Thirty years of longitudinal talent development research: A systematic review and meta-aggregation

Lawrence, Gavin; Dunn, Emily; Gottwald, Vicky; Oliver, Sam; Roberts, Ross; Hardy, James; Woodman, Tim

International Review of Sport and Exercise Psychology

DOI:
10.1080/1750984X.2024.2309623.

E-pub ahead of print: 22/02/2024

Peer reviewed version

This article was accepted in its current form for publication in *International Review of Sport and Exercise Science* on 16.01.2024.

Thirty years of longitudinal talent development research: A systematic review and meta-aggregation

Emily L. Dunn[1], Gavin P. Lawrence[1]*, Victoria M. Gottwald[1], James Hardy[1], Ben Holliss[3], Samuel J. Oliver[2], Ross Roberts[1], and Tim Woodman[1].

Institute for Psychology of Elite Performance, School of Human and Behavioural Sciences, Bangor University, UK[1], Institute for Applied Physiology, School of Human and Behavioural Sciences, Bangor University, UK[2], UK Sport, London, UK[3].

*Corresponding author, Dr Gavin Lawrence: g.p.lawrence@bangor.ac.uk ORCID 0000-0001-9232-6718

Institute for the Psychology of Elite Performance,

207 George Building

Holyhead Rd

Bangor

LL572PX

Wales, UK

Emily Dunn : emily.louise.dunn@bangor.ac.uk and 0000-0003-3644-1855

Victoria Gottwald v.m.gottwald@bangor.ac.uk and 0000-0002-0158-9721

James Hardy j.t.hardy@bangor.ac.uk and 0000-0001-5264-7672

Ben Holliss Ben.Holliss@eis2win.co.uk and 0000-0003-4828-3196

Samuel Oliver s.j.oliver@bangor.ac.uk and 0000-0002-9971-9546

Ross Roberts ross.roberts@bangor.ac.uk and 0000-0003-0268-1228

Tim Woodman t.woodman@bangor.ac.uk and 0000-0003-1834-463X

Acknowledgements

This research forms part of the Pathway2Podium project. The project is a 4-year funded collaboration between Bangor University, UK Sport, and the Economic and Social Research Council. The research aim is to enhance UK Sport's talent development pathway. Predictors of differences between higher and lower achieving athletes on the organisation's Performance Pathway were examined across a wide range of psychosocial and socio-cultural variables, life events and lifestyle, physical characteristics, training and practice conditions, and the coaching environment. The P2P project is led by Dr Gavin Lawrence, Prof. T Woodman, and Dr Ben Holliss.

Abstract

Talent pathways are longitudinal and multidimensional in nature offering developmental environments for athletes that incorporate multiple processes at multiple timepoints. Recent reviews have unilaterally targeted static talent areas (i.e., talent detection and identification). The present review aimed to identify quantitative and qualitative studies with longitudinal designs, within an elite athlete population, that considered development *and* selection literature collectively. Taking a novel pragmatic approach achieved pluralism in a strive to greatly advance our methodological understanding to acquire knowledge of more effective talent development in sport. The present review followed the Preferred Reporting Items for Systematic Review and used a Meta-aggregation methodology. A search of talent development and selection literature identified 41 quantitative and 3 qualitative longitudinal studies. Overall, ten (quantitative) studies investigated interactions between multidimensional selection (i.e., measures of performance) and development characteristics; performance variables changed non-linearly alongside talent development characteristics. No longitudinal mixed-method research studies were found. For practitioners, multiple performance measures need to be considered alongside development characteristics to better assess talent. For researchers, the design of the present review models an epistemological and ontological congruent approach that can be used to facilitate the design of future mixed-method and longitudinal research; capturing the dynamic and multifaceted individual differences of talent development.

Keywords: Longitudinal talent development, Expertise, High performance, Academy athletes

Introduction

Recent literature suggests the concept of talent can be multifaceted, multidimensional, and dynamic (Baker et al., 2019). The lack of a concrete definition of talent suggests talent

programs do not currently have optimal guidance for effective talent development (Baker, et al., 2017). To better operationalise and define talent, literature suggests four areas pertinent to talent pathway systems. *Talent detection* finds potential athletes suitable for consideration of talent programs. *Talent identification* formally invites athletes into talent programs. *Talent development* aims to provide an environment to accelerate athletes' potential. *Talent selection* measures athletes' performance during talent development in order to retain or transition athletes in or out of talent pathways (Reilly et al., 2000; Till & Baker, 2020).

A consideration of talent programs and talent research within distinct areas (e.g., detection, identification, development, & selection), allows for a clearer understanding of what is known and what limitations are currently present within existing literature (Williams et al., 2020). So far, talent detection, identification, development, and selection studies could be considered as any study that examines a (multidimensional) performance characteristic (Huijgen et al., 2014). Within the literature many studies have examined performance characteristics in silo (Johnston et al., 2018), likely due to practicality constraints associated with complex and time-consuming multidisciplinary longitudinal research designs when working in an elite sport environment (Farrow et al., 2018). This may explain why an examination of the relatively standalone and static processes involved in talent detection and identification have been popular in recent reviews (Baker et al., 2020; Faber et al., 2017; Gledhill et al., 2017; Johnston et al., 2018; Koopmann et al., 2020).

These reviews (Baker et al., 2020; Faber et al., 2017; Gledhill et al., 2017; Johnston et al., 2018; Koopmann et al., 2020) have led to an understanding that the literature contains an overrepresentation of talent identification studies that primarily examine physiological characteristics (Johnston et al., 2018; Koopmann et al., 2020; Murr et al., 2018) and employ cross-sectional designs in predominantly male samples. Adopting a cross-sectional design is likely popular because it also lends itself to the somewhat static nature of these talent processes.

That is, the identification of talent by measurement(s) over a relatively short time scale. However, several studies have adopted longitudinal or retrospective research methods (Cobley and Till, 2017; Johnston et al., 2017) that involve comparing an athlete's performance during adolescence with their eventual career outcomes. This research aims to identify early traits that may predict future career success. Here studies typically measure physiological maturity processes (Le Gall et al. ,2010;, Ostojic et al. 2014; Till et al., 2016) due to the strong relationships between physical performance metrics and one's maturation e.g., size, strength, power, and speed (Malina et al., 2004b; Till and Jones, 2015; Howard et al., 2016). As a result, talent identification and selection biases associated with physiological attributes have emerged. For example, age effects where relatively older athletes have increased selection opportunities (e.g Barnsley & Barnsley, 1985; Jones et al., 2017). However, despite maturation factors featuring heavily in talent identification processes (Till & Baker, 2020), they don't reliably predict career success (Le Gall et al. ,2010;, Ostojic et al. 2014; Till et al., 2016) with recent research indicating that future success is often linked to relatively later maturation (see Jones et al., 2017; Anderson et al., 2020).

In contrast, to talent identification, talent development and selection are longitudinal in nature. Research in this area could be considered as any study that examines a (multidimensional) characteristic that helps or hinders an athlete's development or progression (Gagné, 2004). More specifically, talent selection and development research could be considered as any study that measures a (multidimensional) characteristic for use as a determinant of performance (e.g., Huijgen et al., 2014) and ultimately talent enhancement (e.g., considering strategies to enhance the performance further [talent development] and/or status i.e., using the performance metric(s) to inform decisions around retaining or transitioning talent out of or up the pathway [talent

selection]). Research around talent development and selection has received relatively little attention in comparison to talent detection and identification (Till & Baker, 2020). Furthermore, despite the dynamic and multifaceted processes highlighted within talent development and selection, studies that have investigated these processes have employed cross-sectional designs and examined potential factors in silo. This approach has resulted in a dearth of longitudinal and multidimensional talent development and selection research (Rees et al., 2016; Burgess & Naughton, 2010).

Similarly, there remains a gap in the literature examining how talent development and talent selection interact over time (Williams et al., 2020). Moving in this research direction would advance knowledge by highlighting factors during the process of talent development that may impact upon talent selection. In addition, adopting a combined approach would help better understand the dynamic factors that impact selection during development; something currently not well understood and warranted to advance and unite the respective literatures (Baker et al, 2022; Dehghansai et al., 2022; Wrang et al., 2022). This combined approach is also important when one considers the processes within talent pathways/programmes. Here, the athlete's level of performance during development determines whether they are selected to continue to be developed or deselected out of the pathway/programme (Baker et al., 2018). Furthermore, the dearth of longitudinal designs means it is currently challenging for researchers to inform talent pathways/programmes, particularly when one considers that expertise is developed over many years and athletes do not follow linear trajectories (Gulbin et al., 2013; Ericsson et al., 1993). Investigating longitudinal multidisciplinary talent development research that includes environmental characteristics (e.g., coaching & practice structure), in conjunction with their respective impact on talent selection, will therefore greatly advance long-term athlete support during development; especially when considering individual differences (Phillips et al., 2010).

Additionally, recent research (Till & Baker, 2020) indicates that organisations should aim to develop a sports specific comprehensive performance model that provides a talent identification *and* development vision that incorporates evidence-based physical, psychological, technical, and technical objectives for different ages and stages of the sport (also see the concept of the 'mental model' by Richards et al., 2012; Tee et al., 2018). Creating such a performance model would require an intricate analysis of the sport's demands with the need for a focus on interactions between physical, psychological, technical, and tactical factors and would require deep understanding of the talent development and selection literature (Till & Baker, 2020). The aim of the present systematic review is to provide a deeper understanding of talent by considering longitudinal talent development *and* selection literature collectively. This novel approach will advance both the academic and practitioner understanding of effective talent development and selection in sport by helping inform comprehensive performance modelsTo our knowledge, no review has attempted to systematically review both quantitative and qualitative longitudinal research across more than one talent area (i.e., talent development & selection). With an overrepresentation of quantitative studies in the study of Talent (Johnson et al., 2018), strengths of capturing individual developmental journeys can be missed. Therefore, we applied a Pragmatic philosophy that afforded a mixed method approach (i.e., included and reviewed both quantitative and qualitative articles) to help enhance current understanding and future design of talent development literature; to highlight what is currently known and provide a methodological approach to reviews that facilities mixed-method designs. The specific rationale being that a Pragmatic approach may be better suited to understanding the dynamic characteristics that impact selection during development and perhaps advance and unite the respective quantitative and qualitative literatures (Baker et al, 2022; Dehghansai et al., 2022; Wrang et al., 2022). To address this gap in the knowledge, it is important to acknowledge where this systematic review's epistemology and ontology is derived to

understand the gravitas of what we believe is the first attempt to synthesise an epistemologically congruent systematic review in Talent research.

Essentially, epistemology is the theory of knowledge (e.g., Spark & Smith, 2014; Borge, 2015) and ontology is the existence of our reality (e.g., Lincon and Guba, 1985). Both epistemology and ontology are intrinsically linked because how researchers acquire is dictated by researchers' view of reality (i.e., 'there is one reality that can be fragmented and measured independently through prediction and control' versus 'there are multiple constructed realities that can only be measured holistically'; for an in-depth discussion of the nature of inquiry, see Lincon and Guba 1985). In light of this, researchers' epistemology and ontology dictate their choice of research method to acquire knowledge. For example, a researcher whom has adopted a quantitative method (e.g., an experimental laboratory design) aligns with an epistemology (e.g., positivism) that assumes knowledge can be acquired by objectively measuring an external reality (realism). In contrast, a researcher that adopts a qualitative research method aligns with an epistemology (e.g., constructivism) that assumes knowledge can be acquired by subjectively observing multiple realities (relativism).

