

Interpreting and Implementing the Long Term Athlete Development Model: English Swimming Coaches' Views on the (Swimming) LTAD in Practice

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ABSTRACT

The LTAD (Long Term Athlete Development) model has come to represent a sports-wide set of principles that significantly influences national sports policy in England. However, little is known about its impact 'on the ground.' This study is concerned with how national sporting bodies have adapted the model to their specific requirements and how local interpretation and implementation of this is operationalized and delivered. Interpretation and implementation of the LTAD model used in English swimming was investigated through interviews with six elite and five non-elite swimming coaches in the north of England. While there were concerns with aspects of the Amateur Swimming Association (ASA) regulations governing competition for age-group swimmers, the major concern expressed by participants was with over-emphasizing volumes of training, leading to the neglect of technique.

Key words: Amateur Swimming Association, Fundamental Motor Skills, Istvan Balyi; Swimming Technique, Training Volume

INTRODUCTION

LONG TERM ATHLETE DEVELOPMENT (LTAD)

Growing recognition of the political and commercial value of sport over recent decades has seen government initiatives and funding aimed at developing elite athletes supersede those targeting mass sports participation [1, 2]. Within this context, the development of progressive pathways that nurture talented athletes from junior to senior level has come to form a core focus for national governing bodies of sport (NGBs) in England, which are now required to have a sport-specific Long Term Athlete Development (LTAD) plan to receive state funding [3].

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The LTAD model was created by sports scientist Istvan Balyi in the early 1990s. The primary goal of the LTAD is to ensure that children learn fundamental skills during their optimal physical development stages as this is seen as being pivotal for long-term athletic improvement [4-7].

In particular, research highlights the need for the systematic development of fundamental physical and movement skills as pre-requisites for the development of more sport-specific skills and effective long-term development [5, 6, 8, 9]. Unless these fundamental skills are learned by age 13, elite success in the long term is improbable [5] with most coaches considering technique to be an essential precursor to future sporting excellence [5, 10]. Moreover, Balyi himself emphasizes motor skills must be learned between the ages of 8-12, in LTAD stages 2 and 3 [11, 12]:

If fundamental motor skill training is not developed between the ages of 8-11 and 9-12 respectively for females and males, a significant window of opportunity has been lost, compromising the ability of the young player/athlete to reach his/her full potential. ... The Learn to Train and Training to Train stages are the most important phases of athletic preparation. During these stages, we make or break an athlete! [11]

Moreover, the notion that it takes at least 10 years or 10,000 hours of deliberate practice to excel, the so-called 10-year or 10,000-hour rule, has become central to the LTAD model [13-15].

THE SWIMMING PATHWAY

In English swimming, the adapted version of the LTAD provides guidelines for clubs affiliated with the ASA to develop athlete-training programs and is known as *The Swimmer Pathway* [16]. Introduced in 2003, *The Swimmer Pathway* has seen a significant rise in the success of the Great Britain swimming team, as evidenced from Beijing with the best results in Olympic swimming since the 1908 Olympic Games in London a hundred years prior. Subsequent success in international competition suggests that results for swimming in London 2012 are likely to be even better.

Although coaches at ASA-affiliated clubs have been obliged to develop programs that follow the principles laid down in *The Swimmer Pathway* since its introduction in 2003, little is known about the ways in which this model is realized in practice. Therefore, this study investigated competitive swimming coaches' views on the interpretation and implementation of the LTAD model used in English swimming.

In terms of the LTAD model, swimming is categorized as a late-specialization sport comprising the following stages: 1) FUNdamentals (boys aged 6-9 and girls aged 5-8); 2) Learning to Train (boys aged 9-12 and girls aged 8-11); 3) Training to Train (boys aged 12-15 and girls aged 11-14); 4) Training to Compete (males aged 15-18 and females aged 14-16); 5) Training to Win (males aged 18 and over and females aged 16 and over); and 6) Retirement/Retention [16].

Building on the generic LTAD model, *The Swimmer Pathway* specifies the frequency of swim training sessions and weekly volume to be covered. At the FUNdamentals stage, participation in general sports is encouraged and a structured, fun approach is advocated to learn basic swimming-specific skills, such as stroke technique, through what the ASA terms the "ABC's of athleticism", which refers to agility, coordination, power, endurance and speed [11, 16]. At stage two, Learning to Train ("SwimSkills"), stroke technique is further developed ahead of endurance training, based on the understanding that the former is an essential precursor to future excellence [5, 10]. Here, 4-7 hours per week of swimming

training covering 8,000-16,000 meters is recommended in addition to continued participation in complementary sports that use similar energy systems [16, 17]. Stage three, Training to Train, advocates more individualized training of predominantly high volume, low intensity workloads in order to develop the aerobic base, or in Balyi's terms 'build the engine' [17]. Stage four, Training to Compete, aims to optimize individual and sport-specific skills and fitness ('optimizing the engine') through year-round, high-intensity training. It emphasizes aerobic conditioning and, towards the end of the stage, strength work, with between 16-24 hours per week pool training recommended, covering between 24,000-52,000+ meters [17]. Finally, the Training to Win stage aims to capitalize on the training that has been completed thus far ('maximizing the engine') through more specific specialization of generally high-intensity, high-volume training punctuated by frequent breaks to obviate physical and mental burnout [11]. It suggests 20-24 hours of swim training weekly, covering at least 44,000 meters [16, 17]. The final stage, Retirement/Retention, was added in recognition of the need to retain athletes who have retired from competitive swimming and assumes the previous stages of the LTAD model will increase the likelihood of former athletes remaining within sport.

CRITICISMS OF THE SWIMMING PATHWAY

Although the take-up of the LTAD model across sports has been buoyed by the requirement that NGBs produce 'one-stop' plans for athlete development to receive government funding, support for the model is not universal. Three core concerns have been raised about the LTAD model and underpin the rationale for the study reported here. These concerns are outlined below.

High Volume of Training

There is concern that *The Swimmer Pathway* places too much emphasis on achieving specified volumes of training, which has the potential to lead to the neglect of technique [18]. Research has found that high-training volumes and the corollary high-aerobic capacity this brings have little impact on performance in events lasting between 20 seconds and 5 minutes [19]. Given that 80 percent of swimming events do not exceed 5 minutes, this is significant [19]. Such research encourages questioning of the training loads stipulated in *The Swimmer Pathway* and, particularly, in relation to stage three, Training to Train. According to Balyi [11], this is one of the most important phases of athletic preparation – where more individualized training of predominantly high-volume, low-intensity workloads is advocated [17]. The risk here for young athletes is that a focus on high volume can lead to overuse injuries [20], physical and mental 'burnout' [21] and dropout [22], as well as squeezing out time for developing swimmers' technique. In addition, in specifying training frequencies and volumes at each stage and age, *The Swimmer Pathway* has been criticized for 'writing off' young athletes who, for various reasons, do not/cannot commit to recommended training loads or who enter the sport late [20].

Amateur Swimming Association (ASA) Regulations

Several ASA regulations appear to contradict elements of the model. The first contradiction relates to the emphasis in the second stage, SwimSkills, on placing technique work ahead of endurance training and the ASA's competition entry requirements for its youngest competitors [18]. As of 2000, the sprint 50-meter events at national age-group swimming championships, which were open to girls 11-13 years old and boys 11-14 years old, were dropped "to discourage the 'bash-and-dash' approach of one-length events" [23]. At the same

time, girls aged 10 and boys aged 11 were prohibited from competing in 100-meter sprint events at district, regional and national events unless they had first achieved a qualifying time for the corresponding 200-meter event. Meanwhile, 800 and 1,500-meter events, the two longest events in pool-based swimming competitions, were added to the schedule for girls aged 11 and boys aged 12 [23].

The ASA argues this system of encouraging young swimmers to compete in longer 200-meter freestyle, but not in 50-meter events, is beneficial to young competitors who “do not have the physiological development required to swim [sprint] events correctly” [23, p. 4]. However, with only limited opportunity for youngsters to compete in shorter 50- and 100-meter events at a national level, the current system encourages coaches to train young athletes for 200-meter events, which involves higher training loads and intensity than for the 50- and 100-meter sprint events and places young swimmers’ bodies under more physical stress than would be the case if they were training for sprints [24, 25].

A second apparent contradiction relates to ASA regulations on minimum competition qualifying ages. As of 2000, changes in ASA law reduced the minimum qualifying age for national competitions to age 10 for girls and age 11 for boys. In doing so, the ASA is encouraging youngsters who, according to *The Swimmer Pathway*’s SwimSkills stage, should just be beginning to develop sport-specific skills and excellent technique [23] into an elite competitive environment at an increasingly young age. This is despite Balyi’s comments that: “Overemphasizing competition in the early phases of training will always cause shortcomings in athletic abilities later in an athlete’s career” [11, p. 4].

