

ENDURANCE ADM V1.2B

INTRODUCTION

Many coaches have requested guidelines surrounding long-term athlete development, specifically in relation to how to progress from when they first become involved in athletics through to international success. To meet this need, UCOACH created the Athlete Development Model (ADM), which provided insight into how young athletes develop through puberty and the implications this has on training.

This document complements and builds upon the generic ADM by taking the core principles and applying them to the Endurance event group. Using current knowledge surrounding athlete development and the underpinning principles of competency based progression and deliberate practice, this provides a suggested model of how training could be progressed to maximise senior success.

Within this document we have included diagrams to graphically illustrate how key factors related to Endurance running could change throughout an athlete's development. These diagrams are not intended to be interpreted without the accompanying information in this document. Where lines denoting a change from one aspect to another at a specific age are included, these should not be taken as a definitive cut off point because this always relates to developmental age, which varies considerably from athlete to athlete.

Any model will always have limitations and the ADM is a growing document that will be expanded upon as new research and information is published.

In order for this document to meet your needs we need your comments and feedback so we can clarify any areas of confusion. These comments can be submitted using the feedback comment form at the bottom of this document:

<http://coaching.uka.org.uk/document/endurance-adm/>

For more information regarding athlete development in general be sure to check out the athlete development section on uCoach:

http://coaching.uka.org.uk/coaching/athlete_development/

ASSUMPTIONS OF THE MODEL

The Endurance ADM assumes an athlete may move through a program from age 9 to 28 achieving a podium finish at the Olympic Games or World Championships.

We assume performance improves with training age. If an athlete enters the sport in more advanced years they may have to re-visit training components before moving onto more advanced topics but it may also be possible to develop a number of training parameters in parallel.

Reading Notes

This document should be read in conjunction with the ADM V1.2, which can be downloaded from the athlete development section on uCoach:

http://coaching.uka.org.uk/coaching/athlete_development/

An audio presentation providing details about the model can be downloaded from uCoach:

<http://coaching.uka.org.uk/audio/adm-podcast/>

A print version of the ADM can be downloaded from uCoach:

<http://coaching.uka.org.uk/document/uka-athlete-development-model-document/>

In addition you may also like to read the 8 part strength training series (Defining Strength, Maximal Strength Part 1 & 2, Special Strength Part 1 & 2, Specific Strength, Strength Development for Young Athletes Parts 1 & 2) by Derek Evely and Tom Crick which can be accessed from the 'Performance Sciences' section of uCoach:

<http://coaching.uka.org.uk/coaching/performance-science/>

DEFINITIONS

Chronological Age

This refers to “the number of years and days elapsed since birth.” Chronological age is not necessarily a predictor of an individual's stage of development, as children of the same chronological age can differ by several years in their level of biological maturation.

Development Age

This can be multifaceted and refers to the degree of physical, mental, cognitive, and emotional maturity. Unlike chronological age, children of the same developmental age will exhibit similarities in terms of their level of physical, mental, cognitive and emotional development.

Training Age

Training age refers to the number of years since the athlete began formal structured training in Athletics. Years of training in other sports can also be relevant here, e.g. the aerobic development an athlete may have gained from time training for swimming.

Peak Height Velocity (PHV)

The maximum rate of growth in stature during growth spurts.

Absolute Intensity

This refers to the level of performance in any given task relative to the absolute limits of human performance. In running events, the quicker the time the higher the absolute intensity. In jumping and throwing events, the greater the distance the higher the absolute intensity. In physical preparation activities the heavier the weight lifted or the greater the power output the higher the absolute intensity. As a result male athletes tend to elicit higher absolute intensities than females and adults higher absolute intensities than children.

Relative Intensity

Relative intensity refers to the intensity of an activity relative to ones own maximum potential at any moment in time. For example, in the Shot an athlete who can throw 20m is throwing at 50% relative intensity when they put the shot 10m. In the 100m sprint an athlete that could cover the distance in 10s is working at 50% relative intensity when they cover the distance in 20s.

Concentric Muscular Contraction

Muscle length decreases as the muscular contraction occurs.

Isometric Muscular Contraction

Muscle length remains constant as the muscle contraction occurs.

Eccentric Muscular Contraction

A muscular contraction that occurs as the muscle length is increasing. Eccentric contractions produce greater forces than other types of muscular contraction.

Full Recovery

A rest interval that is long enough for the athlete to be capable of performing the next repetition in the same time or faster than the last without an increase in perceived effort. If the athlete is unable to reproduce the previous performance then the rest generally needs to be extended. As a rule of thumb a rest interval of 1-2minutes per second of high intensity sprinting is advisable.

Bone Mineral Density (BMD)

A measure of the hardness of bone, reflecting the amount of calcium present in a given area. Tests for BMD are used to evaluate bone health and fracture risk.

Alactic Speed

Sprints at greater than 95% relative intensity lasting up to a maximum of 7s where FULL recovery is taken between reps.

Speed Endurance

Sprints at greater than 95% relative intensity lasting between 7-15s conducted with FULL recovery between reps. In endurance events many coaches use the term Speed Endurance to refer to what is defined as Specific Endurance within this document.

Specific Endurance

Training conducted at a pace that is 'specific' to the event being trained for. This is typically race pace running activity that aims to simultaneously meet the specific metabolic and biomechanical demands of the event being trained for. For endurance athletes specific endurance training covers a larger spectrum of paces than in the sprint events. For middle distance runners specific endurance training will be predominantly anaerobic in nature. For long distance runners specific endurance training may be a lot slower and more aerobic in nature. For marathon runners who are aiming to run the race at a pace around their lactate threshold, specific endurance workouts may also be classified as 'steady' or 'tempo' workouts.

