

# The diversity of developmental paths among youth athletes: A 3-year longitudinal study of Norwegian handball players

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**Abstract:** This longitudinal study examines pathways leading to adult elite sport in Norwegian handball. The study cohort – a sample of Norwegian female handball players (n=33) selected to youth national team activities – was followed over three years (2013-2015). Some participants reached the elite level (n=21); others reached the near-elite level (n=6) or non-elite level (n=6). The findings show that elite players in Norwegian handball are more involved with youth national team activities than non-elite players. There was more variation in the amount of international experience within the elite and near-elite groups than between the groups; the pathways to the adult elite level were variable between athletes. The findings are discussed in relation to the characteristics of the particular organisational context of Norwegian handball.

**Keywords:**

talent; team sport; coaching; expert performance; sociocultural

## Introduction

Research on talent development (TD) in sport has tended to examine athletes' sports participation histories and the developmental activities leading to top-level performance (Haugaasen & Jordet, 2012). Building upon Ericsson, Krampe, and Tesch-Roemer's (1993) theory of deliberate practice, many of these studies have been rooted in cognitivist traditions which focus on the relationship between practice hours and practice activities. Typically, athlete development is viewed as an individual enterprise. This has meant that the wider contexts of learning and development have received less attention (Araújo et al., 2010). The exploration of the impacts of sociocultural influences on sports development is an important new approach to the study of TD and indicate that integrating broader organisational perspectives into interpretations of expertise can significantly improve understandings of TD (Henriksen, Stambulova, & Roessler, 2010).

Bjørndal, Ronglan, and Andersen (2015) examined the link between wider organisational contexts and talent development, and showed that talent development within the context of Scandinavian team sports involves multiple autonomous key actors (e.g. clubs, sports schools, and regional and national sporting federations) which pursue their own interests and aims. This process effectively makes TD a by-product of practising for team-based competitive goals. According to Bjørndal et al. (2015), the TD model in Norwegian handball is a heterarchically organised governance system of mutual constraints and influences: no actor has sole responsibility for TD processes or has instructional authority over any other. It was hypothesised that the specific form of TD organisation in Scandinavian team sports could be one plausible explanation for the diversity of pathways leading to the elite level in this context. This, they reasoned, is because the multi-centric and loosely-nested structure enables a potentially greater number of

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pathways than a system based on one centralised identification and development structure. In contrast, most models described in contemporary literature are *hierarchical*, and are characterised by an emphasis on early talent identification and the progressive shifting of athletes from one level to the next through an unambiguous systemic order (Bailey & Collins, 2013).

In this paper, we investigate how athlete development pathways to the elite level emerge in the Nordic team sport setting of Norwegian handball. Our definition of a pathway includes an athlete's sport activities and training, their involvement in different practice environments, and their competitive transitions. This study attempts to address gaps in existing research by focusing on variables previously associated with elite development: in this instance, through a context-sensitive longitudinal exploration of the developmental paths of a group of already-selected youth elite athletes. The aim is to explore differences within this selected and talented sample between those who make it to the elite level and those who do not.

### **Conceptual framework**

The most influential theoretical models of athlete development in sport are based on Ericsson et al.'s (1993) theory of deliberate practice. This theory suggests that expertise can be developed through extensive, domain-specific, highly structured and intensive practice over the course of several years. The theory, tested in a range of areas, has had a major influence on research about high-level performers (for a review, see Williams & Ford, 2008). Findings indicate that deliberate practice in sport is task-specific and can take the form of both individual and team activities (Ford, Ward, Hodges, & Williams, 2009).

The theory suggests that starting specialised practice early offers potential advantages in the pursuit of expert level performance. But some sports researchers have argued strongly against early sport specialisation and highlighted the potentially negative consequences of doing so, including an increased risk of injury, a lack of enjoyment, and the pressures of identifying talent early (Capranica & Millard-Stafford, 2011). Further, early talent identification and selection schemes risk being based on biological maturation rather than long-term potential (Wattie, Schorer, Tietjens, Baker, & Cobley, 2012). They may also neglect the possibility of late specialisation and rapid expert development (Bullock et al., 2009), and ignore the role of the psychological factors underpinning development (Abbott & Collins, 2004).

