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Talent development programmes: a retrospective analysis of the age and support services for talented athletes in 15 nations

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ABSTRACT

Research question: Due to increasing competition, national governing bodies (NGBs) are put under pressure to deliver collective success and develop talent programmes for their athletes at an increasingly young age. This paper seeks to make a contribution to the talent development literature from an organisational perspective. It addresses the following research question: How and at what age have athletes received support services as upcoming talent from their sport clubs and NGBs?

Research methods: A total of 2041 elite athletes from 15 nations and 37 different sports were surveyed. Analysis of variance (ANCOVA and MANCOVA) was used to examine the data and identify differences between sports, countries and athletes' sporting achievement levels.

Results and findings: The data revealed that athletes received club or NGB support at a relatively late age. This differed by gender, by sport and between sports in which athletes specialise at younger or older ages. Athletes with higher achievement levels (e.g. in the world's top eight) were slightly younger when they received support services compared with lower level athletes (e.g. national level); however, effect sizes are small. Most elite athletes received a variety of support services and only slight differences were found according to athletes' achievement levels.

Implications: The relevance of these findings relates to the role that sports clubs (can) play in the total development of an athletic career. This paper has practical implications for the management of talent development by NGBs and clubs, national sport associations and for coach education.

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Talent development; elite sport policies; athlete development pathways; sport clubs; high-performance management

Introduction

Elite sport development is marked by increasing competition among countries with growing institutionalisation and government involvement (Houlihan & Green, 2008), with an increasing belief that 'elite sport success is developable: it can be produced by proactive resourcing and the strategic management of national sport associations in an elite sports system' (De Bosscher, Shibli, Westerbeek, & van Bottenburg, 2015,

p. 37). In this global sporting arms race (Oakley & Green, 2001), national governing bodies (NGBs) are put under increasing pressure to deliver collective success and implement elite athlete development programmes that optimise athlete recruitment, retention and advancement at an increasingly younger age (Cooke, Cobley, Till, & Wattie, 2010; Green, 2005). Research has shown that compared with the early 2000s, athletes start younger in their chosen sport and the total duration of their career lasts longer (van Bottenburg, 2009); they train for more hours per week and an increasing number of national and international championships are including ever younger age categories (Güllich & Emrich, 2006; Jonker, Elferink-Gemser, & Visscher, 2009).

Consequently, the programmes and policies around talent identification (TID) and development are characterised by elitism, early selection of young talent and early specialisation in only one sports discipline (Côté, Lidor, & Hackfort, 2009). NGBs have attempted to accelerate youngsters' performance through provision of supposedly more optimal training, improved training conditions and environments (e.g. Cobley, 2015), often these are at younger ages (Allen, Vandenberg, & Hopkins, 2015). This approach has been debated in research on talent development, because of the danger of specialising too early, the lack of reliable TID methods, the risk of overtraining, and because athletes are often required to be away from home to train in a centralised institute and as a result many young talented athletes drop out before they have reached their full potential (Güllich & Emrich, 2014; Martindale, Collins, & Abraham, 2007; Vaeyens, Güllich, Warr, & Philippaerts, 2009). While a considerable body of literature at a micro (individual) level exists, there is a scarcity of research in sports management that analyses the implications at an organisational (meso) level, where NGBs aim for national collective success through earlier interventions and selection into coordinated training programmes. In particular, there is lack of empirical research regarding the age at which training support should start for talented athletes and what support services NGBs should offer in order to develop athletic pathways that capitalise on the identification of the most talented, retain them, and assist them to obtain the required skills to achieve high standards (Sotiriadou, Shilbury, & Quick, 2008).

This paper seeks to make a contribution to the talent development literature from an organisational perspective. In particular, we examine retrospectively at what ages top-level athletes from 15 different nations have received special attention and support services as an upcoming talent from their sports clubs and NGBs, what services they have received and how they perceive these services.¹ Furthermore, this paper explores the extent to which more successful athletes have experienced better NGBs' support services compared to less successful athletes. This paper addresses the following research question: How and at what age have athletes received support services as upcoming talent from their sport clubs and NGBs? These data, recorded at an individual athlete level, suggest implications for the organisational level. The analyses and discussion affords deeper insight into the role that sports clubs and NGBs have played in developing talented athletes and may assist policymakers and high-performance directors in decision-making on the ages for nationally coordinated talent support programmes and the development of their long-term policy plans.

Talent development literature: Concepts of deliberate practice and play

The discussion regarding the age for support programmes during talent development relates to two paradigms within talent development research that attempt to define the prerequisites for athletic excellence at an individual level (Baker & Horton, 2004; Henriksen, Stambulova, & Roessler, 2010). The first advocates early specialisation and deliberate practice. Developed by Ericsson, it is based on the idea that expertise in any domain is tied explicitly with the amount and type of training or practice performed in that domain. Specifically, this concept suggests that 10 years or 10,000 hours of deliberate practice are required to reach an expert status in one's domain (Ericsson, 2003). Studies in sports such as field hockey, soccer, figure skating, martial arts, middle distance running and wrestling have shown that elite athletes can be consistently distinguished from non-elite athletes based on accumulated deliberate practice (Côté & Fraser-Thomas, 2007). Consequently, future experts in early peak performance age sports must devote all their practice time to structured forms of deliberate training regardless of the potential negative physical and psychosocial consequences associated with this approach.

The second concept advocates sampling a range of sports before choosing to specialise in one, this choice is accompanied by a gradual move towards deliberate play, as a healthier route to top-level performance (Baker & Horton, 2004; Côté & Hancock, 2016; Côté et al., 2009). Côté and colleagues' Developmental Model of Sport Participation highlights the importance of developmentally appropriate physical training patterns and psychosocial influences. It suggests that elite athletes are involved in high amounts of deliberate play during childhood, which allows children to experience sports in various contexts and further nurture the excitement associated with playing sport. The problem is that if children are not encouraged to experience and practice a range of different motor skills, this may prevent them from capitalising on individual strengths or transferring these skills when specialising at later stages. Furthermore, practising in a range of different physical activities, particularly at an early age, helps to improve generalisable coordination skills such as postural control and timing, which can be later transferred to other sports (Abbott, Button, Pepping, & Collins, 2005). Numerous studies have shown that elite athletes at higher levels performed less organised practice and greater playing activities (e.g. Abbott & Collins, 2004; Baker, 2003; Côté et al., 2009; Farrow, Baker, & MacMahon, 2013; Güllich & Emrich, 2014; Hornig, Aust, & Güllich, 2014). Specifically, this deliberate play concept prescribes participation in a variety of sports during the sampling years (age 6–12), a reduced variety during the specialising age (13–15 years) and substantial investment in a single sport above 16 years (Burgess & Naughton, 2010).