Monitoring and Evaluation

The Swimmer Pathway and the LTAD model upon which it is based are guidelines; i.e., they have no enforceability and it remains unclear how adherence to LTAD is monitored and evaluated [26, 27]. As such, the benefits for children included within the plan – its avoidance of basing training and competition models on athletes’ chronological age and its emphasis on trying to modify training programs to meet the physical, social and psychological developmental needs of youth athletes – may be pushed aside by coaches who are driven to pursue podium results.

Numerous scholars have highlighted the potential for lack of implementation of the LTAD [7, 18, 20, 26, 28]. Indeed, while coaches from a range of sports in Martindale et al.’s [28] study suggested that de-emphasizing age-group success was crucial for effective implementation of talent identification pathways such as LTAD, they also recognized that this was not currently occurring. Similarly, others have suggested that the drive for early success pervades contemporary English sports culture [18, 20] and is often even built into athlete- and coach-selection procedures [20] despite evidence that an emphasis on winning contributes to dropout rates within competitive programs [22, 29]. Moreover, as a large proportion of coaching knowledge and practice comes from personal interpretations of previous experiences [7, 30-32], this lack of monitoring of the implementation of LTAD has led to suggestions that policy slippage and incomplete implementation may occur [7].

METHOD

This article draws on data collected in a wider ethnographic study on coaches’ perceptions of good practice within competitive youth swimming [18]. The data reported in this article emerged from interviews with coaches conducted by the first author. Only interview data that covered responses linked to the LTAD (see interview guide in the Appendix) and which has not previously been published is used in this article. Questions aimed at exploring coaches’

understandings of and views on the implementation of *The Swimmer Pathway* were asked during interviews.

SAMPLING AND RECRUITMENT

Three ASA-affiliated swimming clubs in the north of England were purposefully selected to take part in the study, because the first author is a former international swimmer from this region and had what McNeill [33] calls ‘an insider identity’ that enable her to approach ‘gatekeepers’ who acted as brokers to facilitate access to the coaches. Club coaches were approached to take part in the study if they held an ASA-accredited coaching qualification and worked with competitive age-group, youth or open-age swimmers, as opposed to beginning swimmers or masters (i.e., swimmers aged over 25).

Ethical approval for the research was granted by the University’s research ethics board, after which a meeting with the head coach of each club was arranged to explain the study and negotiate access to the coaches who operated there. Coaches at Central Seals were approached first as the research began in late spring, before the start of the main competitive swimming season, and it was recognized that coaches at an elite club such as Central Seals would have less time to take part in the research when they are regularly travelling to and from competitions. Coaches at North Eels and South Dolphins were approached next, after the main competitive season for their respective club levels was complete. Coaches were purposefully sampled [34, 35] and, as the study was concerned with *competitive* swimming, only coaches who worked with swimmers who competed were involved. All participants provided written informed consent.

PARTICIPANTS

Eleven coaches participated in this study, comprising six elite-level coaches and five non-elite-level coaches. Coaches were classified as elite or non-elite according to the level of club in which they operated. The annual National Arena League competition, England’s largest inter-club swimming competition with more than 500 teams and 12,000 competitors [36, 37], was used to categorize clubs. Two of the eleven coaches were women. All were white and classified themselves as middle class, which is in line with previous research that suggests 94 percent of sports coaches are white and almost three-quarters come from the ABC1 socio-economic bracket [38]. Participants were between 22 and 60 years old and all were ASA qualified. In total, six coaches from Central Seals, three coaches from North Eels and two from South Dolphins took part in interviews. The names in Table 1 are pseudonyms.

Table 1. Research Participants

	Central Seals	North Eels	South Dolphins
Division in Arena League	Premier	One	Two
Club Level	Elite	Non-elite	Non-elite
Head Coach	Andrew	Amanda	Jim
Assistant Coaches	Steven John Mike Chris Jenny	Keith Dave	Kevin

DATA GENERATION

Interview guides were sent to participants in advance, to prepare them for the content and form of the interview. The interviews were semi-structured and took place in a private area within the leisure center where the coaches were based. Interviews lasted between 50 minutes and two hours and were digitally audio-recorded. The interview guide, which is reproduced in the Appendix, was devised from reading past literature on (among other issues) the LTAD model, and sought coaches' perspective on athlete development, talent identification and the LTAD model used in swimming. Interviews included two types of approaches to guide the conversation to the areas of interest: i) main questions, such as those surrounding the key principles that coaches emphasize in their coaching, how they aim to develop athletes' skills, how they incorporate each of *The Swimmer Pathway* stages into their training plans, and their perceptions of the strengths and limitations of *The Swimmer Pathway*; and ii) probes to elicit expanded responses [39].

DATA ANALYSIS

Interviews were conducted by the first author and transcribed verbatim within 24 hours of taking place, with information that might identify a particular coach removed from the transcripts. Data from Central Seals were transcribed and analyzed first, because they were the first complete data set obtained. This procedure was repeated for data from North Eels and, finally, South Dolphins.

Content analysis was used to analyze the data inductively as an approach that produces a "systematic and comprehensive summary or overview of the data set" [40, p. 182] through the reduction of information that is categorized into themes by finding relationships and grouping similar topics. In this case, the transcriptions were the unit of analysis so the process began with the first author reading and re-reading the interview transcripts to identify recurrent themes. These themes were then systematically identified across the data set and re-grouped together into categories. Next, data were coded into the two core categories presented below, relating to concerns over emphasis on volume at the expense of technique and competition rules that appear to contradict elements of *The Swimmer Pathway*.

METHODOLOGICAL RIGOR

Several methods were employed to enhance the data collection process. First, interviews were digitally audio-recorded to ensure the interviewer did not miss or mishear any details and to allow for full concentration on the interview [41]. These transcripts were then returned to participants for verification and comment. Moreover, as the analysis developed, member validation was used [42], with participants asked to comment on extracts of their interview and examples of the first author's interpretations of these. Four of the eleven participants – all from the two non-elite clubs – responded to this request and all returned the documents unchanged.

In addition, the study was based on interviews with eleven coaches at three different competitive swimming clubs. Working in different settings in this way enabled data gathered from one club to be compared and contrasted with that gathered from the others and, as such, data triangulation was used to enhance the methodological rigor of the study [43].

RESULTS

In order of importance, the two central findings to emerge from this study were coaches' concerns with: i) the negative impact of an over-emphasis on volume; and ii) competition rules that appeared to contradict elements of *The Swimmer Pathway*.

TOO MUCH VOLUME: 'BUILDING THE ENGINE' AT THE EXPENSE OF TECHNIQUE

Across all clubs and all coaches, there was unanimity regarding the objective of promoting good stroke technique as it was seen as an essential building block for swimming fast in competition:

... what I understand is that if your technique is good then anyone can build up strength and speed, so if your technique is great when you're 13 and you've got no good times then you can still say 'I know my technique, I just need to get in the gym and build some muscles up' then you will get to be a fast swimmer. Whereas if you get to 13 and you're thinking, 'I've got muscles like I don't know what but I can't swim for toffee' ... then it's too late to learn. (Keith)

Both the elite-level and non-elite level coaches identified similar problems with *The Swimmer Pathway*, although they differed in their views on their cause. The dominant concerns of both groups of coaches were with an over-emphasis on volume at the expense of the development of technique and with aspects of competition that saw coaches neglecting the long-term development of swimmers for short-term podium results. The elite-level coaches felt that these problems arose from the misinterpretation and misunderstanding of LTAD and a failure to implement it correctly, which was linked to a lack of monitoring of the plan. Meanwhile, the non-elite coaches tended to feel that the content of the swimming LTAD itself was at fault.