In the Developmental Model of Sport Participation (DMSP), early diversification is seen as an alternative pathway to the elite level and as a way of enabling athletes to sample several sports before later specialisation (Côté & Vierimaa, 2014). Recent studies of national team-level athletes in team sports have noted patterns of early sport diversification among athletes prior to reaching the expert level (Leite, Baker, & Sampaio, 2009), and have also noted that some elite athletes start their careers later (Moesch, Hauge, Wikman, & Elbe, 2013). Although participating in other sporting activities could play a functional role in the development of sporting expertise, the concept of early diversification stands in conceptual opposition to the theory of deliberate practice (Mommert, Baker, & Bertsch, 2010).

In both models, learning and development are understood to be linear and predictable. The application of these models gives rise to a normative system for the production and enhancement of high-level athletic performance, which Bailey and Collins (2013) term the Standard Model of Talent Development (SMTD). Other examples of applied models in which TD pathways are assumed to be linear, hierarchical and predictable, include the Long-Term Athlete Development Model (Balyi, Way, & Higgs, 2013) and the Sports Policy

Factors Leading to International Sporting Success Model (De Bosscher, De Knop, Van Bottenburg, & Shibli, 2006). Researchers are increasingly interested in the unique and non-linear relationships that appear to characterise the developmental processes of individuals (e.g., Collins, Macnamara, & McCarthy, 2016). In their study of Australian national team athletes, for example, Gulbin, Weissensteiner, Oldenziel, and Gagné (2013) show that most athletes experience at least one period in which their developmental trajectory declines before returning to a higher competitive level. Further, successful competition pathways may include concurrent experiences in both age-categorised competitions and higher levels of competition (Collins & MacNamara, 2012). Gulbin et al. (2013) therefore contend that the assumption that progress and development are linear fails to recognise complex competition patterns and assumes that the transition to expertise is predictable.

Recent studies have demonstrated that pathways to expertise are influenced by cultural and societal values, and that the ‘specialisation versus diversification’ dichotomy is an overgeneralised conceptualisation (Araújo et al., 2010). In their study of Danish elite athletes, Storm, Henriksen, and Krogh (2012) argue, for example, that “the existing pathways in the Developmental Model of Sports Participation are inadequate as analytical categories” (p. 208). They show that early specialisation need not necessarily involve a high amount of deliberate practice and that early diversification can occur through intensive training in several sports at the same time. Further, they demonstrate that Danish athletes are embedded within a sampling culture that is a product of a wider societal context. This particular Scandinavian context may also explain the late intensification and specialisation noted in other studies of Scandinavian athletes (e.g., Fahlström, Gerrevall, Glemne, & Linnér, 2015; Moesch, Elbe, Hauge, & Wikman, 2011). If this is so, we would argue that guidelines for practitioners should offer a clear recognition of the specific cultural and organisational contexts in which TD processes occur. By putting “culture into context”, as Stambulova and Alfermann (2009, p. 302) contend, investigations of athlete pathways will be able to develop more contextually sensitive understandings which can “separate the universal from the culture-specific”.

## Method

This examination of the development pathways of youth elite handball players was designed as a longitudinal study. The purpose of the study was to investigate the sporting experiences of youth national team players throughout late adolescence, and to explore the differences between athletes who do – and do not – continue to the adult elite level.

## Participants

Norwegian handball is a competitive sport played in all Scandinavian countries, and is characterised by its international success and broad participation. Individual handball players were the observational unit in this study, and the units of analysis were their developmental pathways. The study sample was a cohort of Norwegian female handball players ( $n=33$ ) who had been selected to youth national team activities. International youth handball is organised into 2-year age categories, and the study cohort therefore consisted of players born in 1996 (58%) and 1997 (42%). The players were either 16 or 17 years old at the start of the study, and represented six of the seven geographical handball regions in Norway. The players had experience in youth national team activities and regional TD initiatives, and their club-level experience ranged from the U16 level to the elite level.

During the study period, 41 additional female players within the same age group were selected to youth national team activities. Because these players were selected to youth national team activities after the cohort subjects had been recruited, we did not include them in the longitudinal data collection. However, we included these players in the final

retrospective analysis of involvement in practice, and competition for, the youth handball national team.