Within the sprints, Specific Endurance shares a similar definition to that used in Endurance and is typified by sprints at greater than 95% relative intensity lasting longer than 15s conducted with FULL recovery between reps. For example 2 x 300m (15mins).

Aerobic Endurance

Longer term endurance running relies primarily on the aerobic pathway to generate energy. Aerobic running is generally continuous in nature. However we can define continuous and aerobic running in many ways, which will be dependent upon the speed of the run and therefore also where the run sits on the lactate curve (this dictates how much lactate will be present in the blood at a given intensity of exercise). It is worth noting that there is always some lactate present in the blood, even when at rest. The presence of lactate in blood is therefore not evidence itself for exercise being anaerobic in nature; it is the amount of lactate which classifies it as being aerobic or anaerobic. The defined speeds for continuous running can be defined in the following table.

Zone	1	2	3	4
Description	Recovery	Easy	Steady	Tempo
Perceived Exertion	Very easy	Easy	Comfortable	Uncomfortable
Breathing reference	Very easy to talk	Easy to talk	Ok to talk	Hard to talk
Typical %HRmax	<60%	<80%	81-89%	90-95%
Typical [La] range (mM)		<2.0	1.0-4.0	4.0-9.0

All the following training sessions for each zone are purely examples.

Zone 1: Recovery

Recovery running aims to contribute to the development of the aerobic system while allowing the athlete to recover from previous higher intensity training sessions, such as repetition sessions, races and strength sessions. **Example session:** 20-30 minute continuous run.

Zone 2: Easy

Easy running is used in long runs, supplementary runs, warm-ups, cool-downs and active recoveries between higher intensity intervals. The primary benefit of easy running is that it enables you to run greater distance without significantly increasing stress on your body.

Running faster on easy days may reduce performance on harder days. On the other hand, simply resting between harder runs will not allow accumulation of mileage, possibly negating further fitness benefits. **Example session:** 30 – 120 minutes continuous run.

Zone 3: Steady

Steady running is executed above lactate threshold (LT) but below lactate turn point (LTP) (e.g. 81-89 % of max heart rate). At the lower end of the zone (81-85% of max heart rate) this involves medium to long workouts, and at the higher end of the zone (86-89% of max heart rate), this involves short to medium workouts.

All workouts regardless of duration are generally run at a fairly constant pace. The athlete should get tired as a function of the volume, not of the intensity of the session. Training progressions are achieved by increasing the length of time at this load and/or the average speed the runs are completed at. **Example session:** 30 – 60 minutes continuous run.

Zone 4: Tempo

Tempo pace is traditionally defined as the pace of running at or slightly above which the blood lactate level begins to spike – that is, the LTP.

Tempo runs are traditionally run just above LTP at the lower end of the tempo zone and are generally constant pace efforts that last for a relatively prolonged period of time. They typically take the form of a sustained effort, the primary purpose of which is to increase the pace one can sustain for a prolonged period of time, and increase the time one can sustain a relatively fast pace. Prolonged running at this relatively hard intensity builds a good sense of maintaining a strong pace for an extended period of time. Additionally, some runners gradually build up the intensity of a longer tempo run until actually running at tempo pace for the target duration. All these practices can yield positive results. However, it should be noted that many athletes do longer tempo runs at slower than true tempo pace. **Example session:** 50 minutes with 20 minutes at Tempo.

Special Strength

Special strength methods are those that make use of the elastic properties of the human body and involve eccentric muscular contractions. When implemented in training they typically use non-maximal loads and develop one or more of the following characteristics - reactive strength, explosive strength, power, or speed-strength, and rate of force development. They may also include various proprioceptive and re-educating type activities including corrective and stabilizing type movements.

Maximal Strength

Maximal, or absolute, strength is the ability to produce large amounts of force with a single concentric muscle contraction. Maximal strength does not relate to time constraints, so the amount of time required to develop force is not a consideration. Maximal strength also does not take into account the athlete's body weight.

Physical Preparation

Physical preparation is any type of training that addresses the physical elements (physical fitness) of sports such as mobility, flexibility, strength, speed, power, acceleration, deceleration, dynamic vision, reaction time, and recovery. All of these elements need to be addressed to help best prepare an athlete or team for successful sports competition.

Mental Preparation

Mental Preparation involves any strategies that assist the athlete to execute technical skills and make use of all necessary physical potential when necessary. Mental preparation should allow optimal performance in both competition and training.

General Strength

Exercises typically using bodyweight or very light resistance such as push ups, pull ups, walking lunges etc.

Ancillary Strength

Exercises typically using light resistance that are performed for 10-15 repetitions.

ENDURANCE TRAINING AND COMPETITION PROGRESSIONS

In this section we will describe the key changes to training and competition that occur for an athlete who has decided to focus on Endurance events.

These guidelines are designed to accompany the generic ADM and provide greater event specific detail in relation to Endurance Running (and walking). Central to the philosophy of long term athlete development is the concept of ‘competency based progression’, where the athlete is not progressed to more challenging aspects of training until they are able to demonstrate that they have mastered underpinning principles. In the endurance events key components of high-level senior performance are a relaxed and efficient technique allied to aerobic power and excellent relative speed, as such a progression of skills should be based around an athlete’s ability to perform workouts in this manner.