These two concepts have been debated intensively in sport science literature because of the gaps in knowledge about the precise long-term effects and consequences for senior performance as well as the risks for dropout and physical/mental health of athletes. This literature helps us to understand what determines athletes' performance holistically at the micro-level (from an individual athlete perspective) and clearly has consequences for the organisation of talent development at a meso-level.

The management and design of talent programmes and the role of NGBs and sports clubs in talent development is an under researched area (Güllich & Emrich, 2012; Vaeyens et al., 2009). As a result, developing elite athletes is predominately based on

fulfilling athletes' needs, with rather scant appreciation of how NGBs or clubs play a part in that process (Sotiriadou & Shilbury, 2009).

The role of NGBs and clubs in the organisation of talent development pathways

The majority of TID and development issues need to be analysed on a sport-specific basis as talented athletes are usually recruited from within the existing participation base of a sport (De Bosscher, De Knop, Van Bottenburg, & Shibli, 2006). As such, clubs, NGBs (and their regional departments) and some (both public and private) sports academies (e.g. tennis, football) are key stakeholders in athlete pathway development (Brouwers, Sotiriadou, & De Bosscher, 2015; Sotiriadou, 2009). Sports clubs are a vehicle for talent development (Vaeyens et al., 2009), but in some cases, they are seen as too competitive and exclusive, focusing on an elite level of sport development (Säfvenbom, Geldhof, & Haugen, 2013; Skille, 2010). Emphasising the short-term performance of talented athletes within the club often takes priority over their long-term development.

The increasing international pressure to perform has forced NGBs to search for keys to more effective TID and development systems. As a viable way to fulfil these prerequisites and in the pursuit of developing collective success, NGBs in many nations have increasingly started to nationally coordinate and centralise talent programmes – away from sports clubs – where talented athletes move up the talent pyramid from regional to national and international selection, and many others drop out. The prevailing ideology is that talent's potential can be fostered if they receive the necessary support from an early age (i.e. concept 1 above), with recurrent procedures of (NGB) selection, deselection and replacement of selected athletes during all age periods (Güllich & Emrich, 2012). Reasons for this are related to the fact that NGBs tend to find that sports clubs do not always have the opportunity to deliver a talent programme that meets athletes' needs (Brouwers et al., 2015). The merit of these NGB programmes is also contested in the literature, as talent can hardly be reliably predicted a priori (e.g. Burgess & Naughton, 2010; Farrow et al., 2013; Vaeyens et al., 2009), and therefore this can lead to many 'false talented athletes' being wrongly selected (e.g. early maturing athletes, athletes with more training experience) on the one hand and 'missed' talented athletes not being selected (e.g. late maturing athletes) on the other. Furthermore, as a result of talent loss, sports clubs often lose the motivation to invest further in youth development. In addition, the literature provides indicators of only low to moderate efficacy in TID programmes based on early age recruitment (Güllich & Emrich, 2012; Vaeyens et al., 2009). Few researchers have related the contextual or structural characteristics of these programmes to success in international elite sport (Güllich & Emrich, 2013; Vaeyens et al., 2009). It may come as a surprise that the role of sports clubs in the development of athletes' pathways is seldom even described in the strategic plans of NGBs (Sotiriadou & Shilbury, 2009), while athletes spend much of their training time in the early years within their clubs. This is striking, given the negative correlations found in the literature between early selection and later senior success (Güllich & Emrich, 2012). For example, Güllich and Emrich (2013) concluded from empirical investigations that the overall recruitment age in German elite sport schools was 2.1 years later for medalists compared to non-medalists. In addition, international comparative research has also confirmed

that, at a national level, strategies for TID and talent development are relatively underdeveloped in many nations and plans are still underdeveloped in NGBs (De Bosscher, Bingham, Shibli, Van Bottenburg, & De Knop, 2008; De Bosscher et al., 2015). These findings confirm that the consequences of early specialisation, deliberate practice and deliberate play theories previously explained, are not always transferred to the organisational level of talent development. This leaves a gap in academic research on the role of different organisations, at what age and which support services are beneficial and how this relates to later athletic success.

Methods

Data collection

Elite athletes from 15 countries responded to a standardised structured online questionnaire administered by a local research partner in ten European nations: Belgium (Flanders and Wallonia with separate sports systems), Denmark, Estonia, Finland, the Netherlands, Northern Ireland (as part of the UK), Portugal, Spain and Switzerland); and also Australia, Brazil, Canada, Japan and South Korea. The survey, called the 'Elite Sport Climate Survey', was part of a large-scale project on the Policy factors Leading to International Sporting Success (SPLISS) that was conducted in 2012 and covered nine sport policy dimensions, one of which was related to TID and development, used for the purpose of this paper (see note 1). This project did not receive coordinated funding and was realised through a collaboration of 58 researchers and 33 policymakers, with one coordinator per nation, who used the methods and procedures as defined by the coordinating researchers (cfr. Procedures, validity and reliability). Under supervision of the SPLISS lead researchers, a research partner collected the data locally in each country, using strict guidelines, predefined research instruments and sample definitions, as will be further described.

Participants

The SPLISS study focused only on summer Olympic sports and winter Olympic sports for the able-bodied. Potential participants were instructed that their response was voluntary, it would remain anonymous and that the use of the data was exclusively for scientific purposes. To guarantee international homogeneity and comparability, selection of athletes was based on strict definitions. To evaluate 'sport systems', elite athletes were defined as follows:

- (1) 'An elite athlete should be regarded as an (able-bodied) athlete who, whether as an individual, or as part of a team, is ranked in senior competitions in the world's top 16 for his or her discipline, or in the top 12 of any equivalent continental ranking system.' OR
- (2) 'An athlete who receives direct or indirect funding and/or other services via a support programme funded and/or organised on a national (or regional) basis for the purpose of achieving success in at least one of the following levels of senior competition: the Olympic Games; the senior World Championships; and the senior Continental Championships in his or her sport (European, Asian, Pan American etc.).'