### **Context**

The Nordic model of sports is dominated by voluntary sports organisations (Ronglan, 2014). Children's, youth, mass and elite sports are largely part of the same organisational structure, and the responsibility for TD belongs to the sporting associations for each sport (Andersen, Bjørndal, & Ronglan, 2015). In Norwegian handball, the TD model is characterised by a nested structure with four key actors: clubs, sport schools, and the regional and national levels of the Norwegian Handball Federation (NHF). Sport schools (both public and private upper secondary schools) are increasingly important actors and provide regular academic education and three to four training sessions per week during school hours. Sports clubs provide daily practice and competition for all athletes and the general education provided by sport schools is supplemented by specialised sport programs. The regional level of the NHF offers broad-based player development initiatives and organises youth national team activities at the national level. A player must belong to at least one club team setting but most also take part in other team and practice settings (e.g. sport school programs and national team activities). Most coaches are amateur and/or parent-coaches; professional coaches are found only in sports school, national team, and senior elite settings.

In each setting, talent identification is hierarchical *and* non-linear in nature (athletes proceed from one level to the next but may also move up and down between the youth and adult levels of training and competition); athletes are involved simultaneously in more than one practice setting (being selected in one setting does not exclude participation in others); and TD in Scandinavia is loosely structured (athletes enter, exit, and re-enter TD initiatives continuously throughout their adolescence). Thus, these organisational contexts offer a range of different practice settings which, together, comprise the developmental experiences that shape the pathways leading to adult sports. Team-based club practices and competitions, for example, offer promising athletes a lot of competitive experience in a safe environment. The national team provides a high-level practice environment in which most athletes are pushed outside their own comfort zone and given international experience. The sport schools, in contrast, focus on individual development rather than the team-based agendas of the other actors.

### **Procedure and analysis**

Data were gathered from: (a) self-reported responses from the 33 participants to a questionnaire about their practice and competition, and (b) publicly available participation statistics on players selected to the Norwegian youth handball national team. Data were gathered from 2013 to 2015 throughout the seasons (including pre- and post-seasons). The purpose of the questionnaire (see Appendix 1) was to collect information on the weekly training schedule of athletes and their involvement in different team settings. The practice hours were 'deliberate practice hours' (Ford et al., 2009). The questionnaire was validated prior to data collection by the second and third authors. The questionnaire was based on participants' recall of events and was sent by email quarterly (12 measurement points in total) during the data collection period.

The study protocols followed the guidelines of the Norwegian Social Science Data Services and the organisation granted ethical approval. Prior to the data collection, all the study participants were informed about the aims of the study, how the data would be stored and handled confidentially, and told that they had the right to withdraw from the study at any time. Written consent for participation was obtained.

Demographic information was collected from all the participants. The sports participation histories of the athletes were also collected to determine a baseline (T1) of individual

involvement at the club, school, and youth national team levels. The participants from the cohort were divided into three different groups based on their level of performance after three years (T2): (a) elites ( $n=21$ ) who played at the first national level, (b) near-elites ( $n=6$ ) who played at the second national level, and (c) non-elites ( $n=6$ ) who played at lower levels. We then descriptively analysed the history of the athletes' participation in sport. This was based on the following variables associated with elite sport pathways: starting age, years of involvement in other sports, and age of specialisation. Furthermore, we analysed the change in weekly practice hours from T1 to T2. Practice was operationalised as: individual and team-based, formal and informal, and handball and other practice (e.g. fitness training). We conducted an intra-class correlation analysis (ICC) to assess the relative reliability of the measure of practice hours from baseline. The test and re-test were conducted 2 weeks apart and an ICC of .966 (95% CI = .928-.984) demonstrated excellent relative reliability.

Finally, we calculated the level of involvement for the full sample of youth national team players in youth national team practice and competition ( $n=74$ ). A Mann-Whitney U test was used to calculate if there were differences between the groups. A visual inspection showed that the distributions of the scores for the dependent variables – (a) the number of international matches played, and (b) the practice hours in relation to youth national team activities – were not similar. Statistical analyses were performed using the statistical program SPSS for mac (2012, version 21); statistical significance for the analytic methods was set at  $p < 0.05$ .

## Results

Overall, multi-sport involvement was characteristic of the sport participation histories of the study cohort (Table 1). All the participants had spent several years sampling multiple sports but did not specialise until adolescence (at age 10 years or later): no differences were identified in this respect between the cohort groups. There was no significant difference in the amount of international match experience between the elite and near-elite. However, the number of international matches was significantly higher among the elites (mean rank = 38.39), than the non-elites (mean rank = 23.37),  $U = 236$ ,  $p = .001$ . No significant difference was found in the number of practice hour scores between the elites and near-elites. However, the number of practice hours was significantly higher for elites (mean rank = 28.17) than for non-elites (mean rank = 13.50),  $U = 76.500$ ,  $p = .001$ . Interestingly, substantial variation was found within all groups in relation to both experience in international competitions and the number of hours of practice with the national team.