Pragmatism however, is a paradigm that allows both quantitative and qualitative methods to be conducted because of a given flexibility in standpoint (Patton, 1990). In essence, a pragmatic paradigm assumes neither (e.g., positivist or constructivist) epistemological standpoint in a attempt for reconciliation. In doing so, a pragmatic viewpoint adopts a critical realist ontology; an ontology that assumes whilst truth can be objectively and externally measured, how we view truth, and thereby knowledge, is subjective and constructed by individuals (Sparke and Smith, 2014). With a pragmatic and critical realist ontology in mind, it was imperative to select a meta-aggregation methodology; a qualitative systematic review method underpinned in pragmatism that enables the synthesis of different epistemological studies that utilise qualitative research (e.g., ethnography, phemonology & constructivism).

To achieve a meta-aggregation, authors' original findings from included studies should not be re-interpretated as part of a systematic review synthesis; instead, studies are aggregated and categorised into an overarching finding (Lockwood et al., 2015); an overall finding must be supported by two or more findings. If authors' original findings from included studies were re-interpretated prior to categorisation, a constructivist or interpretivist epistemology would be adopted and thus call into question the epistemological continuity of the present systematic review. Moreover, due to the scope and variation in research designs and methods, a narrative analysis was deemed most appropriate ((Popay, et.al., 2006; Siddaway, Wood & Hedges, 2019).

Without a pragmatic approach, synthesising a review that is comprised of studies that utilised quantitative, qualitative and/or mixed-method research methods would be problematic because switch between epistemological standpoints (e.g., positivist and constructivist) could occur within the same review (Ryba, et al., 2022). Therefore, an apparent difficulty in synthesising a review that can remain firm within a congruent epistemology may perhaps explain why, to our knowledge, no one has attempted to conduct a systematic review that incorporates studies that have utilised both quantitative and qualitative research methods within the Talent domain.

Thus, the current review's epistemological and ontological standpoint (pragmatism & critical realism ontology) provides an approach that can happily marry quantitative and qualitative research method; a worthwhile attempt when considering a recent call for an advancement in mixed-method methodology to enhanced understanding of phenomena (Ryba et al., 2022). Therefore, the aim of this systematic review is twofold. One, to identify quantitative and qualitative longitudinal designs, within an elite athlete population, that investigated development *and* selection characteristics. Two, design a mixed-method review that adopts pluralism to facilitate future longitudinal, mixed-method research; a worthwhile step towards encouraging future mixed methods research in an attempt to more greatly advance

our understanding of effective talent development in sport. In doing so, we hope to encourage and direct future longitudinal and multidisciplinary talent research by providing greater understanding of the existing literature. Additionally, the observations within the reviews can help shape future research and applied work that aim to inform talent pathways/programmes by providing more effective long term athlete support during development, whilst simultaneously reducing the likelihood of talent being overlooked or missed within development programmes (Baker, et al., 2018; Johnston & Baker, 2020).

Methods

Meta-aggregation

It is important authors have congruence between the purpose of their review, method, and methodology of data extraction particularly when synthesising qualitative studies. Consequently, this has led to the evolution of over 30 different methods to synthesis qualitative research (Noyes et al., 2018). These methods may broadly fit into two categories of reviews, namely aggregative (descriptive) reviews and configuring (iterative) reviews (see Gough, 2013). Specific aggregative reviews such as meta-aggregation collate evidence to inform policy decision making (e.g., Munn et al., 2019). In contrast, configuring reviews tend to seek new knowledge through understanding and enlightenment (Gough, Thomas & Oliver, 2012). As such, since configuring (iterative) methods would be largely incongruent to included quantitative research, we did not consider inductive methods for synthesising qualitative research (e.g., meta-ethnography, Noblit & Hare, 1988; Barnett-Page & Thomas, 2009). Our choice of design was guided by the RETREAT guidance of Booth et al (2018) for choosing appropriate method and methodology. In doing so, we found adopting a pragmatic approach

(e.g. Morgan, 2007) through utilisation of a meta-aggregation the most appropriate for synthesising quantitative and qualitative studies collectively. In doing so, a pragmatic methodology and meta-aggregation method helps to achieve our second aim of the review: to achieve pluralism to help guide and facilitate future longitudinal and mixed-method research.

To our knowledge, the present design of systematic review is the first in sport and exercise science that achieves pluralism as it models an epistemological congruent approach to synthesis both quantitative and qualitative research collectively. Our design was appropriate to capture a broad research question of a complex and dynamic topic (i.e., what quantitative and qualitative studies, with longitudinal designs within an elite athlete population, exist that has considered development *and* selection literature collectively). Because of the heterogeneous nature of studies, it was most appropriate to conduct a narrative synthesis as part of the present systematic review (e.g., Popay et al., 2006).

Eligibility Criteria

To identify studies that measure performance and development characteristics within an elite athlete population, the inclusion criteria were derived from similar reviews published in elite talent development (Johnston et al., 2018; Baker, 2015; Rees et al., 2016). Specifically, the study needed to have a longitudinal panel design whereby the length of data collection was at least 12 months or longer whereby measurements were taken at least twice during this period (i.e., baseline and time point one); at least one group of athletes had trained or represented a minimum of a national level[1]; and studies had been through the peer review process and were

[1] The rationale for this criteria was to help direct the focus of the review to talent programmes that are striving to accelerate individuals towards the highest level of sporting performance (e.g., UK

written in English been published between January 1990 and January 2020. To avoid replicating the work of the previous reviews, we excluded studies with talent "identification" within their title or abstract. Studies were excluded if they had assessed the predictive validity of performance characteristics between higher or lower skill groups (e.g., Schorer et al, 2020). Assessing studies for at least a minimum two time points measured within a minimum 12-month duration attempted to capture a dynamic aspect within talent development (i.e., talent development and selection literature).

To secure a better understanding of potential characteristics impacting talent development and selection, it was important to define talent development and talent selection studies within the literature. We considered and included a talent development study that measured a change in a multidimensional (i.e., physiological, psychosocial & technical) characteristic that helps or hinders performance and/or development. For example, symptoms of burnout could be considered to negatively impact characteristics pertinent within talent development, such as performance goals and motivation (e.g., Daumiller et al., 2020; Bicalho et al., 2018). Therefore, a longitudinal study of burnout (that met the inclusion criteria) would have been categorised as a talent development study and included within the review (e.g., Isoard-Gautheu et al., 2015). In contrast, we categorised a talent selection study if it had measured a performance characteristic at multiple time points (e.g., tactical skill) during development (e.g., Kannekens et al, 2009a). We therefore categorised and excluded talent identification or detection studies which measured a single time point of performance. For example, a study may have assessed the predictive validity of a performance characteristic by

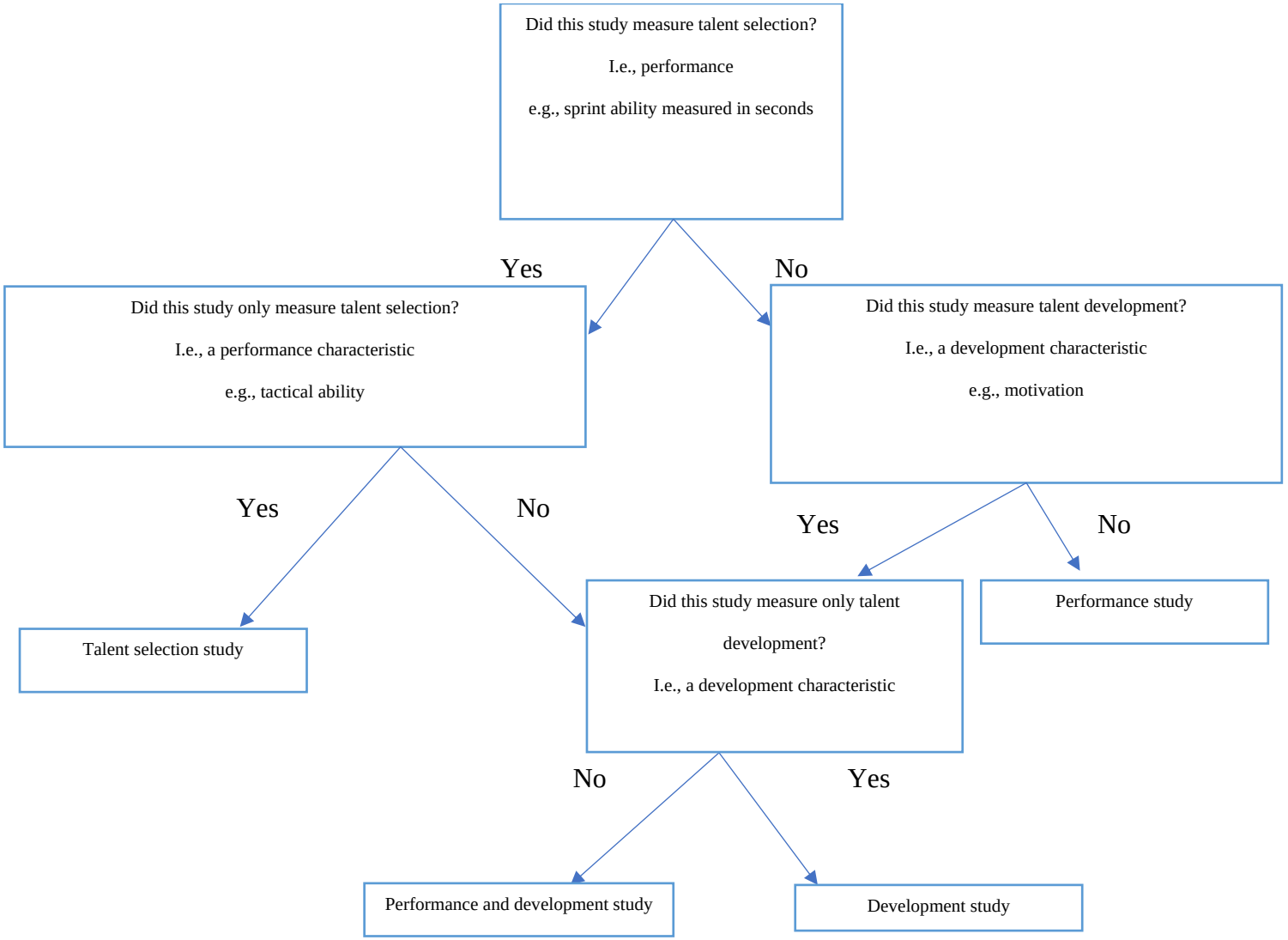
Sports World Class Programme). Here athletes are funded to train. The level of funding typically centres around competition achievement or rankings at national level or above.

observing adulthood selection into differentiating performance groups (e.g., Schorer et al., 2020; Höner et al., 2021). Based upon the above definitions, we categorised a talent development and selection study as those studies which measured both a development and performance characteristic, at multiple time points within the same study. One example is Elferink-Gemser et al (2006). They assessed changes in motivation and endurance performance. See Figure 1.