Countries that had talent programmes, had to survey these athletes and advise the SPLISS consortium group about the standard of the athletes in their study.

This selection was made by the national sports authorities in every country (governments or national Olympic committees), sometimes in collaboration with the NGBs.

Instruments

Introductory questions in the survey, among others, concerned gender (male/female), birth-date, sport discipline (listed 26 summer Olympic sports in 2012; 7 winter Olympic sports), nationality, country where athletes train the majority of the time. Also, a question regarding the highest level of success athletes had ever achieved as a senior elite athlete in an Olympic discipline was included. In order to answer this question, athletes had to categorise themselves according to six achievement levels: (a) international levels top 3; (b) top 8; (c) top 16 in the world (e.g. medal winning in senior world championships, Olympic Games, grand slams, and world ranking); (d) international level – top 8 in their continent (e.g. top 8 in senior European championships, Pan American Games, Asian Games, ...); (e) national senior level in their country and (f) ‘others’, for example if athletes were not yet competing at senior level (who were excluded from the data set later).

The questionnaire mainly consisted of closed dichotomous (yes/no) and rating (five-point Likert scale) questions. Athletes were questioned about three main topics: (a) at what age they started practising their main sport for the first time, (b) at what age they first received extra attention and extra provision as emerging talented athletes from either their NGB or (c) their club. In addition, the survey provided choices about what kind of extra services/benefits they received as a talented athlete (e.g. more frequent and more intensive training, separate group/private training, extra strength and conditioning training, training and competition schedules, better training facilities, participation in international competitions, transport, apparel and sporting equipment and reimbursement of expenses), what extra coaching and guidance support they received as a talented athlete (e.g. mental coaching from a professional sports psychologist, nutrition coaching/diet by a dietician, medical support services from specialised doctors, physiotherapy, massage, medical follow-up (medical diary: close follow-up with regard to injuries), biomechanics support, career advice – career planning, study support (planning for exams, extra time for training, ...), whether they perceived the age of extra attention as about right, too early or too late. Even though a study requiring respondents to recall past behaviours and events bears methodological risks (e.g. recall bias), it can provide interesting and meaningful insights into the early experiences of elite athletes when there are insufficient resources for a longitudinal study (Güllich & Emrich, 2014; Moesch, Elbe, Hauge, & Wikman, 2011), which is especially difficult to manage on an international basis (De Pelsmacker & Van Kenhove, 1999). Côté, Ericsson, and Law (2005), documented that elite athletes recall objective information like training practices fairly reliably, both in questionnaires and interviews.

The survey was pilot-tested in six nations in 2006 as part of a PhD project before it was used more broadly between 2012 and 2015.

Procedures, validity and reliability

Comparability of data and the reliability of the comparison was a major concern of the research group. The local researchers received a research manual and adopted a protocol

that provided guidance on the process of data collection, aiming to standardise data-gathering procedures and to facilitate cross-national comparisons on selected variables common to all surveys. This protocol contained a description of the proposed methods, definitions of the target groups and guidelines for the sports to be included and excluded in the research. All documents were provided through a joint web platform.

Researchers also received precoded SPSS files to enter the data and an instruction manual to accompany the SPSS database, to avoid possible interpretative errors in the data input and analysis. The surveys were translated by the local researchers from English into their language (12 languages in total) and pretested among elite athletes in their countries. It was emphasised that the questionnaires should remain unchanged, wherever possible, to ensure consistency of data collection and comparison across the samples. Several international meetings were organised to fine-tune data collection, improve international comparability and identify possible gaps in the research methodology. To avoid a timing bias, all surveys had to be responded at least one month prior to the Athens Olympic Games.

Respondents received several reminders by email or phone. To increase response rates, some countries offered incentives, such as iTunes cards in Canada, iPads in Switzerland or a video message by the Olympic Team Chief in the Netherlands.

Sample

In total, 8495 elite athletes received the surveys in 15 countries. After data cleaning and omission of respondents who did not fulfil the criteria (e.g. non-Olympic sports disciplines, disabled athletes or unreliable responses), 3142 athletes (37.4%) representing 37 different sports responded. Of these 1101 elite athletes (35%) did not fully complete the survey in nine pillars. Accordingly, for each variable separately, respondents with incomplete data were excluded, leaving a total sample of 2041 elite athletes. For example, Australia decided, for confidentiality reasons, not to deliver specific information on the level of athletes and their sport. It was therefore excluded from the sections requiring this particular important information.

Data analyses

Analyses were carried out in SPSS 23.0. Descriptive data calculated for the sample included frequency distribution, mean value, standard deviation and Pearson's variability coefficient (V). Extreme outliers were removed using the Z -score (absolute value threshold of 3.29). Constant error variance was checked by performing an ANOVA (saving residuals) and Levene's test. Normal distribution of the error terms (residuals), QQ-plot of standardised residuals of the dependent variable and Shapiro Wilk/Kolmogorov test of normality were explored. It should be noted that in this fairly large data sample, bearing in mind the central limit theorem, a significant Levene's test of equality of variances should be interpreted cautiously, because finding within group variances is not surprising but rather expected (Field, 2013). All assumptions were met so that an analysis of variance (ANOVA) or MANCOVA could be performed.

The three main measures under study were (i) the age when the athletes started with their sport, (ii) the age from when he/she first received extra support and coaching services

Table 1. Age at questionnaire completion split by achievement levels.

	Top 3/8 (1.00)	Top 16 (2.00)	National (3.00)
<i>Age when completing questionnaire (±SD)</i>	26.5 (±0.2)	24.8 (±0.2)	22.1 (±0.2)

from the club or (iii) from the NGB support as an emerging talented athlete. An ANOVA was used to test whether the mean age (in *a-b-c*, i.e. the dependent variable) differed by nationality or by sport (i.e. factors).