Endurance Athlete Development Model (V1.2)



Developmental Age +/-																			
Chrono. Age	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26+	
Stage of Development	Pre-Puberty			Puberty							Post-Puberty			Adulthood					
Sports Focus	Multi-Sport			Multi-Event				Endurance				MD, LD , STEEPLECHASE							
Comp. Focus	MD	100m*, 150m*, Hurdles* 600m*, 800m*, 1200m* 1500m, CC*			100m*, 200m* Long Hurdles*, 800m* 1500m*, 3K, CC*			200m, 400m, 800m, 1500m, CC		(200m), 400m, 800m, 1500m, (3k), CC		400m, 800m, 1500m, 3k, (CC)							
	LD							800m, 1500m, 3k, CC		(800m), 1500m, 3k, 5k, 10k track & road, CC		(800m), 1500m, 3k, 5k, 10k track & road, Mar, CC							
	SC							800m, 1500m, 3k, CC, SC		(800m), 1500m, 3k, 5k, CC, SC		1500m, 3k, 5k, (10k), CC, SC							

Development Focus	Alactic Speed & Aerobic Capacity		Alactic Speed, Aerobic & Lactic Capacity	Event Specific Endurance	
	Running Mechanics & General Physical Preparation		Running Mechanics, General Preparation & Tactics	Running Mechanics, Specific Strength, Tactics	
CE	N/A		Broad range of Specific Endurance work spread across MD, LD, SC		Specific Endurance work dedicated to a specific event focus
SDE	Alactic Speed Aerobic Development		Alactic Speed Aerobic Dev Long Term Anaerobic Dev	Development of full anaerobic system	All Methods inc. Altitude Training
SPE	Athletics 365	Core Work	Gen. & Anc. Strength Core Work	Strength Endurance, General Strength, Ancillary Strength, all endurance based Extremity Conditioning, Core Work etc.	
GPE	Covered by other event groups & Athletics 365		Special Strength (inc. MJs & MTs)	Max Strength, Special Strength, all alactic generic work including Mobility & Extremity Conditioning etc	
Running Drills	As part of Athletics 365		Learning technique	Perfection of technique	

* = Preferred competition distances given current physical attributes

Note: These diagrams are for illustration purposes only. They can only be fully interpreted after reading the accompanying notes and audio presentations.



Developmental and Chronological Age

Developmental age refers to the degree of physical, mental, cognitive and emotional maturity. Physical developmental age can be determined by skeletal maturity or bone. For coaches this is best assessed in relation to the rate of growth of the individual.

Chronological age refers to ‘the number of years and days elapsed since birth.’ However the rates of growth, development, and maturation vary greatly between individuals, thus children of the same chronological age can have very different levels of biological maturation. Since many of the social aspects of our lives, such as when we begin school and when we are legally considered an adult (18 in the UK), are related to chronological age, it is included in the ADM. However, the majority of the key considerations in the coaching of developmental athletes are more appropriately addressed after assessing the developmental age of the athlete.

Stage of Development

For the purpose of simplicity we have divided the development of a child up into four key stages:

- Pre-puberty: prior to the release of sex hormones when the child is growing steadily
- Puberty: the period of rapid growth that accompanies the release of sex hormones
- Post-puberty: the period of steady decline in growth that occurs after the initial onset of puberty
- Adulthood: The period of cessation of growth where physical maturation is completed.

Sports Focus

Multi-Activity: Up until the age of around 12 all children should ideally be engaged in multiple sports with little specific focus on one over the others. This coincides with the period of rapid skill acquisition for both girls and boys, where participation in the broadest range of sports possible will allow the young athlete to rapidly pick up all the fundamental movement patterns required for training in the future.

Multi-event: From the age of around 12-16 young athletes should be exposed to a range of Athletics events across as many event groups (running, jumping and throwing) as possible. At this stage in their development, it is very difficult to predict what event or even event group the athlete may be best suited to when they are fully mature. Furthermore, as a fully mature athlete, regardless of event, their training will, to some degree, involve a variety of running, jumping and throwing activities and so a background in a range of events will provide a solid foundation for the future.

Endurance Event group: around the ages of 15-16 athletes will probably begin to focus on a specific event group (in this case Endurance) as they begin to realise where their potential and interests lie. At this point the athlete should focus on the full

spectrum of endurance events, including concepts behind steeplechase and walks so as to develop a good all round event group specific conditioning and co-ordination base.

Endurance Event Specialisation: once the athlete is reaching full maturity they will probably begin specialising in a single or perhaps two closely related events (800m/1500m, 5k/10k, 5k/Steeplechase, Race Walking). If they have gone through a suitable progression from multi-sport to multi-event to event group they will have acquired a strong foundation in terms of conditioning and run, jump, throw specific skills from which they can now draw upon to improve performance at their chosen event(s).

Note: those entering the sport late at 18/20 may have to revisit some of the skills required to train. However, they will probably have been doing other sports where they may have developed many of these abilities (for example cricket for throwing, basketball for throwing and jumping, team sports for running, cycling or swimming for endurance etc).

Competition Focus

The competition structure currently employed within the UK uses an age group structure that does not take into consideration the wide variation in growth and maturation amongst athletes. With this in mind, some of the competition distances available to the young athlete are unsuitable for the majority of individuals because they require levels of speed endurance and specific endurance that cannot be obtained until the lactic energy pathways are fully mature and the athletes have adequate strength levels.

