. On the other hand, there were different training profiles, as each group had tendencies to devote more hours to a specific set of conditions for each training type. For example, athletes with impairments acquired during adulthood reported more individual training without supervision while athletes with congenital and early-acquired impairments had more hours invested training with a group under a coach's supervision.

Chapter Six

The third in this series examined athletes' experiences in other sports (Paralympic and able-bodied) as an explanation for athletes with late-onset impairments' 'fast-tracking' through sporting milestones and acquiring a more complex training portfolio earlier in their careers. There were some indications from the able-bodied literature that athletes are able to transfer general (i.e., nutritional awareness, exposure to competition, self-regulation, training regulation, etc.) and sport-specific knowledge (i.e., tactical awareness, pattern recognition, anticipation) from their experiences in previous sports (Baker et al., 2003; Dweck, 2006; Halson et al., 2006; Toering et al., 2009). Results in Part III suggested the majority of athletes with impairments acquired during adolescence and onwards had experience in able-bodied sports prior to acquiring their impairment and these experiences were generally in sports of a similar type to their current focus. Involvement in PS was reduced for the entire sample in comparison to participation rates for able-bodied sports. These experiences took place mainly in clubs in open settings (i.e., with able-bodied athletes and no modification to the game) and in sports that were of a similar type to athletes' current PS.

Chapter Seven

The final study identified factors contributing to athletes' consideration for retirement or transfer between sports. Aside from re/de-classification, other reported reasons were similar to previously reported themes from the able-bodied literature (Collins et al., 2014; Fortunato & Marchant, 1999; Lavallee et al., 1997) such as psychological withdrawal from sport either due to lack of motivation or toxic environment, physical exhaustion (e.g., burnout, injury), or lack of opportunities. Athletes perceived transfer as an alternative to retirement, allowing for a prolonged career. Key factors contributing to optimal transfer were effective communication between the athlete and sports involved in the transfer process, an in-depth understanding of the sporting demands, expectations of each other (the athlete and the new sport), and the range of resources available for athletes during and post-transfer.

Limitations

This dissertation highlighted the limitations of traditional methods used to understand athletes' development. Throughout, this work emphasized the need to avoid generalization of athletes' trajectories and design frameworks to better understand athletes' experiences holistically. That said, the sample size prevented a multivariate analysis to consider multiple impairment-related factors (impairment type, nature of impairment, classification), resulting in a focus on one impairment-specific analysis (i.e., nature of impairment). In addition, the previous (limited) literature had only examined differences between athletes with congenital and acquired impairment. While this dissertation addressed this issue by creating more age-appropriate groups, using a continuous variable (age) as a categorical variable in the analysis resulted in high variability within groups. As a result, caution should be used when attempting to generalize these findings. Admittedly, research in this area is in its infancy, and findings of this nature are necessary to allow for extension of different approaches. The limitations of this study emphasize the message that has been at the forefront of this dissertation, that is, the complexity of athlete development needs to be considered, which becomes more complicated when introducing impairment-related factors.

For example, in Chapter Six (Part III), athletes with impairments acquired during pre-adolescence reported very limited experiences in physical education at school. Furthermore, they had very little experience in other organized sports (Paralympic or able-bodied) and devoted relatively fewer hours to a variety of training conditions (Chapter Five, Part II). However, this group demonstrated a similar career trajectory to athletes with congenital impairments (similar age and pace to which they reached various milestones) and they reached a high level of success (Chapter 4, Part I). While there was a relatively even distribution of this cohort among different types of sport (Chapter 5, Part III), further examination of this cohort highlighted that most of the athletes had a visual impairment. Therefore, the inability to control for impairment type and the potential classification that influenced opportunities for athletes, confounded the results of this study and limited generalizability. While considerations were made to control for these moderating variables, the large number of sub-groups (e.g., a wide range of impairment types [spinal cord injuries, amputations, visual impairments, spina bifida, etc.]) minimized possibilities of any between-group comparisons.

A similar constraint was introduced when sport-specific analysis was considered. Understandably, there were variations between sports. For example, wheelchair rugby and wheelchair basketball are more established sports with a competitive pathway and, as a result, athletes may have more competition across the pathway. On the other hand, newly established sports such as Para badminton may introduce an ‘easier’ pathway for athletes to navigate through. In relation to that, different classifications in sports also vary in competitive depth. Some classes with fewer domestic and national competition permit athletes to advance through the stages more quickly while others in more competitive classes may not even have the chance to be carded (i.e., resources [financial, expert staff, training facilities] provided to support athletes’ developments) during the initial years of their careers.

As more of these sports advance and mature, the pathways will understandably evolve and become more competitive. Therefore, another limitation of this study was the inability to consider the growth of the Paralympic Games in recent decades. While this study included athletes with a wide range of experiences currently or previously involved at the Games, the lack of control for the evolution of the Games and the athletes’ experiences across this progression present challenges that warrant complex and resource-expansive strategies (i.e., longitudinal studies while considering historical changes). Although these were beyond the scope of this project, they remain important factors to consider. This dissertation addressed a key component within athletes’ development in the Paralympic context. It also highlighted the importance of moving forward considering these complex and interactive factors and introducing more sophisticated and dynamic methods of analysis to better inform environment structure, policy, and resource allocation to maximize athletes' potential.

Practical Implications

A key objective of this dissertation was to provide immediate and long-term implications for the PS community. To date, numerous initiatives have stemmed from this work and findings continue to inform key community projects to better shape programs to suit athlete needs. First, the newly modified framework (Chapter Two) has been designed with coaches and practitioners in mind. This simple yet informative resource provides an overview of factors for consideration within micro (i.e., training), macro (i.e., sport organization, family involvement), and meso (i.e., policy, funding) environments. It provides the landscape for coaches and practitioners to design their programs holistically while considering the nuances associated with the interaction of variables within athletes' dynamic environment.

Findings from Chapter Three have already been used to inform the Canadian Paralympic Committee of their advertising strategy and broaden location designation for upcoming events. In addition, the data from this study was used to formulate a new (successfully obtained) grant for a new female-only Paralympian Search event to increase awareness and create a more welcoming environment for female participants looking to begin PS.

Sports that participated in the study discussed in Chapters Four, Five, and Six received a sport-specific report card tailored to their questions and needs. This information helped stakeholders better understand the individuality of athletes' careers and extend the discussion regarding a more compatible and adaptive system to tailor the environment to athletes' needs. On a broader scale, this research highlights the importance of continuing to test and refine current Paralympic models, most of which have been developed using evidence from the able-bodied literature. The results in this study highlight the lack of support for the ‘neat and tidy’ models that arrange athletes into chronological age stage-based trajectories. Clearly, there are nuances, such as impairment-related factors, that influence athletes’ development that need to be considered. The results here can be used to inform initiatives such as those targeting where funding is distributed and/or the importance of various resources to support athletes at different stages of their careers. For example, the majority of athletes with late acquired impairments entered PS with previous sporting experiences, selecting a PS that was similar to their previous able-bodied sports. These athletes adopted a more complex training routine upon entry into PS and advanced through their milestones quicker than other athletes. On the other hand, athletes with congenital or early acquired impairments started PS at a younger age and sampled a variety of sports before adopting a more complex training profile and advancing in their main PS. Considerations on the optimal type of resources for each group will vary, as the former group may benefit from identifying a key sport and ensuring they are provided with the optimal resources to support their development in that particular sport including access to expert staff (i.e., performance psychologists, sport scientists, coaches) within an appropriate training environment (i.e., access to weight room, court/field, other teammates), and readily accessible high-quality equipment. On the other hand, the latter group may benefit from an inclusive environment with the opportunity to sample a broad range of sports, promoting multi-sport programs with cost-effective (non-customized) equipment with coaches who facilitate an environment that promotes exploration and learning before athletes are prepared to advance to a more competitive stream.

As alluded to in Chapter Seven, transfer is seen as an alternative to retirement, and having open pathways may allow more athletes to extend their careers and maintain long-term participation in sports. The capacity to sample multiple sports, communicate with coaches across different sports, and develop a better understanding of demands within each sport can help athletes make informed decisions about the next steps in their careers. Training in facilities that are shared with other similar sports exposes athletes to this cross-training and cross-group interactions. These findings have been used as a foundation to drive the Canadian Paralympic Committee's new athlete transfer initiative.

In sum, there have been and continue to be strong practical implications generated from the findings of this dissertation. However, the current practical advances in conjunction with the limitations expressed throughout the research program highlight the need for further research in this area.

Future Directions

As highlighted several times previously, it is imperative to continue to advance our understanding of PS athletes' development by expanding the range of variables that are considered throughout athletes' careers. This includes the introduction of more complex analyses that consider a wider range of factors including individual and impairment-related factors (i.e., nature of impairment, impairment type), interpersonal (i.e., family structure and support, coaches and support staff), sociocultural (i.e., policies and funding), and infrastructure environments (i.e., availability and accessibility of programs), and task-related factors (i.e., sport demands, classifications, competitiveness of pathway/classification, etc.). To attempt this type of analysis, understandably, more data is necessary. While the current dissertation includes the largest sample ever collected of sporting histories of PS athletes, this analysis remained beyond the scope of this dissertation. Thus, an even larger pool of data is necessary and until such a dataset is developed, each of these factors can be examined individually or in some combination to further expand our understanding of each factor's role in athletes' development. For example, an impairment type analysis can examine the commonality of specific impairments across various sports and determine whether trajectories differ for athletes with different impairments and/or in different classifications. This can be further cross-referenced to better understand the commonality of impairment onset for a specific group of athletes with a certain impairment type (e.g., are athletes with visual impairment more likely to be in a specific group within the impairment-onset categories). Subsequent analysis could expand on the role of the family in supporting athletes' development and the type of resources necessary for athletes to succeed in these environments.

In addition to these quantitative approaches, some questions may be best addressed utilizing qualitative or mixed-methods approaches. For example, athletes commonly reported sporting experiences in an open setting. It would be valuable to better understand athletes' experiences in these environments and whether they made an explicit choice to participate in these environments, or whether it was the only opportunity available to them (if so, has this contributed to the concerning high dropout and low participation rates). Furthermore, there is a need to understand athletes' sport selection and whether their impairment and subsequent sport classification requirements influenced their decision. Athlete development involves a complex interaction of a host of variables, which can only be further addressed by using a wide range of analyses, input from various stakeholders, studying a multitude of factors, and merging findings to collate and expand our understanding.