The elite-level coaches consistently expressed a belief in the importance of learning technique early in the first and second stages of *The Swimmer Pathway* and concern with the impact that a lack of attention to technique can have on the long-term development of swimmers. They felt that good technique needed to be established and developed as the basis for improvement and that it should not be neglected in favor of high volume and intensity training at a young age:

When they're in the younger groups it's all about their skills and the acquisition of those skills and refining them. ... These clubs that just think very short-term, they miss all that out and it's no good in the end, it's not what makes a great older swimmer. (Chris)

However, they felt that many coaches in the region's clubs generally misunderstood or misinterpreted *The Swimmer Pathway* and that this had significant consequences for the development of age-group swimmers. They suggested that some of these coaches were having their swimmers do too much volume and were not paying enough attention to making swimming fun and developing technique, as outlined in stages one and two of *The Swimmer Pathway*, FUNdamentals and Learning to Train. They consistently suggested this was a result of focusing too much on 'building the engine' and increasing speed at the expense of developing swimming technique. The coaches interviewed feared this omission would have negative consequences for the development of swimmers' stroke technique in the long term:

[The Swimmer Pathway] is about getting them to swim right, doing the technique. ... Other clubs I know who might beat us sometimes ... they're working less on skill and less on technique and they're missing out the key stages, the FUNdamentals and that, so the swimmers don't get the technique and the skills they need. (Steven)

The five non-elite coaches were also concerned with other coaches having young swimmers do too much volume, suggesting that *The Swimmer Pathway* was at fault because the frequency of swim training sessions and weekly volumes specified within it were excessive. In particular, they singled out the elite-level development programs that their better swimmers attended and the impact that these had on swimmers' technique:

Quite often when swimmers come training here after being in the [elite] squad system, I give them a real easy session with lots of technique work because you find they forget that when they're training at the [elite] squads. ... They might be putting in a lot of yardage but they start swimming sloppy, forget what you've taught them, you know. (Jim)

They suggested that the elite training regimes were undoing much of the good work they had done with their swimmers in developing good technique. Typically, they identified an over-emphasis on volume and intensity that they considered was leading to the deterioration of swimmers' technique. An assistant coach at South Dolphins was explicit about this:

They [elite clubs] focus too much time on mileage. There's more quantity than quality. I understand that quantity, there should be some, but I think the quality should be maintained all the way through the quantity and from what I've seen it's not. They're losing their technique just so they can do more yardage. (Kevin)

While the elite-level coaches suggested that over emphasizing volume was a misinterpretation or mis-implementation of the swimming LTAD, the non-elite level coaches suggested that technique was neglected due to the time it took from the coaches' sessions, thus limiting coaches' ability to meet the distance requirements specified in *The Swimmer Pathway*. Most suggested that the emphasis on technique in stages one and two should be continued through all stages of swimmers' development and not sidelined by attempts to 'build the engine':

I've seen it too often where, you know, the focus is on distance and they're doing 7,000 meters [four and a half miles] a session and I think there should be more emphasis on the coaches looking at the swimmers and saying, 'oh they're absolutely knackered so let's stop them now; let's do some technique.' ... I've been sat there thinking, 'why doesn't somebody recognize the fact that they're tired?' ... Perhaps somebody should be asking what's going on in these higher level squads. (Kevin)

The non-elite coaches also felt that the focus on volume within *The Swimmer Pathway* and what they saw as being the increasing normalization of specialization at a young age was detrimental to the FUNdamental principle of participation in varied sporting activities and the development of the basics of athleticism. The idea that children should experience a range of sports and other physical activities informs *The Swimmer Pathway*, but several of the non-elite level coaches suggested the frequencies of training specified in the plan left little time for alternative activities:

We're also told by the ASA [LTAD plan] that they need to be doing other activities at FUNdamentals [stage]. Well if we're asking them to train so much and parents want them to train so much, when are they going to do these other activities? (Amanda)

I'm not sure when they're supposed to do their football, or their netball though. I mean they're [swimming] training from such a young age now. They do a full day at school, then they go swimming five times a week. Where are they supposed to be fitting in the other stuff? It's no wonder they get sick of swimming and join a football club! (Dave)

This concern with excessive training volumes and frequencies was seen by the non-elite coaches to discourage lifelong participation in sport. While Dave from North Eels saw it as ignoring the FUNDamentals stage, Kevin at South Dolphins felt *The Swimmer Pathway* was itself at fault as it did not consider lifelong participation after the first stage. He and other non-elite coaches were critical, suggesting that *The Swimmer Pathway* was elitist and did little to encourage lifelong participation in swimming or any other sport:

There is this drive now to get people more active, lifelong participation in sport and swimming does have a huge problem of dropout and I often wonder if that's because there's too much asked of them at too young an age now. We should be trying to keep them in the sport and I'm not sure ... not sure that LTAD [in swimming] is helpful in that. (Kevin)

COMPETITION RULES THAT CONTRADICT THE SWIMMER PATHWAY PRINCIPLES

Both elite and non-elite coaches expressed concerns with the rules and regulations regarding competition that were largely tied into the issue of excessive volume and time spent on this.

Fast Tracking Young Swimmers for Podium Results

Coaches from the elite club were critical of the hothouse atmosphere of competitive sport and the desire of many coaches and clubs for short-term podium results rather than long-term development. The coaches at elite-level club Central Seals suggested that many other coaches focused on results, resulting in them ignoring the principles of *The Swimmer Pathway* in favor of a 'fast track' approach for short-term results. Several of these elite coaches discussed neighboring clubs and coaches that they visited who trained swimmers over and above the volumes recommended in *The Swimmer Pathway* in order to produce champions at a young age:

Other clubs around the area might be beating us at age-group level ... well, these clubs are working higher volumes than us and more intensity, above and beyond Long Term Athlete Development ... A lot of clubs they do think short term, they do think solely about national age groups year to year, but it's the wrong way of producing an international swimmer. (Steven)

I know down the road at Eastern Otters they don't follow [the swimming] LTAD at all. They do loads more yardage when they're only still young than we do here. There's loads of clubs like that, that just slog them up and down, doing sloppy yardage just to get them dead fit when they're, like, 12 ... because Bob [the head coach] just wants to get some winners at age groups to raise the club's profile and I understand that but it's no good in the long term. (Mike).

Forcing Young Swimmers to Compete in 200-meter Events

As of 2000, 50-meter events at national age-groups championships were dropped by the ASA and boys aged 10 and girls aged 11 were also prohibited from competing in 100-meter events at district, regional and national events unless they had first achieved a qualifying time for the corresponding 200-meter event [29]. Coaches from both the elite and non-elite clubs in this study noted the apparent contradiction between this policy and the emphasis in the second stage of *The Swimmer Pathway* on technique rather than endurance. The concern was that with only limited opportunity for talented youngsters to compete in shorter 50- and 100-meter events, coaches are being encouraged to train youngsters for more endurance-based events:

I can't understand it, on the one hand they're bringing out the Long Term Athlete Development plan and on the other they're telling us we've got to train athletes younger for longer distances ... that's promoting them to train for 200 [meters] at 9 years old ... so again they're promoting swimmers to swim as fast as they can for distance, which isn't good. (John)

It's really not good that they have to qualify in the 200 [meters] before they can swim in the 100 [meters] at nationals. All that's doing is telling coaches to train swimmers harder...for the longer distances and...well surely that's not what LTAD is about? Well I thought, and maybe I'm wrong, but I thought it was about getting them to swim with the right technique at that age. (Jim)

Competing at National Level Too Early

Similarly, most of the elite-level coaches felt that by permitting swimmers as young as 10 years old to compete in longer distance events, coaches are being encouraged to build swimmers' aerobic base so they can compete at longer distances rather than focusing on developing and consolidating movement and basic sport-specific skills as the early stages of *The Swimmer Pathway* suggest:

I'm very unhappy about the introduction of age-group nationals at 11 years old. ... I think it's promoting to clubs now to get swimmers better at a younger age. ... What are we trying to promote there? We're only trying to promote one thing and that's making kids swim as fast as they can. (John)

Swimmers as young as 10 years old are able to compete in the national age-group championships and many non-elite coaches felt this was too young. They suggested that exposing children this young to competition at a national level and the related pressure on them to perform was a specific issue, with some suggesting limiting competition for the younger swimmers to reduce pressure placed on them by over-zealous coaches and parents:

Now that the age is so low, they're actually competing nationally at 10 and regionally younger, I don't think it's good practice. ... I think raising the age would take all the pressure off the child, the coach and the parent until they're 10, because they could only swim for the club so all that pressure is gone, so you get a good 7 or 8 year-old swimmer and there's no pressure there to come through, or fast track as they call it now, because there's nothing to fast track for. (Jim)

The emphasis on volume in *The Swimmer Pathway* led coaches at the two non-elite clubs to express concern with the impact of high workloads on the motivation and welfare of many young swimmers. Stage one of *The Swimmer Pathway* emphasizes fun, but there was concern among the non-elite coaches with the impact that too much hard work and too much pressure to perform might have on young children:

If this 7 year-old child is training three times a week! At 7, a one-hour session, maybe two, that's fine. Let them enjoy what they're doing. You can't even compete at 7, you know. ... I disagree with children of age 11 going to a performance squad ... it can be too much for them, too much pressure to go training a lot. I mean, they're children, just children! (Amanda)

DISCUSSION

The coaches in this study regarded developing good stroke technique and other skills in competitive swimming as being essential building blocks for future successful performance. Indeed, research suggests that most coaches feel that learning technique is an essential precursor to future sporting excellence and should not be neglected [5, 10].

The ASA recognizes the importance of technique and clearly emphasizes the focus on skill development at this age by naming the second stage of *The Swimmer Pathway* as “SwimSkills”. However, the coaches in this study felt that this critical stage is often neglected through an exclusive focus on volume that squeezes out time for technique. This can impact upon the development of technique in two ways. First, the time taken to complete high-volume sessions does not leave enough time to focus on technique. Secondly, the state of fatigue associated with high-volume training regimes makes it difficult for swimmers to ‘hold their form,’ detracting from the maintenance, improvement and embedding of technique that results in what Mike from elite-level club Central Seals terms “sloppy yardage.”