All Endurance Groups – to age 16

100m*, 150m*, Hurdles*, 600m*, 800m*, 1200m*, 1500m, CC* - Up until the age of 12 athletes who will eventually focus on any of the endurance event groups would be looking to compete across the breadth of running events, from 75/100m through to the 1500m and hurdles. It is also very likely that cross country running will occupy their winter months. It is important for endurance athletes to be engaged with sprinting and hurdling at this age because these events will help lay the foundations for the steeplechase and the kick finish for the longer endurance events as a senior competitor. Due to its high pace and significant endurance requirement the 1500m may be unsuitable for many athletes at this stage of development.

100m*, 200m*, Long Hurdles*, 800m*, 1500m*, 3K, CC* - After the age of 12, athletes should continue to compete over a similar breadth of events but perhaps with more of a focus on the longer running events. The 1500m and occasionally 3000m, will be more common in their programmes. Cross country races will continue to be an important part of their programmes, with the race distances gradually increasing up to about three miles in duration. During this phase of development the 3000m is the most

likely event to be unsuitable for many young developing endurance athletes and so its inclusion should be carefully considered.

From the age of 16 it is likely that athletes will typically focus more on a single event grouping, be it middle distance, long distance or steeplechase; some will also move towards the walking events. This, however, does not mean that they will not, or should not, forget about doing other events within the endurance family, or indeed sprint events.

Middle Distance

200m, 400m, 800m, 1500m, CC – Upon entering the event group development phase athletes training to become successful middle distance runners should be looking to compete in the longer sprints (200m & 400m) as they continue to develop their speed and sprinting technique. Concurrently, they will be honing their racing and tactical skills over their main racing distances and continuing to invest in their aerobic development through cross country running.

(200m), 400m, 800m, 1500m, (3k), CC – Towards the end of the event group development phase the athlete will probably begin to specialise in either the 800m or the 1500m and therefore may stop competing over either the 200m (for 1500m focused athletes) or the 3k (for 800m focused athletes). However, cross country may continue to play a part in their overall aerobic development.

400m, 800m, 1500m, 3k, (CC) – As seniors it is likely that these athletes will compete across a range of events with 800m runners looking to race from 400m through to 1500m on the track; some may still include cross country within their programmes. 1500m runners will race from 800m through to 3000m and it is more common that they will still be regulars on the cross country fields.

Long Distance

800m, 1500m, 3k, CC – Upon entering the event group development phase, athletes hoping to become successful long distance runners will look to focus more on the longer side of the endurance offering, leaving sprint races behind and instead concentrating more to middle distance events.

(800m), 1500m, 3k, 5k, 10k track & road, CC – Towards the end of the event group development phase they will also begin to look to add longer races such as the 3000m and 5000m to this repertoire as they become available on the competition programme. Some athletes may also begin to stop competing at 800m as it becomes obvious they are best suited to longer distances. Cross country will continue to play a major part in their development and road racing will also appear in their programmes on occasions. For some athletes, they may begin to run occasional 10,000m track races in the latter stages of their junior careers.

(800m), 1500m, 3k, 5k, 10k track & road, Mar, CC - As seniors, long distance athletes will generally compete in middle distance races only sporadically with 3000m, 5000m and 10,000m races forming the majority of their track programmes. Road racing may also become a bigger part of their race schedule. Cross country is likely to be a major focus and half and full marathons may become the primary focus as the athlete matures, typically (but certainly not exclusively) into their 30s.

Steeplechase

800m, 1500m, 3k, CC, SC - Upon entering the event group development phase, athletes hoping to become successful steeplechasers will continue to race middle distance events but may include 3000m races and have their first opportunities to race over the steeplechase barriers, initially at 1500m, then at 2000m and eventually at 3000m.

(800m), 1500m, 3k, 5k, CC, SC - Towards the end of the event group development phase, 5000m races may begin to form part of their race season and cross country will continue to be important. World class steeplechasers will typically be excellent 1500m runners.

1500m, 3k, 5k, (10k), CC, SC - As seniors, steeplechasers will compete in largely the same events, with perhaps the mix of those changing slightly and it is common (like the long distance specialists) that they will begin to include road racing into their programmes.

Development Focus

The focus in terms of the development of Endurance Running related skills, needs to change in accordance with the athlete's physical development needs.

Development Focus – Metabolic demands

Alactic Speed & Aerobic Capacity: At this early stage of their development as an athlete, the potential endurance runner should be looking to develop their basic speed (alactic speed) qualities as well as their aerobic capacity. This enables the athlete to develop the volume of running in the future, as well as having their speed capabilities developed as much as possible at an age when skill learning is most effective.

Alactic Speed, Aerobic Capacity & Lactic Capacity: Moving into the event group development phase endurance athletes should look to continue the development of their aerobic system, gradually building a greater volume of continuous running, at a variety of paces, into their programme. This should be coupled with continued development of their speed qualities, although the degree of focus on each of these will be affected by the future direction the athlete will potentially take, with middle distance athletes looking to be more focused in terms of speed development while the longer distance athlete will develop their aerobic qualities further.

At this stage the athlete should also have a developed (or developing) lactate system and as such the coach should now look to begin progressing this. This should be done through the gradual introduction of lactate training sessions such as short tempo runs and sessions targeting longer term lactate repetitions. Over time this will progress towards developing the shorter end of the anaerobic system, particularly for the middle distance focused athlete.

