Elementary / Middle School Coaches Cross Country Coaches Clinic

1) Introducing endurance training to Elementary and Middle School students
   a) Basic understanding of what student has done activity wise in the prior month.
   b) Prior sports involvement
   c) Recent literature (GASTIN, Journal of Sports Med, 2001), indicated that the ratio of optimal aerobic work is even higher than we believed for many distances. What does this mean? We should primarily be concerned with general aerobic development versus anaerobic development. Here are some examples of these ratios for certain distances.

Distance	Gastin Aerobic/Anaerobic Ratio
Marathon	97.5/2.5
10K	90/10
5K	84/16
1500m/mile	84/16
800m	66/34
400m	43/57

   d) Concentrate on developing proper mechanics (drills) / warm up (active) / buildups – motor skill dependent (DEMO)
   e) Concentrate on developing aerobic capacity – duration versus intensity.
   f) Kids play in a "fartlek" manner. Sprint / Jog / stop-rest / sprint again. Getting them to switch gears and control bouts of speed effectively is challenging. Pacing or developing the ability to control effort runs counter to how kids play on the playground and are first exposed to the ball sports
   g) <u>***Never use running as a form of punishment.***</u> Too often in our society young kids' first exposure to running in organized sports is punitive. These first impressions unfortunately lay an unhealthy foundation for running as an enjoyable activity.
2) Practice Logistics
   a) Find and secure safe running routes. Grass is preferable to pavement or sidewalk. If none is available make sure you keep you athletes away from high traffic areas. Encourage parents that run or walk to help out. The more "eyes" you have on kids the better.
   b) Have options in your running routes. Running the same course every day will make for a dreary practice by the end of the season.
   c) Vary the types of runs you do (out-and-backs / loops / continuous relays / point to point with walk backs)
   d) Be aware of how your runners split up during practice according to their state of physical readiness. Modify practice to accommodate all physical capacities.
   e) Have a backup – cancelation plan for weather – printed and available for parents (lightning – thunder – rain – heat)
   f) Encourage your athletes to bring their own water. Always make sure you have backup Hydration handy at your practice site for those that forget (what? Kids forget things? Surely not!)
3) Practice Frequency
   a) ES – 2 days a week – plus one meet and optional Sunday group run = 3-4 days total a week
   b) MS – 3-5 days a week plus one meet and optional Sunday Group run = 4-6 days total a week
4) Initial Practice Goals
   a) ES – learning drills and stretches – gradual extension of number of minutes / distance run without having to stop. Further distance through walk/jogs. Distance running is different from what most ES students are used to in their normal play. ES students are used to 'fartlek type" activities – short / intense bursts followed by rest.

Will take time for them to adapt to extended activities (mentally and physically). ** * Introduction of running games – keep it fun ***

b) MS – Understanding your students – evaluation form. Many will have had prior sports experience and preconceived notions about running that will need to be overcome. Learning drills and stretches. Use initial 1 week – 10 days to understand who you have on your team – Group separation according to ability to handle distance of run – builds camaraderie within group – support. Identify leaders. Gradual increase in distance.

5) How to build a training plan

a) ES – First two weeks – walk / jogs – games – one max run day – with stops. Then as season progresses : one shorter run .75-1.25M / race / one max run day with shorter breaks – upwards of 1.75-2M / one optional group run day with additional distance.

b) MS – depending on the size of your team develop Group schedules (could be as many as 3 groups). Can move kids between groups according to how they progress physically – also can be used to rest any runner having difficulty (injury / illness) handling workouts. Sample week - in season (remember mileages will vary according to group):

M – Easy run day prior to meet – 1-2M followed by 4-5x100m buildups
T – Race day
W – Longer recovery run – 3-4M
TH – Easy Intermediate Run (3M) or harder workout depending on how they have recovered from race
FR – Easy Longer Run (3-4M) or harder workout
S – Rest Day
S – Longest Run of the week – Goal here is to get most of your groups to be able to run 4-6M comfortably before the end of the season.

6) Supplemental Training – Core

7) Competition – Bottom Line.

a) Manage expectations – for many the goal is to just finish. For others it is to place in the top X. While others would like to finish X place within their own team. There are many ways to quantify performance without going over the top – all the while encouraging the entire range of capabilities.

b) Time is irrelevant – place is everything in CC. Performance / Improvement in CC based on place. If you focus your practices on building aerobic capacity and set realistic goals for kids – they will improve their place from meet to meet.

c) Remember there is no athletics governing body that has produced or printed an accepted way to certify the distance of a cross-country course. They are gross estimates at best. Courses differ, degree of difficulty varies, surfaces are not consistent so trying to get caught up in the preciseness of time and distance is a fruitless proposition from meet to meet (with the exception of a race that is repeated on the same course)

d) Educate and engage parents.

e) If the only thing you do is to teach your kids a true love of running – everyone becomes a winner in the long run.