This article was accepted in its current form for publication in *International Review of Sport and Exercise Science* on 16.01.2024.

Figure 1

A Logic Diagram Depicturing the Process of Categorising Included Studies



This article was accepted in its current form for publication in *International Review of Sport and Exercise Science* on 16.01.2024.

Search Strategy

The following search terms were developed and grounded in a range of sources. Firstly, visual inspection of a talent development internet and library search returned the key words listed in Table 1 as being commonly used in talent development literature. Secondly, once key words had been identified, we inspected the reference lists and the search terms of previous talent development reviews (e.g., Johnston et al., 2018). Synonyms and closely related words were then added to the search strategy. Following this, the research team discussed and critiqued the search strategy and closely related words that were added. These words were collectively deemed important to answer the research question (i.e., what quantitative and qualitative studies, with longitudinal designs within an elite athlete population, exist that has considered development *and* selection literature collectively)? At the development of the search strategy, we chose not to include 'elite' as an individual search term to avoid inadvertently missing studies which investigated an elite population but had not termed them as 'elite'. Instead, we had broader terms (e.g., 'expertise') to highlight potential studies that could then be refined by our exclusion criteria (e.g., at least one group had participated at a national level) could then determine whether studies were to be included.

Table 1. Search strategy

Key word	Synonym / Closely related
Longitudinal design	NA
Talent	Expertise, Athlete
Development	Academy
Sport	NA

Search 1 and 2.

Due to time and restricted access, our search engines and limits ensured we used two electronic search platforms, Clarivate Web of Science, and Science Direct to search relevant databases in life science research (e.g., Medline & BIOSIS Citation Index™), and applied the following limits to the search: studies were journal articles published between January 1990 – January 2019; peer-reviewed; and published in English. We undertook the search of key terms in January 2019. Specifically, single line was used with the Boolean operator (AND). Therefore, the following search terms were entered manually into each database "Expertise AND Sport", "Talent AND Development AND Sport", "Longitudinal Design AND Academy Athletes", "Longitudinal Talent Development AND Sport", "Longitudinal Athlete Design", "Longitudinal Athlete Development". An updated search took place in August 2020. To ensure key articles were not missed, we performed a supplementary backward citation search whereby the reference list of each included study was scanned (Bethel et al., 2021). Due to time and practicality constraints, no later searches were performed following August 2020.

Study selection and data extraction

A flow diagram of the identification, screening, and inclusion of studies can be seen in Figure 2. Studies were first screened (using the inclusion criteria) by their title and abstracts. We read the full text if a study's eligibility could not be determined from reading the title or abstract alone. This screening process was completed by the first and second authors in the publications by-line. To help ensure a rigorous approach, 20% of potential articles were screened for inclusion by both authors. Where their authors respective choices to include or exclude were at odds, a discussion ensued and the authors screened the article together before agreeing on a final decision. All included studies were downloaded to a reference management tool (Mendeley Desktop, Elsevier, Netherlands) to facilitate full screening and data extraction processes. Automated tools were not applied and instead we used Microsoft excel (Microsoft,

USA) spreadsheet for data extraction. Data included authors, title, year of publication, study design, duration of study (months), sport, level of athlete (national or above), number of time points examined, main findings, statistical analysis, and conclusion[2]. Similarly to when determining a study's inclusion, duplicate data were extracted from a random subset of 20% of the included articles by the first and second authors in this publications by-line. The reporting of these data were then cross checked for parity. When discrepancies occurred, the researchers sat together and extracted the required data as a pair to help ensure accuracy.

In January 2019, a search was conducted on the Web of Science and Science Direct search databeases which collectively identified 13,194 citations in a single search. Following the removal of 48 duplicates, the two researchers scanned the title and abstract of 13,146 records. Of the scanned records, 42 studies met the inclusion criteria and 13,104 studies were excluded. To help find additional studies that had not been returned following our original search, we scanned the reference lists of the 42 included studies. This identified an additional 126 articles and resulted in a total of 168 full-text articles being assessed for eligibility. Of these, 42 (39 quantitative & 3 qualitative) met the inclusion criteria.

A second search of Web of Science and Science Direct was conducted in August 2020 covering the period between January 2019 – August 2020. This returned 5,228 citations with no duplications. The title and abstract of these 5,228 records were screened as above which resulted in 1 further study meeting the criteria for inclusion. Thus, a total of 43 studies (40 quantitative & 3 qualitative) were included in the review.

[2] The research data contained within the extraction file is available on request. Please contact the corresponding author.

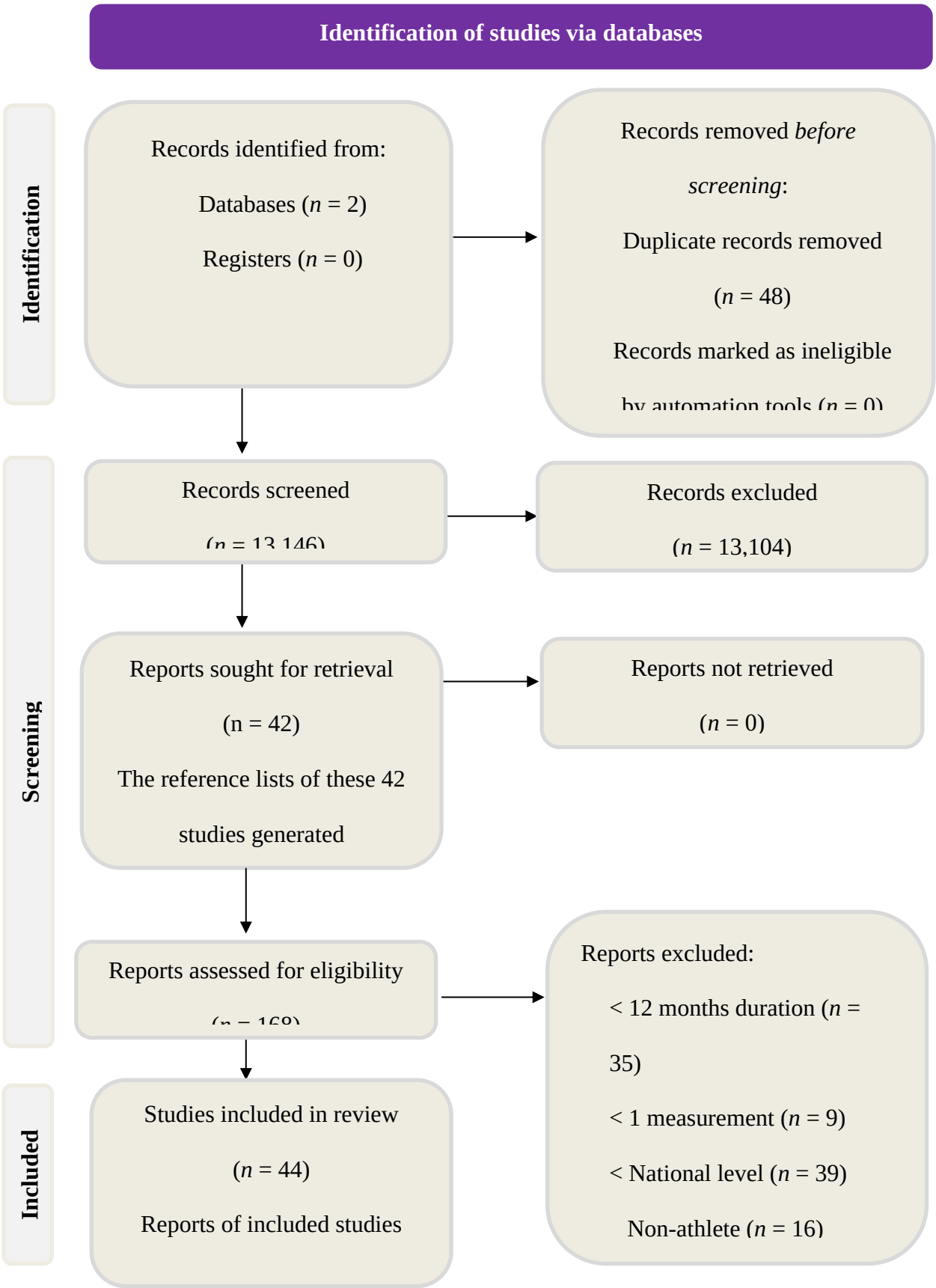
Quality Assessment

In line with JBI guidance, all included studies undertook a process of critique / appraisal prior to synthesis (Lockwood et al., 2015). In doing so, two JBI critical appraisal checklists were used to assess bias and methodological rigor in both quantitative and qualitative studies. Both checklists assessed methodological quality through the possibility of bias during the study's design, conduct and analysis. The checklists comprised 11 and 10 items, respectively. As anticipated, no included studies were withdrawn prior to the data synthesis due to a lack of methodological bias or rigour. Therefore, all included studies were still put forward for data synthesis. Specifically, a narrative synthesis was deemed most appropriate to synthesise quantitative studies and a meta-aggregation was deemed most appropriate to synthesise qualitative studies. As part of the meta-aggregative synthesis, we established the dependability and credibility of synthesised qualitative findings with CONqual (Lockwood et al., 2015).

We calculated a percentage quality score which assessed methodological rigor for each study and assigned an overall mean score to the talent selection, talent development and combined talent selection and development categories. According to Faber et al. (2016) and Sarmento et al. (2018), a $\leq$50% study has low methodological rigor, a 51% to 75% study has good methodological rigor, and a $\geq$75% study has excellent methodological rigor. The methodological rigor within talent selection studies ranged between good and excellent (56–88%); in talent development studies the methodological rigor ranged between low and high (44–100%); and talent selection and development studies the methodological rigor ranged between low and high (56–86%).

Results

Figure 2 *A PRISMA Flow Diagram (Page et al., 2020)*


Identification of studies via databases
Identification
Records identified from:
Databases (n = 2)
Registers (n = 0)
Records removed before screening:
Duplicate records removed (n = 48)
Records marked as ineligible by automation tools (n = 0)
Screening
Records screened
(n = 13,146)
Records excluded
(n = 13,104)
Reports sought for retrieval
(n = 42)
The reference lists of these 42 studies generated
Reports not retrieved
(n = 0)
Reports assessed for eligibility
(n = 168)
Reports excluded:
< 12 months duration (n = 35)
< 1 measurement (n = 9)
< National level (n = 39)
Non-athlete (n = 16)
Included
Studies included in review
(n = 44)
Reports of included studies

Descriptive Statistics

In total, 44 studies used either quantitative (*n*=41) or qualitative research methods (*n*=3). Across these research methods, studies measured either talent development characteristics (62%), talent selection characteristics (14%) or talent development and talent selection characteristics simultaneously (24%). Studies that measured talent development characteristics primarily examined a mixed sample of male and female athletes (61%), whilst studies that examined talent selection characteristics primarily examined a male only sample (83%). Those studies that examined talent development and talent selection characteristics primarily examined a male only sample (80%). When categorising studies by their year of publication into either <2000 (i.e., published between 1990–2000), <2005, <2010, <2015, <2020, the highest volume of included longitudinal studies were published in the last category (i.e., between 2016–2020).