Event Specific Endurance: As the athlete matures into a senior competitor it is necessary to really target the physiological needs of the event they are training for. As such they need to address the exact input they require from alactic speed, short and long term anaerobic conditioning and aerobic power for the event(s) they are targeting. This will mean addressing the athlete's current capabilities and marrying them to the requirements of the event. The coach will then have to set a programme such that the athlete can develop to a stage where their qualities are maximised for their chosen event.

Development Focus – Technical & Physical Preparation

Running Mechanics and General Physical Capacity: As with sprinters and jumpers, it is essential that endurance athletes optimise their running mechanics to ensure that they are as efficient as possible. This applies to both running on the track, and crucially when doing continuous aerobic running. This will not only improve economy it will also help to reduce the incident of overuse injury as running volumes increase. Good running technique should be encouraged in all forms of sport they are participating in.

It is also necessary to develop the athletes overall physical capacity and all round strength qualities through the range of sports, and events within athletics, they regularly participate in.

Running Mechanics, General Preparation and Tactics: As athletes begin to specialise in the endurance event group, an emphasis on general preparation (mainly through circuits based activities incorporating multiple jumps and throws) will need to be added to offset the loss of these skills from the overall athletics programme, now that they are no longer engaged so frequently in other event groups and multi-sport

training. The focus on running and sprinting mechanics should also be maintained as athletes will continually need to fine-tune their skills as they mature into their adult body shape. This is especially important for female athletes who undergo the greatest change in body shape during puberty.

At this stage, the coach should begin working on race tactics with their athletes. This will be both in terms of effort distribution throughout the duration of their event, and looking at how to out manoeuvre opponents to achieve race wins/highest possible finishes. This can be done through training exercises and also through experimentation in identified races.

Mechanics, Special Strength and Tactics: The excellent running mechanics an athlete has worked on throughout their early development should be retained as their training volumes increase and their chosen event evolves, to ensure that they maintain the most efficient technique to maximise performance and reduce injury occurrence. Athletes' bodies can continue to change considerably, even once adulthood has been reached and so the relearning of existing skills may still need to be reinforced.

In order to facilitate the athlete's performance and mechanics it will be necessary to ensure that a programme of special strength exercises is included within the programme. This can include reactive strength (plyometric) work, as well as strength and power development relevant to the event.

Additionally the increased demands of racing, particularly at international level, will mean that the coach will need to further hone the tactics of the athlete to ensure that they can maximised their physical potential. Often, patience can be one of the most important tactics for athletes to learn.

Competitive Exercises (CE)

N/A: For young athletes who are yet to develop a mature lactic system and are engaged in multi-sport activity there is no need to include any specific endurance qualities within their athletics training. Instead the focus should be firmly placed on technical skill development.

Broad Range of Specific Endurance Work spread across MD, LD, SC: Once the athlete's lactic systems are fully mature the young endurance athlete can begin to incorporate specific endurance work into their training. As the athlete is still developing at this stage of their career this should be fairly general in nature and spread between work targeting both the middle and long distance events. Such a spread of work will both develop an athletes general endurance capability and also assist in helping them to find their best event as they mature towards adulthood.

Specific Endurance work dedicated to a specific event focus: As senior athletes, the training programme will focus much more towards the one, or two, specific events the athlete is targeting. As such the programme will become more finely tuned towards demands of that event(s). It may be that the athlete has two different event focuses within a single year, such as cross country and 1500m or Marathon and 5k or 10k, and that the training which is specific to one can be viewed as general endurance work (SDE) with respect to the other. For example cross country is SDE with respect to the specific endurance work required for the 800m or Marathon training is SDE with respect to specific endurance work required to race over 5k or 10k on the track.

Specific Development Exercises (SDE)

SDE exist to develop qualities required to undertake the competitive exercises. Therefore, their progression is dictated primarily by how the athlete is developing in relation to CE work.

Alactic Speed & Aerobic Development: As young athletes, the focus should be on developing alactic speed qualities together with the aerobic system. At this age the lactic system is not sufficiently developed for specific anaerobic work to be a priority. Therefore, it is an ideal time to instead focus on developing sprint mechanics and the alactic system. Developing the aerobic system at this age is also ideal as the aerobic system predominates in pre-pubescent's and such a focus best prepares the athlete's body for the further aerobic development work it will undergo in the future. This aerobic development can be sought through running activities as well as other sports the athlete may be participating in, such as swimming, cycling and team games.

Interestingly, some of the success of Eastern African endurance athletes is attributed to the extensive development of their aerobic systems at a young age as they run to and from school.

Alactic Speed, Aerobic Development & Long Term Anaerobic Development:

As the athlete matures they will continue with the further development of their aerobic system, running for longer and more frequently. They should also continue with the development of the alactic system. As they grow and become stronger the length of their alactic work will naturally become longer as they are able to cover a greater distance within the seven second timeframe.

At this stage the coach will also be able to start developing the long-term anaerobic system through the use of tempo running. The athlete will have to be introduced to this progressively and it may be that initially this is done through runs of 5/6minutes arranged into sets of work, rather than as a continuous Tempo run of 15minutes or longer.

Development of full anaerobic system: Towards the end of their junior careers, endurance athletes will look to fully develop their anaerobic systems. This will mean keeping in the Tempo running they have been doing, perhaps stretching the distances and certainly increasing the speeds as physiological maturation occurs. In addition to this, athletes will introduce shorter-term anaerobic work, looking specifically to include sprint specific speed endurance (particularly for the middle distance athletes) work to complement the specific endurance work tailored for their events. This will all be worked into the athletes programme at various stages through the year depending upon the athlete, the event and the strategy for training organisation preferred by the coach.