8) Parents – can't live with them – can't live without them. How to manage parental expectations. Building a top flight distance runner takes "years" not one season. This is NOT MCONALDS – Distance runners are trained over time. It takes years to build your aerobic "foundation"

- A great summary of the what type of training is most beneficial in young runners can be found in Raphael Brandon's article in: BRANDON, R. (2003) Aerobic and Anaerobic Development. *Brian Mackenzie's Successful Coaching,* (ISSN 1745-7513/ 4 / August), p. 4-5

Cardio-respiratory function develops throughout childhood. Lung volume and peak flow rates steadily increase until full growth. For example, maximum ventilation increases from 40 L/min at five years to more than 110 L/min as an adult (Wilmore & Costill, 1994)[1]. This means that children have higher respiratory rates than adults, 60 breaths/min compared to 40 breaths/min for the equivalent level of exercise (Sharp, 1995)[5]. The ventilatory equivalent for oxygen is also higher in children, VE/V02=40 for an eight-year-old compared to 28 for an 18 year-old. This means that children have inferior pulmonary functions to adults.

Cardiovascular function is also different for children. They have a smaller heart chamber and lower volume than adults. This results in a lower stroke volume than adults, both at rest and during exercise. Chamber size and blood volume gradually increase to adult values with growth. Children compensate for the smaller stroke volume by having higher maximal heart rates than adults have. For a mid-teenager, max heart rate could be more than 215 beats/min compared to a 20 year-old whose max heart rate will be around 195-200 bpm (Sharp, 1995)[5]. However, the higher heart rates cannot fully compensate for the lower stroke volume and so children's cardiac output, measured in L/min, is lower than adults (Wilmore & Costill 1994)[1]. Children can compensate a little again, as their arterial venous oxygen difference is greater. This suggests that a greater percentage of the cardiac output goes to the working muscles than in adults (Wilmore & Costill, 1994)[1].

Because of the fact that lung and heart capacity increase with age, one would expect aerobic capacity to increase accordingly. This is true in absolute terms. V02max, measured in L/min, increases from 6 to 18 years for boys and from 6 to 14 for girls. However, when V02max is normalized by bodyweight, little change is observed with age in boys, and in girls there is a slight decline after puberty. Therefore, relative to bodyweight, children have a Cardio respiratory system for effective aerobic exercise. This is demonstrated by the fact that children can run quite well compared to adults. Indeed 10 year olds have completed marathons in very respectable times.

For the young athlete, an inferior V02max, expressed in L/kg/min does not limit running endurance performance. In fact, young pre-pubescent girls have an advantage before their relative body fat increases. Instead, endurance performance is limited by poor running economy. This means that for a given pace a child requires higher oxygen consumption than an adult. Children have shorter limbs and a smaller muscle mass, resulting in a lower mechanical power. They have disproportionately long legs, meaning that they are biomechanically out of balance and potentially less coordinated. In addition, they have a greater surface area to mass ratio. All these factors reduce biomechanical efficiency. Physiologically, children have inferior cooling mechanisms, due to low blood volume and high skin temperature. They also expend more energy per kilogram of body weight. Children have a higher VE/V02 ratio due to their inferior lung function and they rely more on fat metabolism because of a lack of muscle glycogen and glycolytic enzymes.

All these factors reduce physiological efficiency. Combined, these biomechanical and physiological limitations lead to a reduced running economy, though this seems to improve with age from 8 to 20 years (Wilmore & Costill, 1994)[1]. Although they are biomechanically and physiologically inefficient, children rely heavily on aerobic metabolism for exercise. Sharp (1995)[5] describes them as aerobic animals. The anaerobic capacity for both boys and girls increases with age, but is not fully developed until around 20 years. The main reason for this is probably the lack of muscle mass. However, children also have less glycogen stored per gram of muscle along with less phosphofructokinase (PFK), an important glycolytic enzyme. They also have lower creatine phosphate stores per gram of muscle (Sharp, 1995)[5]. Children are thus unable to generate the low blood pH or high blood lactate values that are associated with anaerobic work (Malina, 1991)[4]. This means that the natural fatigue mechanisms from intense work that adults possess do not exist with children. This, along with the fact that they tend to overheat more than adults, are the major risk factors that coaches need to be aware of when training young athletes at high intensities. For instance, on sprint interval training, while they may appear to be able to keep going in that they have not developed high acidosis, their muscles will still be fatigued and they may be hot if it is warm weather or indoors.