Subsequently, an analysis was performed to see whether these ages differed among three sporting achievement levels: ‘world top 8 ($n = 692$)’; ‘world top 16 or continental top 8 ($n = 577$)’; and ‘national level ($n = 745$)’.² As the athletes were still active at the time of completing the questionnaire and in order to control for a possible sample bias, the age differences by achievement level were checked. As can be seen from [Table 1](#), higher-level athletes appeared to be older and may have been at different stages of their career. In order to correct for this possible age bias, a MANCOVA was used controlling for the covariate ‘age of respondent’. Doing this, within-group error variance will be reduced and relevant confounds eliminated (Field, 2013). Overall, it was found that the covariate affected the outcome variables to a large extent. Testing the independence between the covariate and the factor variable (achievement level) revealed a significant effect ($F(2,2854) = 128.23$, $p < .001$), meaning that different ‘ages of respondents’ occur in the three achievement level groups and thus controlling for this effect is opportune. By including the covariate, the fit of the overall model increased significantly as there was a shift in the amount of explained variance that the model accounted for (SSm): from 242.72 to 609.48 units for the age of starting the sport, from 258.03 to 181.79 for the age of club support and from 460.14 to 218.51 for the age of NGB support.

In the text, the main effects are reported as F , df , p , mean, standard deviation (SD). All statistical hypothesis testing was two-tailed. A significance level of $p < .05$ was used. Effect sizes are expressed as Cohen’s d (d) with pooled variance for differences in group means, omega squared and partial η^2 . Effect sizes for contrasts were measured. Effects were considered small, medium or large according to Cohen’s guidelines (r 0.1, 0.3, 0.5; d 0.2, 0.5, 0.8; partial η^2 0.01, 0.06, 0.13) (Kirk, 1996).

Results

1. Athletes’ age when support provided by NGBs and clubs and starting age

General

The senior athletes first received extra attention and extra provisions as emerging talented athletes, on average, at the age of 15.6 (± 3.8) years, from their club and at 17.0 (± 3.6) years from the NGBs ([Table 2](#)). More than half of the respondents gained NGB support between 15 and 18 years old. There is high variation between these ages: almost all athletes (92.8%) received NGB support after the age of 12 years; 78.2% after the age of 14 years; and half of the athletes (49.2%) were older than 16 years. In addition, the data in [Table 2](#) reveal that athletes had practised their sport on average for five years before they received any form of special attention from their club and nearly six and a half years before they received extra support from their NGB. [Table 2](#) also shows that there are gender differences: men were,

Table 2. Age at which elite athletes started their sport and received club and NGB support as an emerging young talent.

		Starting age	Club-support	NGB-support
All athletes	Mean	10.6	15.6	17.0
	<i>n</i>	2905	2352	2467
	<i>s</i>	5.1	3.8	3.6
(a) Male	Mean	10.88	16.02**	17.62**
	<i>n</i>	1667	1362	1403
	<i>s</i>	5.5	4.2	4.3
(b) Female	Mean	10.75	15.48**	16.94**
	<i>n</i>	1253	1011	1011
	<i>s</i>	5.6	4.5	4.4
All athletes				
% older than 10 years		46.8%	91.5%	98.2%
% older than 12 years		33.5%	80.1%	92.8%
% older than 14 years		19.7%	61.9%	78.2%
% older than 16 years		11.0%	35.3%	49.2%
% older than 18 years		6.4%	17.3%	26.5%
World top 8 athletes	Mean	9.7 ^{(1) (2)}	15.3 ⁽¹⁾	16.8 ⁽¹⁾
	<i>n</i>	978	815	880
	<i>s</i>	5.1	3.8	3.6
World top 16 /continental top 8	Mean	10.9 ⁽¹⁾	15.9 ⁽¹⁾	17.6 ⁽¹⁾
	<i>n</i>	799	641	673
	<i>s</i>	5.0	3.9	3.8
National level athletes	Mean	10.8 ⁽²⁾	15.9 ⁽¹⁾	17.4 ⁽¹⁾
	<i>n</i>	1067	861	882
	<i>s</i>	4.8	3.6	3.4

Notes: The MANCOVA's contrast analysis revealed the significant differences according to achievement levels of athletes. Significant levels are shown for groups compared to the world top eight athletes (⁽¹⁾ $p < .001$; ⁽²⁾ $p < .01$). ** $p < .01$.

on average, approximately half a year older when they received club and NGB support. Interestingly, no differences were found in the starting age.

Table 2 further illustrates whether or not there are differences between the sporting achievement levels of the respondents (world top 8; world/continental top 16; or national level) and the three measures (starting age, club support and NGB support). After adjusting the group means for the effect of the covariate (age of respondent), it was found that world top eight athletes received club support and NGB support exactly half a year earlier than national level athletes; additionally, they started their sport 1.1 years earlier. Note that although significant differences are found, which is typical for a large sample, the calculated effect sizes are (very) small (Field, 2013). For the three respective measures, there are small effect sizes for the age at which athletes started their sport ($F(2,2063) = 12.43$, $p < .001$, $\eta^2 = 0.012$) and even lower effect sizes are found for the age at which they received club support ($F(2,2063) = 5.36$, $p = .005$, $\eta^2 = 0.005$) and NGB support ($F(2,2063) = 7.20$, $p < .001$, $\eta^2 = 0.007$). Taken together, these results suggest that world-class athletes started their current elite sport earlier and received support services earlier than lower-level athletes. However, as the effect sizes are small, no achievement levels will be further explored when exploring smaller sport-by-sport samples.

The surveys also questioned whether athletes thought the age when athletes received extra attention from an NGB appropriate. A total of 63.9% of the athletes indicated they thought the age about right. Only a few thought it too early (2.3%) and 33.9% thought that the support of the NGB came too late.

Differences by sport

Obviously one can expect that previous findings will differ depending on the sport. A one-way independent ANOVA revealed that the sports discipline has an effect that accounts for 37.6% of the variance.³ In Table 3, sports where the sample size was below 20 were excluded (kayak, golf, archery, rugby, modern pentathlon, softball, baseball, and taekwondo), resulting in 29 sports remaining ($n = 1969$).