Alongside this the athlete should retain and aim to further develop their alactic and aerobic qualities towards those required of a senior athlete. This is especially important for athletes whose futures may be focused on the 800m.

All Methods inc. Altitude Training: As a senior athlete, all methods of training should be employed and it is the job of the coach to fit together a tapestry where all elements of the programme can be worked in together to achieve the desired outcome for the athlete and the event. The 800m is perhaps the most difficult of these to achieve owing to the combination of extreme speed and endurance required for success at the very highest level.

Recent changes to the structure of 800m competitions at major games, with only three rounds instead of four, has shifted the event in favour of more speed orientated athletes. Evidence that the 800m has in many ways become a sprint is best illustrated by the 2012 Men's Olympic Games 800m final where the slowest competitor in the race still clocked a staggering 01:43s.

Many athletes will achieve training volume through running, but for some this may also be achieved through various types of cross training – such as use of an Alter-G treadmill that allows athletes to run without supporting their full bodyweight. Such training is often required by athletes who struggle to get in enough volume through normal running because their biomechanical make-up makes them susceptible to injury.

Altitude training may also be employed to specifically target defined biological systems. However, it should be noted that this kind of work is perhaps best categorised as SDE because the reduction in oxygen availability reduces absolute intensity and can also require the athlete to use subtly different running mechanics to those employed during races at sea level.

Special Preparatory Exercises (SPE)

Athletics 365 > Core Work > Core Work, Gen. & Ancil. Strength: At the SPE level, a vast array of non-running related endurance activities can be used to physically prepare the endurance athlete. Initially this will come from resources surrounding general physical preparation found in Athletics 365 and then grow to include some general Core Work to develop the muscle of the trunk. Core Work will probably be an endurance runners first real introduction to endurance based physical preparation activity and once a foundational level has been achieved General Strength and also Ancillary Strength work can also be added.

Ancillary Strength (AS) exercises are typically performed using light resistance such as dumbbells or rubber bands for between 10-15 reps. In many ways they resemble traditional ‘bodybuilding’ training for increasing the CSA of muscle. In contrast, General Strength (GS) exercises are typically performed in the 10-30 rep range using bodyweight only or very light resistance such as a medicine ball.

All General Preparatory Activities (inc GS, AS, Mobility, Extremity Conditioning, Core Work etc): As athletes begin to specialise in the Endurance events, SPE activity will be expanded to include strength endurance work and endurance based extremity conditioning exercises and core work. Much of this endurance based remedial activity is designed to help the body maintain posture and conserve breathing patterns while under fatigue, all of which helps to reduce injury potential.

General Preparatory Exercises (GPE)

Covered by other event groups & Athletics 365: While athletes are involved in Multi-Sport and Multi-Event development alactic and explosive activity is replaced by jumping and throwing activities, which may include competitive exercises from

numerous event groups (such as shot, javelin, long and high jump) as well as other explosive and speed based sports.

Additional non-fatiguing balance and co-ordination work will be included in this category, such as those included in Athletics 365. Targeted mobility work may also be included as GPE as it does not contribute to endurance qualities.

Special Strength (inc. MJs and MTs): As athletes begin to specialise in the Endurance event group, GPE work will now be expanded to include less technically focused jumping and throwing activities. This will predominantly come from Multi Jump and Multi Throw circuits although other developmentally appropriate special strength exercises can also be used – see the Generic ADM for further generic details.

Max Strength, Special Strength, All alactic generic work including Mobility & Extremity Conditioning: As athletes mature and become technically proficient with the use of various strength training exercises they can be exposed to the full array of different maximal and special strength activities in a progressive competency based fashion. For endurance athletes GPE work will also include all generic alactic work including mobility and alactic extremity conditioning.

Running Drills

As part of Athletics 365: Early on in an athletes development work on running drills will be included as part of their warm up in a multi-sport or multi-event focused programme such as Athletics 365.

Learning technique: As athletes begin to specialise in the Endurance event group they will begin to learn how to correctly execute specialist running drills aimed at improving core aspects of proprioception surrounding race walking, running and hurdling (for Steeplechase) technique.

Perfection of technique: Having learned how to correctly execute running drills, mature athletes can begin to master and perfect their execution as well as progress their challenge through increasingly greater attention to detail and relaxation.