Aerobic Training

As children are naturally more aerobic, it would be useful to know if aerobic capacity is trainable in them. Unfortunately, few studies have shown that aerobic capacity in children improves with aerobic training. However, Rowland (1992)[2] argued that no study has been done that included all the following criteria: at least 12 weeks training, three times a week training, heart rate at least 160 bpm for at least 20 minutes, and using a large group plus matched controls. This would be the equivalent of an adult aerobic training program in a well-controlled study. Rowland found in his study of children that, when adult-type training in terms of intensity was performed, V02max improved between 7 and 26%. This suggests that children can improve their aerobic fitness from a training program of adult-like intensity.

The argument for doing this is probably valid. Sharp (1995)[5] shows that, because of lower lactate production, the anaerobic threshold for children is normally at pulse rates around 165 to 170 bpm, similar to that of trained endurance adults. With sedentary adults, the anaerobic threshold will vary from 120 to 150 bpm. Thus the optimal heart-rate-training stimulus may be relatively higher for sedentary children than for sedentary adults. Other evidence supporting the high-intensity stimulus theory is the fact that activity levels in children are not related to V02max (Rowland, 1992)[2]. While children may not be as active now as they were in the past, they are still as aerobically fit (Armstrong & Welsman, 1994)[3]. This shows that general activity does not provide a training stimulus, and suggests that children have a natural fitness. Thus, to improve on their natural fitness, a reasonably tough training program is required.

Conclusions

It's useful for coaches to know that aerobic capacity is probably trainable in children with a sufficient training stimulus. This makes aerobic training worthwhile, since it will improve their performance. However, the training effect will not be as great as is possible with adults because the lower stroke volume in children prior to full growth will limit the potential cardiac output increases with training. In addition, until after puberty, a poor running economy limits running endurance.

Thus, as before, it is probably best to wait until the young athlete reaches adolescence before starting tough aerobic training, as this is the age when the athlete will truly benefit. Tough anaerobic training is of even more limited use for children since they possess little anaerobic capacity. In my opinion, the most important areas of training for children are strength, speed, co-ordination, sport-specific skills, and agility. These are areas where improvements can be made through enhanced neuromuscular recruitment, laying down the skills for adulthood. As the nervous system develops, it seems that the potential for improvement in skills is the greatest. Training for aerobic and anaerobic endurance can be improved from adolescence when the body has reached its natural capacity and responses from this kind of metabolic training are greatest.

Other considerations:

Heat Stress:

The data (enumerated in a 2000 AAP Sports Medicine and Fitness Committee statement) show that children do not adapt to heat stress as well as adults for several reasons. Children have a greater body surface area to body mass ratio than adults therefore, children gain more radiant heat on a hot day and lose more heat to the surrounding environment on a cool day compared to adults. Children are subject to a greater increase in core temperature during endurance activities than are adults.

> Children adapt less well to exercise in the heat, especially at temperatures above skin temperature.
> At any exercise level, children produce more metabolic heat per kg of body weight (i.e., are less efficient).
> Their larger surface area/body weight ratio permits greater heat absorption from the environment when air temperature exceeds skin temperature. The smaller the child, the greater the potential for heat absorption.
> Children produce less sweat. Thus, the ability for evaporative cooling is lower. This is critical, as evaporation of sweat is the most important means of heat dissipation during exercise, especially under hot conditions.
> Children require longer to acclimatise to a hot climate.
> Hypohydration (lower body water content) has more profound effects on children.
> Children must be trained to drink frequently even when not thirsty.

Musculoskeletal:

Risk factors unique to the growing child are numerous. It is well known that stress fractures, a distinct overuse injury, are a function of the number of repetitions and amount of applied force per footstrike.

> Stress fractures are a function of the number of repetitions and amount of applied force per repetition. A child with shorter stride length subjects himself to more repetitions of impact to cover the same distance as an adult.

> Immature articular cartilage is more susceptible to shear force than adult cartilage and predisposes children to osteochondritis dissecans.

> Injuries to the growth plate from repetitive trauma are possible factors in adult onset arthritis of the hip.

> Children are also prone to injury at apophyses such as the tibial tubercle, resulting in Osgood-Schlatter disease, and the calcaneus, resulting in Sever's disease.

> Asynchrony of bone growth and muscle-tendon elongation. During periods of rapid growth, bone growth occurs first with delayed muscle tendon elongation and resultant decreased flexibility.

Wrap up

The US Olympic Committee (2001) surveyed US Olympic athletes from 1988 to 1996 and concluded that it took between 10 and 13 years of practice or training just to make the Olympic team and between 13 and 15 years for those athletes who won a medal. Being a great distance runner does not happen overnight. There is absolutely no rush to get there in ES or MS.