Table 3 shows that in only a few sports, athletes indicated they had received extra attention and extra provision as an emerging talent from their club when they were younger than 12 years: in tennis (11 ± 2.8), table tennis (11.9 ± 2.3) and gymnastics (12.0 ± 3.6). These are also the sports where athletes started their sport at the youngest age (under eight years, along with ice hockey, football and aquatics). In six other sports (skiing, badminton, equestrianism, ice hockey, aquatics and skating) the age of club support occurs between 12 and 15 years old. In all other sports, athletes tend to be older when they first received club support. Similarly, in most sports, NGBs supported the athletes on average after the age of 16 years; only in tennis, table tennis and gymnastics were athletes younger than 14 years. In cycling, sailing, athletics, rowing, shooting, boxing, wrestling, triathlon and bobsleigh, NGBs start to support athletes only after the age of 18 years.

It can also be noted that athletes in equestrianism, basketball and sailing start relatively young (under eight years old), but receive specific support services as an emerging talent much later. In the sample, bobsleigh is an interesting sport where athletes' age of club

Table 3. Overview by sport of the average ages at which elite athletes started their sport, decided to concentrate on their current elite sport only and received club and NGB support (data sorted by NGB support age).

Sport	Starting Age	Club support	NGB support
Tennis ($n = 30$)	6.2 (± 1.6)	11.4 (± 2.8)	13.4 (± 2.1)
Table Tennis ($n = 25$)	7.1 (± 2.0)	11.9 (± 2.3)	13.4 (± 2.3)
Gymnastics ($n = 84$)	6.6 (± 2.2)	12.0 (± 3.6)	13.7 (± 3.0)
Badminton ($n = 47$)	7.9 (± 2.2)	13.3 (± 2.4)	15.3 (± 2.6)
Ice Hockey ($n = 69$)	6.4 (± 2.6)	14.4 (± 3.4)	15.6 (± 2.8)
Skating ($n = 46$)	8.4 (± 3.2)	14.8 (± 3.4)	15.6 (± 2.8)
Aquatics ($n = 185$)	7.5 (± 3.6)	14.6 (± 3.4)	15.8 (± 3.4)
Football ($n = 31$)	6.5 (± 3.9)	15.3 (± 2.6)	16.0 (± 3.1)
Handball ($n = 123$)	9.2 (± 3.3)	15.8 (± 2.7)	16.2 (± 2.7)
Skiing ($n = 138$)	8.2 (± 5.3)	13.3 (± 3.9)	16.2 (± 3.4)
Judo ($n = 98$)	7.9 (± 3.2)	15.1 (± 3.8)	16.6 (± 3.2)
Volleyball ($n = 101$)	10.5 (± 3.7)	15.3 (± 3.0)	16.8 (± 3.6)
Equestrian ($n = 47$)	7.9 (± 4.1)	14.2 (± 4.5)	16.8 (± 5.2)
Canoe ($n = 59$)	11.3 (± 3.8)	15.9 (± 2.1)	17.0 (± 2.8)
Biathlon ($n = 26$)	13.0 (± 3.7)	15.4 (± 2.3)	17.0 (± 1.4)
Basketball ($n = 22$)	7.5 (± 2.6)	15.5 (± 2.7)	17.1 (± 2.8)
Hockey ($n = 79$)	10.1 (± 5.2)	16.2 (± 3.7)	17.4 (± 3.6)
Weightlifting ($n = 21$)	13.4 (± 3.0)	16.9 (± 2.7)	17.48 (± 2.4)
Curling ($n = 50$)	10.8 (± 4.1)	15.9 (± 3.4)	17.6 (± 3.4)
Fencing ($n = 50$)	10.3 (± 3.3)	15.5 (± 3.4)	17.7 (± 3.7)
Cycling ($n = 110$)	13.0 (± 3.8)	16.7 (± 3.5)	18.0 (± 3.1)
Sailing ($n = 57$)	9.0 (± 3.2)	15.1 (± 4.3)	18.4 (± 3.8)
Athletics ($n = 147$)	12.3 (± 4.0)	17.4 (± 3.6)	18.6 (± 3.7)
Rowing ($n = 122$)	14.4 (± 3.3)	16.9 (± 2.8)	18.9 (± 3.1)
Shooting ($n = 70$)	13.7 (± 4.0)	17.6 (± 4.6)	19.0 (± 4.7)
Boxing ($n = 25$)	14.3 (± 3.0)	17.3 (± 2.0)	19.0 (± 2.9)
Wrestling ($n = 42$)	12.2 (± 3.5)	18.3 (± 3.1)	19.0 (± 2.6)
Triathlon ($n = 42$)	17.4 (± 5.6)	18.2 (± 4.2)	19.1 (± 3.7)
Bobsleigh ($n = 24$)	20.5 (± 3.1)	19.7 (± 5.1)	20.5 (± 4.4)

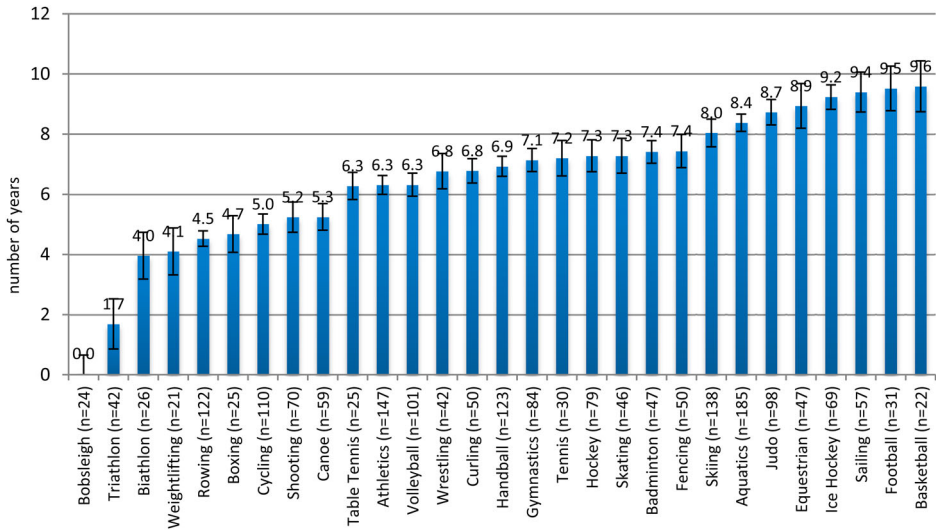


Figure 1. Number of years that athletes practised their sport before they received NGB support.

support coincides with their starting age; typically, these athletes had transferred from other sports.