Talent Selection Studies

In total, the methodological quality of 6 longitudinal talent selection studies were rated between good and excellent 56–88% (See Table 2). Studies involved only two sports (speed skating and soccer) with only one (in soccer) using multidimensional performance measures (see Figure 3). Studies found performance improved non-linearly with age (Clark et al., 2008; Kannekens et al., 2009; Keiner et al., 2014; Leyhr et al., 2018; Stoter et al., 2020; Wiersma et al., 2017). Specifically, jump performance increased in male soccer players between 9–12 years (Keiner et al., 2014), technical performance improved between U12-U15 (Leyhr et al., 2018), and tactical performance improved between 14–18 years (Kannekens et al., 2009). In male and female speed skaters, tactical performance improved later, between U17–U19 (Wiersma et al., 2017), and technical performance increased between 17–18 years (Stoter et al., 2020). In adulthood, anaerobic threshold increased between 25–28 years, whilst aerobic power remained stable in male soccer players (Clark et al., 2008).

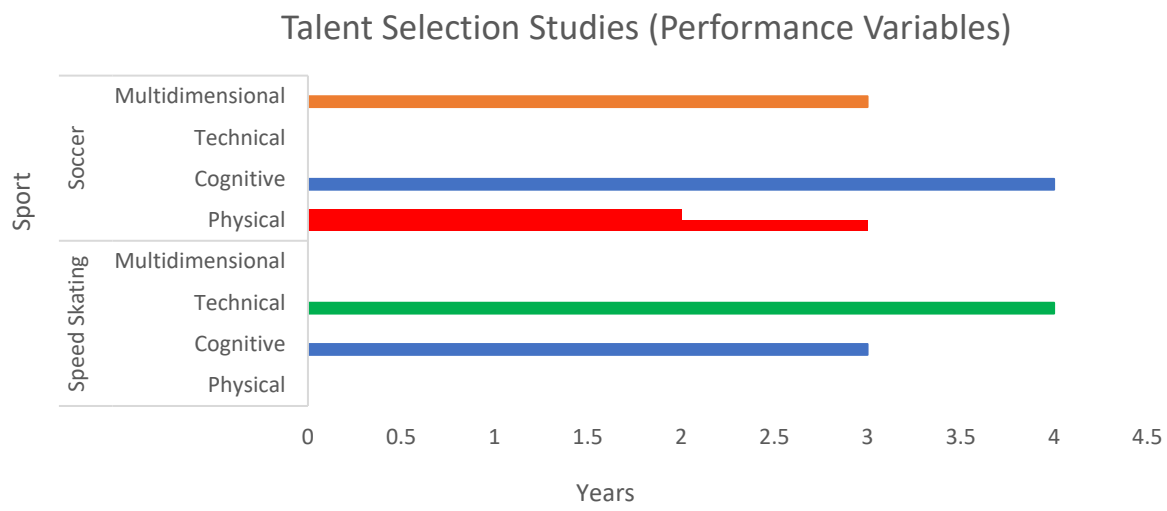


Figure 3. Talent seclection studies as a function of sport, perfromance variables, and longitudinal duration.

Table 2.

Included quantitative longitudinal talent selection studies.

Reference	Subcategory	Duration (months)	Characteristics	*N*	Sport	Sex	Quality score (%)
Clark et al., (2008)	Physical	36	Aerobic power and anaerobic threshold	42	Soccer	M	56
*Kannekens et al., (2009)	Cognitive	48	Tactical performance	191	Soccer	M	88
*Keiner et al., (2014)	Physical	24	Jump performance	70	Soccer	M	75
Leyhr et al., (2018)	Multi-dimensional	36	Motor and physical performance	1134	Soccer	M	63
Stoter et al., (2020)	Technical	48	Knee and push off angles during competition	123	Speed skating	M/F	70
Wiersma et al., (2017)	Cognitive	36	Tactical performance	104	Speed skating	M	75

* Indicates studies which investigated different aged athletes during the study (e.g., 14-18 years).

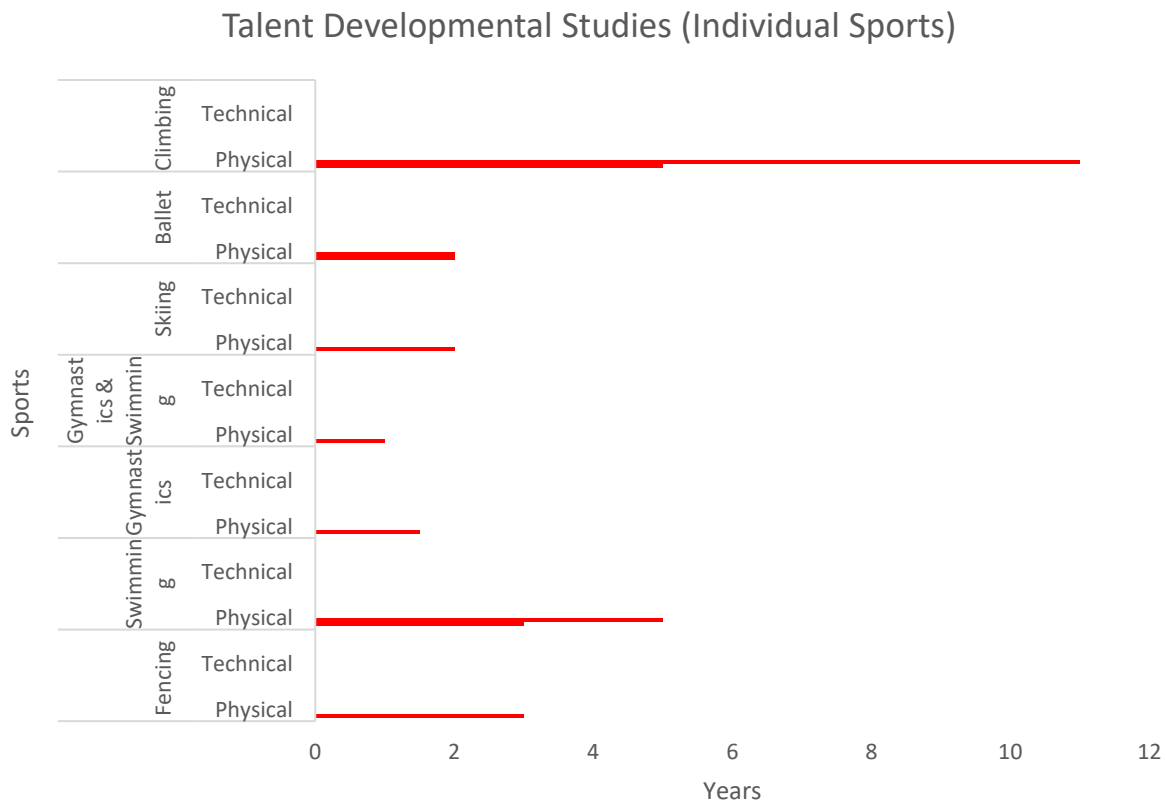
Talent Development Studies

The summary of the Talent Development studies can be seen in Tables 3 (quantitative) and 4 (qualitative). In total, we rated talent development studies' methodological quality between low (44%) and excellent (100%). Of 28 (n = 25 quantitative or n = 3 qualitative) longitudinal studies, 10 included individual sports and 18 team sports. Those focusing on individual sports included only physical metrics. Whereas the research on team sports included both physical and cognitive metrics. However, cognitive metrics were predominately featured in the sport of soccer (n = 4) with only one study outside of soccer (handball) measuring cognitive development (see Figure 4). 19 studies found anthropometric characteristics changed with age (e.g., Bilsborough et al., 2017). Specifically, between 16–18 years, cartilage thickness increased (Culvenor et al., 2017; Eckstein et al., 2014; Wirth et al., 2014) and ligament / tendons strengthened (Mersmann et al., 2017). Changes in abnormal patellar tendons were found alongside years of training and bone mineral density (Schöffl et al., 2007) which predicted injury in basketball (Giombini et al., 2013), soccer (Fredberg & Bolvig, 2002) and rugby (Georgeson et al., 2012). However, abnormal patellar tendons or training between 13–15 hours/week did not always predict overuse injury (Gisslén et al., 2007; Schöffl et al., 2018). Although male and female differences were found in the development of injuries (Cook et al., 2000; Habechian et al., 2018; Helenius et al., 2002). Whilst late maturing male and female athletes were at risk of overuse and frequent injuries (Kolt & Kirkby, 1999; Maïmoun et al., 2013; Van Der Sluis et al., 2015), late maturing athletes were not always at greater risk of injury across all sports (Rudavsky et al., 2018a), and abnormal tendons could reverse post peak growth (Rudavsky et al., 2018b).

When considering psychological characteristics, there were male and female differences found in the development of burnout signs with female athletes being at a potentially greater risk of developing signs of burnout (i.e., sport devaluation) between ages

14–19 years and emotional / physical exhaustion appeared to be attenuated by sport devaluation (Isoard-Gautheu et al., 2015). Despite male and female differences in signs of burnout, intrinsic motivation predicted deliberate practice in both male and female basketball and volleyball players (Vink et al., 2015). The longitudinal qualitative studies revealed a transitional period challenged athletes to balance life, education, and training in national development programmes. Both male and female athletes perceived balancing high education and transitioning into a talent program as challenging. Lifestyle support alongside, psychological characteristics in developing excellence (PCDE skills), and planning for retirement, may help overcome challenges (Devaney et al., 2018; MacNamara & Collins, 2010; Torregrosa et al., 2015).

In male athlete development, general cognition increased between 10–15 years and sport-specific cognition increased later between and 12–15 years (Beavan et al., 2020). Psychosocial characteristics changed between 13–17 years; level of stress, hope for success, self-optimisation, and self-concept decreased (Feichtinger & Höner, 2015), whilst recovery increased, and need satisfaction, quality of school life, and athletic identity remained stable (Rongen et al., 2020), along with self-determined motivation which decreased between U15–U17 (Hendry et al., 2019).