Conclusion

An in-depth understanding of athletes' experiences and factors that influence their development can inform policy and resource allocation to optimize athlete development and maximize athletes' experiences and potential. This dissertation aimed to expand our limited understanding of PS athletes' development from sport entry to elite competitive levels. Findings emphasized the importance of considering the individuality of developmental patterns demonstrated by PS athletes and a need to reconsider the 'neat and tidy' approach to generalizing athlete development in this context. This work has resulted in numerous practical implications and continues to inform policy and decision making by stakeholders while highlighting key areas for future research.

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Appendix A. Paralympian Search Questionnaire and Consent Form

Welcome: Paralympian Search

Welcome!

The Canadian Paralympic Committee (CPC) is working with a research team at York University that is studying factors that lead to sport participation and successful development for persons with a disability.

The objective of this questionnaire is to develop a better understanding of your experiences in your main sport and involvement in other sports.

In the interest of privacy and confidentiality, all of your responses to the questionnaire will be identified using a participant code. As such, only the research team and the CPC will have access to your personal information and you will remain anonymous throughout the course of the research. All reporting of the findings (e.g., in presentations at conferences and coaching workshops and/or publications in various scientific journals and coaching magazines) will be completely anonymous.

Your participation in this study, being conducted by York University, Canada, by Mr. Nima Dehghansai, and Dr. Joseph Baker and colleagues at the Canadian Paralympic Committee is voluntarily. By entering your email address below and continuing to the next page, you are giving consent to participate and acknowledge all information you provide will be kept confidential.

Email address: ______________________________

Demographics

1. **What is your first name?**

____

2. **What is your last name?**

____

3. **Are you male or female?**

☐ Male

☐ Female

4. **What is your date of birth?**

____
Day Month Year

5. **What is your place of birth?**

____

6. **In which city have you resided for the majority of your life?**

____

School-based sporting experience

This section will ask you about your ***sport involvement*** in a ***school setting***. There will be questions later that will ask about your sport experience or involvement ***outside of school***, such as in your community or province.

7. Have you competed in school sport, either currently or in the past?

☐ Yes

☐ No

If you have never participated in school sports, please place a tick in the box below and continue to next page, **'Sporting experience outside of school'**:

☐ I have never participated in school sports

8. For each level of schooling applicable to you, please select the choices that best describe your school sport experiences.
Please list your responses below. **(see below the table for description and options for answers for each column)**

Level of schooling	Nature of school	My sport experience	Main sport played
Example: Elementary	*Open/integrated*	*Physical education class*	*Baseball*
Elementary/Primary School			
Middle School			
High School/ Secondary School			
College/CEGEP			
University			

Please add any other comments about your school sport experiences:

For **'Nature of School'** please select:

Open/integrated for **open/integrated school**
Specialized for **specialized/segregated school for students with disability**
N/A if this does not apply to you.

For **'My Sport Experience'** please select one of the options (1-5) as applicable to your experiences:
None
Physical education class
Intramural sport league
Extracurricular sport for fun
Extracurricular sport to compete against other schools (Extracurricular vs. other schools)

9. **Please list the other sports that you were participating in throughout your school years.**

____

____

____

____

____

____

____

Sporting experience outside of school

This section addresses your ***sport experiences outside of school.***

1. **Have you ever participated in any sports outside of school?**

☐ Yes

☐ No

If you have never participated in sports outside of school, please place a tick in the box below and continue to next section, **'Training history'**:

☐ I have never participated in sports outside of school

2. **What factors led to your participation in sport (i.e., encouragement from family/friends, health benefits, social reasons, etc.)? Please list in order of importance.**

____

____

____

____

____

3. **Outside of school, what would you consider to be your *__main sport__* (usually indicated by the sport you have competed at the highest level)? If you played multiple sports, please decide which sport you feel you have spent most time in or have the chance to advance further in.**

In the table in this page, please describe your experiences in your ***main sport*** starting from your ***initial involvement*** to the highest level of competition you have participated in. *For example, you may have initially started participating at the recreational level in open setting, then progressed to competing at the provincial level in the adapted format.*

If you are still competing at a particular competition level, you may select 'C' for the column 'age you stopped competing at this competition level'.

10. **Please enter your responses below (see below the table for description and options for answers for each column)**

	Level of competition	*Age you moved into this competition level*	*Age you stopped competing at this competition level*	*Setting/Type of Sport*
Example	*Recreational*	*8*	*12*	*Open w/ mix athletes*
Initial Involvement				
Subsequent experiences				
Subsequent experiences				
Subsequent experiences				
Subsequent experiences				
Comments:				

For the level of competition, please select the appropriate number associated with each competition level listed below.

Recreational for **Recreational (for fun and health)**
Local for **Local or Regional (against athletes from your city or region)**
Province for **Provincial (against athletes from across your home province)**
National for **National (against athletes from provinces across the country)**
International for **International (against athletes from other countries)**

For setting/type of program, please select the appropriate number associated with the setting/program type listed below.

Open for settings where there was no athletes with a disability
Open w/ mix athletes for **Open/integrated with a mix of athletes with and without disabilities**
Open w/ only a few para-athletes for **Open/Integrated where I was the only or one of very few athletes with a disability**
Adapted/para only for **Adapted/Para setting where all athletes have a disability**

Training history

The first set of questions will ask you about unorganized, play-like involvement in sport. The next set of questions will ask more in-depth details about elements of sport-specific ***training*** in your ***main sport.***

Unorganized/Play-like Involvement: the goal of these activities is to maximize **enjoyment**, they are regulated and rules are adapted from the standardized sport rules; similar to free play but more organized and structured (i.e., swimming laps at the beach/backyard pool, wheelchair basketball games with friends at a community center).

11. **Have you ever participated in unorganized/play-like activities?**

☐ Yes

☐ No

If you have never participated in unorganized/play-like activities, please place a tick in the box below and continue to **next page:**

☐ I have never participated in unorganized/play-like activities.

12. **At what age did you start unorganized involvement in sport?**

____

13. **If different, what age did you start unorganized involvement in parasport?**

____

14. **Roughly, how many hours a week did you devote to unorganized involvement during this time (if different, refer to your experiences in parasport)?**

____

15. **How many hours a week on average do you currently spend in unorganized involvement?**

____

Sport-specific Practice: refers to organized training activities done with the specific goal of improving performance.

16. **Have you ever participated in sport-specific practice?**

☐ Yes

☐ No

If you have never participated in sport-specific practice, please place a tick in the box below and continue to **next page:**

☐ I have never participated in sport-specific practice.

17. **At what age did you start sport-specific training?**

____

18. **If different, what age did you start sport-specific training in parasport?**

____

19. **Roughly, how many hours a week did you devote to sport-specific training during this time (if different, refer to your experiences in parasport)?**

____

20. **How many hours a week on average do you currently spend in sport-specific training?**

____

Other sports

In this section, we are interested to know more about your experiences in sports other than your main sport.

In the table below, please highlight your experiences in other sports.

21. **Please enter your responses below: (see below the table for description and options for answers for each column)**

Sport	*Age started participating*	*Years participated*	*Highest level of competition*	*Setting/type of program where you had your highest level of competition*
For example: wheelchair tennis	*8*	*3*	*Recreational*	*Open w/ mix athletes*
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
Comments:				

For the **level of competition**, please select the appropriate number associated with each competition level listed below.

Recreational for **Recreational (for fun and health)**
Local for **Local or Regional (against athletes from your city or region)**
Province for **Provincial (against athletes from across your home province)**
National for **National (against athletes from provinces across the country)**
International for **International (against athletes from other countries)**

For **<u>setting/type of program</u>**, please select the appropriate number associated with each setting/program type listed below.

<u>Open</u> for settings with no athletes with a disability
<u>Open w/ mix athletes</u> for **Open/integrated with a mix of athletes with and without disabilities**
<u>Open w/ only a few para-athletes</u> for **Open/Integrated where I was the only or one of very few athletes with a disability**
<u>Adapted/para only</u> for **Adapted/Para setting where all athletes have a disability**

<u>Thank You</u>

You have reached the end of this survey! Thank you very much for your time, patience, co-operation, and assistance. Your contribution towards this project is paramount.

Appendix B. Consent Form for Developmental Histories of Athletes' Questionnaire

Informed Consent Form

Date: May 02, 2017

Study Name: Comprehensive analysis of factors affecting the development of expertise in athletes with disabilities

Researchers: Dr. Joseph Baker, School of Kinesiology and Health Science, 338 Bethune College, York University, 4700 Keele St. Toronto, ON M3J 1P3 with PhD student Nima Dehghansai (York University, School of Kinesiology and Health Science).

Purpose of this study: This research focuses on collecting information related to the **sporting experiences, training histories, and environmental factors associated with the development of elite sports performance.** Sporting histories will be compared between athletes of different skill levels, in different sports, and in different countries.

Requirements from you: If you agree to participate, you will be asked to fill out the "Modified Developmental History of Athletes Questionnaire". It is anticipated that the entire task will take you roughly 1 hour to complete.

Risk and discomforts: There are no known or anticipated risks or discomforts associated with participating in this study.

Benefits of the research and benefits to you: Information obtained from this project will be used to provide recommendations regarding the conditions of sport participation and practice that are optimal for the development of expertise in parasport.

Voluntary participation: Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the nature of the relationship you may have with the research team or the nature of your relationship with York University or your affiliated sports team either now, or in the future.

Withdrawal from the study: You can stop participating in the study at any time, for any reason, if you decide to. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the research team, York University, your affiliated sports team or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be immediately destroyed.

Confidentiality: In the interest of privacy and confidentiality, all of your responses to the questionnaire will be identified using a participant code. As such, only the research team will have access to your personal information and **you will remain anonymous** throughout the course of the research. Your data will be safely stored in a password-encrypted computer in a locked facility and only research staff will have access to this information. Data for this study will be stored for 7 years, after which all hard copies of data will be shredded and electronic files will be deleted from relevant hard drives. At all times, confidentiality will be provided to the fullest extent possible by law.

Questions about the research? If you have questions about the research or about your role in the study, please feel free to contact Dr. Joseph Baker by e-mail (bakerj@yorku.ca).

This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any queries or complaints about the project, or the way you have been treated, you are of course, free to contact the Manager of the York University Research Ethics Department (Ms. Alison Collins-Mrakas, 309 York Lanes, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3, +1 416 736 5914, acollins@yorku.ca).