Excessive volume was also central to coaches’ concerns with the ways in which they thought that some ASA rules and regulations for competition actually contradict the principles of *The Swimmer Pathway*. These included criticisms of (other) coaches fast tracking young swimmers, ASA rules that force the youngest swimmers to compete in and train for minimum distances of 200 meters, and allowing swimmers to compete at national level at an age they considered to be too early.

Despite the common concerns expressed by all coaches with excessive volume, there were differences in the causes of this, related to different views on misinterpretation of the LTAD/*Swimmer Pathway*. The elite-level coaches blamed misinterpretation of *The Swimmer Pathway* by English coaches, while the non-elite coaches found fault in the minimum distances set out in *The Swimmer Pathway* document. To provide a point of reference for considering this view, we compare the requirements of *The Swimmer Pathway* with the equivalent in Australia: the *Australian Swimming Multi-Year Age-Group Development Model* [44], specifically focusing on two similar age groups. The UK model suggests distances for males aged 9-12 and females aged 8-11 of 8,000-16,000 meters over 4-6 pool sessions a week, while the Australian model’s suggestions for males and females aged 8-12 are 2,000-3,500 per session over 3-5 weekly pool sessions (a weekly total of 6,000-17,500 meters). For males aged 12-15 and females aged 11-14, the UK model suggests 24,000-32,000 meters a week over 6-12 pool sessions, while the Australian model suggests that females aged 11-13 and males aged 12-14 complete 3,500-6,000 meters a session over 4-6 weekly pool sessions (a weekly total of 14,000-36,000 meters). Although there is a wider range available in the

Australian model, there is not a significant difference between distances suggested in the two models. This suggests that either both models ask for excessive volume or the problem lies in some coaches exceeding *The Swimmer Pathway*'s requirements. It may also support the claims of the elite-level coaches that many coaches are misinterpreting *The Swimmer Pathway* by failing to integrate technique into the volumes of training they have their swimmers undertake.

CONCLUSION

The views of the coaches in this study on the implementation of *The Swimmer Pathway* identify some specific areas for concern in regard to the ways in which it is being used to regulate coaching practice in swimming. The strongest reservation about *The Swimmer Pathway* expressed by the coaches in this study was with the impact of excessive volume upon the development of technique and, to a lesser degree, motivation. Given the importance of developing good technique by the age of 13, it clearly needs to be emphasized in any program of training with long-term development as its aim. If, as the non-elite coaches in this study suggest, the training volumes required by *The Swimmer Pathway* take too much time to fit in time to work on technique as well, then its distance requirements might need revising. If, on the other hand, as the elite coaches suggest the problem is coaches misinterpreting *The Swimmer Pathway*, then strategies for monitoring coaching or for coach education would seem to require consideration. If coaches are not implementing the swimming LTAD as set out by the ASA, then this would make any assessment of its efficacy very difficult.

Beyond the detail of the coaches' concerns expressed about the implementation of *The Swimmer Pathway*, this study points toward challenges involved in the process of adapting a general model for athlete development to specific sports. The LTAD was originally developed for the sport of alpine skiing before being proposed as a general model for all sports. This study has identified two stages of interpretation and adaptation in the process of having the LTAD guide swimming coaching practice from where the problems identified by participants originated: i) the interpretation of the LTAD and its adaptation to swimming in the form of *The Swimmer Pathway*; and ii) coaches' interpretation of *The Swimmer Pathway*. These are both points in the process of adapting a model of athlete development that are likely to provide challenges for NGBs in other sports and which warrant further research.

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APPENDIX

INTERVIEW GUIDE

- Introductory Questions
 - a. Coaching background/career
 - b. Highlights/low points
 - c. Coaching role
 - d. Coaching philosophy
- Club/Squad Questions
 - a. Club mission/philosophy and reputation
 - b. Structure of club
 - c. Squad system
 - d. Content of training sessions
- Athlete Development Questions
 - a. Athlete development process/practice
 - b. LTAD/ *The Swimmer Pathway*
 - c. Role of elite clubs/squads
 - d. Role of training and competitions
 - e. Talent-identification process
 - f. Categories of swimmers
- Concluding Questions
 - a. Future of swimming
 - b. Anything I've forgotten?

Interpreting and Implementing the Long Term Athlete Development Model: English Swimming Coaches' Views on the (Swimming) LTAD in Practice

A Commentary

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INTRODUCTION

Melanie Lang and Richard Light highlight the continuing need for coach education, as the messages about Long-Term Athlete Development (LTAD) appear to have been misinterpreted by the coaches interviewed in their article. The article makes some valid points and it is clear that LTAD has both strengths and weaknesses.

SMALLER CLUBS HOLDING ON TO SWIMMERS FOR TOO LONG

The 'non-elite' coaches questioned in the article spoke of "elite clubs undoing much of the good work they have done with their swimmers in developing techniques". The labelling of some of the coaches questioned in the article as being as 'elite' is misleading as they are not coaching at an elite level or within an elite programme. These views came across as local, inter-club, coach rivalry. However, the views expressed do suggest the coaches may fall into the trap of what Bill Sweetenham described as one of the biggest failings in British swimming; i.e., smaller clubs holding onto their swimmers for too long and only letting them go when it is too late. Smaller clubs do not see the need to encourage their swimmers to move to a club that can provide more for them in the long term. If the coaches believe the bigger clubs are not doing what they are supposed to do (as appears to be the case after reading the coaches' comments in this article), then the problem will continue. (On the matter of issue of swimmers progressing to different coaches, see [1, 2]) With the promotion of the Amateur Swimming Association (ASA)'s Swim 21 Accreditation Scheme, this problem (and Bill Sweetenham's highlighting of the problem) should not still be with us. This again points to the need for continued, or improved, coach education.

AEROBIC SWIMMING AND TECHNIQUE DEVELOPMENT

There are disagreements among the coaches questioned around the use of aerobic swimming

with young swimmers. Aerobic swimming can be seen in two ways: i) as training of the aerobic system; or ii) using the aerobic system to train the skills. The training of the skills is important, but it is not necessarily important to do large distances. One of the comments in the Lang and Light's article is that technique time is "squeezed out" due to the high volumes of training outlined in the LTAD. This suggests that the LTAD is being misinterpreted. The technique is best developed at slower speeds, thus pointing towards the use of aerobic type swimming to best develop it. The fault is with the coach if he lets a swimmer continue with an obvious fault during a swim/set, whether the swim/set be long or short. Consider a child playing on a Play station; the child does not start at the highest (or fastest) level. Rather, the child starts at the slower, easier-to-achieve, levels; and then more practice is needed to move up to the higher, more difficult levels. Swimming is the same; start at easy, slower levels then progress. However, it is not possible to get to the higher levels without hour upon hour of practice. At age-group levels, every swim should be focused on technique enhancement whatever the speed or distance of the swim. After reading their comments, this may be where the confusion lies with the coaches questioned. They appear to be saying distance swims are purely for aerobic development and are not related to technique. Furthermore, they do not appear to think they should be correcting swimmers during the longer swims.

All knowledgeable coaches would support the need for better stroke technique development at all stages of a swimmer's career, but perhaps Lang and Light should focus on what this actually means and how to achieve it rather than reducing a swimmer's participation in training. We feel time would be better spent in constructing strict descriptions of satisfactory technique on each stroke (with example videos of what is acceptable and unacceptable) in order to determine swimmers who are competent to move on from one level to the next. The steps between FUNdamentals and SwimSkills and from SwimSkills and Training to Train are critical in this respect.

PHYSIOLOGY OF THE LTAD

The coaches in Lang and Light's study appear to believe that the LTAD guidelines are towards making all swimmers into distance swimmers. This shows a lack of understanding of the physiological aspects of LTAD. To make solid the skills, aerobic swimming is a necessity and cannot be done anaerobically as the swimmers cannot maintain this level of swimming without the techniques becoming impaired. Use of aerobic swimming during the Training to Train phase of LTAD emphasises the optimum window of maximising the swimmers' aerobic-potential development. The aerobic system is crucial in later years to all who swim competitively, and not just those who go onto become distance swimmers. According to Istvan Baly (LTAD Lecture, Sheffield, UK, 2003), the aerobic system is directly linked to the effective recovery of the swimmer from anaerobic and high-intensity training sets, and from competition (often heats, semi-finals and finals in senior swimming). It is in the long-term interest of both the swimmer and the coach to maximise the aerobic development in this period as the diaphragm and the thorax are at their peak growth rate (Richard Gordon, ASA LTAD Roadshow, Leeds International Pool, UK 2004). Too much anaerobic type training at this stage will result in a reduction of the swimmer's potential to be a successful senior swimmer.