Last but not least, [Figure 1](#) specifically shows the difference between the age at which athletes first received NGB support and the age when they started their sport. The figure illustrates that in most sports athletes practised their sport for longer than six years before they received extra attention from their NGB. The sports where this time frame is short are all sports where athletes started relatively late, after the age of 13.0 years, except canoeing ($n = 50$), where athletes started, on average, at 11.3 years (± 3.8). This means that most athletes have practised their sport for a long time in their sports club before they receive any extra NGB support services as a young talent.

Early versus late specialisation sports

For the purpose of this paper and in relation to support services that athletes received, it can be interesting to cluster the sports according to the so-called ‘early specialisation sports’ and ‘all other sports’. Early specialisation sports are sports where athletes start early, specialise early, and have early involvement in high-intensity training and competitive sport (Baker, 2003). A visual diagram ([Figure 2](#)) helps to confirm whether athletes in these sports receive club and NGB support at earlier ages. According to Malina (2010), the exact meaning of ‘early’ is disputed and inconsistent. It depends on a number of factors, such as developmental traditions in the country, influences of significant others and the nature of the sport. We cluster diving, figure skating, gymnastics, rhythmic gymnastics, swimming and synchronised swimming, snowboarding (half-pipe) and table tennis as the sports with an early specialisation approach, according to the suggested classification from Balyi and Hamilton (2004). Recognising the continuum between sports, they see all the others as ‘late specialisation sports’.

The results in [Figure 2](#) show that both club support and NGB support start, on average, 2.0 and 1.4 years later respectively, in other sports compared with early specialisation

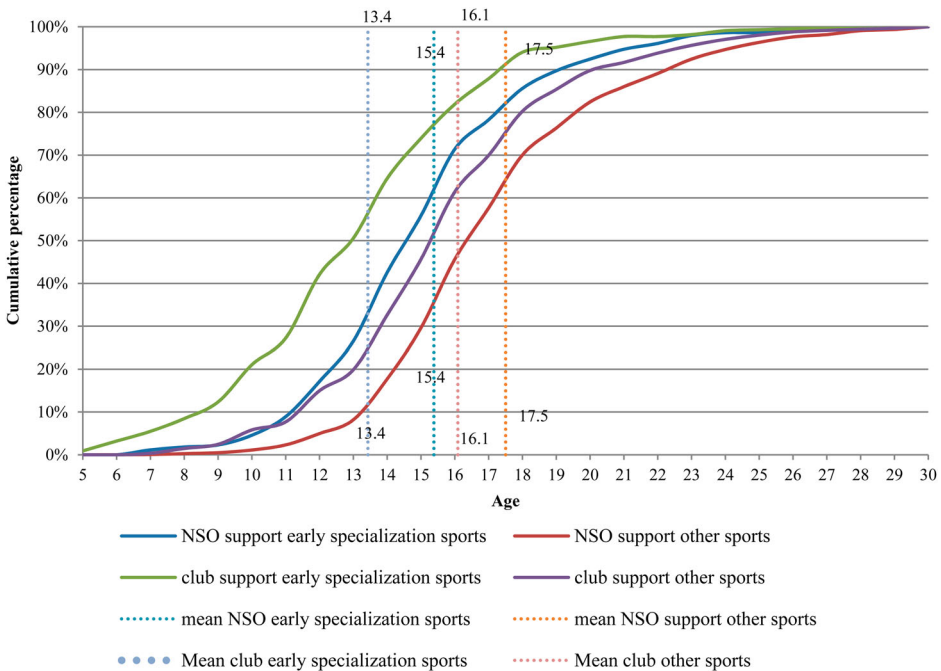


Figure 2. Visual representation of the percentual distribution of the age from which athletes received club and NGB support clustered by early specialization sports and all other sports.

sports. However, the findings also show that, even in early specialisation sports, it could be argued that the support by NGBs takes place at a relatively late age: on average this is only after the age of 15.4 (± 3.4) years. In the other sports this is, on average, after the age of 17.5 (± 3.7) years. Figure 2 also shows that there is a high variation in the chronological ages of athletes. At the age of 13 years, almost half of the athletes (49.4%) in early specialisation sports had not yet received support from their club and almost three out of four (73.5%) from their NGB. More than half of these athletes (55.8%) only reported NGB support after they had reached 15 years of age. For the other sports this is approximately two years later.

2. Support services for young talented athletes

The second part of the analysis was related to the type of support services athletes received as an emerging talent from their sports club (or personal coach), NGB or others, as well as different forms of extra coaching and extra attention. In general, the support services, such as extra training opportunities, training in separate groups, training schedules, access to international competitions, equipment and reimbursement of expenses, were assessed as quite reasonable across the sample nations, with an average of between 60% and 80% of all athletes receiving these services as an 'emerging talent' from their respective NGBs and/or clubs (Table 4). Fewer athletes (less than 50%) indicated they received better training facilities, transport and reimbursements as a young talent. With regard to extra coaching support services (e.g. mental, nutrition, medical, ...), less than 50% of the athletes had received most services, except for physiotherapy and massage.

Table 4. Percentage of athletes that indicated they had received any of the following: (a) extra support services and (b) coaching services from their sports club (or personal coach), NGB or other organisations as an emerging talented athlete – data by country.