Legal Rights and Signatures:

I______________________________, consent to participate in *"Comprehensive analysis of factors affecting the development of expertise in athletes with disabilities"* conducted by *(Dr. Joseph Baker, PhD-student Nima Dehghansai)*. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form.

Appendix C. Developmental Histories of Athletes' Questionnaire

THE DEVELOPMENTAL HISTORY OF ATHLETES QUESTIONNAIRE

Please note: This page will be removed and separated from the remainder of the questionnaire. Your responses will remain completely anonymous.

Name: ______________________________

Email address: ______________________________

Today's date: ______________________________

DD / MM / YYYY

Please do not hesitate to skip any questions that you are not comfortable answering.

Section 1 of 10: Demographic Information

To begin we would like to ask a few ***questions about you****.*

Are you male or female?

☐ Male

☐ Female

What is your date of birth?

____

Day Month Year

In which city and country have you resided for the majority of your life?

____

Did you ever have to move due to disability-related or sport-related matters? If yes, please list the city and age you moved below.

City, Country	*Age Relocation Occurred*

What is the highest level of education that you have completed?

☐ Less than secondary school

☐ Some secondary school

☐ Completed secondary school

☐ Some post-secondary college / undergraduate university

☐ Completed a post-secondary college diploma / undergraduate university degree

☐ Some postgraduate university

☐ Completed a masters degree

☐ Completed a law / professional degree

☐ Completed a doctoral degree

☐ Other – Please specify:

____

Section 2 of 10: Disability

*In this section, we would like to ask you a few questions about **your disability.***

1.a) What category(ies) does your impairment fall under as classified eligible by the IPC?

☐ **Ataxia** (Loss of control of muscle movements)
☐ **Athetosis** (Involuntary muscle movements, and difficulty maintaining a symmetrical posture)
☐ **Hypertonia** (Abnormal increase in muscle tension, a reduced ability of a muscle to stretch)
☐ **Impaired Muscle Power** (Reduction of force generated by muscles or muscle groups)
☐ **Impaired Passive Range of Movement** (Permanent reduction of range of movement in one or more joints
☐ **Intellectual Impairment** (Limitation in intellectual functioning and adaptive behavior)
☐ **Leg Length Difference** (Bone shortening in one leg)
☐ **Limb Deficiency** (Total/partial absence of bones or joints)
☐ **Short Stature** (Reduce standing height)
☐ **Visual Impairment** (Partial or Full Visual Impairment)

b) What is the nature of your impairment?

☐ Amputation

☐ Arthrogryposis

☐ Cancer/Stroke

☐ Cerebral Palsy

☐ Dysmelia

☐ Intellectual

☐ Leg Length Difference

☐ Loss or Deformity of Limbs

☐ Multiple Sclerosis

☐ Muscular Dystrophy

☐ Osteogenesis Imperfecta

☐ Poliomyelitis

☐ Short Stature

☐ Spinabifida

☐ Spinal Cord Injury (including: Para-/Tetraplegia)

☐ Visual: Eye Structure

☐ Visual: Optical Nerves

☐ Visual: Optical Pathway

☐ Visual Cortex

Other:

☐ Other – Please specify:

____

c) If applicable, please provide any additional detail regarding your impairment.

Example: spastic diplegia cerebral palsy, spastic hemiparesis cerebral palsy or below-knee single leg amputation

____

d) If applicable, what category does your impairment classify under your main sport's classification system?

____

e) Were you born with the impairment or was it obtained post birth?

Congenital ☐ Acquired ☐

f) Do you have a secondary impairment(s)? If yes; please select the affiliated impairment category(ies) and also write down the specific impairment(s)

☐ Physical

____

☐ Intellectual/Cognitive/Learning

____

☐ Visual/Auditory

☐ Neurological ____________________

☐ Other ____________________

____

If you were born with the disability, please ***skip*** *the following questions.*

1. **What was the cause of your disability?**

____

2. **How old were you when the incident occurred?**

____

The following questions relate to your involvement in ***organized sports prior to sustaining your injury.***

Organized sports include sporting activities in which you have ***regular practice sessions*** *under the* ***formal supervision*** *of a coach or adult. They may or may not involve competitions. Participation in organized sports often requires registration with a team or a club.*

When answering the following questions about your involvement in other organized sports, please do not include sporting activities completed as part of compulsory physical education classes at school, but do include any school sporting activities in which you participated in regular, supervised practice sessions.

Also, ***please do not include the informal playful sporting games*** *that you engage in every now and again, for fun with your friends and family, in the back yard or local streets (such as pick-up games of basketball).*

Please include all organized sports that you participated in for ***at least one season or more****, but do not include wheelchair basketball.*

For involvement in each of the organized sports that you participated in, please indicate:

a) The type of sport. Please be specific as possible e.g. indoor volleyball, football–soccer, football–American, field hockey, ice hockey etc.

b) The age at which you started participating in that sport.

c) The total years you spent participating in that sport.

d) The highest level of competition that you participated at for that sport. To identify the highest level of competition that you participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a ‘5’ in the box below if the highest level of competition you participated at for a particular age was “competition against others within the local area, at the senior / open level”.

e) And if you still participate in that sport.

If you have never participated in any other organized sports prior to sustaining your injury, please place a tick in the box below and continue to page 5:

☐ I have never participated in any mainstream organized sports

	Sport 1				***Sport 2***				***Sport 3***			
	Age started participating	*Total years of participation*	*Highest level of competition*	*Still participating?*	*Age started participating*	*Total years of participation*	*Highest level of competition*	*Still participating?*	*Age started participating*	*Total years of participation*	*Highest level of competition*	*Still participating?*
Example	Swimming				Soccer				Baseball			
	7	6	8	N	12	5	4	Y	6	11	14	Y
SPORTS 1-3												
SPORTS 4-6												
SPORTS 7-9												
SPORTS 10-13												

Section 3 of 10: Sporting Career

Next we would like to ask some general questions about ***your career in your main sport****.*

How were you introduced to adapted sports?

- ☐ Through parents
- ☐ Through siblings
- ☐ Through online search
- ☐ Through rehabilitation centers/physiotherapists/physicians
- ☐ Through workshops/community programs/talent identification
- ☐ Through friends/relatives
- ☐ Through school/teachers
- ☐ Through watching elite athletes/international competitions
- ☐ Through APC/CPC/National Federation
- ☐ Through come and try days/Paralympian search
- ☐ Through talent search programs
- ☐ Other – Please specify:

____

What sport do you presently consider to be your main sport?

____

The majority of the remaining questions will relate to the main sport that you have identified above. If you participate in more than one sport, please complete the remaining questions as they relate to the sport you have identified above.

The ***junior*** *level of competition requires athletes to be younger than a certain age in order to participate.* ***Senior/open*** *level competition usually has no age restrictions and* ***master*** *level of competition requires athletes to be at least 35 of years of age for eligibility to compete.*

For your main sport, what is the highest level of competition that you have participated at?

- ☐ No competition - Recreational involvement only, at the junior level
- ☐ No competition - Recreational involvement only, at the senior / open level
- ☐ No competition - Recreational involvement only, at the masters level
- ☐ Competition against others within the local area, at the junior level
- ☐ Competition against others within the local area, at the senior / open level
- ☐ Competition against others within the local area, at the masters level
- ☐ Competition against others within the state / province, at the junior level
- ☐ Competition against others within the state / province, at the senior / open level
- ☐ Competition against others within the state / province, at the masters level
- ☐ Competition against others from across the country, at the junior level
- ☐ Competition against others from across the country, at the senior / open level
- ☐ Competition against others from across the country, at the masters level
- ☐ Competition against others from different countries, at the junior level
- ☐ Competition against others from different countries, at the senior / open level
- ☐ Competition against others from different countries, at the masters level
- ☐ Other – Please specify:

____

For your main sport, what level of competition are you participating in at the moment?

☐ Junior Level ☐ Senior/Open Level ☐ Both

For your main sport, do you feel that you have reached the peak of your career?

☐ Yes

If yes: At what age did you reach the peak of your career? ____________________

If yes: Are you still participating in practice activities for your main sport?

☐ Yes

☐ No

If no: At what age did you cease participation in practice activities for your main sport? ____________________

If yes: Are you still participating in competition activities (at any level) for your main sport?

☐ Yes

☐ No

If no: At what age did you cease participation in competition (at any level) for your main sport? ____________________

☐ No

If no: At what age do you predict that you might reach the peak of your career? ________

If no: What is the highest level of competition that you predict you will participate at?

☐ No competition - Recreational involvement only, at the junior level

☐ No competition - Recreational involvement only, at the senior / open level

☐ No competition - Recreational involvement only, at the masters level

☐ Competition against others within the local area, at the junior level

☐ Competition against others within the local area, at the senior / open level

☐ Competition against others within the local area, at the masters level

☐ Competition against others within the state / province, at the junior level

☐ Competition against others within the state / province, at the senior / open level

☐ Competition against others within the state / province, at the masters level

☐ Competition against others from across the country, at the junior level

- ☐ Competition against others from across the country, at the senior / open level
- ☐ Competition against others from across the country, at the masters level
- ☐ Competition against others from different countries, at the junior level
- ☐ Competition against others from different countries, at the senior / open level
- ☐ Competition against others from different countries, at the masters level
- ☐ Other – Please specify:

____

Section 4 of 10: Sporting Milestones

*Now we would like to ask about your career progression in your main sport. The following section relates to the **ages at which you reached various sporting milestones**.*

Thinking specifically about your involvement in your main sport, at what age did you reach the following sporting milestones?

	Age when reached this milestone	*This milestone is not applicable to me / I have not yet reached this milestone*	*This milestone is not applicable to my sport*
First participated in your main sport (in any format)		☐	☐
First participated in regular supervised practice for your main sport (i.e. practice with a coach)		☐	☐
First participated in regular unsupervised practice for your main sport (i.e. practice without a coach)		☐	☐
First participated in non-sport specific training (e.g. physical conditioning, weights, pilates etc.)		☐	☐
First participated in off-season or year-round training for your main sport		☐	☐
Stopped involvement in all other sports to concentrate on your main sport		☐	☐
The idea of becoming an elite athlete first emerged		☐	☐
Made a conscious decision to become an elite athlete		☐	☐
All of your leisure time began being spent on activities relating to your main sport		☐	☐
Moved house for reasons relating to your main sport		☐	☐
Established a close and extended relationship with a coach for your main sport		☐	☐

THE FOLLOWING TWO PAGES ARE PRESENTED FOR TEAM SPORT ATHLETES

*The following question relates to your involvement in your main sport at the **junior** levels of competition.*

Junior age group categories can vary from sport to sport. When answering this question please think about your participation in all competitions that would be classified as junior level competition according to the rules of your main sport. Junior age group categories typically require athletes to be below a particular age at the time of competition.