Figure 1 shows the change in the number of weekly practice hours per group throughout late adolescence. Typically, sport programs in upper secondary schools in Norway include three to four weekly practices during school hours. As expected, the number of training hours increased rapidly in the cohort at the transition from middle school to upper secondary school (at age 16-17 years). The athletes also had more club practices, resulting in an increase in training loads of up to 100%. Initially, the analysis suggested that the amount of training for the near-elite group was lower than the non-elite group. However, two players within the near-elite cohort group who did not attend a sport school program had a strong influence on this finding due to the small group size. When these two players were excluded from the analysis, no differences were found in the number of practice hours between the elite and non-elite groups. Players who attended a sport school program practised 16.3 hours (SD = 0.7) on average per week during the three years of upper secondary school; the others practised an average of 11.2 hours (SD = 1.7) per week.

Table 1.

*The specialisation pathways of youth elite handball players and their involvement in youth national team activities*

Cohort	All (n=33)	Non-elite (n=6)	Near-elite (n=6)	Elite (n=21)
Starting age	7.7 ± 1.4 <sup>a</sup>	8.4 ± 0.7 <sup>a</sup>	6.5 ± 1.0 <sup>a</sup>	7.8 ± 1.4 <sup>a</sup>
Number of other sports	2.1 ± 1.5 <sup>a</sup>	2.1 ± 1.0 <sup>a</sup>	1.5 ± 1.0 <sup>a</sup>	2.3 ± 1.7 <sup>a</sup>
Years in other sports	5.3 ± 3.2 <sup>a</sup>	4.6 ± 3.0 <sup>a</sup>	4.3 ± 2.6 <sup>a</sup>	5.9 ± 3.2 <sup>a</sup>
Start of specialisation	13.4 ± 3.0 <sup>a</sup>	14.0 ± 3.0 <sup>a</sup>	12.2 ± 2.7 <sup>a</sup>	13.6 ± 2.9 <sup>a</sup>
Sport school (upper secondary)	81.8%	83.3%	66.6%	85.7%
Total sample	All (n=74)	Non-elite (n=30)	Near-elite (n=13)	Elite (n=31)
International matches	5 ± 0-49 <sup>b</sup>	4.5 ± 0-28 <sup>b*</sup>	5 ± 2-43 <sup>b</sup>	18 ± 0-49 <sup>b</sup>
Practice hours	154 ± 14-531 <sup>b</sup>	62 ± 14-271 <sup>b*</sup>	200 ± 87-519 <sup>b</sup>	245 ± 50-531 <sup>b</sup>

Note: <sup>a</sup>The first number is the mean value, and the second number is the standard deviation; <sup>b</sup>The first number is the median and the second number is the range. \*The (a) number of international matches played, and (b) the number of practice hours in relation to youth national team activities were significantly higher for those in the elite group than those in the non-elite group ( $P < 0.05$ ). There were no other statistical differences between the groups.