DELIBERATE PRACTICE AND ENJOYMENT

Lang and Light question the swimming time (recommended durations) or training volume, but appear to contradict themselves in emphasising the importance of the 10,000 hour rule of practice. It would seem that expertise in swimming, just as in many other domains (see

the work of Anders Ericsson and Malcolm Gladwell) is not easy to gain, and requires close to 10,000 hours of deliberate practice. Whether the practice is physical, technical, mental or tactical (or most commonly a combination of more than one at a time), something close to 20 hours per week of related activity for 10 years is required to maximise potential. In other words, a reasonably high training volume (conducted with good technique) is a 'necessary evil' for swimmers wishing to maximise their full potential. It should be emphasised, however, that training volume and durations are included throughout LTAD as *guidelines* not inflexible prescriptions.

Some of the coaches questioned appear to believe the recommended volume of metres and number of sessions in the LTAD guidelines cause swimmers to leave the sport of swimming. We would argue that the actual amount of metres is not important and that swimming should be enjoyed by the young swimmers. In an ideal world, young swimmers would start school at 10 am and finish at 3 pm so their swimming training could easily be fitted in around it without the swimmers becoming fatigued. It is an unfortunate part of competitive swimming that you have to put the hours of training in to get results. This does not mean training 12 times per week, but the swimmers will have to attend morning training even at an early age. At a certain point, just training five evenings per week will not be enough to keep pace with rivals. While not mimicking a senior programme, it is important that the younger swimmers begin to adapt to the frequency of training. The introduction has to be gradual, but attending shorter sessions frequently and consistently should promote a successful transfer to the next stage of the LTAD. To not become adjusted to the frequency of sessions at one level means the next level will require not only a more taxing training intensity, but also a big jump in sessions per week. This may prove to be too big an increase all round for the swimmer.

COMPETITION AND SWIMMER AUTONOMY

The question of what age to start competing at Nationals is raised in Lang and Light's article. We believe that children love to compete even at very young ages. If you try to stop a swimmer competing, they will leave the sport (i.e., *because* they want to compete). We advocate multi-skilled events for youngsters and encourage swimmers to compete in shorter events, longer events and 200m and 400m individual medley. While it is important for the young swimmers to do the events outlined above, it is also important for the coach not to hijack the swimmers career. It is important to let the swimmers experience the events they want to do. Coaches should be advised to treat the swimmers as individuals. This will increase the chances that the swimmer stays in the sport for longer.

CONCLUSION

Lang and Light are quite correct in identifying some anomalies in the LTAD content. We would fully agree that there should be a full evaluation of the current LTAD documentation produced by the ASA. There are clearly gaps between the theory and what that means in practice to clubs, coaches and swimmers across the UK.

There is a need to consider sports-specific and practical issues in addition to general and theoretical aspects. Much of this work will be difficult to conduct as longitudinal data needs to be collected to make true decisions based on results.

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Bill Furniss has been the Head Coach of NOVA Centurion SC for 30 years and has coached more than 200 senior and junior international swimmers during this time. He has coached Rebecca Adlington since she was 13 years old, culminating in two Olympic Gold Medals and a World Record in the 800 m freestyle. Bill has been involved at the highest levels in coach education and runs his own very successful SwimSkills business to pass on the importance of great swimming technique. He has an Honorary Doctorate from Nottingham Trent University.

Interpreting and Implementing the Long Term Athlete Development Model: English Swimming Coaches' Views on the (Swimming) LTAD in Practice

A Commentary

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INTRODUCTION

The article by Melanie Lang and Richard Light highlights a very important issue in the planned development of swimmer pathways. Large distances in training programs can have negative effects on health and negate optimal training gains for performance by incorrect use of glycogen reserves. In the past there has been an over-importance placed on total distance in a weekly program as opposed to a logic behind what is done at speed and the necessary amount of low-level recovery and stroke work which in the main generates a lower total volume.

I agree with the authors that the LTAD places too much emphasis on achieving specified volumes of training, which has the potential to lead to the neglect of technique. The primary goal of the LTAD should be to ensure that children learn fundamental skills during their optimal physical development stages and this is seen as being pivotal for long-term athletic improvement. We should also make sure they learn to have fun.

STAGE OF DEVELOPMENT

A lack of attention paid to technique in early training can have a negative impact on swimmers' future development. High-training volume by coaches is a negative throughout the coaching networks that many successful coaches are now starting to redress. I have witnessed too many potentially elite swimmers put out of the sport by the 100k hell week mentality of coaches with its similar approach to 'more swimming is best' for the younger age groups.

The Learn to Train and Training to Train stages are the most important phases of athletic preparation. During these stages, we can make or break an athlete. I disagree with Balyi's assertion that motor skills must necessarily be learned between the ages of 8-12. It would be optimal to do so at as early a stage as possible, however, to prevent loss of a significant window of opportunity for the young player/athlete to reach his/her full potential. Experience has shown me that basic skills not learned by age 13 can still be developed as long as the athlete has a relaxed ability in their stroke during the recovery phase.

EMPHASIZE TECHNIQUE NOT HIGH VOLUME

Recently I have personally been involved with changing the technique of two mature athletes

who subsequently obtained their first Olympic Gold medals. They were able to dramatically change their stroke, because they both had a relaxed recovery in their stroke. Relaxed stretch in the swimming stroke prior to the catch is also an important part of the technique of successful swimmers.

As with Lang and Light, I strongly disagree with Balyi when he advocates predominantly high-volume, low-intensity workloads. I agree that high volume can lead to overuse injuries, physical and mental 'burnout' and dropout as well as the chance of neglecting time for developing swimmers' technique and really working on optimising the muscle lactate removal functions important for race improvement.

Why penalise and ignore the athletes who are born with a high percentage of fast fibres by minimising the sprint 50m and 100m events at national age-group swimming championships and also the training that will optimise their potential? This goes against all we know about muscle physiology and its restricted potential for change. Planning programs so that all types of muscle structures can be optimally progressed in the sport should be the major goal. What the coaches in this study are saying is that experience on the pool deck shows that unless you spend time on technique and watch carefully for the over-fatigued swimmers, then you lose talent from the sport. The main swimmers who would fall into this category would be the high-percentage fast-twitch fibre potential sprinter type who would be trapped into swimming too fast for their lactate build up to cope with distance work. There is logic available to prevent this as a problem, if better guidelines than those proposed in the LTAD were proposed.

PHYSIOLOGICAL PRINCIPLES AND COACHING RULES

Since 1978 I have been involved with evolving programs on the pool deck with coaches that have culminated with eleven different swimmers breaking world records. The ideas that were pushed into these programs, creating the final major sets and weekly program design, took into account the following physiological measures and limitations and the Rules for their control.

GLYCOGEN USE AND REPLACEMENT RATE AT DIFFERENT TRAINING SPEEDS

Rule1:

- Two days between major high heart rate sets (30 minutes of work each)
- Three days between 50 to 200m race speed sets (maximum of 800m in 50 and 100m pace sets)

Muscle fibre glycogen and lactate transporter replacement rates are:

- 36 hours for IA fibres
- 12 hours for IIA fast-twitch fibres
- Three days full recovery for IIB fibres in transporters and the glycogen reserves

Glycogen in the fast twitch fibres (IIA and IIB) is used up at different rates depending on the speed used by the swimmer; i.e., working at 50m race pace (about 200% of $\dot{V}O_2$ max) will deplete the glycogen in the type II fibres in about 8 minutes or less. Critical speed (V_{cr}) is the steady-state speed at which maximum heart rate is first reached (which is also when $\dot{V}O_2$ max is first reached). If the work is done at 200m pace (106% of V_{cr} , 120% $\dot{V}O_2$ max), the swimmer will obviously be able to train for longer with the same glycogen reserves. Distance

swimmers are able to train race speed sets at 200 to 400m pace for greater than 15 min (e.g., 30 x 50m on 1.30 cycle at 200m to 400m pace).

It is important to monitor the swimmer's program so as to avoid full glycogen depletion and also to optimize the high-intensity sets. Constant training without full glycogen stores can lead to muscle breakdown

DETERMINATION OF THE SPEED AT WHICH $\dot{V}O_2$ MAX IS ACHIEVED

Rule 2:

- Determine V_{cr} by a regular test - this speed is close to 400m speed
- This speed is used in one major heart rate set per week.

At this speed, the lactate removal rate is at a maximum and is the best speed to put this removal rate under pressure to improve. One way to establish V_{cr} is to have the swimmer swim a set of 5 x 200m on about 5 min ascending in speed from easy to 80% of maximum speed. From this test, an estimate of V_{cr} is determined graphically by extrapolation to their maximum heart rate.