Any competition involving participation against adults is classified as senior / open competition and should not be considered when answering the following question.

Thinking specifically about your involvement in *junior* competition for your main sport, at what age did you reach the following milestones?

	*Competition against others within the **local area***	*Competition against others within the **state / province***	*Competition against others from **across the country***	*Competition against others from **different countries***
First participation on a team at this level of competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became a regular starting player on a team (i.e. a player who regularly begins the competition / match on the playing surface and receives regular playing time)	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became one of the top 5 players on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became the best player for my position on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became the best player overall on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport

*The following question relates to your involvement in your main sport at the **senior / open** levels of competition.*

Senior / open competition refers to adult competition. In some sports for reasons relating to safety, a lower age limit may apply, however in the majority of cases senior / open competitions are free of age restrictions, allowing junior athletes to participate in senior / open competition events. Any competition involving participation against adults is classified as senior / open competition.

Thinking specifically about your involvement in *senior / open* competition for your main sport, at what age did you reach the following competition milestones?

Please provide a response to each item for all of the different levels of *senior / open* competition indicated.

	*Competition against others within the **local area***	*Competition against others within the **state / province***	*Competition against others from **across the country***	*Competition against others from **different countries***
First participation on a team at this level of competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became a regular starting player on a team (i.e. a player who regularly begins the competition / match on the playing surface and receives regular playing time)	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became one of the top 5 players on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became the best player for my position on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First became the best player overall on a team	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport

(THE FOLLOWING TWO PAGES ARE PRESENTED FOR INDIVIDUAL SPORT ATHLETES)

The following question relates to your involvement in your main sport at the ***junior*** *levels of competition.*

Junior age group categories can vary from sport to sport. When answering this question please think about your participation in all competitions that would be classified as junior level competition according to the rules of your main sport. Junior age group categories typically require athletes to be below a particular age at the time of competition.

Any competition involving participation against adults is classified as senior / open competition and should not be considered when answering the following question.

Thinking specifically about your involvement in *junior* competition for your main sport, at what age did you reach the following competition milestones?

Please provide a response to each item for all of the different levels of *junior* competition indicated.

	Competition against others within the ***local area***	*Competition against others within the* ***state / province***	*Competition against others from* ***across the country***	*Competition against others from* ***different countries***
First participation on at this level of competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to make competition finals	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to place in the top 3 at competitions	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to place first at competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport

*The following question relates to your involvement in your main sport at the **senior / open** levels of competition.*

Senior / open competition refers to adult competition. In some sports for reasons relating to safety, a lower age limit may apply, however in the majority of cases senior / open competitions are free of age restrictions, allowing junior athletes to participate in senior / open competition events. Any competition involving participation against adults is classified as senior / open competition.

Thinking specifically about your involvement in *senior / open* competition for your main sport, at what age did you reach the following competition milestones?

Please provide a response to each item for all of the different levels of *senior / open* competition indicated.

	*Competition against others within the **local area***	*Competition against others within the **state / province***	*Competition against others from **across the country***	*Competition against others from **different countries***
First participation on at this level of competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to make competition finals	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to place in the top 3 at competitions	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport
First started to place first at competition	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport	Age: _____ ☐ N/A to me ☐ N/A to my sport

Have you won any medals in your main sport (junior and/or senior level)

☐ Yes

☐ No

How many medals have you won at the junior level of competition in your main sport?

	Gold	*Silver*	*Bronze*
Regional			
Provincial			
National			
International			
Paralympics/World Championships			

How many medals have you won at the senior level of competition in your main sport?

	Gold	*Silver*	*Bronze*
Regional			
Provincial			
National			
International			
Paralympics/World Championships			

Have you won any medals at the national or international level of competition outside of your main sport?

☐ Yes

☐ No

Please state the sport,* number *of medals, types of medal (gold, silver, bronze) earned at each level of competition (national or international). Within each sport, please list junior and senior achievements separately.

	Sport	*Junior or Senior*	*Gold (International)*	*Silver (International)*	*Bronze (International)*	*Gold (International)*	*Silver (International)*	*Bronze (International)*
Sport 1								
Sport 2								
Sport 3								
Sport 4								
Sport 5								
Sport 6								
Sport 7								
Sport 8								
Sport 9								
Sport 10								

Half Way There!

Well done, you have just completed Section 4 of 9. You are half way there!

Have you had any difficulties understanding or answering any of the questions you have seen so far?

☐ No
☐ Yes

If yes, please describe the question(s) and the difficulties you have had:

Section 5 of 10: Practice History

We would now like to ask about your practice history for your main sport. The following section takes a detailed look into the ***amount of practice*** *and the* ***types of practice*** *activities that you have engaged in throughout your career in your main sport to date.*

The next set of questions will address your participation in:

1. ***Sport specific physical practice***
2. ***Physical preparation*** *(e.g. strength and conditioning, weights, fitness, pilates, yoga, flexibility)*
3. ***Mental preparation*** *(e.g. working with a psychologist, video analysis / review, reading about your sport, talking about your sport, searching the internet for news and results)*
4. ***Informal play*** *involving activities relating to your main sport (e.g. pick-up basketball, swimming in the backyard pool)*
5. ***Training camps***

First, we would like to ask about your participation in **sport specific physical practice** for your main sport.

Sport specific physical practice includes those **activities that directly resemble the technical and/or tactical demands associated with your main sport**. These activities require *physical effort* as well as *concentration*, and are *aimed directly at improving performance*.

Please note that sport specific physical practice **does not include**:

- Non-sport specific physical preparation activities such as strength and conditioning, weights, fitness, yoga, pilates, or flexibility.
- Informal playful games relating to your main sport that you engage in for fun with friends and family such as pick-up basketball or recreational swimming.

Your involvement in these activities will be discussed in a moment.

There are four conditions in which sport specific physical practice can take place:

1. A **coach is present** at the training venue providing supervision to **you and 1 or more other athletes**.
2. A **coach is present** at the training venue providing **one-on-one** supervision to you and only you in an individual practice session.
3. **No coach** is present to provide supervision but **you and 1 or more other athletes** are practicing together.
4. **No coach** is present to provide supervision, no-one else is practicing with you, but you are practicing **on your own**.

The next questions relate to your participation in sport specific physical practice under each of the four conditions described above. **Please consider your involvement in each of the four practice conditions separately.**

During each year of your participation in <u>sport specific physical practice</u> for your main sport, please indicate how many hours per week (on average) you engaged in this type of activity within the four conditions outlined below, and for how many months of the year.

	*A **coach is present** at the training venue providing supervision to **you and 1 or more other athletes***		*A **coach is present** at the training venue providing **one-on-one** supervision to you and only you in an individual practice session*		***No coach** is present to provide supervision but **you and 1 or more other athletes** are practicing together*		***No coach** is present to provide supervision, no-one else is practicing with you, but you are practicing **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Example	6	10	1	10	0	0	1	12
Age 5								
Age 6								
Age 7								
Age 8								
Age 9								
Age 10								
Age 11								
Age 12								
Age 13								
Age 14								
Age 15								

	A ***coach is present*** *at the training venue providing supervision to* ***you and 1 or more other athletes***		*A* ***coach is present*** *at the training venue providing* ***one-on-one*** *supervision to you and only you in an individual practice session*		***No coach*** *is present to provide supervision but* ***you and 1 or more other athletes*** *are practicing together*		***No coach*** *is present to provide supervision, no-one else is practicing with you, but you are practicing* ***on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 17								
Age 18								
Age 19								
Age 20								
Age 21								
Age 22								
Age 23								
Age 24								
Age 25								
Age 26								
Age 27								
Age 28								
Age 29								
Age 30								

	*A **coach is present** at the training venue providing supervision to **you and 1 or more other athletes***		*A **coach is present** at the training venue providing **one-on-one** supervision to you and only you in an individual practice session*		***No coach** is present to provide supervision but **you and 1 or more other athletes** are practicing together*		***No coach** is present to provide supervision, no-one else is practicing with you, but you are practicing **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 31								
Age 32								
Age 33								
Age 34								
Age 35								

Next, we would like to ask about your participation in **physical preparation activities** for your main sport.

Physical preparation includes all activities aimed at **improving physiological and muscular capacities** such as strength, power, endurance, and flexibility. Examples of physical preparation activities include, but are not limited to, strength and conditioning, weights, fitness, pilates, yoga, and flexibility training.

These activities are sometimes completed during sport specific physical practice sessions, however, for the following questions please refer only to your participation in physical preparation activities **completed outside of sport specific physical practice** as separate stand-alone practice sessions.

There are four conditions in which physical preparation activities can take place:

1. A **coach / specialized instructor is present** at the training venue providing supervision to **you and 1 or more other athletes**.
2. A **coach / specialized instructor is present** at the training venue providing **one-on-one** supervision to you and only you in an individual training session.
3. **No coach / specialized instructor** is present to provide supervision but **you and 1 or more other athletes** are training together.
4. **No coach / specialized instructor** is present to provide supervision, no-one else is training with you, but you are training **on your own**.

The next questions relate to your participation in physical preparation activities under each of the four conditions described above. **Please consider your involvement in each of the four training conditions separately.**

During each year of your participation in physical preparation activities for your main sport, please indicate how many hours per week (on average) you engaged in this type of activity within the four conditions outlined below, and for how many months of the year.