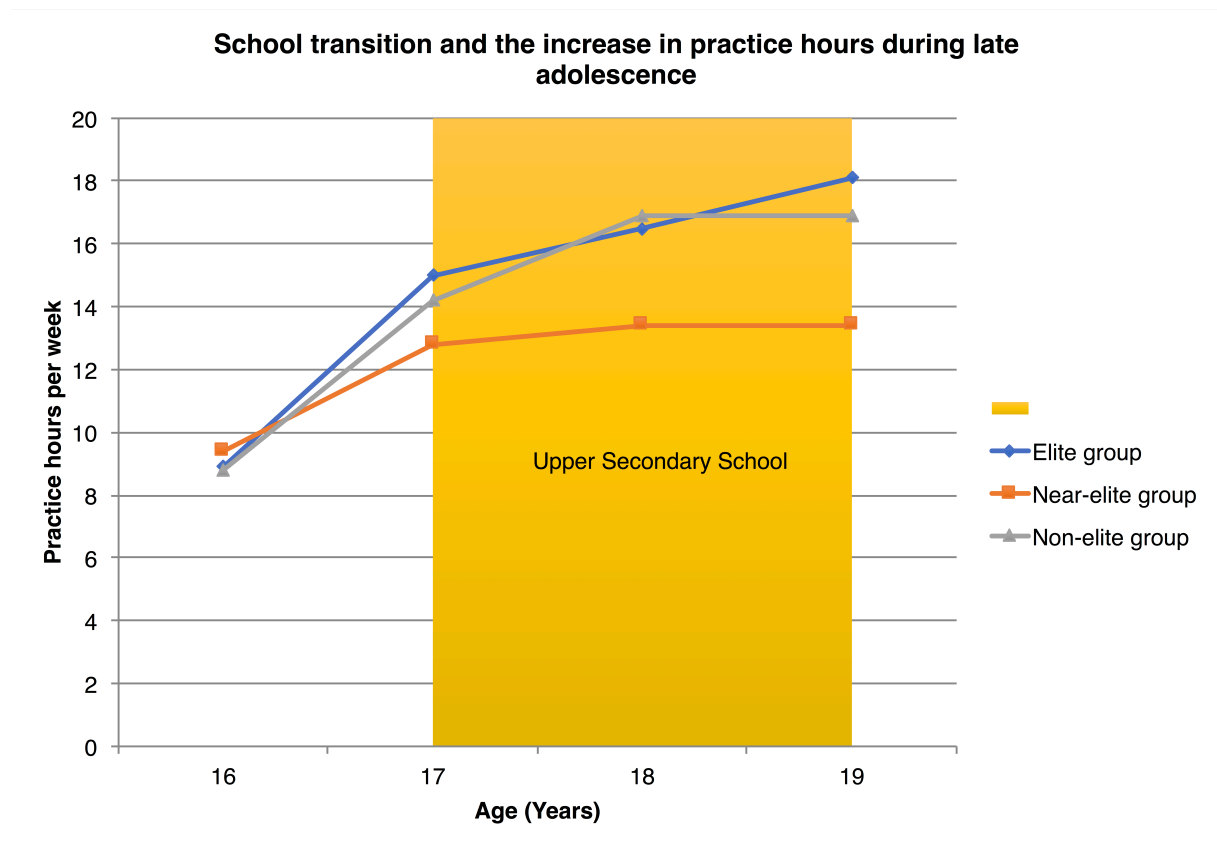
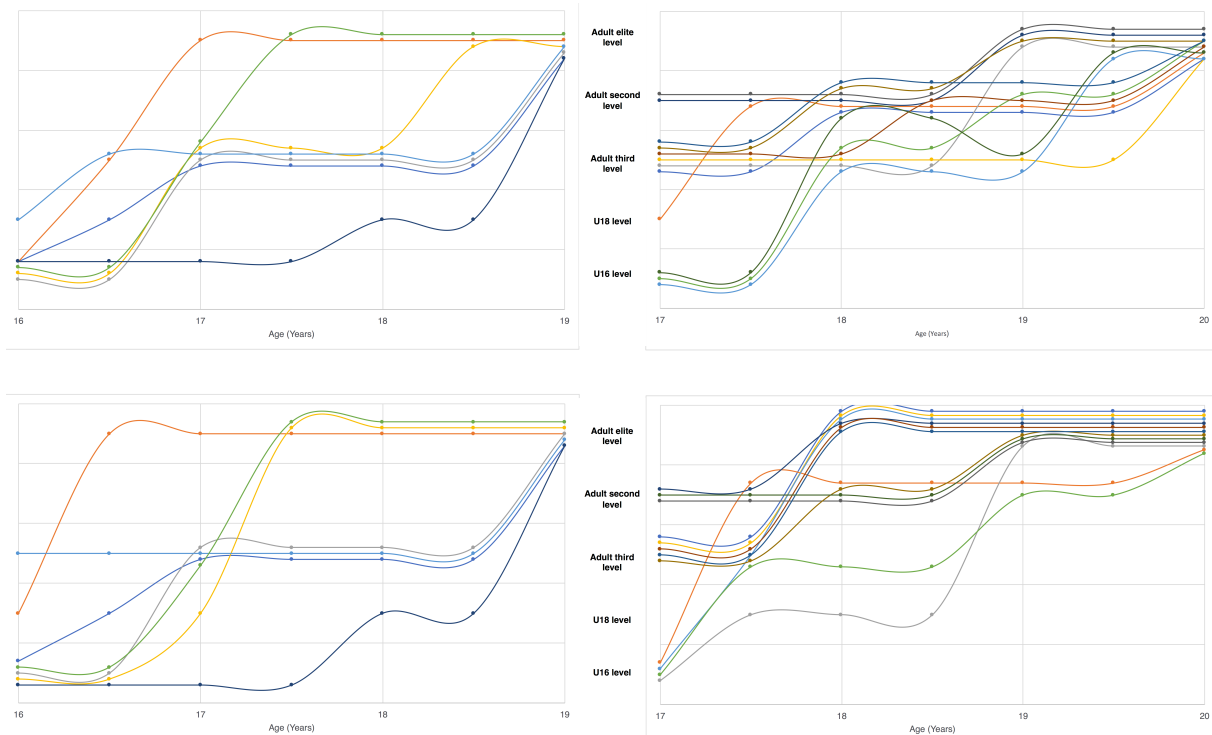