Talent Developmental Studies (Individual Sports)
Sports
Climbing
Technical
Physical
Ballet
Technical
Physical
Skiing
Technical
Physical
Gymnastics & Swimming
Technical
Physical
Gymnastics
Technical
Physical
Swimming
Technical
Physical
Fencing
Technical
Physical
0
2
4
6
8
10
12
Years

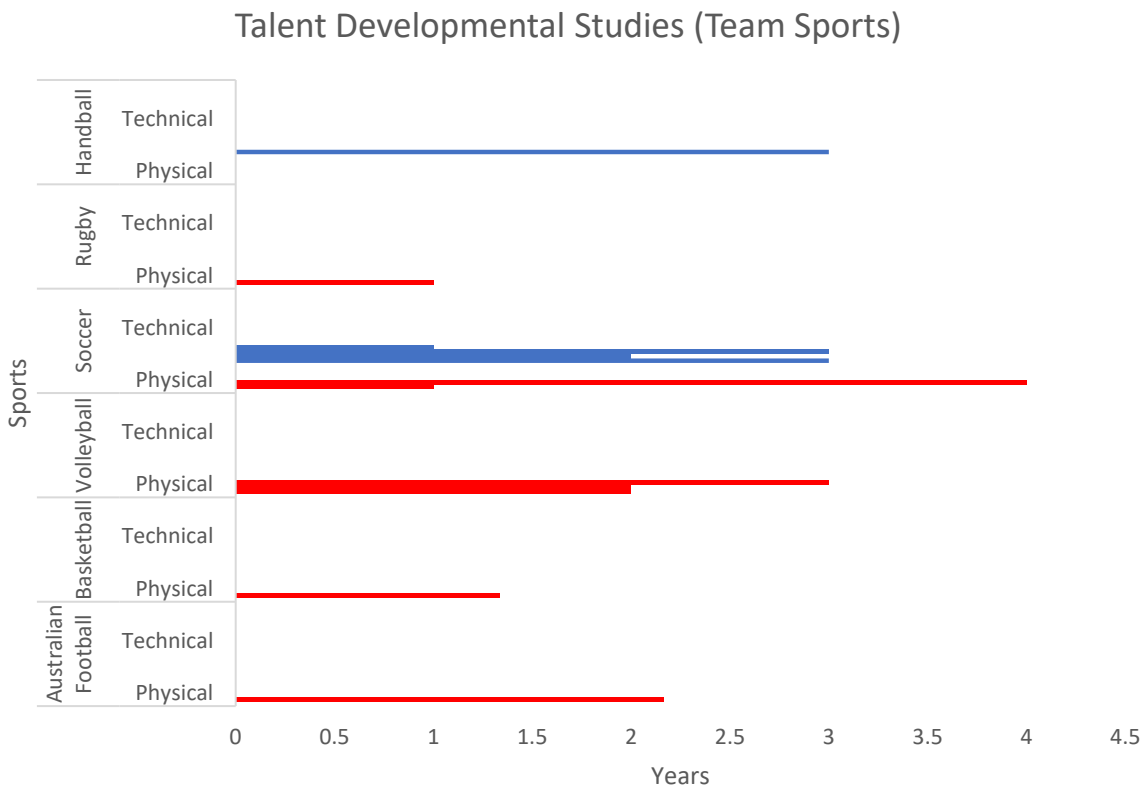


Figure 4. Talent development studies as a function of sport, perfromance variables, and longitudinal duration.

Table 3.

Included quantitative longitudinal talent development studies.

Reference	Subcategory	Duration (months)	Characteristics	*N*	Sport	Sex	Quality score (%)
*Beavan et al. (2020)	Cognitive	36	Cognitive development	304	Soccer	M	75
*Bilsborough et al. (2017)	Physical	26	Body composition	45	Australian football	M	83
*Cook et al. (2000)	Physical	16	Injury risk in patellar tendons in males	52	Basketball	M/F	86
Culvenor et al. (2017)	Physical	24	Cartilage development	40	Volleyball	M/F	71
Eckstein et al. (2014)	Physical	24	Cartilage development	40	Volleyball	M/F	71
Feichtinger and Höner (2015)	Cognitive	24	Training behaviours	151	Soccer	M	75
*Fredberg and Bolvig (2002)	Physical	12	Injury	54	Soccer	M	50
Georgeson et al. (2020)	Physical	12	Body composition and injury	37	Rugby	M	50

Giombini et al. (2013)	Physical	36	Injury	37	Fencing	M/F	57
*Gisslen et al. (2007)	Physical	36	Injury	22	Volleyball	M/F	63
Habechian et al. (2018)	Physical	36	Injury	31	Swimming	M/F	71
Helenius et al. (2002)	Physical	60	Airway inflammation	42	Swimming	M/F	56
*Hendry et al. (2019)	Cognitive	36	Self-determined motivation	63	Soccer	M	100
*Isoard-Gautheu et al. (2015)	Cognitive	36	Burnout	895	Handball	M/F	78
Kolt and Kirby (1999)	Physical	18	Injury	62	Gymnastics	F	100
Maimoun et al. (2013)	Physical	12	Bone density and biological maturation	72	Gymnastics and Swimming	F	90
Mersmann et al. (2017)	Physical	24	Tendon development	82	Skiing	M/F	90
Rongen et al. (2020)	Cognitive	12	Psychological characteristics	115	Soccer	M	86
*Rudavsky et al. (2018a)	Physical	24	Maturation and tendons	52	Ballet	M/F	44

*Rudavsky et al. (2018b)	Physical	24	Maturation and tendons	52	Ballet	M/F	56
Schöff et al. (2007)	Physical	60	Skill level, training, and osteoarthritic changes	40	Climbing	M/F	75
Schöff et al. (2018)	Physical	132	Range of motion and osteoarthritis changes	37	Climbing	M/F	78
Van der Sluis and Elferink-Gemser (2015)	Physical	48	Maturation and injury	120	Soccer	M	33
Vink et al. (2015)	Multi-dimensional	12	Deliberate practice and intrinsic motivation	163	Volleyball & Basketball	M/F	80

* Indicates studies which investigated different aged athletes during the study (e.g., 14-18 years).

Table 4.

A meta-aggregation of included qualitative studies. All findings were rated as unequivocal using CONqual.

Finding	Category	Synthesised finding
Athletes faced challenges when transitioning into an NDP.	Transitioning is a process for higher skilled athletes who are challenged to balance education with training in NDPs.	Higher skilled athletes are challenged to balance education with training in NDPs. Lifestyle support, PCDE skills, and planning for retirement, may help to overcome challenges.
Some athletes found it difficult to control emotions.		
Athletes can find it difficult to adapt and manage competing demands between education and NDPs.		
Players acknowledged the value of gaining clarity over what they want to become, when faced with tension created between uncertainty and identity negotiation.		
Athletes perceived transition to university as a process.		

Athletes used psychological characteristics in developing excellence (PCDEs) to overcome challenges.	
Players appreciated lifestyle support.	Lifestyle support alongside, PCDE skills, and planning for retirement may help to overcome challenges.
Athletes who could balance job/education with a NDP had a stronger sense of identity, perceived social support, had an active coping strategy and was able to plan for retirement.	

Included studies: MacNamara et al (2010); Torregrosa et al (2015); and Devaney et al (2018)

Talent Development and Selection

A summary of the Talent Development and selection studies can be seen in Table 5 and Figure 5. In total, the methodological quality of 10 studies were rated between good and excellent (56–86%). All Studies included multidimensional measures and physical, technical, and psychological performance improved non-linearly with age. For example, whilst physical, technical, and psychological performance improved with age (Elferink-Gemser et al., 2007; Güllich, et al., 2017; Hendry, et al., 2018; Huijgen, et al., 2010; Roescher et al., 2010), anthropometrics (Matthys et al., 2013), and training (Elferink-Gemser et al., 2006; Visscher & Lemmink, 2006), physical, technical and psychological performance remained stable in male soccer players between 12–14 years (Forsman et al., 2016) and reflection skills remained stable between 17–20 years in male basketball players (te Wierike et al., 2018).

Figure 5. Talent development and selection studies as a function of sport, perfromance variables, and longitudinal duration.

Table 5.

Included quantitative longitudinal talent selection and development studies.

Reference	Subcategory	Duration (months)	Characteristics	*N*	Sport	Sex	Quality score (%)
Elferink-Gemser et al (2006)	Multidimensional	36	Anthropometrics, motivation, and endurance capacity	217	Hockey	M/F	67
Elferink-Gemser et al (2007)	Multidimensional	24	Anthropometrics, psychological characteristics, physical, technical, and tactical performance	65	Hockey	M/F	86
*Forsman et al (2016)	Multidimensional	12	Psychological characteristics and physical, technical, and tactical performance	288	Soccer	M	57
Güllich et al (2017)	Multidimensional	24	Organised practice, non-organised play and coach rated player performance	44	Soccer	M	71
Hendry et al (2018)	Multidimensional	36	Coach rated performance and athlete perception of tactical, technical, physical skill	102	Soccer	M	86

Mattys et al (2013)	Multidimensional (Physical)	60	Anthropometrics, maturation, and physical performance	207	Soccer	M	75
Huijgen, et al (2010)	Multidimensional	36	Physical, technical, performance and years of soccer practice	53	Handball	M	63
*Roescher et al (2010)	Multidimensional	60	Intermittent endurance capacity, practice history and anthropometrics	130	Soccer	M	56
te Wierike et al (2018)	Multidimensional	48	Ball control and self-regulation	73	Basketball	M	67
Visscher & Limmink (2006)	Multidimensional	36	Intermittent endurance capacity and training volume	137	Soccer	M	67

Discussion

The present review highlighted that the past 30 years of talent research has primarily examined studies solely within silos (i.e., talent development or selection). Those studies that measured talent development and selection characteristics simultaneously suggested physical, psychological, and technical performance can increase non-linearly with age when measured alongside anthropometric, practice and training, and psychosocial characteristics. Examination of longitudinal talent development characteristics highlighted later maturing male athletes may be at risk of overuse injury around peak growth, female athletes may be at risk of burnout, and both male and female athletes may experience challenges when transitioning into a talent pathway. Examination of talent selection characteristics suggested performance characteristics increased with age. In line with previous talent reviews, different athlete populations were underrepresented particularly female athletes, athletes who identify as LGBTQ+, athletes with a disability, and/or athletes' race or ethnicity (Baker et al., 2020; Johnston et al., 2018; Koopmann et al., 2020). Studies have typically adopted quantitative research methods. Additionally, studies focusing on talent development (an environment to accelerate athletes' potential) within an individual sport only measured physical metrics. It is very clear that future research needs to longitudinally investigate talent development and talent selection characteristics simultaneously and when doing so include interactions between physical, psychological, technical, and tactical factors (e.g.,multidimensional performance, maturation, and injury incidence).

Maturation, development, and selection

Biological maturation can impact both talent development and selection (Towlson et al., 2021) because there is evidence to support a relative age effect, whereby early biologically

maturing athletes can have a physiological and cognitive advantage over late maturing athletes (e.g., Cumming et al., 2018). Recent evidence and commentary suggest the stage in biological maturation may account more when explaining observed superior displays of physical performance in adolescence (Towlson et al., 2021). Biological maturation may then partially explain why this review found sprint performance increased most rapidly between 14–16 years of age. It therefore may be pertinent for practitioners to take biological maturation into account during talent selection in adolescent development (Towlson et al., 2021), especially considering differences in physical performance may dissipate between approximately between ages 16–18 years (DiFiori et al., 2018).

Around peak growth, biological maturation may also increase the risk of overuse injury in some athletes. In the present review, talent development studies highlighted that later maturing male athletes may be at risk of over-use injury around peak growth (Van Der Sluis et al., 2015). Therefore, late maturing athletes who are currently completing the same training load as their age-matched early maturing athletes, may be undertaking more load at their joint and tendons; inadvertently increasing athletes' likelihood of injury and possible deselection. Injury risk factors in talent programs are currently not well understood, possibly due to differences in the type of injury e.g., traumatic or overuse injury (Kolokythas et al., 2021; Wik et al., 2020), together with differences in athlete population (e.g., females; Alahmad et al., 2020). Understanding sex differences and the potential role of biological maturation and psychosocial maturation is important given that over-use injuries can terminate athlete careers (Mueller et al., 2017). Talent programs need to take into consideration athletes' sex, stage of biological and psychosocial maturation when managing training load.