If you have never participated in physical preparation activities for your main sport please place a tick in the box below and continue to page 20:

☐ I have never participated in physical preparation activities for my main sport

	*A **coach / specialized instructor is present** at the training venue providing supervision to **you and 1 or more other athletes***		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** supervision to you and only you in an individual training session*		***No coach / specialized instructor** is present to provide supervision but **you and 1 or more other athletes** are training together*		***No coach / specialized instructor** is present to provide supervision, no-one else is training with you, but you are training **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Example	4	10	0	0	2	12	2	12
Age 5								
Age 6								
Age 7								
Age 8								
Age 9								
Age 10								
Age 11								
Age 12								

Age 13								
Age 14								

	*A **coach / specialized instructor is present** at the training venue providing supervision to **you and 1 or more other athletes***		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** supervision to you and only you in an individual training session*		***No coach / specialized instructor** is present to provide supervision but **you and 1 or more other athletes** are training together*		***No coach / specialized instructor** is present to provide supervision, no-one else is training with you, but you are training **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 15								
Age 16								
Age 17								
Age 18								
Age 19								
Age 20								
Age 21								
Age 22								

Age 23								
Age 24								
Age 25								
Age 26								
Age 27								

	*A **coach / specialized instructor is present** at the training venue providing supervision to **you and 1 or more other athletes***		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** supervision to you and only you in an individual training session*		***No coach / specialized instructor** is present to provide supervision but **you and 1 or more other athletes** are training together*		***No coach / specialized instructor** is present to provide supervision, no-one else is training with you, but you are training **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 28								
Age 39								
Age 30								
Age 31								
Age 32								

Age 33								
Age 34								
Age 35								

Now we would like to ask about your participation in **mental preparation** activities for your main sport.

Mental preparation includes all activities aimed at **improving your knowledge** of your sport, your team, and/or your opponents. Examples of mental preparation activities include, but are not limited to, working with a psychologist, video analysis / review, watching your sport live or on television, reading about your sport, surfing the internet for websites and articles about your sport, or talking about your sport with others.

These activities are sometimes completed during sport specific physical practice sessions, however, for the following questions please refer only to your participation in mental preparation activities **completed outside of sport specific physical practice** as separate stand-alone practice sessions.

There are four conditions in which mental preparation activities can take place:

1. A **coach / specialized instructor is present** at the training venue providing guidance to **you and 1 or more other athletes** as you learn.
2. A **coach / specialized instructor is present** at the training venue providing **one-on-one** guidance to you and only you in an individual session.
3. **No coach / specialized instructor** is present to provide guidance but **you and 1 or more other athletes** are learning together.
4. **No coach / specialized instructor** is present to provide guidance, no-one else is learning with you, but you are learning **on your own**.

The next questions relate to your participation in mental preparation activities under each of the four conditions described above. **Please consider your involvement in each of the four training conditions separately.**

During each year of your participation in mental preparation activities for your main sport, please indicate how many hours per week (on average) you engaged in this type of activity within the four conditions outlined below, and for how many months of the year.

If you have never participated in mental preparation activities for your main sport please place a tick in the box below and continue to page 23:

☐ I have never participated in mental preparation activities for my main sport

	*A **coach / specialized instructor is present** at the training venue providing guidance to **you and 1 or more other athletes** as you learn*		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** guidance to you and only you in an individual session*		***No coach / specialized instructor** is present to provide guidance but **you and 1 or more other athletes** are learning together*		***No coach / specialized instructor** is present to provide guidance, no-one else is learning with you, but you are learning **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Example	2	6	1	6	0	0	3	12
Age 5								
Age 6								

	*A **coach / specialized instructor is present** at the training venue providing guidance to **you and 1 or more other athletes***		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** guidance to you and only you in an individual session*		***No coach / specialized instructor** is present to provide guidance but **you and 1 or more other athletes** are learning together*		***No coach / specialized instructor** is present to provide guidance, no-one else is learning with you, but you are learning **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 7								
Age 8								

Age 9								
Age 10								
Age 11								
Age 12								
Age 13								
Age 14								
Age 15								
Age 16								
Age 17								
Age 18								
Age 19								
Age 20								

	*A **coach / specialized instructor is present** at the training venue providing guidance to **you and 1 or more other athletes***		*A **coach / specialized instructor is present** at the training venue providing **one-on-one** guidance to you and only you in an individual session*		***No coach / specialized instructor** is present to provide guidance but **you and 1 or more other athletes** are learning together*		***No coach / specialized instructor** is present to provide guidance, no-one else is learning with you, but you are learning **on your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*	*Hours per week*	*Months per year*
Age 21								
Age 22								
Age 23								
Age 24								
Age 25								
Age 26								
Age 27								
Age 28								
Age 29								
Age 30								
Age 31								

Age 32								
Age 33								
Age 34								
Age 35								

The following question relates to your participation in **informal play** involving activities relating to your main sport.

Informal play includes activities that **resemble the skills and goals of your main sport** but involve **modified rules and/or equipment**, with very little to **no formal instruction, coaching, or supervision**. The main emphasis of these activities is on fun and enjoyment rather than performance improvement.

Informal play relating to your main sport often occurs in the home, the backyard, the school yard, the local park, and/or the local streets. Examples for wheelchair basketball may include pick-up basketball or shooting hoops for fun with friends. Examples for swimming may include swimming at the beach or playing in the backyard pool with your family.

Please note: These questions relate to informal play involving activities **relating to your main sport only**. Your participation in informal play involving other sporting games will be addressed elsewhere.

There are two conditions in which informal play relating to your main sport can take place:

1. **With 1 or more other people** such as your team mates, friends, or family.
2. **On your own**.

The next questions relate to your participation in informal play relating to your main sport under each of the conditions described above. **Please consider your involvement in each of the conditions of play separately.**

During each year of your participation in informal play involving activities relating to your main sport, please indicate how many hours per week (on average) you engaged in this type of activity within the two conditions outlined below, and for how many months of the year.

If you have never participated in informal play involving activities relating to your main sport please place a tick in the box below and continue to the bottom of page 25:

☐ I have never participated in play involving activities relating to my main sport

	With 1 or more other people *such as your team mates, friends, or family*		***On your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*

Example	2	8	4	12
Age 5				
Age 6				
Age 7				
Age 8				

	With 1 or more other people *such as your team mates, friends, or family*		***On your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*
Age 9				
Age 10				
Age 11				
Age 12				
Age 13				
Age 14				
Age 15				
Age 16				

Age 17				
Age 18				
Age 19				
Age 20				
Age 21				
Age 22				
Age 23				
Age 25				

	With 1 or more other people *such as your team mates, friends, or family*		***On your own***	
	Hours per week	*Months per year*	*Hours per week*	*Months per year*
Age 25				
Age 26				
Age 27				
Age 28				

Age 29				
Age 30				
Age 31				
Age 32				
Age 33				
Age 34				
Age 35				

The following question relates to your participation in **training camps** for your main sport.

Training camps refer to **intensive periods of training** during which your team comes together for an extended time to participate in practice activities that **exceed your regular** week to week training commitments.

Training camps can last from one weekend to several months in duration, and they are often held at a location away from your regular training venue.

Typical activities involved in a training camp include sport specific physical practice, supplementary practice activities such as physical conditioning and video review, education sessions, team building exercises, and mock competitions.

Training camps are commonly held in the pre-season training period or in the lead up to an important competition. They can also serve as a regular practice opportunity for teams who do not train together on a weekly basis.
For each year of your involvement in training camps for your main sport, please indicate the total number of days, weeks, and/or months you spent in training camps.

If you participated in multiple training camps within a single year, please add the total number of days, weeks, and/or months you spent in training camps together to provide an overall total duration for the year.

If you have never participated in any training camps for your main sport please place a tick in the box below and continue to page 28:

☐ I have never participated in training camps for my main sport

	Total number of days, weeks, and/or months spent in training camps

Example 1	4 Days ______ Weeks ______ Months
Example 2	2 Days 2 Weeks 2 Months
Age 5	______ Days ______ Weeks ______ Months
Age 6	______ Days ______ Weeks ______ Months
Age 7	______ Days ______ Weeks ______ Months
Age 8	______ Days ______ Weeks ______ Months
Age 9	______ Days ______ Weeks ______ Months
Age 10	______ Days ______ Weeks ______ Months
Age 11	______ Days ______ Weeks ______ Months
Age 12	______ Days ______ Weeks ______ Months
Age 13	______ Days ______ Weeks ______ Months
Age 14	______ Days ______ Weeks ______ Months
Age 15	______ Days ______ Weeks ______ Months
Age 16	______ Days ______ Weeks ______ Months
Age 17	______ Days ______ Weeks ______ Months

	Total number of days, weeks, and/or months spent in training camps
Age 18	______ Days ______ Weeks ______ Months
Age 19	______ Days ______ Weeks ______ Months
Age 20	______ Days ______ Weeks ______ Months

Age 21	______ Days	______ Weeks	______ Months
Age 22	______ Days	______ Weeks	______ Months
Age 23	______ Days	______ Weeks	______ Months
Age 24	______ Days	______ Weeks	______ Months
Age 25	______ Days	______ Weeks	______ Months
Age 26	______ Days	______ Weeks	______ Months
Age 27	______ Days	______ Weeks	______ Months
Age 28	______ Days	______ Weeks	______ Months
Age 29	______ Days	______ Weeks	______ Months
Age 30	______ Days	______ Weeks	______ Months
Age 31	______ Days	______ Weeks	______ Months
Age 32	______ Days	______ Weeks	______ Months
Age 33	______ Days	______ Weeks	______ Months
Age 34	______ Days	______ Weeks	______ Months
Age 35	______ Days	______ Weeks	______ Months

Section 6 of 10: Family Details

*We would now like to ask some questions about your **immediate family**, and their **participation in sport and physical activity.***

*First we would like to ask about your **biological mother**.*

What is your mother's date of birth?

Day Month Year

In which country has your mother resided for the majority of her life?

What is the highest level of education that your mother has completed?

- ☐ Less than secondary school
- ☐ Some secondary school
- ☐ Completed secondary school
- ☐ Some post-secondary college / undergraduate university
- ☐ Completed a post-secondary college diploma / undergraduate university degree
- ☐ Some postgraduate university
- ☐ Completed a masters degree
- ☐ Completed a law / professional degree
- ☐ Completed a doctoral degree
- ☐ Other – Please specify:

During the time that you lived with your mother, what was her occupation?

How old were you when you started living with your mother?

- ☐ From when I was born
- ☐ I have never lived with my mother
- ☐ From age:

How old were you when you stopped living with your mother?

☐ I still live with my mother

☐ I have never lived with my mother

☐ At age:

____

Does your mother suffer from a disability?

☐ No

☐ Yes

What's the nature of her disability?

____

During the time that you lived with your mother, on average, how often did she participate in the following types of physical activity?

Please tick one box within each row.

	Never	*Occasionally*	*1-2 times per week*	*3-5 times per week*	*More than 5 times per week*	*N/A – I have never lived with my mother*
General fitness activities	☐	☐	☐	☐	☐	☐
Recreational sport/informal sporting games	☐	☐	☐	☐	☐	☐
Competitive sport	☐	☐	☐	☐	☐	☐

<u>At any time throughout her life</u>, did your mother ever participate in <u>any competitive sports</u> for an extended duration (i.e. 3 years or more)?