Figure 1. School transition and the increase in practice hours during late adolescence

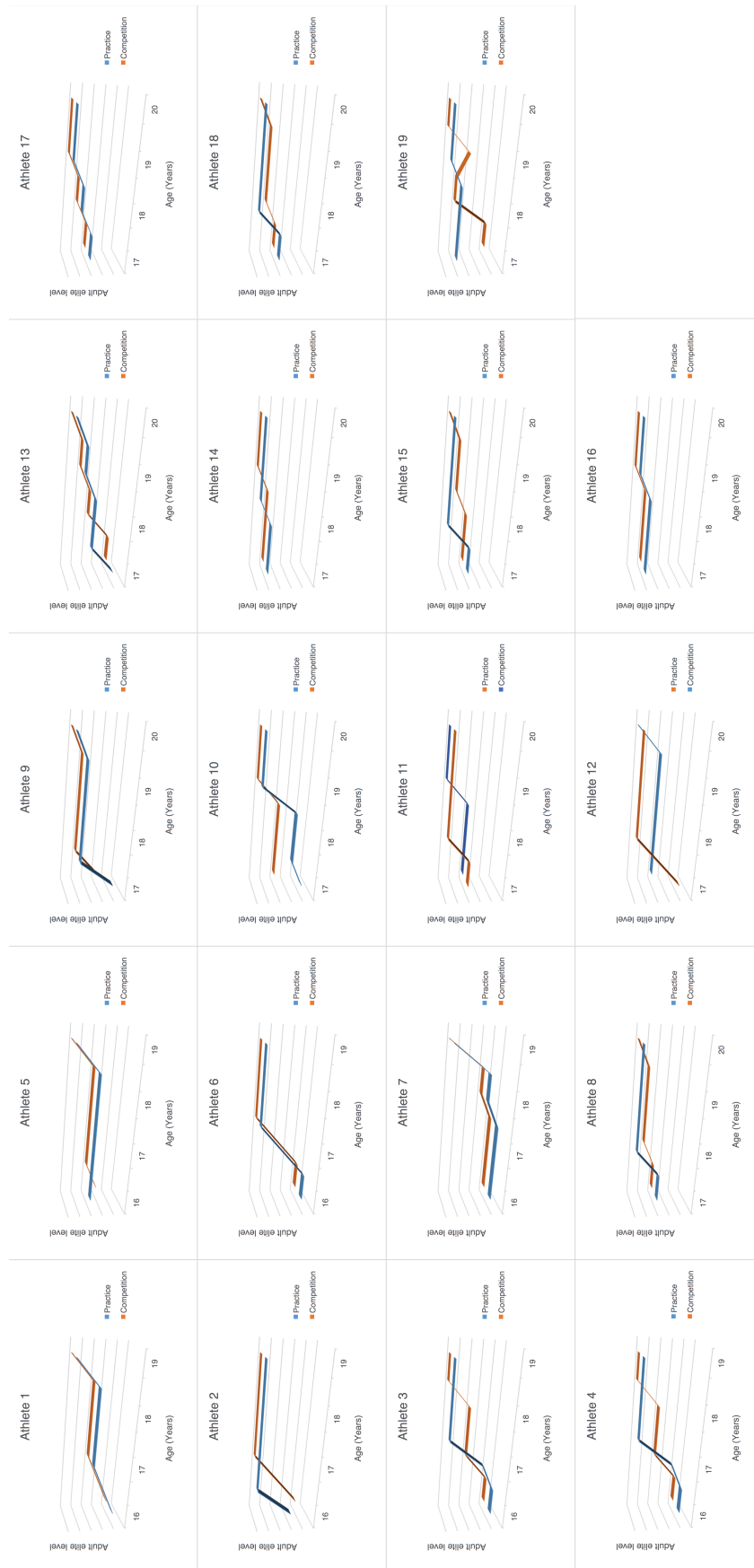
The performance trajectories leading to the elite level among the athletes in the elite group varied considerably both in terms of how the athletes moved between levels, and in terms of when such transitions occurred from one level to the next (see Figure 2). Their simultaneous involvement in different team and practice settings suggests that TD pathways are characterised by what could be described as a 'practising upwards' prior