NEED FOR THE TRAINING TO BE SPECIFIC FOR THE SWIMMERS EVENT AND THE EFFICIENCY OF THE STROKE TO BE DEVELOPED AT COMPETITIVE SPEEDS

Rule 3:

- For 50m and 100m specialists, use 25m, 30m, 40 and 50m distances; not the pool length

Swimmers should rigorously and frequently train at the pace in which they are to compete to overload the race's requirements and therefore initiate improvements. For example, swimmers aiming for the 200m as the main goal for the season should train at the goal time speed for the 200m. Muscle function and overload should not be limited by the length of a pool when constructing sets utilizing this goal time speed. It is impossible for a 100m swimmer to be able to swim 100m at their goal time 100-m pace in training sessions. Therefore race-speed sets constructed using distances that they can swim at their race pace should be constructed. This normally means training using several distances less than 50 meters to make up a total of 100m. The main improvement with a 50 to 100m swimmer with training comes from an increase in the lactate removal rate from the white fast-twitch fibres and its eventual oxidation in the type II fibres. The maximum length of race-speed sets should be limited to 8 min work for 50/100 swimmers (based on 8 min to glycogen depletion at 50m pace). The length of work can be increased to 15 min for 200-m/400-m swimmers (based on around 15 min of work for glycogen depletion at this 200m/400m pace).

WATCH FOR VARIOUS MAJOR ADAPTATIONS THAT CAN OCCUR WITHIN THE BODY AND THEN ALTER THE TRAINING ROUTINE

Rule 4:

- Train athletes and coaches to understand pulse measures and the coach to take responsible decisions

Adaptations occur almost daily within the muscles of a training athlete, but there are two main adaptations which restrict the athlete in training. One of these adaptations involves the sudden mitosis of up to 10% of mitochondria. The full transition of mitochondria appears to

take up to 10 days. During this 10-day period, the aerobic ability is decreased and the heart rates are increased at training speeds. Heart rate measurements can be used to ascertain whether an athlete is going through an adaptation. This enables the coach to establish when the 10-day adaptation period begins. During this adaptation time the program might be altered. Lowering the intensity or introducing more 1000m to 1500m fat-metabolism sets in the weekly program to enable the athlete to get through the adaptations.

CONSERVE RED AND WHITE FIBRE GLYCOGEN IN SETS AND SESSIONS OUTSIDE THE MAJOR SETS

Rule 5:

- 70% of work to be done in the fat metabolism area of training

The high-intensity heart rate sets need to be suitably located when the red slow and fast twitch fibres are almost fully stocked with glycogen. Two days should be allowed between major 30 min high heart-rate sets. (HR sets). Three days should be allowed between 8 min at 50 to 100m race-speed. Fat metabolism sets should be between these sets. A session with a heart-rate set should preferably be followed by a fat metabolism and a recovery session. Plan the week to use specific race-speed fibres and their metabolic functions, but also allow for recovery. This requires fat-metabolism sets.

There is no reason why these same considerations used on elite international swimmers cannot be taken into account in a revised LTAD model for the long-term development of younger athletes. This base development would be best done by controlling the swimming at all stages to utilize the full muscle range correctly. It would be easy to set up a structure to start at the second season of a swimmer's career that would be able to fit into a club training program that would cope with all varieties of swimmers from sprint- to open-water capabilities.

IMPROVING THE STRUCTURE OF THE LTAD

The structure that I propose to improve on the Amateur Swimming Association's LTAD model would include the following elements:

- Simple test to establish for each swimmer a high heart rate V_{cr} to do 'heart-rate sets'. This test need not necessarily require heart-rate measures. This test would be repeated every 10 weeks.
- 20 different heart-rate sets using this speed as a basis but with 25m, 50m, 75m, 100m distances different in different lanes so that potential sprinters, 100m, 200m, 800m, 1500m, open-water swimmers could be trained in different lanes on the same leave cycles.
- Simple test to establish for each swimmer a 50-100m speed to do race-speed work. This test would be repeated every 10 weeks.
- Use at least 20 different race-speed sets.

Successful international programs have 2 to 3 sets a week swum at high heart rates for about 30 min each. These would be planned to start at 10 min work per set for the first year of their career then 15 min in the second year, and 20 min in the third year. To set these up at appropriate speeds, the athletes would be asked to swim a test such as a 300m (400m for the 3rd year group) as fast as they can. The average time for 100m determined would be close to their V_{cr} . This would set the basis for the time of each 100m, 75m, 50m, 25m in the heart-

rate set. Once these sets are structured, then the warm-up and swim-downs would be controlled to no more than 15 minutes on both sides of the main set.

A successful program also has 1 or 2 race speed sets at speeds at their 50m and 100m best pace. These sets are no longer than a total of 800m for the elite senior swimmers. A recommended progression for the total distance swum in each set would be 200m, then 400m then 600m in the first 3 years. For proper development of the fibres each week, the training program should contain enough race speed work to remind the muscle system of the need to retain the full use of the fast fibres. This work needs glycogen. If a swimmer in a particular recovery or technique set has too much work at 30 bpm below maximum, then the glycogen stores in the white fibres necessary for sprint work will eventually be utilized. They therefore should be trained to measure their heart rate by pulse and learn to control their low-level training at 50bpm below their maximum so that they are predominately using fat. For this reason, the main slower technique work should be very well controlled by heart rate measures. Until they can do this, their technique is not yet good enough to fully control their main sets. Any work that extends to a distance where the athlete loses control of his stroke is in excess of what is required.

The first and second season should emphasize training control using pulse or heart-rate monitors to swim at 50 bpm below their maximum and maintain this for long distances. The time to swim 300m at this heart rate is a measure of their technique. To swim this 300m faster in each phase of their training should be engendered as a major goal.

I recently worked with an Australian Coach who structured his new club in 2001 in a similar way to what I propose. He started this club with no Queensland State swimmers at the time. He produced three Olympians in 2008, two of whom gold-medalled in a relay and a World open-water winner. The swimmers trained from age 11 upwards in different lanes, separated only by their distance of swimming capabilities and not necessarily age. Stroke was emphasized in all phases of training.

CONCLUSION

I agree with the tone of Lang and Light that there is a need for a relook at the LTAD controlling measures as there is too much difficulty for potential sprinters to get safely through the processes. Perhaps taking into account a reasonable physiological model and using it to create other controlling measures for the youth swimmers in England would be a way forward.

Editors's Note:

Bob Treffene, Ph.D., worked with all of the Australian coaches (e.g., Bill Sweetenham) whose swimmers achieved long-course world records between 1977 and 1996. Since 2001, he has been involved with British swimming as a consultant with assigned coaches (e.g., Sean Kelly, Bill Furniss and Dave Haller) on individual-swimmer set planning and measures to control those sets to optimize the physiological gains from the sets for competition speeds and also to advise on and help control taper processes. Bob was part of the British Team for the last two Olympic Games.

Interpreting and Implementing the Long Term Athlete Development Model: English Swimming Coaches' Views on the (Swimming) LTAD in Practice

A Commentary

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INTRODUCTION

The article by Melanie Lang and Richard Light provides interesting information related to the difficult task of adapting a swimming training programme to the general guidelines that the sport governing bodies impose to obtain funding support for the competitive programme.

In general terms, a long term athlete development (LTAD) model is written by sport experts to define a general pathway of athlete development to achieve national or international performances in different sports or in a particular sport based on an interdisciplinary scientific knowledge. Numerous such models have been published and distributed for years in many countries and seek to guide the achievement of outstanding performances in many sports (see Canadian and English examples [1, 2]).

The programme application entails a considerable effort on the part of the participants (swimmers, coaches and clubs), but unfortunately this effort seems absolutely necessary to obtain international performances. The problem arises when external guidelines based on LTAD may contradict, in some cases, the competitive rules that should stimulate participation in this long-term programme, as the cited article tries to demonstrate.

However, I wish to deal with the conclusion of the article that concerned the impact of excessive volume upon development of technique. This led me to deal with the lack of attention that swimming-planning specialists devote to this highly influential factor in swimming performance.

DIFFERENT APPROACHES TO THE LTAD MODEL

A LTAD swimming framework has been developed in recent years for different countries such as Australia, England and Canada. Five phases or periods can be adapted to athlete development and are broadly named as: FUNdamentals, SwimSkills, Training to Train, Training to Compete and Training To Win. The first phases are in the beginning of the swimmer's sport participation periods (about 7 years old) and later phases are at the finishing period of the swimmer's competitive life, about or a little later than 22 years old. In the England, the LTAD is normally coordinated with a funding program such as "Swim 21". It is accredited and given public recognition (by Sport England in this case) that the club is

“safe, effective and child friendly” [3, 4]. Their proposers consider it an important planning tool because:

It is core to all we do; It is swimmer centred; It provides a clear pathway based on sound principles of growth and development; It provides a simple framework for all swimming providers and implementers; It provides guidelines for success on the world stage; It is central to the re-engineering of coach education and; You can’t argue with it!! [4]

A sample of a different models of LTAD is shown in the Table 1. The phases are similar, but a different denomination is applied. Comments about “efficient technique” or “integration of efficient biomechanics and physiology” are included, but not detailed, in the manual [5].