☐ Yes

☐ No

If yes, in which competitive sport(s) has your mother participated in for an extended period of time (i.e., 3 years or more), and what is the highest level of competition that she has participated at?

To identify the highest level of competition that your mother participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a ‘5’ in the space below if the highest level of competition your mother participated at was “competition against others within the local area (at the senior/open level)”.

	Sport Type (Please be specific as possible)	*Highest level of competition (Please enter the corresponding code from the list on the back page of the questionnaire)*
Sport 1		
Sport 2		
Sport 3		
Sport 4		
Sport 5		
Sport 6		
Sport 7		

*Next we would like to ask about your **biological father**.*

What is your father’s date of birth?

____
Day Month Year

In which country has your father resided for the majority of his life?

____

What is the highest level of education that your father has completed?

☐ Less than secondary school

- ☐ Some secondary school
- ☐ Completed secondary school
- ☐ Some post-secondary college / undergraduate university
- ☐ Completed a post-secondary college diploma / undergraduate university degree
- ☐ Some postgraduate university
- ☐ Completed a masters degree
- ☐ Completed a law / professional degree
- ☐ Completed a doctoral degree
- ☐ Other – Please specify:

____

How old were you when you started living with your father?

- ☐ From when I was born
- ☐ I have never lived with my father
- ☐ From age:

____

How old were you when you stopped living with your father?

- ☐ I still live with my father
- ☐ I have never lived with my father
- ☐ At age:

____

Does your father suffer from a disability?

- ☐ No
- ☐ Yes

What's the nature of his disability?

____

During the time that you lived with your father, on average, how often did he participate in the following types of physical activity?

Please tick one box within each row.

	Never	*Occasionally*	*1-2 times per week*	*3-5 times per week*	*More than 5 times per week*	*N/A – I have never lived with my father*
General fitness activities	☐	☐	☐	☐	☐	☐
Recreational sport/informal sporting games	☐	☐	☐	☐	☐	☐
Competitive sport	☐	☐	☐	☐	☐	☐

<u>At any time throughout his life</u>, did your father ever participate in <u>any competitive sports</u> for an extended duration (i.e. 3 years or more)?

☐ Yes

☐ No

If yes, in which competitive sport(s) has your father participated in for an extended period of time (i.e., 3 years or more), and what is the highest level of competition that he has participated at?

To identify the highest level of competition that your father participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a '5' in the space below if the highest level of competition your father participated at was "competition against others within the local area (at the senior/open level)".

	Sport Type (Please be specific as possible)	*Highest level of competition (Please enter the corresponding code from the list on the back page of the questionnaire)*
Sport 1		
Sport 2		
Sport 3		
Sport 4		

Sport 5
Sport 6
Sport 7

Next we would like to ask about your ***step-mother or female legal guardian****.*

If you have never had a step-mother or female legal guardian other than your biological mother, please place a tick in the box below and continue to page 51:

☐ I have never had a step-mother or female legal guardian other than my biological mother

Please describe this person's relationship to you:

☐ Aunt

☐ Foster parent

☐ Godmother

☐ Grandmother

☐ Step-mother

☐ Other – Please specify:

____

What is this person's date of birth?

____

Day Month Year

In which country has this person resided for the majority of her life?

____

What is the highest level of education that this person has completed?

☐ Less than secondary school

☐ Some secondary school

☐ Completed secondary school

☐ Some post-secondary college / undergraduate university

☐ Completed a post-secondary college diploma / undergraduate university degree

☐ Some postgraduate university

☐ Completed a masters degree

☐ Completed a law / professional degree

☐ Completed a doctoral degree

☐ Other – Please specify:

____

How old were you when you started living with this person?

☐ From when I was born

☐ I have never lived with this person

☐ From age:

____

How old were you when you stopped living with this person?

☐ I still live with this person

☐ I have never lived with this person

☐ At age:

____

Does your guardian suffer from a disability?

☐ No

☐ Yes

What's the nature of her disability?

____

During the time that you lived with your guardian, on average, how often did she participate in the following types of physical activity?

Please tick one box within each row.

	Never	*Occasionally*	*1-2 times per week*	*3-5 times per week*	*More than 5 times per week*	*N/A – I have never lived with her*
General fitness activities	☐	☐	☐	☐	☐	☐
Recreational sport/informal sporting games	☐	☐	☐	☐	☐	☐
Competitive sport	☐	☐	☐	☐	☐	☐

<u>At any time throughout her life</u>, did your guardian ever participate in <u>any competitive sports</u> for an extended duration (i.e. 3 years or more)?

☐ Yes

☐ No

If yes, in which competitive sport(s) has your guardian participated in for an extended period of time (i.e., 3 years or more), and what is the highest level of competition that she has participated at?

To identify the highest level of competition that your guardian participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a '5' in the space below if the highest level of competition your mother participated at was "competition against others within the local area (at the senior/open level)".

	Sport Type (Please be specific as possible)	*Highest level of competition (Please enter the corresponding code from the list on the back page of the questionnaire)*
Sport 1		
Sport 2		
Sport 3		
Sport 4		
Sport 5		

*Now we would like to ask about your **<u>step-father or male legal guardian</u>**.*

If you have never had a step-father or male legal guardian other than your biological father, please place a tick in the box below and continue to page 53:

☐ I have never had a step-father or male legal guardian other than my biological father

Please describe this person's relationship to you:

☐ Uncle

☐ Foster parent

☐ Godfather

☐ Grandfather

☐ Step-father

☐ Other – Please specify:

____

What is this person's date of birth?

____

Day Month Year

In which country has this person resided for the majority of his life?

____

What is the highest level of education that this person has completed?

☐ Less than secondary school

☐ Some secondary school

☐ Completed secondary school

☐ Some post-secondary college / undergraduate university

☐ Completed a post-secondary college diploma / undergraduate university degree

☐ Some postgraduate university

☐ Completed a masters degree

☐ Completed a law / professional degree

☐ Completed a doctoral degree

☐ Other – Please specify:

____

How old were you when you started living with this person?

☐ From when I was born

☐ I have never lived with this person

☐ From age:

____

How old were you when you stopped living with this person?

☐ I still live with this person

☐ I have never lived with this person

☐ At age:

____

Does your guardian suffer from a disability?

☐ No

☐ Yes

What's the nature of his disability?

____

During the time that you lived with your guardian, on average, how often did he participate in the following types of physical activity?

Please tick one box within each row.

	Never	*Occasionally*	*1-2 times per week*	*3-5 times per week*	*More than 5 times per week*	*N/A – I have never lived with him*
General fitness activities	☐	☐	☐	☐	☐	☐
Recreational sport/informal sporting games	☐	☐	☐	☐	☐	☐
Competitive sport	☐	☐	☐	☐	☐	☐

<u>At any time throughout his life</u>, did your guardian ever participate in <u>any competitive sports</u> for an extended duration (i.e. 3 years or more)?

☐ Yes

☐ No

If yes, in which competitive sport(s) has your guardian participated in for an extended period of time (i.e., 3 years or more), and what is the highest level of competition that he has participated at?

To identify the highest level of competition that your guardian participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a ‘5’ in the space below if the highest level of competition your mother participated at was “competition against others within the local area (at the senior/open level)”.

	Sport Type (Please be specific as possible)	*Highest level of competition (Please enter the corresponding code from the list on the back page of the questionnaire)*
Sport 1		
Sport 2		
Sport 3		
Sport 4		
Sport 5		

*The next few questions relate to your **siblings** (brothers and sisters). Please include any step-siblings, half-siblings and/or adoptive siblings when responding to the following questions.*

If you do not have any siblings, please place a tick in the box below and continue to page 67:

☐ I do not have any siblings

*First we would like to ask about your **oldest sibling**.*

Is this sibling male or female?

☐ Male

☐ Female

Please describe your relationship to this sibling:

☐ This sibling is my identical twin (monozygotic twin)

☐ This sibling is my non-identical twin (dizygotic twin)

☐ This sibling and I share the same mother and father

☐ This sibling and I have a different mother and/or father

What is this sibling's date of birth?

____
Day Month Year

In which country has this sibling resided for the majority of their life?

____

What is the highest level of education that this sibling has completed?

☐ Less than secondary school

☐ Some secondary school

☐ Completed secondary school

☐ Some post-secondary college / undergraduate university

☐ Completed a post-secondary college diploma / undergraduate university degree

☐ Some postgraduate university

☐ Completed a masters degree

☐ Completed a law / professional degree

☐ Completed a doctoral degree

☐ Other – Please specify:

____

How old were you when you started living with this sibling?

☐ From when I was born

☐ I have never lived with this sibling

☐ From age:

____

How old were you when you stopped living with this sibling?

☐ I still live with this sibling

☐ I have never lived with this sibling

☐ At age:

____

Does your sibling suffer from a disability?

☐ No

☐ Yes

What's the nature of their disability?

____

During the time that you lived with your sibling, on average, how often did they participate in the following types of physical activity?

Please tick one box within each row.

	Never	*Occasionally*	*1-2 times per week*	*3-5 times per week*	*More than 5 times per week*	*N/A – I have never lived with my sibling*
General fitness activities	☐	☐	☐	☐	☐	☐
Recreational sport/informal sporting games	☐	☐	☐	☐	☐	☐
Competitive sport	☐	☐	☐	☐	☐	☐

At any time throughout their life, did your sibling ever participate in any competitive sports for an extended duration (i.e. 3 years or more)?

☐ Yes

☐ No

If yes, in which competitive sport(s) has your sibling participated in for an extended period of time (i.e., 3 years or more), and what is the highest level of competition that they have participated at?

To identify the highest level of competition that your sibling participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a '5' in the space below if the highest level of competition your mother participated at was "competition against others within the local area (at the senior/open level)".

	Sport Type (Please be specific as possible)	*Highest level of competition (Please enter the corresponding code from the list on the back page of the questionnaire)*
Sport 1		
Sport 2		
Sport 3		
Sport 4		
Sport 5		

Section 7 of 10: Participation in Other Organized Sports

Athletes often participate in a variety of sports before choosing to specialize in their main sport.

*The following questions relate to your involvement in **organized sports other than your main sport**.*

Please include your experiences pertaining to parasports only.