In comparison to biological maturation, fewer research articles have examined psychosocial maturation, particularly in sport. Better understanding of this relatively

unexplored talent development factor may further help to unpick the apparent individual differences in talent development and selection. For example, whilst logic reasoning can be developed by age 15 years, psychosocial maturity can continue to develop into adulthood (Steinberg, 2004) and may impact psychosocial characteristics important within elite sport, such as decision making (e.g., Miller et al., 2011). Furthermore, psychosocial maturation often occurs after biological maturation (Gluckman & Hanson, 2016) which may explain why tactical and technical performance improved later in adolescence in some sports (e.g., U17–U19, Wiersma et al., 2017). Indeed, individuals may be in their late 20s before being fully psychosocially mature (Icenogle et al., 2019). These later psychosocially maturing athletes may require a different practice environment to accelerate technical performance, given the role of self-regulation and psychosocial characteristics in skill development (Young & Starkes, 2006; Carvalho & Araújo, 2022). Therefore, psychosocial maturation appears to be a pertinent talent development characteristic for practitioners to consider because it is likely to impact on both what constitutes an effective development environment and talent selection.

When considering athletes can be either early, on-time, or late to biologically mature, it is likely that psychosocial maturation follows a similar pattern. Furthermore, athletes do not mature both physically and psychosocially at a linear rate (Malina et al., 2015). Therefore, athletes may find themselves being early to biologically mature, but late to mature psychosocially or vice versa. Indeed, this interplay between biological and psychosocial maturation may explain why physical, psychological and technical performance improved non-linearly with age (García-De-Alcaraz Serrano et al., 2015; Stoter et al., 2020; Wiersma et al., 2017). Perhaps a mismatch between biological and psychosocial maturation may explain why some late biologically maturing athletes have developed superior psychosocial characteristics (Baker et al., 2010; Gottwald et al., 2021) and survive talent pathways (Gibbs et al., 2012;

Jones et al., 2017), whilst others appear to be doubly disadvantaged (Rubajczyk et al., 2017) i.e., have matured late both biologically and psychosocially. Identifying psychosocially late athletes may be a strategy to reduce a current relative age bias within a talent pathway and help target interventions (Dixon et al., 2020), which may reduce the likelihood of talent wastage of those doubly disadvantaged athletes.

Future directions

The present review highlights both biological and psychosocial maturation as important factors within talent development and selection together with impacting the likelihood of athlete injury. Longitudinal research is needed to investigate interactions between maturation, injury, and performance as talent programs may currently be inadvertently nurturing early maturing athletes and disadvantaging later maturing athletes; contributing to a loss of talent in terms of individuals not being developed optimally with pathway systems (Guimarães et al., 2019; Torres-Unda et al., 2013). One strategy for talent programs and research to reduce the likelihood of talent loss is the use of develop pathways that use comprehensive sport specific performance models that provide an evidence-based talent identification *and* development vision (e.g., a model that incorporates evidence-based physical, psychological, technical, and technical objectives for different ages and stages of the sport). However, without detailed understanding of additional metrics associated with developing talent (e.g., cognitive, technical and tactical) the current research limits the level to which organisations to create environments that optimise talent development.

Longitudinal investigation of factors that enable progression in psychosocially delayed athletes is currently unexplored and could be important given the rise in research linking effective practice environments with psychosocial characteristics (Guadagnoli & Lee, 2004;

Güllich, 2014; Young et al., 2021). Perhaps then the microstructure of practice could be adjusted to better suit the stage of psychosocial development as an attempt to accelerate skill development and performance. A consideration of psychosocial maturity in talent development is essential to impact current sport specific talent pathways' structure. For example, it may perhaps be more beneficial for later psychosocially mature athletes to follow a zigzag pathway; one that allows athletes to move in and out of a talent program (Gulbin et al., 2013; Lascu et al., 2021). Adopting a zigzag philosophy may reduce the pressure to specialise early and in doing so reduce the risk of performance related anxiety, injury, burnout, and loss of athletic identity associated with deselection. Ultimately a zigzag approach may reduce the likelihood of talent loss. A shift in philosophy is likely be met with immediate criticism and challenges (e.g., funding and resource constraints). However, somewhat surprisingly, this review revealed that all previous research investigating talent development within an individual sport have done some from only a physical perspective. Additionally, the research that did incorporate talent development measures outside of physically based metrics are limited to the team sports of Soccer and Hockey. Thus, there is a need to conduct more research that incorporates multidimensional measures of talent development if sports are truly able to develop pathways that use comprehensive sport specific performance models designed to optimise talent development by provide an evidence-based talent identification *and* development vision.

Limitations

Firstly, due to practicality in conducting a focused and meaningful review, the exclusion of talent identification studies was necessary. However, this allowed for a practical and meaningful synthesis of longitudinal talent development and selection research. Secondly, the search of only academic journals may have limited the generation of studies. To mitigate a risk of studies being missed we took an approach in line with a previous systematic review that

searched the reference list of included studies (Johnston et al., 2018). The search of reference lists yielded 126 additional studies. Secondly, exclusion retrospective longitudinal designs is worth noting because these designs are often more practical within the talent development literature (Till et al., 2017; Valente-Dos-Santos et al., 2012). Thirdly, because our aim attempted to capture long-term talent development, acute changes in characteristics in a sporting season (i.e., changes that were measured over less than a 12 month period) may have been missed (e.g., Granados et al., 2008). However, one would expect any lasting changes to be captured over a longer repeated measurement period (e.g., studies lasting greater than 12 months) so it is unlikely that the observations of the excluded shorter time scale studies would have impacted on the synthesis within current review. Finally, including an elite athlete population as an inclusion criterion may have increased the risk of missing studies due to the differing standards in sports between nations (Bennett et al., 2019).

Conclusion

Little research in the past 30 years has simultaneously investigated both talent development and talent selection factors. The few studies that have, suggest physical, psychological, and technical performance increase non-linearly with age when measured alongside anthropometric, practice and training, and psychosocial characteristics. An interaction between biological maturation and psychosocial maturation may explain why performance increases non-linearly within development and provides a fruitful avenue for longitudinal talent programmes and research. To better understand non-linear talent development in sport, future research needs to longitudinally investigate the effect of simultaneous talent development and selection attributes on athlete progression within a talent pathway. For example, the longitudinal effect of biological and psychosocial maturation on athlete performance and progression. Simultaneous examination will provide a platform to

build upon by inviting future longitudinal research to investigate attributes that underpin talent development; this is vital to better cater for individual differences that may affect the rate of progression (e.g., psychosocial maturation). Ultimately, guiding future longitudinal research in this direction will enhance our understanding of talent development in sport and the current levels of talent loss, particularly within those individuals that are currently doubly disadvantaged. Additionally, the lack of female athlete cohorts together with qualitative research designs means the talent development literature contains another significant lacuna. This seems particularly important considering the individual differences in talent development observed both within and across sports; one cannot expect to achieve the same level of outcome when applying the research from predominantly male cohort studies when aiming to develop female athletes within talent programmes. Finally, for organisations to meet the call by talent experts (e.g., Richards et al., 2012; Tee et al., 2018; Till & Baker, 2020) to develop a sports specific comprehensive performance model that provides a talent identification *and* development vision (e.g., one that incorporates evidence-based physical, psychological, technical, and technical objectives for different ages and stages of the sport (also see the concept of the 'mental model' by), then considerably more research is required that incorporate multidimensional measures.

References

Alahmad, T. A., Kearney, P., & Cahalan, R. (2020). Injury in elite women's soccer: a systematic review. *The Physician and sportsmedicine, 48*(3), 259-265.

Baker, J., Cobley, S., Schorer, J., & Wattie, N. (2017). Talent identification and development in sport: An introduction. In J. Baker, S. Cobley, J. Schorer & N. Wattie (Eds) *The*

Routledge handbook of talent identification and development in sport. London: Routledge.

Baker, J., Johnston, K., & Wattie, N. (2022). Survival versus attraction advantages and talent selection in sport. *Sports Medicine – Open, 8*, article 17.

Baker, J., Schorer, J., & Cobley, S. (2010). Relative age effects. *Sportwissenschaft, 40*(1), 26-30.

Baker. J., Wattie, N., & Schorer, J. (2019). A proposed conceptualization of talent in sport: The first step in a long and winding road. *Psychology of Sport and Exercise, 43*, 27-33.

Baker, J., Wilson, S., Johnston, K., Koenigsberg, A., de Vegt, S. & Wattie, N. (2020). Talent research in sport 1990-2018: A scoping review. *Frontiers in Psychology: Performance Science*, *11*, 607710.

Beavan, A., Chin, V., Ryan, L. M., Spielmann, J., Mayer, J., Skorski, S., ... & Fransen, J. (2020). A longitudinal analysis of the executive functions in high-level soccer players. *Journal of Sport and Exercise Psychology*, *42*(5), 349-357.

Bennett, K. J., Vaeyens, R., & Fransen, J. (2019). Creating a framework for talent identification and development in emerging football nations. *Science and Medicine in Football*, *3*(1), 36-42.

Bethel, A. C., Rogers, M., & Abbott, R. (2021). Use of a search summary table to improve systematic review search methods, results, and efficiency. *Journal of the Medical Library Association: JMLA*, *109*(1), 97.

Bicalho, C. C. F., Costa, I. T. D., Noce, F., & Costa, V. T. D. (2020). Prevalence of burnout in soccer athletes of the under-20 category over a sports season. *Journal of Physical Education*, *31*.

Bilsborough, J. C., Kempton, T., Greenway, K., Cordy, J., & Coutts, A. J. (2017). Longitudinal changes and seasonal variation in body composition in professional Australian football players. *International journal of sports physiology and performance*, *12*(1), 10-17.

Borge, S. (2015). Epistemology and sport. *Routledge handbook of the philosophy of sport*, 115-130.

Burgess, D.J., & Naughton, G.A. (2010). Talent development in adolescent team sports: A review. *International Journal of Sports Physiology and Performance, 5*(1), 103–116.

Carvalho, A., & Araújo, D. (2022). Self-regulation of learning in sport practices: An ecological dynamics approach. *Asian Journal of Sport and Exercise Psychology*, *2*(1), 3-7.

Clark, N. A., Edwards, A. M., Morton, R. H., & Butterly, R. J. (2008). Season-to-season variations of physiological fitness within a squad of professional male soccer players. *Journal of sports science & medicine*, *7*(1), 157.

Cook, J. L., Khan, K. M., Kiss, Z. S., Purdam, C. R., & Griffiths, L. (2000). Prospective imaging study of asymptomatic patellar tendinopathy in elite junior basketball players. *Journal of Ultrasound in Medicine*, *19*(7), 473-479.

Culvenor, A. G., Wirth, W., Maschek, S., Boeth, H., Diederichs, G., Duda, G., & Eckstein, F. (2017). Longitudinal change in patellofemoral cartilage thickness, cartilage T2 relaxation times, and subchondral bone plate area in adolescent vs mature athletes. *European journal of radiology*, *92*, 24-29.

Cumming, S. P., Brown, D. J., Mitchell, S., Bunce, J., Hunt, D., Hedges, C., ... & Malina, R. M. (2018). Premier League academy soccer players' experiences of competing in a tournament bio-banded for biological maturation. *Journal of sports sciences*, *36*(7), 757-765.

Cumming, S. P., Lloyd, R. S., Oliver, J. L., Eisenmann, J. C., & Malina, R. M. (2017). Bio-banding in sport: applications to competition, talent identification, and strength and conditioning of youth athletes. *Strength & Conditioning Journal*, *39*(2), 34-47.