All models include basic recommendations about annual training volumes for every period of development. Samples of these volumes are compiled in the Figure 1, where different models from US Swimming, Russia and English Swimming LTAD are compared. The volume path shows differences between models in specific periods. However, all the models posit a correct distribution of training loads, such as strength, cardiovascular endurance, peak velocity and so on, during specific sensitive periods that will induce proper functional adaptations.

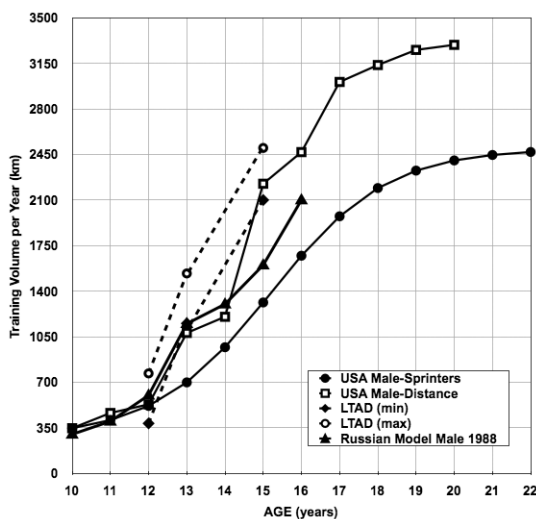


Figure 1. Comparison of US Swimming Workload Progression in Career Training for Male Sprinters (km per year) with the LTAD Minimum and Maximum Volumes and the Russian Swimming Model in 1998 [4, 6, 8]

A drastic increase of the training volume is observed in all the models during the 12 to 15 year period. Higher differences can be observed between the USA male sprinters trend and the British LTAD (maximum volumes). But LTAD (max) differences were double the USA volume per year at 13 and 15.

Table 1. Swimming Sport Participation Categories and General training Objectives, Technical Focus and Training loads (adapted from [5])

Sport Participation Category (Development stage)	Training Objective(s)	Biomechanical or Technical focus	Training load imposed
Reflexive awareness (0-2 years)	Stimulation of body		
Motor memory development (3-6 years)	Motor pattern development	Using appropriate stroke patterns	
Sport participation (6-9 years)	Stroke technique, aerobic development	Efficient technique	2 x 3 per week, 1500-4000 m/wk
Sport delineation I (9-12 years)	Technique development, aerobic base, muscular endurance	Efficient technique	3 x 6 per week, 5000-40000 m/wk
Sport delineation II (12-14 years)	Aerobic maintenance, technique	Efficient technique, integration of physiology and mechanics	6 x 10 per week, 30000-60000 m/wk
Sport mastery (14-20 years)	Integration of efficient biomechanics and physiology	Efficient technique	8 x 12 per week, 40000-100000 m/wk
Elite mastery (17-24+ years)	Integration of efficient biomechanics and physiology	Efficient technique	Event-length specific

LTAD MODELS AND SWIMMING PERFORMANCE

The workload progression models shown in Figure 1 all have in common a drastic increase of the training volume during the 12 to 15 years period (i.e., the sensitive period for the full development of cardiovascular endurance [6]). The correct application of the models should result in a progressive improvement of the performances, as Figure 2 indicates. The performance values in Figure 2 at age 11, however, shown an extraordinary mean value (USA ten best times, 2010 long course) that may be a result of combining very skilled swimmers, clever coaches and “very low volume of training”. Even basic knowledge of swimming shows that this is impossible. What the models aim to do - namely a progressive build-up of workload volumes from 8 to 12 years - is contradicted by the swimmers’ performances. In this way, the long-term objective is changed to a short-term aim. Another explanation may be that the long-term progression is started at 7 and not at 10 as the models proposed and the volumes are shifted to the left (related to age) in the figures. In this case, the sampled performances shown in the Figure 2 could be achieved.

However, this “fast track” in the performances (modelled in Figure 3) contradicts the final participation of elite swimmers as a study by US Swimming demonstrated:

A small number of elite swimmers from the Top 100 at age 17-18 were ranked in the Top 100 at a younger age. Typically, a little over 10% were ranked as a 10 and under, about the same figure as a 11-12 year old, a little over 30% as a 13-14 year old, and a little over 50% as a 15-16 year old [male swimmers]. [7]

They concluded that most elite swimmers were unknown at young ages and about half the elite swimmers listed in the Top 100 at age 17-18 are new swimmers who were never listed in the Top 100 at any age.

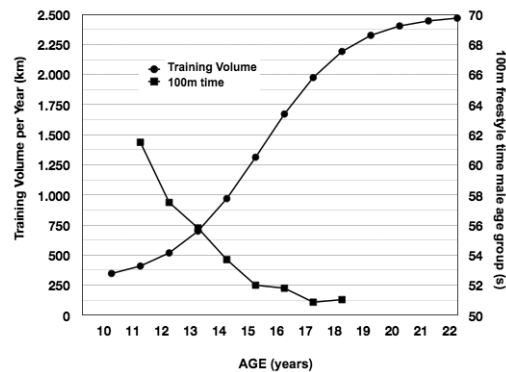


Figure 2. A Comparison between Training Volume Progression [6] and 100m Male Freestyle Performances (Average of Top Ten Age Group, USA Age-Group 2010 ranking, Collected from www.usswimming.org)

A first glance demonstrates a clear relation between the increase in training volume and the 100m times reduction during the critical phases of male maturation (11 to 15 years). However, the initial average time at 11 years (about 61.5 s), suggests higher volumes of training than the proposed model.

Table 2. Recommended Target Times to be Obtained by Future Age Group Swimmers (12 years old male or female) to be Able to Participate in National or International Competitions

This target or better times should be obtained with technically oriented training and with the lowest training volume possible to have enough room for improvement in the future (they can be considered medium or slow track times, see Figure 3).

Event	100m Freestyle	100m Backstroke	100m Breaststroke	100m Butterfly	200m Individual Medley	400m Freestyle
Target Times (min.s)	1.04	1.11	1.19	1.08	2.35	4.56

Based on these results, it would be appropriate to suggest criteria to define when an age-group swimmer is able to initiate a progressive training programme to start the Training to Train phase of the English LTAD. Vorontsov [8] recommended between a 85 and 100% training attendance plus training performances as 400m freestyle under 5.30 min, 1500 freestyle under 22.30 min, 400m individual medley (IM) under 6.00 min or 200m butterfly under 3 min. Age or sex does not matter and these training results can be achieved at age of 9 or 12, as the review of international age-group swimming rankings can confirm.

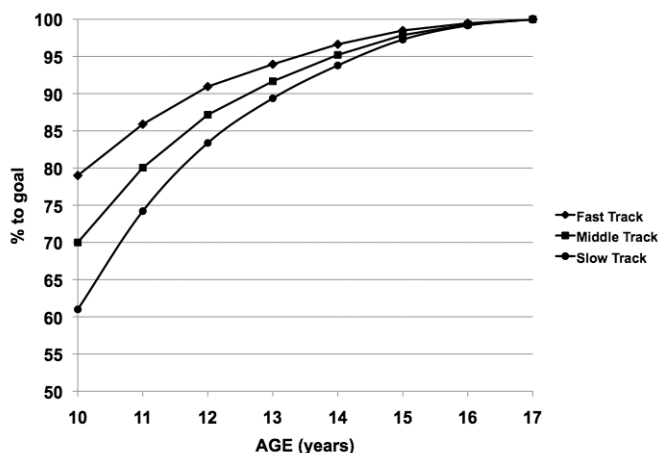


Figure 3. Possible Patterns of Results Progression to Achieve the Planned Goal (Adapted from [8])

LTAD AND SWIMMING TECHNIQUE

Reviewing the different LTAD model guidelines, we find some general recommendations about technique development in the first two periods. Later the technique is lost because more importance is given to the physiological aspects of a swimmer’s planning. An example can be found in the training loads proposed by US Swimming (Rec[reational], End[urance]-1, End-2, End-3, Spr[int]-1, Spr-2 and Spr-3 [9]) where the technique is not incorporated and quantified in the training plan. It is difficult to consider swimming technique as relevant when it is omitted from the model.

A clear definition of the technique training loads and exercises should help to resolve this situation. An initial classification of the technical training will separate cyclic (stroke technique) and no cyclic (start and turns) exercises. Later more specific technical loads can be added to the plan (coordinative exercises, linking drills, feel-of-the-water drills, body-position exercises, competitive exercises, etc.). All these ideas are developed in a recently published (in Spanish language) book by Spanish Swimming Federation [10], of which I am the author. In this case, a documented and specific model that includes the technical loads or units in the training plan is developed. The technical load is defined, classified and included in the training plan (micro-cycles, meso-cycles and macro-cycles).