to the introduction of formal competitive activities. Eighty-five percent of the cohort (79% of the elite group), for instance, took part in adult competitions before or during the season in which they turned 17 (legislation in Norway prohibits players under the age of 16 years from doing so). Typically, athletes start their adult careers by experiencing adult competition at lower levels (e.g. in a reserve team). In this study cohort, the average duration of a transition from adult practice to adult competition was 0.95 years. However, the length of the transition between youth and adult sport was varied (see Figure 3). To date, 64% of the cohort ( $n=33$ ) and 43% of our entire sample ( $n=74$ ) have made the transition to the elite level. As all the participants are still at a relatively early stage in their adult careers, it is likely that more will proceed to the elite level over time. It is also likely that several of the players currently at the elite level will transition to lower levels or pursue other careers outside sport.



**Figure 2.** Performance trajectories leading to the elite level

Note: Data are missing for the athletes assigned as Numbers 20 and 21 in the cohort.



**Figure 3.** The relationship between practising and playing upwards for each individual athlete

Note: Data are missing for the athletes assigned as Numbers 20 and 21 in the cohort.



## Discussion

The findings of this study suggest that although the pathways to the elite level in Norwegian handball share a set of basic commonalities on an aggregated level, they are also highly variable. Our findings demonstrate clearly the high variability in the amount of practice and competition in the youth national team, within-club performance trajectories, and the duration of transitions from junior to senior sports.

To meaningfully compare the sporting experiences of athletes in different groups, variations of involvement *between* the groups should be larger than variations within them. However, the performance variability within the elite and near-elite groups in our study was larger than the differences between these groups. This suggests that other extraneous reasons for such differences should be considered. Findings from studies showing that above-average amounts of domain-specific training have a favourable influence on selection to the national team in handball (Baker, Bagats, Büsch, Strauss, & Schorer, 2012) seems analytically inadequate when attempting to explain their success – or lack of success – when transitioning to the adult elite level. Above a certain threshold, other mechanisms (social, environmental and psychological, for instance) may shape the development of athletes (MacNamara & Collins, 2011). Self-regulatory skills (Jonker, Elferink-Gemser, & Visscher, 2011) and social mechanisms such as early international success at the senior grade (Hollings, Mallett, & Hume, 2014), for example, may determine whether athletes will be able to establish themselves successfully at the adult elite level. Developmental pathways are also influenced by the cultural contexts in which they are embedded (Storm et al., 2012). Sports participation histories, in isolation, therefore provide limited insights into causal inferences related to successful and less successful pathways (Ford et al., 2012). Studies have shown that social relations and the psychosocial environment are important to TD and that power relations are central to team sport practices (Potrac & Jones, 2009).

Vaeyens, Gullich, Warr, and Philippaerts (2009) demonstrated that institutionalised TD programs during adolescence need not necessarily be associated with greater success in senior elite sport. In a study of Portuguese athletes, Barreiros, Côté, and Fonseca (2014) reported that only one-third of pre-junior athletes became senior national team athletes. Our findings, in contrast, indicated that elite players tended to have greater involvement in national team competition and practice. This may be due to the specific national team context of TD in Norwegian handball, in which practice takes place under the guidance of expert coaches and also involves expert players with high levels of skill and motivation. Such practice provides ongoing opportunities for selection, for more practice, and learning environments of higher quality. However, our sample only included players who had been involved with Norway's national team, and the degree to which such cultural or organisational influences may have impacted upon player development is therefore difficult to determine. Though studies have shown that talent identification systems help to produce self-strengthening motivational mechanisms (Hancock, Adler, & Côté, 2013), few have attempted to investigate exactly *how* youth national team activities may influence TD. Exploring this issue may be challenging because the content and volume of national team activities varies considerably between countries and between sporting organisations, and are therefore difficult to compare.