Daumiller, M., & Janke, S. (2020). Effects of performance goals and social norms on academic dishonesty in a test. *British Journal of Educational Psychology*, *90*(2), 537-559.

Dehghansai, N., Pinder, R., & Baker, J. (2022). Pathways in Paralympic sport: An in-depth analysis of athletes' developmental trajectories and training histories. *Adapted Physical Activity Quarterly*, *39*(1), 37-85.

Devaney, D. J., Nesti, M. S., Ronkainen, N. J., Littlewood, M., & Richardson, D. (2018). Athlete lifestyle support of elite youth cricketers: An ethnography of player concerns within a national talent development program. *Journal of applied sport psychology*, *30*(3), 300-320.

DiFiori JP, Güllich A, Brenner JS, Côté J, Hainline B, Ryan E, et al. The NBA and Youth Basketball: Recommendations for Promoting a Healthy and Positive Experience

Dixon, J. C., Horton, S., Chittle, L., & Baker, J. (Eds.). (2020). *Relative age effects in sport: international perspectives*. Routledge.

Eckstein, F., Boeth, H., Diederichs, G., Wirth, W., Hudelmaier, M., Cotofana, S., ... & Duda, G. (2014). Longitudinal change in femorotibial cartilage thickness and subchondral bone plate area in male and female adolescent vs. mature athletes. *Annals of Anatomy-Anatomischer Anzeiger*, *196*(2-3), 150-157.

Elferink-Gemser, M. T., Visscher, C., Lemmink, K. A., & Mulder, T. (2007). Multidimensional performance characteristics and standard of performance in talented youth field hockey players: A longitudinal study. *Journal of sports sciences*, *25*(4), 481-489.

Elferink-Gemser, M. T., Visscher, C., Van Duijn, M. A. J., & Lemmink, K. A. P. M. (2006). Development of the interval endurance capacity in elite and sub-elite youth field hockey players. *British journal of sports medicine*, *40*(4), 340-345.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological review*, *100*(3), 363.

Faber, I.R., Bustin, P.M.J., Oosterveld, F.G.J., Elferink-Gemser, M.T., & Nijhuis-Van der Sanden, M.W.G. (2016). Assessing personal talent determinants in young racquet sport players: a systematic review. *Journal of Sports Sciences*, *34*(5), 395-410.

Farrow, D., Reid, M., Buszard, T., & Stephanie Kovalchik, S. (2018). Charting the development of sport expertise: challenges and opportunities. *International Review of Sport and Exercise Psychology*, *11*(1), 238-257.

Feichtinger, P., & Höner, O. (2015). Talented football players' development of achievement motives, volitional components, and self-referential cognitions: A longitudinal study. *European journal of sport science*, *15*(8), 748-756.

Forsman, H., Gråstén, A., Blomqvist, M., Davids, K., Liukkonen, J., & Konttinen, N. (2016). Development of perceived competence, tactical skills, motivation, technical skills, and speed and agility in young soccer players. *Journal of sports sciences*, *34*(14), 1311-1318.

Fredberg, U., & Bolvig, L. (2002). Significance of ultrasonographically detected asymptomatic tendinosis in the patellar and achilles tendons of elite soccer players: a longitudinal study. *The American journal of sports medicine*, *30*(4), 488-491.

Gagné, F. (2004). Transforming gifts into talents: The DMGT as a developmental theory. *High Ability Studies*, *15*, 119-147.

García-de-Alcaraz, A., Ortega, E., & Palao, J. M. (2015). Effect of age group on male volleyball players' technical-tactical performance profile for the spike. *International Journal of Performance Analysis in Sport*, *15*(2), 668-686.

Georgeson, E. C., Weeks, B. K., McLellan, C., & Beck, B. R. (2012). Seasonal change in bone, muscle and fat in professional rugby league players and its relationship to injury: a cohort study. *BMJ open*, *2*(6), e001400.

Gibbs, B. G., Jarvis, J. A., & Dufur, M. J. (2012). The rise of the underdog? The relative age effect reversal among Canadian-born NHL hockey players: A reply to Nolan and Howell. *International Review for the Sociology of Sport*, *47*(5), 644-649.

Giombini, A., Dragoni, S., Di Cesare, A., Di Cesare, M., Del Buono, A., & Maffulli, N. (2013). Asymptomatic A chilles, patellar, and quadriceps tendinopathy: a longitudinal clinical and ultrasonographic study in elite fencers. *Scandinavian journal of medicine & science in sports*, *23*(3), 311-316.

Gisslén, K., Gyulai, C., Nordström, P., & Alfredson, H. (2007). Normal clinical and ultrasound findings indicate a low risk to sustain jumper's knee patellar tendinopathy: a longitudinal study on Swedish elite junior volleyball players. *British journal of sports medicine*, *41*(4), 253-258.

Gledhill, A., Harwood, C., & Forsdyke, D. (2017). Psychosocial factors associated with talent development in football: A systematic review. *Psychology of Sport and Exercise*, *31*, 93–112.

Gluckman, P. D., Buklijas, T., & Hanson, M. A. (2016). The developmental origins of health and disease (DOHaD) concept: past, present, and future. In *The epigenome and developmental origins of health and disease* (pp. 1-15). Academic Press.

Gottwald, V., Anderson, D., & Lawrence, G. (2021). Early promise versus late bloomers: a longitudinal and multidisciplinary analysis of relative age effects throughout an elite weightlifting pathway. *Journal of Expertise*, *4*(4), 335-364.

Gough, D., Thomas, J., & Oliver, S. (2012). Clarifying differences between review designs and methods. *Systematic reviews*, *1*(1), 1-9.

Granados, C., Izquierdo, M., Ibanez, J., Ruesta, M., & Gorostiaga, E. M. (2008). Effects of an entire season on physical fitness in elite female handball players. *Medicine & Science in Sports & Exercise*, *40*(2), 351-361.

Guadagnoli, M. A., & Lee, T. D. (2004). Challenge point: a framework for conceptualizing the effects of various practice conditions in motor learning. *Journal of motor behavior*, *36*(2), 212-224.

Guimarães, E., Baxter-Jones, A., Maia, J., Fonseca, P., Santos, A., Santos, E., ... & Janeira, M. A. (2019). The roles of growth, maturation, physical fitness, and technical skills on selection for a Portuguese under-14 years basketball team. *Sports*, *7*(3), 61.

Gulbin, J., Weissensteiner, J., Oldenziel, K., & Gagné, F. (2013). Patterns of performance development in elite athletes. *European journal of sport science*, *13*(6), 605-614.

Güllich, A. (2014). Many roads lead to Rome–developmental paths to Olympic gold in men's field hockey. *European journal of sport science*, *14*(8), 763-771.

Güllich, A., Kovar, P., Zart, S., & Reimann, A. (2017). Sport activities differentiating match-play improvement in elite youth footballers–a 2-year longitudinal study. *Journal of sports sciences*, *35*(3), 207-215.

Habechian, F. A., Van Malderen, K., Camargo, P. R., & Cools, A. M. (2018). Changes in shoulder girdle strength in 3 consecutive years in elite adolescent swimmers: a longitudinal cohort study. *Brazilian journal of physical therapy*, *22*(3), 238-247.

Hannes, K., Lockwood, C., & Pearson, A. (2010). A comparative analysis of three online appraisal instruments' ability to assess validity in qualitative research. *Qualitative health research*, *20*(12), 1736-1743.

Helenius, I., Rytilä, P., Sarna, S., Lumme, A., Helenius, M., Remes, V., & Haahtela, T. (2002). Effect of continuing or finishing high-level sports on airway inflammation, bronchial hyperresponsiveness, and asthma: a 5-year prospective follow-up study of 42 highly trained swimmers. *Journal of allergy and clinical immunology*, *109*(6), 962-968.

Hendry, D. T., Crocker, P. R., Williams, A. M., & Hodges, N. J. (2019). Tracking and comparing self-determined motivation in elite youth soccer: Influence of developmental activities, age, and skill. *Frontiers in Psychology*, *10*, 304.

Hendry, D. T., Williams, A. M., & Hodges, N. J. (2018). Coach ratings of skills and their relations to practice, play and successful transitions from youth-elite to adult-professional status in soccer. *Journal of Sports Sciences*, *36*(17), 2009-2017.

Höner, O., Murr, D., Larkin, P., Schreiner, R., & Leyhr, D. (2021). Nationwide subjective and objective assessments of potential talent predictors in elite youth soccer: An investigation of prognostic validity in a prospective study. *Frontiers in Sports and Active Living*, 115.

Huijgen, B.C.H., Elferink-Gemser, M.T., Lemmink, K.A.P.M., & Visscher, C. (2014). Multidimensional performance characteristics in selected and deselected talented soccer players. *European Journal of Sport Science, 14*(1), 2-10.

Huijgen, B. C., Elferink-Gemser, M. T., Post, W., & Visscher, C. (2010). Development of dribbling in talented youth soccer players aged 12–19 years: A longitudinal study. *Journal of sports sciences*, *28*(7), 689-698.

Icenogle, G., Steinberg, L., Duell, N., Chein, J., Chang, L., Chaudhary, N., ... & Bacchini, D. (2019). Adolescents' cognitive capacity reaches adult levels prior to their psychosocial maturity: Evidence for a "maturity gap" in a multinational, cross-sectional sample. *Law and human behavior*, *43*(1), 69.

Isoard-Gautheu, S., Guillet-Descas, E., Gaudreau, P., & Chanal, J. (2015). Development of burnout perceptions during adolescence among high-level athletes: A developmental and gendered perspective. *Journal of sport and exercise psychology*, *37*(4), 436-448.

Johnson, K., Wattie, N., Schorer, J., & Baker, J. (2018). Talent identification in sport: A systematic review. *Sports Medicine, 48,* 97-109.

Johnston, K.D., & Baker, J. (2020). Waste reduction strategies: Factors affecting talent wastage and the efficacy of talent selection in sport. *Frontiers in Psychology: Movement Science and Sport Psychology, 10,* 2925.

Jones, B. D., Lawrence, G. P., & Hardy, L. (2018). New evidence of relative age effects in "super-elite" sportsmen: a case for the survival and evolution of the fittest. *Journal of sports sciences*, *36*(6), 697-703.

Kannekens, R., Elferink-Gemser, M. T., Post, W. J., & Visscher, C. (2009). Self-assessed tactical skills in elite youth soccer players: a longitudinal study. *Perceptual and Motor Skills*, *109*(2), 459-472.

Keiner, M., Sander, A., Wirth, K., & Schmidtbleicher, D. (2014). The impact of 2 years of additional athletic training on the jump performance of young athletes. *Science & Sports*, *29*(4), e39-e46.

Kolokythas, N., Metsios, G. S., Dinas, P. C., Galloway, S. M., Allen, N., & Wyon, M. A. (2021). Growth, maturation, and overuse injuries in dance and aesthetic sports: a systematic review. *Research in Dance Education*, 1-23.

Kolt, G. S., & Kirkby, R. J. (1999). Epidemiology of injury in elite and subelite female gymnasts: a comparison of retrospective and prospective findings. *British journal of sports medicine*, *33*(5), 312-318.