Brent S. Rushall [11] proposed a curriculum for swimming stroke development that includes skills competences adapted to each age group, swimmer's practice session behaviours plus swimming coaches' assessment forms oriented to observe the efficiency of the coach's stroke-technique work. This model of stroke development could be easily integrated in the different LTAD programmes.

A different approach has been developed in Australia [12] where blocks of stroke progressions are defined for every stroke, to be included as technical units (or loads) in the training sessions. These stroke-efficiency progressions are finished with linking drills to improve the whole stroke technique and are evaluated with the 8 x 50m progressive efficiency test or observational stroke-checklists.

These arguments arrive at a similar point to the article by Lang and Light, who claim the negative influence of high training volumes on stroke development. What should be taken into consideration is that the general model of stroke development, 'swim, swim and swim', is based on the belief that water feedback will naturally correct the swimmer's mistakes, thus making technique training unnecessary. I do not agree with this belief.

CONCLUSION

As an expert in swimming biomechanics, I have been concerned about the lack of consideration shown by the training plans (long-term and short-term) to technique development. Swimming drills ["loads"] are included, but not quantified or differentiated from the physiological water exercises. A similar situation is observed in LTAD models; i.e., they describe the technique development in an imprecise manner and fail to illustrate different procedures to train and evaluate its progress. The early performances obtained by young swimmers in most countries are based on overload rather than skill development programmes that induce low rates of participation of early, top-ranked, age-group swimmers in long-term elite swimming. Experts must pay serious attention to correct this fundamental error in LTAD models.

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Interpreting and Implementing the Long Term Athlete Development Model: English Swimming Coaches' Views on the (Swimming) LTAD in Practice

A Commentary

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INTRODUCTION

Long Term Athlete Development (LTAD) represents one of the most important issues in contemporary sport science. Branches of government responsible for sport in numerous countries require National Sport Organizations (NSOs) to have LTAD plans, often as a condition of public funding. The 'standard' LTAD plan forms the basis for sport-specific plans developed by NSOs. LTAD has two diverse goals: to improve *sport performance* and *sport participation*. It is a seven stage model for training, competition, and recovery based on developmental age. The stages are active start, fundamentals, learn to train, train to train, train to compete, train to win, and active for life. The purpose of this article is to provide a commentary on LTAD with a focus on psychological issues. A Canadian perspective is taken because LTAD originated in Canada (and it is the country in which I work). However, many of the issues addressed here will apply to other countries.

ANECDOTAL VERSUS EMPIRICAL EVIDENCE

A contentious issue is the extent to which the standard LTAD plan is based on empirical scientific evidence. In Canada, the standard LTAD plan is officially described on the "Canadian Sport 4 Life" website. On this website it is claimed that the LTAD document "is fully based on and supported by the coaching and exercise science literature" [1]. Fifty-four background references are cited as a 'Select Bibliography' with the apparent intent of demonstrating the literature that supports LTAD. However, close inspection of this bibliography reveals two issues relevant to the current paper. First, many of the papers cited were published in professional coaching journals (rather than scientific peer-reviewed journals), so this aspect of the evidence base refers largely to general ideas or anecdotal evidence rather than scientifically-derived knowledge that support the predictions of the standard LTAD plan. Second, there are numerous references to physical training, physiology, and motor development papers/books, but very few references to the sport psychology literature. Indeed, Canadian sport psychology researcher Jean Côté suggested that rather than LTAD being developed *from* sport psychology research, existing research has been used to support its claims or make new claims when convenient [2].

To examine the claim that the standard LTAD plan is "fully supported by coaching and

exercise science literature,” I conducted various electronic database searches for articles about LTAD. The majority of articles returned were general descriptions (rather than empirical studies) of LTAD published in the professional coaching literature. There were also a few conference presentations, a couple of student thesis/dissertation projects, a study of coaches’ perceptions of LTAD in Canadian ski-racing [3] and a practical book for coaches [4]. Other papers critiqued LTAD, but did not expressly study the plan. Previous systematic reviews of the sport psychology development literature have revealed no peer-reviewed scientific articles associated with LTAD [5, 6]. Rather than LTAD being “fully supported” by the literature, I would argue that the standard plan is based on some general principles from the physical training, physiology, and motor learning literature. There is very little evidence underpinning the psychological components of LTAD.

PSYCHOLOGICAL BASIS OF LTAD

This raises a question of how the psychological components of LTAD have been created. From what I can ascertain, it appears that NSOs partnered with sport psychologists and coaches in creating sport-specific psychological components of the LTAD. In general, these NSO LTAD plans link stages of athlete development with the psychological skills that ‘should’ be taught and attained. However, psychological components of LTAD plans differ between NSOs, which again suggests there is not a clear evidence base upon which the plans are based. Some NSOs have identified challenges associated with the psychology sections of their LTAD plans. For example, Biathlon Canada produced a section on mental skills associated with various developmental stages, and although some sport psychology texts and peer-reviewed articles were cited as sources, it was acknowledged that:

...the literature on psychological development is more diffuse than that available for physical and physiological development. The subject area is much larger, ranging from skill development to socialization, and there doesn’t appear to be a definitive article that synthesizes or crystallizes the field. [7, p. 9]

Thus, it appears that sport-specific interpretations of LTAD are based on some ‘best practice’ ideas from the sport psychology literature, rather than a specific evidence base associated with stages of athletes’ psychological development.

MOVING FORWARD

Although I realize the irony of making the following suggestion in a commentary article, I wish to argue that researchers should resist armchair criticism of LTAD and get about our business of scientifically examining what works, what does not work, and what can be improved. The article by Long and Light, like that of Black and Holt [3], represents initial steps in evaluating aspects of LTAD, but they have primarily dealt with coaches’ perceptions of the delivery of sport-specific plans. There is a great deal of work that could be done, especially in the area of sport psychology because the psychological components of LTAD appear to have been added in a ‘post-hoc’ fashion. That is, the standard plan was primarily based on general principles from the physical training, physiology, and motor learning literature and NSOs have been required to add psychological components to their interpretation of the standard plan.

Although sport psychology researchers have dealt with psychological issues associated with youth sport for many years [8], there is a dearth of evidence to guide practice in terms of *which* psychological skills should be taught to young athletes, *how* to teach them, and

when to teach them. Specific research questions that have yet to be fully addressed include: Which psychological skills should be taught at various stages of children's development? How should psychological skills be taught to young athletes? In what sequence should psychological skills be taught? What is the role of coaches in teaching psychological skills to young athletes? These are basic questions, but there is a need for research on how to deliver developmentally-appropriate psychological training to assist in athlete development.

THE NEED FOR LONGITUDINAL RESEARCH

Taking a step back to look at the 'bigger picture' there are two fundamental questions that need to be answered: i) Does the application of the LTAD plan increase the number of athletes who obtain international performance success? and ii) Does the application of the LTAD plan increase and sustain sport participation? One challenge for evaluating these questions is the fact that expensive and time-consuming longitudinal studies are needed. Furthermore, it has been suggested that LTAD is a 'mismatch' of concepts that do not really fit together, and therefore it cannot be properly evaluated as a complete model [2]. However, there are also some more manageable research questions that can be posed regarding specific elements of LTAD, and I have provided some examples of key questions in the area of sport psychology.

It may also be useful to consider that alternative models of athlete development have been proposed in the sport psychology literature. For example, Côté's Developmental Model of Sport Participation (DMSP) was created on the basis of numerous (published, peer-reviewed) studies of athlete development. The DMSP is primarily based on athlete psychosocial development rather than the physiological and motor development literature that underpins LTAD. Therefore, DMSP may be a more relevant framework to use for studying ways in which to teach developmentally-appropriate psychological skills. Indeed, a potential advantage of the DMSP over LTAD is that it has testable tenets and postulates [9].

CONCLUSION

There remain fundamental questions about which psychological skills to teach and when and how to teach them. Research is also needed to examine the efficacy and effectiveness of LTAD plans and the various components contained therein, or to show how other models of athlete development will produce different (and possibly more desirable outcomes) in terms of athlete participation and performance. To assist researchers, governing bodies for sport must make funds available for research to evaluate, refine, improve, or replace LTAD plans in order to more effectively meet their stated participation and performance goals.

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I would like to thank Dr. Jean Côté (Queen's University, Canada) for providing his views about LTAD and his own research. Thanks also to Dr. John Dunn and Dr. Pierre Baudin (University of Alberta, Canada) for their helpful comments on earlier drafts of this manuscript. The views expressed here are entirely my own, but the feedback my colleagues provided helped to improve the article.

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