*Organized sports include sporting activities in which you have **regular practice sessions** under the **formal supervision** of a coach or adult. They may or may not involve competitions. Participation in organized sports often requires registration with a team or a club.*

When answering the following questions about your involvement in other organized sports, please do not include sporting activities completed as part of compulsory physical education classes at school, but do include any school sporting activities in which you participated in regular, supervised practice sessions.

*Also, **please do not include the informal playful sporting games** that you engage in every now and again, for fun with your friends and family, in the back yard or local streets (such as pick-up basketball or street hockey).*

*Please include all organized sports that you participated in for **at least one season or more**, but do not include your main sport.*
For each year of your involvement in all of the organized sports that you participated in, please indicate:

a) The type of sport. Please be specific as possible e.g. indoor volleyball, football–soccer, football–American, field hockey, ice hockey etc. **(S)**

b) <u>Age</u> you started participation in that sport. <u>(A)</u>

c) The <u>total years</u> you participated competitively in that sport. <u>(TY)</u>

d) The <u>highest level of competition</u> that you participated at for that sport. To identify the highest level of competition that you participated at please refer to the codes provided on the back page of this questionnaire. You may rip off the back page for your convenience. For example, please enter a '5' in the box below if the highest level of competition you participated at for a particular age was "competition against others within the local area, at the senior / open level". **<u>(HLC)</u>**

e) Sport setting. There are five sport settings which sporting experience may take place in. ***<u>School-based (SB)</u>*** settings involve competition between students within the same school, while ***<u>interscholastic (SI)</u>*** settings consider competition between schools. ***<u>College/university</u> (C/U)*** settings are the competitions occurring in college/university setting; usually against other colleges/universities. ***<u>Community</u>*** settings are sporting programs in ones' community and have no ties with the schooling system, usually promoting a recreational and non-competitive environment. Programs in ***<u>open settings</u> (O)*** are offered by specific sporting organizations which consist of a competitive environment with competition against other organizations/teams. **<u>(SS)</u>**

f) Sport delivery. ***<u>Parallel (P)</u>*** method of delivery consists of training with able-bodied athletes, however, competing in <u>adapted</u> sporting competitions. ***<u>Segregated</u>* <u>(S)</u>** consists of training and competing against other athletes with disabilities. ***<u>Unified</u>* <u>(U)</u>** consists of training and competing with athletes with and without disabilities; however, rules of competition are adapted for all abilities. Last, **<u>general (G)</u>** consist of training and competing in mainstream sports without any modifications to training and/or competition. **<u>(SD)</u>**

g) Relevancy. On a scale of 1-10 (1=low, 10=very high), indicate how much your experience in this sport setting contributed to your sporting development. **<u>(R)</u>**

If you have never participated in any other organized sports other than your main sport please place a tick in the box below and continue to page 40:

☐ I have never participated in any other organized sports other than my main sport

	Sport 1						Sport 2						Sport 3					
	A	TY	HCL	SS	SD	R	A	TY	HCL	SS	SD	R	A	TY	HCL	SS	SD	R
Example	Swimming						Soccer						Baseball					
	4	6	8	C/U	G	5	2	5	4	SB	G	8	3	11	1	SS	SD	9
Sports 1-3																		
Sports 4-6																		
Sports 7-9																		
Sports 10-12																		
Sports 13-15																		

Sports 16-18																		

Section 8 of 10: Access and Accommodations

*In this section, we would like to ask you about the **access to and utility of support services** during each year of your involvement in your main sport.*

Access: was this support service available to you if you required it, regardless of whether you actually utilized it or not?

Utility: If available, did you utilize this support service?

Please indicate if you had **access** to each service (yes/no/unaware of the availability of service), **how many years** you had access to the services, whether you **utilized** the services (yes/no), **how many years** you utilized the services and the **perceived impact** of the services on your **performance** (1 = low impact, 10 = paramount to performance). Make sure to report services provides only for your **main sport.**

	Access	Years of Access	Utility	Years Utilized	Perceived Impact on Performance
Personal Coach					
Team Coach					
Classification Support					
Medicine					
Physiotherapy					
Massage					
Psychology					
Nutrition					
Physiology					
Biomechanics					
Performance Analysis					
Other (Please list)					

Have you received any funding or grants during your sporting career?

☐ Yes

☐ No

If yes, please state the type (e.g., government, private), duration (i.e., one time or continuous), amount and currency each most significant grants/funding you've received.

	Funding Type	*Duration*	*Amount*	*Currency*

Section 9 of 10: Benefits and Barriers of Sport Participation

*Now, we would like to ask about the **benefits** you have experienced from your participation in adapted sports.*

*Next, we would like to ask you about **barriers** and **facilitators** associated with your participation in sport.*

*First, please indicate the **reasons** that you **started** participation in sports.*
Multiple answers possible

☐ Encouragement from family, partner, or friends
☐ For enjoyment/fun
☐ To be in a competitive environment
☐ To enhance my overall health and physical fitness
☐ To increase my self-confidence
☐ To increase my independence
☐ To learn new skills
☐ To learn how to navigate/develop skills with my mobility aid/wheelchair
☐ To learn how to cope with my impairment psychologically/emotionally
☐ To socialize and meet new people
☐ Recommendation from doctor and/or medical staff
☐ Others, please list reasons below

____

*Next we would like to ask you about **barriers** you faced during your **early years of involvement**.*
Multiple answers possible

☐ No barriers
☐ Dependence on others (i.e., transportation, preparation, etc.)
☐ Disability-related complications
☐ Fear of injuries
☐ High expenses associated with sport (i.e., equipment, registration, etc.)
☐ Lack of familiarity with the new environment (i.e., other athletes, staff perception, etc.)
☐ Lack of appropriate training guidelines for my disability/sport
☐ Lack of appropriate equipment
☐ Lack of energy
☐ Lack of facilities/inadequate facilities near my residence
☐ Lack of other athletes with disabilities
☐ Lack of sporting opportunities near my residence
☐ Lack of qualified staff working at facilities
☐ Lack of qualified coaches
☐ Lack of time
☐ Lack of transportation to training/competition sites
☐ Others, please list reasons below

____

*Next, we would like to ask you about **factors facilitating** your **maintenance** in sport. Which of the following items helped keep you involved in your sport? Choose as many items as are relevant for you.*

☐ The competitive environment
☐ Continuous support from family and friends
☐ Being able to maintain and refine skills
☐ Desire to maintain a healthy lifestyle
☐ Desire to maintain contact with peers/teammates
☐ Sense of accomplishment
☐ Sense of belongingness
☐ Sense of independence
☐ Opportunity to travel
☐ Others, please list reasons below

____

*Next, we would like to ask you about **barriers** that have **persisted** or have been introduced during the competitive stages of your career.*
Multiple answers possible

☐ No barriers
☐ Dependence on others (i.e., transportation, preparation, etc.)
☐ Disability-related complications
☐ Fear of injuries
☐ High demands associated with the competition (training, competition, travel, etc.)
☐ High expenses associated with sport (i.e., equipment, registration, etc.)
☐ Lack of advanced programs near my residence
☐ Lack of appropriate equipment
☐ Lack of appropriate advanced training guidelines for my disability/sport
☐ Lack of expert staff
☐ Lack of facilities/inadequate facilities near my residence
☐ Lack of time
☐ Lack of transportation to training/competition sites
☐ Recurring injuries
☐ Others, please list reasons below

____

Reflecting back on your sporting journey, what factors contributed most to starting and staying involved in sport?

____
____
____.

What were the most difficult barriers you faced during this journey?

____
____
____.

Are there any elements related to the overall sporting programs and its structure that you'd like to see improved to enhance the experience of new athletes entering the system (i.e., recruitment, opportunity, available programs, etc.)?

____
____.

Section 10 of 10: Sporting Injuries

Now, we would like to know about ***any significant injuries or illnesses*** *that you have endured while involved in your main sport (if acquired disability; post-incident).*

Age: what age were you when you endured this injury/illness?

Chronic or acute: Was this injury/illness related to a long term condition (chronic) or was its onset sudden (acute)?

Total time affected: In total, how many weeks or months were you affected by this injury/illness?

Total time physically unable to participate in main sport: How many weeks or months were you physically unable to participate in your main sport due to this injury or illness?

Total time on reduced training load: how many weeks or months were you on a reduced training load due to this injury/illness (not including the time you were unable to participate at all)?

Number of competitions missed: how many competitions did you miss due to this injury/illness?

Please complete all items in the table for each injury or illness that you have endured.

Injury	Age	Chronic or acute?	Total time affected		Total time physically unable to participate in main sport		Total time on reduced training load		Number of competitions missed
			How long?	Weeks or months?	How long?	Weeks or months?	How long?	Weeks or months?	
E.g.	*22*	*Acute*	*3*	*Months*	*2*	*Months*	*1*	*Month*	*6*
1									
2									
3									
4									
5									
6									
7									
8									
9									

Final Comments?

You have just completed the final section of the Developmental History of Athletes Questionnaire!

Did you have any difficulties understanding or answering any of the questions relating to your family or where you have lived?

☐ No

☐ Yes

If yes, please describe the question(s) and the difficulties you have had:

Do you have any final comments that you wish to make about the Developmental History of Athletes Questionnaire, your own sport involvement, or any other issues that you feel are important to mention?

Congratulations!

You have now completed the
Developmental History of Athletes Questionnaire.

Thank you very much for your time, patience, co-operation, and assistance. Your participation in this research project is extremely valuable.

Level of Competition Code Sheet

Please use this code sheet to answer Section 2, 6, and 7 of 9: Your Participation in Other Organized Sports and Family History

You may remove this page for your convenience.

To identify the highest level of competition when responding to items within section 2, 6, and 7, please refer to the codes provided below.

For example, please enter a ‘5’ in the relevant space if the highest level of competition is “competition against others within the local area at the senior / open level”.

1. No competition - Recreational involvement only at the junior level
2. No competition - Recreational involvement only at the senior / open level
3. No competition - Recreational involvement only at the masters level
4. Competition against others within the local area at the junior level
5. Competition against others within the local area at the senior / open level
6. Competition against others within the local area at the masters level
7. Competition against others within the state / province at the junior level
8. Competition against others within the state / province at the senior / open level
9. Competition against others within the state / province at the masters level
10. Competition against others from across the country at the junior level
11. Competition against others from across the country at the senior / open level
12. Competition against others from across the country at the masters level
13. Competition against others from different countries at the junior level
14. Competition against others from different countries at the senior / open level
15. Competition against others from different countries at the masters level
16. Other – Please be sure specify the appropriate level of competition in the corresponding space

Appendix D. Consent Form for Talent Transfer Interviews

Paralympic Talent Transfer Framework (PTTF) Informed Consent Form

Thank you for your interest in the **Paralympic Talent Transfer Framework** project in collaboration with the Canadian Paralympic Committee, Own The Podium and York University.