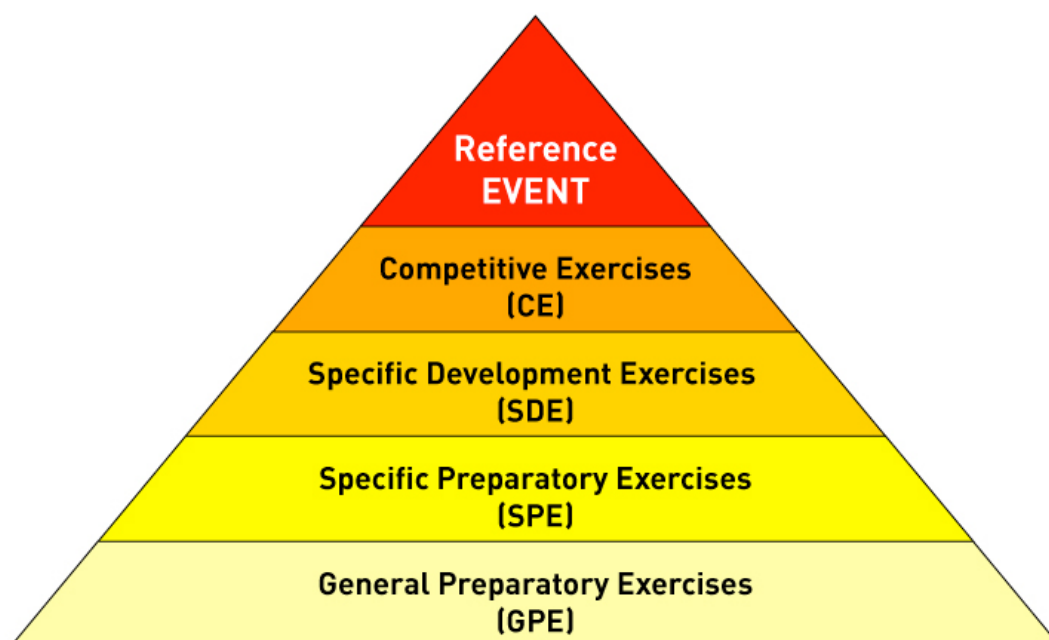
PERFORMANCE STRUCTURE PROGRESSIONS THROUGHOUT DEVELOPMENT

A 'performance structure' outlines all the exercises or groups of exercises that are used in training. Performance structures help coaches to visualise how exercises used in training contribute to performance and affect recovery.

A performance structure is best depicted graphically using a pyramid structure where the event or events being trained for are positioned at the top. The exercise classification hierarchy can then be used to group exercises together in levels below the pyramids peak, moving from the most specific at the top through to the most general towards the bottom.

Sitting just below the reference event are the Competitive Exercises (CE) since they are the most specific, followed by the other three exercise classifications – SDE, SPE and GPE in order of specificity. An example performance structure is illustrated in the graphics below.

EXAMPLE PERFORMANCE STRUCTURE



As we have seen from the Endurance Competition and Training Progressions, as athletes develop and move from an emphasis on Multi-Events to Event Specialisation the performance structure as it relates to Endurance will also grow and develop. This is best illustrated by looking at how a performance structure focused on the Endurance events would change as the athlete moves from the Multi-Event Stage of Athlete Development through to the Event Specialist Stage.

ENDURANCE SPECIFIC PERFORMANCE STRUCTURE DURING THE MULTI-EVENT STAGE

A performance structure focused purely on Endurance is somewhat irrelevant during the Multi-Event Stage of Athlete Development because by its very definition this is the time when athletes are training for several different events simultaneously, hopefully across all of the event groups. However, for the purpose of understanding how exercise selection may change throughout an athlete's development it is worth considering here.

Starting at the base of the pyramid, during the Multi-Event development stage the GPE level for endurance athletes will be fairly sparse as all non running related alactic and explosive activity is already being covered through the event specific technical training undertaken in the jumps and throws. This is because explosive jumping (high jump, long jump etc.) and throwing (shot, javelin etc.) are in themselves special strength exercises. Therefore, the only exercises at this level of the performance structure for endurance runners who are also training in multi-events will be alactic agility, balance and co-ordination work and generic mobility exercises.

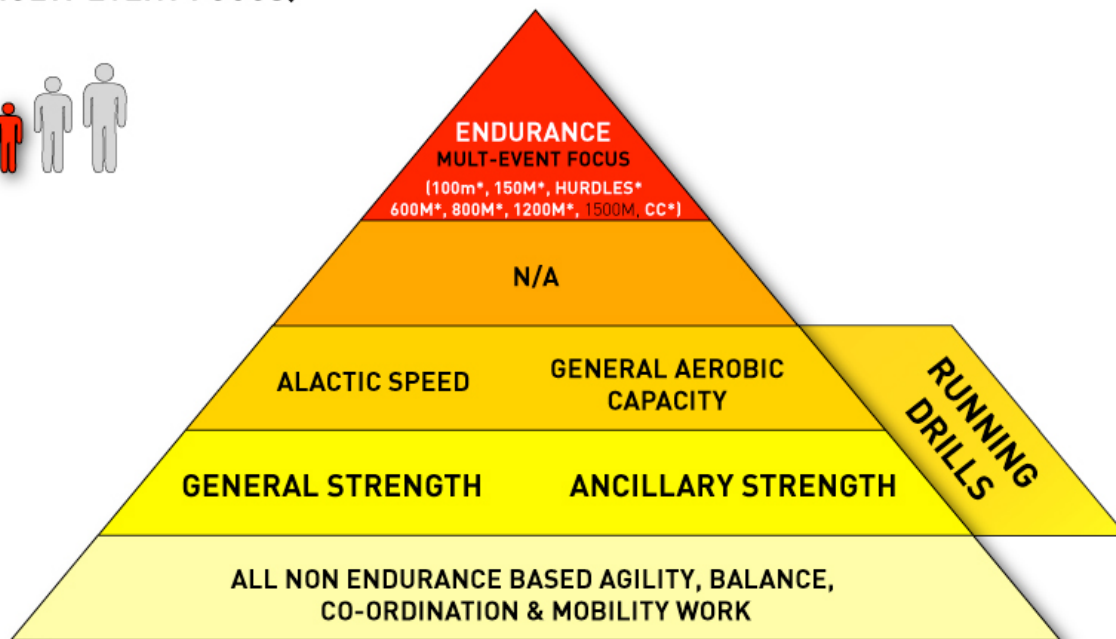
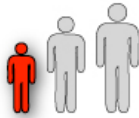
At the next level up SPE work will be primarily based around general and ancillary strength exercises, which primarily develop local muscular endurance for endurance runners.