Koopmann, T., Faber, I., Baker, J., & Schorer, J. (2020). Assessing technical skills in talented youth athletes – A systematic review. *Sports Medicine, 50*, 1593-1611.

Lascu, A., Spratford, W., Pyne, D. B., & Etxebarria, N. (2021). Talent development in women's cricket: Perceptions and practices of elite players and coaches. *International Journal of Sports Science & Coaching*, *16*(4), 900-912.

Lockwood, C., Munn, Z., & Porritt, K. (2015). Qualitative research synthesis: methodological guidance for systematic reviewers utilizing meta-aggregation. *JBI Evidence Implementation*, *13*(3), 179-187.

Leyhr, D., Kelava, A., Raabe, J., & Höner, O. (2018). Longitudinal motor performance development in early adolescence and its relationship to adult success: An 8-year prospective study of highly talented soccer players. *PloS one*, *13*(5), e0196324.

MacNamara, Á., & Collins, D. (2010). The role of psychological characteristics in managing the transition to university. *Psychology of sport and exercise*, *11*(5), 353-362.

Maïmoun, L., Coste, O., Mura, T., Philibert, P., Galtier, F., Mariano-Goulart, D., ... & Sultan, C. (2013). Specific bone mass acquisition in elite female athletes. *The Journal of Clinical Endocrinology & Metabolism*, *98*(7), 2844-2853.

Malina, R. M., Rogol, A. D., Cumming, S. P., e Silva, M. J. C., & Figueiredo, A. J. (2015). Biological maturation of youth athletes: assessment and implications. *British journal of sports medicine, 49*(13), 852-859.

Matthys, S. P., Vaeyens, R., Fransen, J., Deprez, D., Pion, J., Vandendriessche, J., ... & Philippaerts, R. (2013). A longitudinal study of multidimensional performance

characteristics related to physical capacities in youth handball. *Journal of sports sciences*, *31*(3), 325-334.

Mersmann, F., Bohm, S., Schroll, A., Boeth, H., Duda, G. N., & Arampatzis, A. (2017). Muscle and tendon adaptation in adolescent athletes: a longitudinal study. *Scandinavian journal of medicine & science in sports*, *27*(1), 75-82.

Miller, G. E., Chen, E., & Parker, K. J. (2011). Psychological stress in childhood and susceptibility to the chronic diseases of aging: moving toward a model of behavioral and biological mechanisms. *Psychological bulletin*, *137*(6), 959.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews*, *4*(1), 1-9.

Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., ... & Mu, P. F. (2020). JBI Manual for Evidence Synthesis. JBI.

Mueller L, Hildebrandt C, Mueller E, Oberhoffer R, Raschner C. Injuries and illnesses in a cohort of elite youth alpine ski racers and the influence of biological maturity and relative age: a two-season prospective study

Murr, D., Feichtinger, P., Larkin, P., O'Connor, D., & Höner, O. (2018). Psychological talent predictors in youth soccer: A systematic review of the prognostic relevance of psychomotor, perceptual-cognitive and personality-related factors. *PLoS ONE 13*(10):

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021)a. Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. *Journal of clinical epidemiology*, *134*, 103-112.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021)b. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, *88*, 105906.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). Expert performance in sport and the dynamics of talent development. *Sports medicine*, *40*, 271-283.

Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M., ... & Duffy, S. (2006). Guidance on the conduct of narrative synthesis in systematic reviews. *A product from the ESRC methods programme Version*, *1*(1), b92.

Rees, T., Hardy, L., Güllich, A., Abernethy, B., Côté, J., Woodman, T., Montgomery, H., Laing, S., & Warr, C. (2016). The Great British Medalists Project: A Review of Current Knowledge on the Development of the World's Best Sporting Talent. *Sports Medicine*, *46*, 1041–1058.

Reilly, T., Williams, A.M., Nevill, A., & Franks, A. (2000). A multidisciplinary approach to talent identification in soccer. *Journal of Sports Science,18*, 695–702.

Roescher, C. R., Elferink-Gemser, M. T., Huijgen, B. C. H., & Visscher, C. (2010). Soccer endurance development in professionals. *International journal of sports medicine*, *31*(03), 174-179.

Rongen, F., McKenna, J., Cobley, S., Tee, J. C., & Till, K. (2020). Psychosocial outcomes associated with soccer academy involvement: Longitudinal comparisons against aged matched school pupils. *Journal of Sports Sciences*, *38*(11-12), 1387-1398.

Rubajczyk, K., Świerzko, K., & Rokita, A. (2017). Doubly disadvantaged? The relative age effect in Poland's basketball players. *Journal of Sports Science and Medicine, 16*(2), 280-285.

Rudavsky, A., Cook, J., & Docking, S. (2018)a. Quantifying proximal patellar tendon changes during adolescence in elite ballet dancers, a 2-year study. *Scandinavian Journal of Medicine & Science in Sports*, *28*(11), 2369-2374.

Rudavsky, A., Cook, J. L., & Docking, S. (2018)b. Proximal patellar tendon pathology can develop during adolescence in young ballet dancers—A 2-year longitudinal study. *Scandinavian Journal of Medicine & Science in Sports*, *28*(9), 2035-2041.

Sarmento, H., Anguera, M. T., Pereira, A., & Araújo, D. (2018). Talent identification and development in male football: A systematic review. *Sports medicine*, *48*, 907-931.

Schöffl, V. R., Hochholzer, T., Imhoff, A. B., & Schöffl, I. (2007). Radiographic adaptations to the stress of high-level rock climbing in junior athletes: a 5-year longitudinal study of the German Junior National Team and a group of recreational climbers. *The American journal of sports medicine*, *35*(1), 86-92.

Schöffl, V. R., Hoffmann, P. M., Imhoff, A., Küpper, T., Schöffl, I., Hochholzer, T., & Hinterwimmer, S. (2018). Long-term radiographic adaptations to stress of high-level and recreational rock climbing in former adolescent athletes: an 11-year prospective longitudinal study. *Orthopaedic journal of sports medicine*, *6*(9), 2325967118792847.

Schorer, J., Faber, I., Koopmann, T., Büsch, D., & Baker, J. (2020). Predictive value of coaches' early technical and tactical notational analyses on long-term success of female handball players. *Journal of sports sciences*, *38*(19), 2208-2214.

Shamseer, L., Moher, D., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... & Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *British Medical Journal*, *349*.

Siddaway, A. P., Wood, A. M., & Hedges, L. V. (2019). How to do a systematic review: a best practice guide for conducting and reporting narrative reviews, meta-analyses, and meta-syntheses. *Annual review of psychology*, *70*, 747-770.

Sparkes, A. C., & Smith, B. (2013). *Qualitative research methods in sport, exercise and health: From process to product*. Routledge.

Steinberg, L., Chung, H. L., & Little, M. (2004). Reentry of young offenders from the justice system: A developmental perspective. *Youth violence and juvenile justice*, *2*(1), 21-38.

Stoter, I. K., Hettinga, F. J., Otten, E., Visscher, C., & Elferink-Gemser, M. T. (2020). Changes in technique throughout a 1500-m speed skating time-trial in junior elite athletes: Differences between sexes, performance levels and competitive seasons. *Plos one*, *15*(8), e0237331.

te Wierike, S. C. M., Huijgen, B. C. H., Jonker, L., Elferink-Gemser, M. T., & Visscher, C. (2018). The importance and development of ball control and (self-reported) self-regulatory skills in basketball players for different positions. *Journal of sports sciences*, *36*(6), 710-716.

Till, K. & Baker, J. (2020). Challenges and [possible] solutions to optimising talent identification and development in sport. *Frontiers in Psychology: Performance Science, 15*, 664.

Till, K., Morley, D., O'Hara, J., Jones, B. L., Chapman, C., Beggs, C. B., ... & Cobley, S. (2017). A retrospective longitudinal analysis of anthropometric and physical qualities that associate with adult career attainment in junior rugby league players. *Journal of science and medicine in sport*, *20*(11), 1029-1033.

Torregrosa, M., Ramis, Y., Pallarés, S., Azócar, F., & Selva, C. (2015). Olympic athletes back to retirement: A qualitative longitudinal study. *Psychology of sport and exercise*, *21*, 50-56.

Torres-Unda, J., Zarrazquin, I., Gil, J., Ruiz, F., Irazusta, A., Kortajarena, M., ... & Irazusta, J. (2013). Anthropometric, physiological and maturational characteristics in selected elite and non-elite male adolescent basketball players. *Journal of sports sciences*, *31*(2), 196-203.

Towlson, C., Salter, J., Ade, J. D., Enright, K., Harper, L. D., Page, R. M., & Malone, J. J. (2021). Maturity-associated considerations for training load, injury risk, and physical performance in youth soccer: One size does not fit all. *Journal of Sport and Health Science*, *10*(4), 403-412.

Valente-dos-Santos, J., Coelho-e-Silva, M. J., Simões, F., Figueiredo, A. J., Leite, N., Elferink-Gemser, M. T., ... & Sherar, L. (2012). Modeling developmental changes in functional capacities and soccer-specific skills in male players aged 11-17 years. *Pediatric exercise science*, *24*(4), 603-621.

Van der Sluis, A., Elferink-Gemser, M. T., Brink, M. S., & Visscher, C. (2015). Importance of peak height velocity timing in terms of injuries in talented soccer players. *International journal of sports medicine*, *36*(04), 327-332.

Vink, K., Raudsepp, L., & Kais, K. (2015). Intrinsic motivation and individual deliberate practice are reciprocally related: Evidence from a longitudinal study of adolescent team sport athletes. *Psychology of sport and Exercise*, *16*, 1-6.

Visscher, C., Elferink-Gemser, M. T., & Lemmink, K. A. P. M. (2006). Interval endurance capacity of talented youth soccer players. *Perceptual and motor skills*, *102*(1), 81-86.

Wiersma, R., Stoter, I. K., Visscher, C., Hettinga, F. J., & Elferink-Gemser, M. T. (2017). Development of 1500-m pacing behavior in junior speed skaters: a longitudinal

study. *International Journal of Sports Physiology and Performance, 12*(9), 1224-1231.

Wik, E. H., Martínez-Silván, D., Farooq, A., Cardinale, M., Johnson, A., & Bahr, R. (2020). Skeletal maturation and growth rates are related to bone and growth plate injuries in adolescent athletics. *Scandinavian journal of medicine & science in sports, 30*(5), 894-903.

Williams, A.M., Ford, P.R., & Drust, B. (2020) Talent identification and development in soccer since the millennium, *Journal of Sports Sciences, 38*(11-12), 1199-1210.

Wrang, C.M., Rossing, N.N., Agergaard S., & Martin, L.J. (2022). The missing children: a systematic scoping review on talent identification and selection in football (soccer), *European Journal for Sport and Society, 19*(2), 135-150.

Young, B. W., Eccles, D. W., Williams, A. M., & Baker, J. (2021). K. Anders Ericsson, deliberate practice, and sport: Contributions, collaborations, and controversies. *Journal of Expertise, 4*(2), 169-189.

Young, B. W., & Starkes, J. L. (2006). Measuring outcomes of swimmers' non-regulation during practice: Relationships between self-report, coaches' judgments, and video-observation. *International Journal of Sports Science & Coaching, 1*(2), 131-148.