Through interviews with experts, the objective of this project is to develop a better understanding of challenges, barriers and concerns regarding athlete transfer, in order to maximize the potential of the PTTF and ensure a program that is tailored to the needs of athletes and sports.

To address the elements in question, this interview contains the following components:

- Athlete Transfer Identification
- Athlete Transfer Process
- Athlete Transfer Transition

Your participation can have a great impact in shaping this framework and we highly appreciate your time and opinion.

If you have any questions or would like more information, feel free to contact Nima Dehghansai (para@yorku.ca), who is leading the interview process.

You can also contact any of the associates involved in this project listed below.

- Canadian Paralympic Committee -- Catherine Gosselin-Després (CGosselin-Despres@paralympic.ca)

- Own The Podium – Dr. Andy Van Neutegem (Andy.VanNeutegem@ownthepodium.org)

- York University – Dr. Joe Baker (Bakerj@yorku.ca)

We would like to assure you that only the representatives associated with this project will have access to the raw data and your responses will be held strictly confidential. Should there be any reports generated, we will do our best to maximize your anonymity.

Withdrawal from the study: You can stop participating in the study at any time, for any reason, if you decide to. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the research team, York University, your affiliated sports team or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be immediately destroyed.

Confidentiality: In the interest of privacy and confidentiality, all of your responses will be identified using a participant code or pseudonym. As such, only the research team will have access to your personal information and **you will remain anonymous** throughout the course of the research. Your data will be safely stored in a password-encrypted computer in a locked facility and only research staff will have access to this information. Data for this study will be stored for 7 years, after which all hard copies of data will be shredded and electronic files will be deleted from relevant hard drives. At all times, confidentiality will be provided to the fullest extent possible by law.

Questions about the research? If you have questions about the research or about your role in the study, please feel free to contact Dr. Joseph Baker by e-mail (bakerj@yorku.ca). This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any queries or complaints about the project, or the way you have been treated, you are of course, free to contact the Manager of the York University Research Ethics Department (Ms. Alison Collins-Mrakas, 309 York Lanes, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3, +1 416 736 5914, acollins@yorku.ca).

Legal Rights and Signatures:

I________________________________, consent to participate in *"Paralympic Talent Transfer Framework (PTTF)"* conducted by *(Dr. Joseph Baker, PhD-student Nima Dehghansai)*. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form.

Thank you for your participation in this project, we look forward to working with you.

Appendix E. Talent Transfer Athlete Interview Guide

Prior to commencement of interview process, discuss project objectives & introduce the principles of the framework re; talent transfer initiative to prepare them for the following questions.

Statements in italics are probe questions that interviewer can use to obtain more information relevant to the main question.

Section I: Introduction & Past Experience

1. Tell me about your early experiences in sport.
    a. *At what age did you start participating?*
    b. *In what sports?*
    c. *What type of setting (integrated, para, school, club etc.)?*
    d. *Were you classified? Nationally/internationally?*
    e. *What is your current classification?*
    f. *Were you reclassified at any point in your career?*

2. Aside from (current sport), what other sports did you play that had an impact on your career?

3. Tell me a little about your experience in (previous sport [transferred from]).
    a. *How long did you play for?*
    b. *How competitively?*
    c. *What is your overall outlook on your experience in this sport?*
    d. *How did your experience in past sport impact current sport?*

Section II: Transfer Transition

4. Why did you decide to transfer sports?

5. Looking back, how would you describe your experience during the transition period?
    a. *Were there any uncertainties?*
    b. *Was there anyone to support your decision?*
    c. *Socially, who influenced your decision?*
    d. *Sport-specific, what factors influenced your decision?*

6. Did you face any expected and unexpected challenges during the transitional period?
    a. *How did you deal with these challenges?*

7. Looking back, what were some of the benefits of transferring sports?

8. Was there a certain point where you felt that you ‘turned’ the corner and were comfortable in your new sport? Please describe this.

9. How long did it take to adjust to the demands of (new sport)?

10. What factors affected your adjustment to (new sport)?
    a. *What factors helped?*
    b. *What factors were obstacles to your adjustment?*

c. *Was there any person or persons who helped you adjust?*

11. If you had to go back, would you do anything differently?

Section III: General Transfer Perspective
(TO REDUCE REPITITION, AVOID ASKING QUESTIONS RESPONDED TO IN SECTION II)

12. In your opinion, what are some benefits to transferring sports?

13. What should an athlete consider prior to transferring?

14. Is there anything an athlete could do to better prepare for a transfer?

15. When do you think is a suitable time for an athlete to consider a transfer?
    a. *Reached their peak in their current sport*
    b. *Disadvantages in their current classification*
    c. *Lack of resources/coaches close to their residency*
    d. *Reduced motivation/ambition in current sport*
    e. *Competitive/loaded class*
    f. *Others?*

16. On average, how long do you think the athlete needs to transfer to the competition demands of the new sport?

Section IV: Closing Questions

17. In an ideal world with unlimited funding and access to resources, what does a successful talent transfer initiative look like?

    a. *Which organizations will be involved?*
    b. *What would each organizations' role be?*
    c. *What are the expectations of each organization?*
    d. *How would you determine the suitable sport for athletes?*
    e. *How would you support their transition?*

18. If you had one thing to say to your younger-self, what would that be?

We have reached the end of our interview, I really appreciate your time today.

19. Are there any additional comments, or anything we didn't cover that you'd like to talk about?

Final thank you and wrap-up

Appendix F. Talent Transfer Coach Interview Guide

Prior to commencement of interview process, discuss project objectives & introduce the principles of the framework re; talent transfer initiative to prepare them for the following questions.

Statements in italics are probe questions that interviewer can use to obtain more information relevant to the main question.

Section I: Introduction

20. Could you tell me a little bit about your experience in sport?
    a. *What's your current role?*
    b. *In what sport?*
    c. *Other roles that relate to your current job?*

Section II: Current Program

1. Where do you recruit most of your athletes from?
    a. *Rehabilitation centers, talent search days, transfer, schools, referrals, etc.*
    b. *What is the approximate ratio of athletes you actively seek out versus how many come to your sport on their own?*
    c. *Do you have dedicated budgets and staff towards athlete ID and recruitment?*

2. What are some challenges to current athlete recruitment practices in your program?

3. What are some solutions to these challenges? *Follow-up with:* What factors support the implementation of these solutions? What factors prevent implementation of these solutions?

4. Could you specify recruitment considerations that are vital for athlete's success in your sport?
    a. *Ability and classification*
    b. *Physiological*
    c. *Opportunity and their personal resources*
    d. *Personal support*
    e. *Current residing location*

5. How do you test for these factors during talent search days and what specific tests are used to obtain the necessary information to understand if an athlete has potential in your sport?
    a. *What else can complement the testing to help you gauge whether an athlete has potential in your sport?*

6. What are the sports (able-bodied or para) that athletes transfer from and seem to have the most consistent success in your sport?
    a. *Why? Physiological demands or tactical similarities, etc.*

7. Do you currently engage in any official/unofficial talent transfer initiatives, (*if no, how about in the past, are there plans to do so in the future)?*
    a. *How often do these occur?*
    b. *At what point do you consider the transfer a success (on a national program, competing internationally, medaling etc.)?*
    c. *How many athletes have you seen successfully transfer?*

i. *Why do you think the transfer was a success?*
ii. *What factors contribute to a successful transfer?*

d. *How many were unsuccessful?*
   i. *Why do you think the transfer wasn't a success?*
   ii. *What factors contribute to an unsuccessful transfer?*
e. *Are there any HP athletes in your current program from a transfer?*

8. Do you think an athlete can compete in two sports at the same time?
   a. *If so, what does that need to look like? (Different season sports, sports with different time commitments etc.)*
   b. *Are there any benefits to this?*
   c. *Are there any disadvantages to this?*

Section III: Talent Transfer

9. When do you think it is suitable timing for an athlete to transfer?
   a. *Reached their peak in their current sport*
   b. *Disadvantages in their current classification*
   c. *Lack of resources/coaches close to their residency*
   d. *Reduced motivation/ambition in current sport*
   e. *Competitive/loaded class*
   f. *Any other reason?*

10. In your opinion, what are the benefits for the recipient sport?

11. What are some benefits for the feeder (donor) sport?

12. As the donor sport, what are some challenges to participating in a talent transfer initiative?

13. As the recipient sport, what are some challenges to participating in a talent transfer initiative?

14. What would an ideal initiative look like?
    a. *Who do you think should be involved in establishing this initiative (CPC, NSOs, PSOs, OTP)?*
    b. *Once established, what would the role of each of these organizations be?*
       i. *Who is responsible for the program after it's established?*
       ii. *Who will facilitate communication between sports?*
       iii. *Who will host transfer camps and who should attend?*
       iv. *Who decides on selection and athlete transfer?*
    c. *What kind of testing would you incorporate into the talent search days (if this type of method is suggested)?*
    d. *What factors (e.g., physical, psychological) are you looking to test?*
    e. *How often would you want this type of initiative to take place?*
    f. *Should there be communication between organizations throughout the year?*
    g. *How can sports work better together to maximize opportunity for athletes across sports?*

15. How would you ensure a smooth transition into your sport for the athlete? What are some factors that might be important to consider?
    a. *Family support, residing location, available resources, cost of sport*

16. Are there factors to consider for the athletes "left behind" – those who may lose a teammate, training partner, mentor, etc.?

17. What are some challenges that athletes face upon transfer? *Follow up:* What are some things you can do to reduce these challenges?

18. What are some methods that can be used to assess an athlete's progress in his or her new sport?

19. Who should be in charge of the follow-up to track the athlete's progress?

20. Do you think there should be a method of compensation from the recipient sport to support the investment of resources towards athlete's development prior to transfer?
    a. *If yes, what would be the ideal compensation?*
    b. *Should there be incentive programs rewarding transfer sports?*
    c. *Would this come from CPC? OTP? Recipient sport?*

Section IV: Closing Questions

We have reached the end of our interview, I really appreciate your time today.

21. Are there any additional comments, or anything we didn't cover that you'd like to talk about?

Final thank you and wrap-up