	AUS ^a	BRA	CAN	DEN	ESP	EST	FIN	FLA	JPN	KOR	N-IR	POR	SUI	WAL	TOT
Extra support services															
<i>N</i>	193	314	142	205	149	149	69	153	121	341	55	87	661	66	2626
More frequent and more intensive training* (%)	69.9	77.1	67.6	75.1	81.2	84.3	82.6	78.4	62.8	55.1	74.5	83.9	81.5	84.8	75.6
Training in a separate group/private training* (%)	63.0	57.9	51.8	81.2	69.7	68.5	81.4	70.3	30.8	60.6	76.4	63.4	65.4	76.2	65.5
Extra strength and conditioning training* (%)	45.4	56.8	51.1	62.6	65.8	73.2	59.1	66.9	40.0	62.4	63.6	69.2	56.3	73.8	60.4
Training and competition schedules (%)	61.4	78.1	61.6	75.5	74.5	82.3	76.6	75.9	26.4	57.3	58.3	68.3	58.3	71.6	66.2
Better training facilities (%)	44.1	39.0	23.1	55.0	51.4	68.0	53.6	60.6	51.6	40.3	45.1	79.1	49.8	36.5	49.8
Participation in international competitions (%)	62.8	70.8	67.1	87.8	88.7	88.9	77.9	90.0	71.1	63.4	84.7	88.7	88.2	95.5	80.4
Transport (%)	29.4	51.4	45.2	51.8	63.0	73.8	51.4	44.6	30.8	39.5	41.1	68.1	54.7	46.9	49.4
Apparel and sporting equipment (%)	50.3	58.9	51.7	68.3	80.0	74.7	55.3	67.9	50.4	64.3	46.4	70.2	64.4	64.6	62.0
Reimbursement of expenses (%)	31.1	38.3	35.9	55.1	64.7	65.4	34.2	46.1	36.8	17.4	43.1	49.4	37.2	45.3	42.9
Extra coaching services															
<i>N</i>	193	314	142	205	149	70	69	153	121	341	55	87	661	66	2626
Mental coaching from a professional sport psychologist (%)	38.9	32.1	30.1	41.0	38.8	16.9	12.5	43.9	9.9	12.9	39.7	12.9	29.2	20.0	75.6
Nutrition coaching/diet by a dietician (%)	47.2	39.8	30.3	48.8	41.8	18.4	36.5	44.6	38.7	12.4	40.7	18.8	28.5	42.4	65.5
Medical support services from specialised doctors (%)	38.5	43.9	32.9	43.7	67.1	59.7	44.0	61.9	26.4	27.1	28.1	43.5	53.3	55.6	60.4
Physiotherapy, massage (%)	48.0	55.4	55.1	67.7	75.6	36.7	49.3	72.3	45.5	41.2	56.7	53.5	49.5	40.6	66.2
Medical follow-up (medical diary: close follow-up with regard to injuries) (%)	38.5	43.9	32.9	43.7	67.1	59.7	44.0	61.9	26.4	27.1	28.1	43.5	53.3	55.6	49.8
Biomechanic support (%)	29.9	19.1	10.3	15.1	31.2	12.3	5.6	23.5	11.8	17.5	16.1	7.2	14.3	15.9	80.4
Career advice – career planning (%)	54.8	21.0	11.0	30.9	30.1	5.3	40.0	20.3	4.2	21.0	16.4	11.3	24.5	16.9	49.4
Study support (planning for exams, extra time for training, ...)(%)	44.7	24.6	20.1	55.7	39.5	28.8	41.2	35.5	6.0	18.4	27.3	27.0	32.5	44.4	62.0

Note: Differences between countries: *** $p < .001$.

^a as noted earlier, for reasons of confidentiality, Australia did not provide information about performance levels of athletes.

As support services obviously differ by country (significant differences between countries were found in each type of support service), [Table 4](#) also shows these descriptive data. As a general note, services clearly varied by country, for example with regard to more frequent and more intensive training (varying from 55% in South Korea to 85% in Belgium-Wallonia), training in a separate group/private training (varying from 31% in Japan to 85% in Finland), and extra strength and conditioning training (varying from 40% in Japan to 74% in Belgium-Wallonia). With regard to extra coaching and other forms of attention, country differences did only appear for biomechanical support ($p = .076$). Interestingly, as is also shown in [Table 4](#), only minor differences were found regarding the achievement level of the athletes. Higher-level athletes train slightly more frequently and more intensely, more in a separate group/privately and perform extra conditioning training. No other effects with regard to the use of athlete services on the subsequent probability of discontinuities in the training process or on the subsequent development of success were revealed. Finally, the athletes also assessed the amount of support they had received from their club and NGB. Athletes were generally satisfied with the support they received as an emerging athlete.

Discussion

This research provided evidence of the age at which top-level athletes received support from their club and NGB and when they started practising their sport. Furthermore, it showed differences between more and less successful athletes.

The data revealed four main findings. First, athletes had practised their sport on average for nearly six and a half years before they received special attention as an emerging athlete from their NGB. They have thus spent most of the time on training in their sports club and received support services from NGBs at a relatively late age. Second, the age at which athletes specialise differs by sport and between sports. There are also minor gender differences: men are, on average, approximately half a year older when they first received support. Third, higher-level athletes (e.g. the world's top eight) received support services a little earlier than lower-level athletes (e.g. national level); however, effect sizes are small. Fourth, most elite athletes had received a variety of support services and only slight differences were found for higher-level athletes regarding a higher frequency and intensity of training; although the coaching support services were somewhat lower, overall no strong differences according to achievement level were detected.

The relevance of these findings relate to the role that sports clubs (can) play in athlete development (Sotiriadou et al., 2008) and how their role is recognised by NGBs as a critical success factor in talent development planning. On average, talented athletes report having received support from their NGBs only after the age of 17 years. Even in sports that are assumed to call for an early specialisation approach, athletes appeared to be older than 15 years when they first received NGB support (only in tennis, table tennis and gymnastics were athletes younger than 14 years). These findings lend weight to the body of research that emphasises the need for high-quality programmes for young sports persons and talented athletes at a club level (Van Hoecke & De Knop, 2006). Notably, from this perspective it is striking that NGB strategic plans seldom refer to a systemic role of sports clubs in talent development and development of long-term success (Sotiriadou, 2009). General results from the SPLISS study in 15 nations also revealed that sports clubs are

not considered high on the list of priorities of national policy makers as a means of developing long-term elite athletes success(ion) planning (De Bosscher et al., 2015, p. 192). In that study, only Flanders, Japan and Switzerland have a coordinated programme to improve the quality of club support during the fundamental stages of an athletic career, but this programme is not specifically developed for talent development. The data analysed in this paper from an (individual) athlete's perspective have practical implications for the management of NGB talent development pathways, and associated funding by national sports associations. The paper offers evidence to encourage the crucial role of sports clubs during the early development years. From the sports science literature, there are two main arguments to support this view.

First, some essential sports skills are to be trained at younger ages (<12–14), while athletes train in club programmes only, in order to reach the highest level of expertise at later ages. For example, the ages from six to twelve (when athletes train in clubs only) are a sensitive period in terms of developing coordination abilities, posture, balance, flexibility, partial speed and movement dynamics⁴ (Purcell, 2005; Zahradník & Korvas, 2012), as well as certain perceptual and cognitive skills (Martindale, Collins, & Daubney, 2005; Ward & Williams, 2003).