At the SDE and CE levels the range of training methods will be restricted to those that are most appropriate given the event profile and physical development of the athletes during this development stage. This will include alactic speed and general aerobic running for endurance runners at the SDE level. Most notably there will be no specific endurance work at the CE level due to the under developed Lactic system.

So during the Multi-Event stage of an athlete's develop the performance structure will look pretty empty when we purely consider exercises that directly underpin endurance running. An example of a performance structure relating back to purely the endurance running work done by an athlete during the Multi-Event Stage of athlete development is shown below.

Note: Multi Event focused athletes will typically be training for a range of events across all event groups. For the purposes of illustration this diagram only shows exercises as they relate to the Endurance events but in reality sprinting, hurdling, jumping, and throwing exercises would also be included.

ENDURANCE PERF. STRUCTURE (V1.1) (MULTI-EVENT FOCUS)



* = Preferred competition distances given current physical attributes

Note: Multi Event focused athletes will typically be training for a range of events across all event groups. For the purposes of illustration this diagram only shows exercises as they relate to Endurance running but in reality sprinting, hurdling, jumping and throwing exercises would also be included.

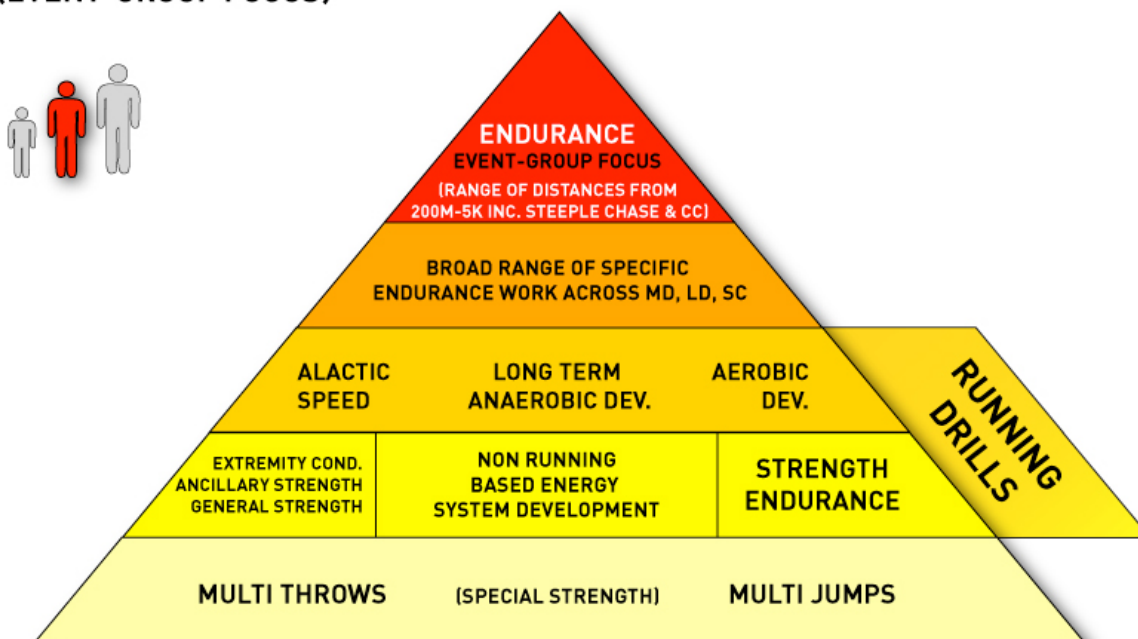


ENDURANCE PERFORMANCE STRUCTURE DURING EVENT GROUP DEVELOPMENT STAGE

As athletes begin to focus on a single event group, during the Event Group development stage, the performance structure begins to become more crowded as General Preparation Exercises are added to compensate for the loss of explosive jumping and throwing that was previously coming from the athlete's event specific technical work (high jump, long jump, shot put, discus etc). Furthermore, additional exercises can be added to the CE and SDE levels of the pyramid as the event profiles change and the athlete's physiology and skill development mature.

So during the Event-Group development stage the performance structure relating back purely to endurance running may expand, especially at the GPE & CE levels, as illustrated below.

ENDURANCE PERF. STRUCTURE (V1.1) (EVENT-GROUP FOCUS)



ENDURANCE PERFORMANCE STRUCTURE DURING EVENT

SPECIALISATION

Once athletes have finished maturing they will hopefully have undertaken a progressive and well structured development plan, which has taken into consideration the changes in their physiology and the event profiles – as outlined in the Endurance version of the ADM.

At this point they should be ready to begin using a full range of exercises across all four classification levels. However, even at this point some of the more advanced activities may be reserved for the most advanced stages of their careers, or excluded all together from the performance structure. For example some coaches avoid maximal sprinting all together because of the associated injury risks or decide not to use altitude training because athletes do not seem to respond well to the stimulus.

A performance structure that includes all the exercises that may be used by an athlete during the Event Specialisation stage and builds upon our previous examples is illustrated below for athletes specialising in Middle Distance running.

ENDURANCE PERF. STRUCTURE (V1.1) (EVENT-SPECIALIST FOCUS)