Within organisational models in which TD is loosely organised, it is difficult to identify clearly-preferred hierarchical pathways leading to the elite adult level; fewer differences between athlete groups in terms of sporting experience prior to reaching adult competition might therefore be expected. In systems that more closely resemble the SMTD (Bailey & Collins, 2013), talent identification is based on particular criteria and athletes move through selection/de-selection at different hierarchical levels. In such systems, it would be plausible to assume that those who reach the elite adult level are

likely to be increasingly similar in terms of their sporting experiences. If players are able to move in and out of, and between, different levels and different practice settings, this could lead to considerable differences within all groups. In such instances, we would therefore assume that the average scores for different training and competition variables would be less representative of either elite or non-elite athlete groups. Such variability was noted within each group in our study sample. Models in which it is assumed that TD pathways are linear, hierarchical and predictable therefore do not seem to accurately represent Norwegian team sport contexts or other sporting contexts (MacNamara & Collins, 2014).

Participation in the full range of the available, diverse practice settings is potentially exhausting for athletes. However, as in other dynamic systems, these settings may be complementary and, collectively, may create multiple pathways and different combinations of sporting experiences (Davids, Araújo, Vilar, Renshaw, & Pinder, 2013). We suggest therefore that the possibility of different combinations of practice and competitive settings within the organisational context of Norway might explain the various and varying ways in which elite level athletes have been able to move through the system (e.g. via national team involvement and transitions at the club level). It is important, too, to recognise the importance of individualisation in TD (Ford et al., 2011): it could be argued, for instance, that organisational contexts characterised by a 'nested structure' of different practice settings provide *more* room for individualisation – expressed as different pathways – compared to more hierarchical TD models. In our study, the successful pathways were clearly characterised by diverse exposure to more adult level practice and/or competition during adolescence. Exposure to adult-level competition offers potential benefits and it has even been suggested that such exposure could be utilised as a tool for providing appropriate challenges for youth athletes (McCarthy & Collins, 2014). However, it should also be noted that too many potential combinations of different practice settings over the course of an athlete's development may also increase the risk of overtraining (Kristiansen & Stensrud, 2016). Daily workloads may therefore need to be carefully monitored.

Being able to follow a cohort of athletes over the course of their development enabled us to avoid the problem of 'survivor bias' which would otherwise have arisen if the analysis and interpretation had been based only on success stories. The study sample was small, however, and the timeframe was limited.

## Implications

The findings of this study highlight the difficulties of providing general guidelines for TD which do not consider the socio-cultural and organisational contexts underpinning TD processes. Developmental pathways in Norwegian handball are characterised by diverse interactivity. If policy makers regard this as important, they need not necessarily focus on encouraging a more streamlined TD pathway system. Instead, it may be more valuable to focus on the mechanisms that could facilitate better interaction and coordination between different practice settings, particularly of club team practices, school practices, and national teams. Currently, the coordination of TD efforts in Norway is left mostly to individual coaches, parents and players. Whether and how these efforts are optimised across contexts is highly variable. Volunteerism is embedded in the organisational context of Norwegian handball and this means that coordination cannot be achieved simply by increasing the level of professionalism. Instead, the facilitation of both formal coordination mechanisms (e.g. adjusting competition schedules) and informal coordination mechanisms (e.g. raising coaches' awareness of the need for individualisation) are likely to be more productive approaches.

Variables such as the total training volume (traditionally associated with success in elite handball) may be *necessary* if athletes are to reach the top level. But focusing on them is not analytically *sufficient* if we wish to understand the nuanced factors shaping the successful pathways of athletes within an already selected and talented population. Future studies should investigate the differences between the impact of such variables, explore the qualitative aspects of development, and strive to analyse how and why similar TD pathways sometimes result in quite different performance levels. We concur with MacNamara and Collins (2014) who argue that TD research needs to “focus on *features* of effective TD systems and *process* markers [...] that can be adapted to meet the need of specific sports, cultures and stakeholders” (p. 793). Closer attention should be given to the idiosyncrasies of particular pathways rather than the commonalities of pathways. Specific attention also needs to be focused on how different activities and the practice settings that constitute them may – or may not – complement each other during TD.

### Acknowledgements

The authors would like to thank Nuno Leite for his valuable comments on an earlier draft of this article.

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## Appendix 1: Examples of the items included in the questionnaire

What kind of upper secondary school program do you attend?

Which team(s) at which levels do you currently play competitive matches for?

When did you start to play for the team(s)?

Which team(s) at which levels do you currently practice with?

When did you start to practice with the team(s)?

How does your weekly practice schedule look like (type of activity, time of day and duration)?

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

How many weekly hours of team-based or self-organised practice do you do:

Of handball practice?

Of strength training?

Of work capacity training?

Of other types of training (please specify)?

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