A second argument relates to deliberate practice and deliberate play approaches. Children need to combine play and practice activities during childhood, to learn a diversity of skills and be encouraged to continued participation, at best in a variety of sports (Côté & Fraser-Thomas, 2007; Vaeyens et al., 2009). However, many of NGBs' strategic plans are built around centralised talent programmes and early selection. Disadvantages of such centralisation are related to low reliability and prediction accuracy of TID (Vaeyens, Lenoir, Williams, & Philippaerts, 2008), increased dropout rates, overtraining and injuries (Baker, Côté, & Abernethy, 2003) and an early one-sport-only focus, which limits the overall development of young athletes (Côté & Fraser-Thomas, 2007; Côté & Hancock, 2016; Côté et al., 2009).

In the longer term, by keeping talented athletes longer in the clubs instead of the centralised NGB programmes, this could lead to the increased motivation of clubs, increased expertise of coaches, a broader talent pool and reduced dropout rates. A good example is the Dutch Swimming Federation. Instead of selecting swimmers for regional training programmes, it selected talented swimmers two years later than the Belgian (Flemish) Swimming Federation, but labelled 19 recognised 'local talent clubs' (based on a quality scan) who received specific support services to improve the quality of their training programmes (KNZB, 2011). Consequently, the talented athletes remained in the clubs for a longer period, the expertise of the local coaches improved and a backup system for late maturing athletes was secured. These findings also have practical implications for the coach education systems, because club coaches need to be taught to balance (short-term) performances and excessive training volumes with making the sport fun and developing techniques for the long-term development (e.g. Greyson, Kelly, Peyrebrune, & Furniss, 2010; Lang & Light, 2010; Martindale et al., 2005).

Methodological considerations

While the present data confirmed the relatively late age of support, surprisingly (in contrast to the literature), they could not confirm earlier findings in the literature that suggest

that world-class athletes received support services at a later age compared to lower-level athletes. For example, Vaeyens et al. (2009) concluded that extended involvement in institutionalised promotion programmes during adolescence is not associated with greater success in senior elite sport. Comparably, Güllich and Emrich (2013) concluded that the overall recruitment age in the German elite sports schools was 2.1 years later for medalists compared to non-medalists. Results in this paper show the opposite, namely the world top eight athletes received support half a year earlier than national level athletes; however, effect sizes were very small. These findings are striking, given the size of the SPLISS sample, and the variety of sports and nations involved. A possible explanation may be that previous studies had not shown evidence of an ‘age of respondent’ bias (many higher-level athletes are older due to their career stage) (e.g. Güllich & Emrich, 2012; Güllich & Emrich, 2014; Moesch et al., 2011), which – when entered as a covariate factor in the MANCOVA analysis – significantly influenced the age of support. More research is needed to investigate this conspicuous finding, specifically with regard to the kind of programmes that are delivered at different ages.

In addition, the results showed that higher-level athletes received support services slightly earlier than national athletes and support services related to frequency and intensity of training were significantly more frequently available for the former; this was not the case for coaching support. This does not entirely resemble the findings of Güllich and Emrich (2014), who observed that athlete support services in Germany did not contribute to explaining success differences of athletes.

Finally, the aim of this study was to analyse data from a unique and large sample of elite athletes worldwide and therefore the paper intentionally focused on a global level. The limitation of this approach is that, in reality, athletes are part of a system and context that is unique to each country. For example, countries may have different funding strategies for talent development, different prioritisation and potential to win medals in a sport and, in turn, this may influence the age of start and support in a sport. This point can be illustrated by some findings in the broader SPLISS study. It was found that across the sample nations, there was a general low level of development regarding TID, with the exception of Switzerland, where sports clubs also receive government funding for talent development programmes/initiatives (De Bosscher et al., 2015). This paper did not focus on the individual countries as NGBs operate within an environment of autonomy, within one country one cannot speak about one system of TID and development. Nonetheless, the country-specific context may influence these factors, as it was shown by the SPLISS results that smaller nations (Switzerland, Flanders/Wallonia, the Netherlands and Denmark) have a more integrated approach to TID and development. These nations may have capitalised on their ‘small size’ to develop a more systematic approach to the age of support over other countries. In relation to the findings of this paper, we could not find specific differences in the starting/support ages when the sample was clustered into small–medium and large nations.

Second, a methodological conundrum arises because the sports were clustered as defined by the International Olympic Committee, since some athletes did not provide details about their discipline in the questionnaire. For example, the sport of ‘gymnastics’, in practice, is comprised of four disciplines namely, artistic gymnastics, rhythmic

gymnastics, trampoline and acrobatic gymnastics, which may all have different ages of starting, specialising and support services. In some countries these disciplines all have separate, independent NGBs.

Notes

1. In the whole SPLISS study, talent identification and development was one of the nine policy areas (Pillar 4) under consideration. This pillar is concerned with the national strategies towards the identification of young talented athletes and how talent development is facilitated in the different nations. It analyses 12 critical success factors, including 169 sub-factors, related to the planning and coordination of talent identification systems, talent development planning, multidimensional support services and dual career support for the combination of elite sport and study. Data collection for this pillar was not only based on surveys with athletes, coaches and performance directors, but also on an inventory completed by the local researchers on each critical success factor, by means of interviews and desk research.
2. Note that differences in the different variables between the top three and the top eight were only small (not significant) and these two were merged in order to compare significant differences with more equal sample sizes.
3. A one-way independent ANOVA revealed significant differences according to the 37 sports disciplines in all three measures: (a) the age that athletes first started their sporting career ($F(36,2004) = 35.2, p < 0.001, \omega = 0.613$), (b) received club support ($F(36,2004) = 14.5, p < 0.001, \omega = 0.439$) and (c) received NGB support ($F(36,2004) = 12.1, p < 0.001, \omega = 0.405$). Note that the overall ANOVA with sport as predictor leads to large effect sizes (above the 0.14 threshold for large effects (Field, 2013)).
4. In addition, endurance, aerobic capacity and muscular-strength abilities are sensitive to training only at older ages as the body and skeleton are not ready to develop these skills (Purcell, 2005; Zahradnik & Korvas, 2012).

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