



## Volume 1: Biathlon Canada LTAD Model



## Introduction

This document is Volume 1: The Biathlon Long Term Athlete Development Model (LTADM). It has a companion volume, published separately as Volume 2: The Biathlon Long Term Athlete Development Program (LTADP). This is a summary for Volume 1.

- Components of athletic ability should be encouraged at all ages.
- Athletic abilities should be trained when a particular capability is most sensitive to development and training.
- Training schema must be linked to physiological age to fulfill this second premise.
- Adult athletic capabilities, which are not manifest until puberty or later, should not be trained in child athletes.

## Part 1: Human Developmental Stages, Child to Adult: Key Trends

### Physical Development:

#### Growth Rates:

- Between the ages of 4 and 11, boys and girls grow and change steadily and in the same way.
- Between the ages of 4 and 11 boys and girls overlap considerably in size distribution.
- Between the ages of 10 and 15, boys and girls manifest a growth spurt and enter puberty.
- After puberty, growth diminishes steadily to zero.

#### Puberty:

- Peak Height Velocity (PHV) is the obvious external marker for the pubertal transformation.
- Children aged 11 – 15 show large variations in size, growth rate and physiological development within age groups due to the asynchronous onset and progression of puberty.
- Children transiting through puberty, aged 11 – 15 show correspondingly large differences in sport performance within age groups.

#### Young Adulthood:

- After puberty, males and females stabilize into statistically separate populations on sexually dimorphic characteristics.
- After puberty, relative statistical homogeneity on physical and physiological capabilities is restored within the male and female populations.

### Mental and Neuromuscular Development:

#### Performance:

- Boy's and girl's athletic abilities change steadily and in essentially similar ways between ages 4 and 11.
- Most of the fundamental athletic and sport skills should normally be in place before puberty.
- Male and female populations overlap significantly on most mental characteristics important to sport performance.
- Perfection of technique via learning from external feedback is not available until late childhood.

#### Skills:

- Kinesthetic skills are best developed before puberty.
- Mental skills can be trained after ages 4-5, mature slowly and peak sometime after puberty.
- Ongoing development of language skills is key to continued development of mental skills.

### Changes in Physical Capabilities Before and During Puberty:

- The opportunity to optimise fundamental athletic capabilities occurs before puberty.
- Fundamental sport skills should be trained before puberty to take advantage of this sequential expression of genetic potential.
- Males and females go through significant physiological changes once puberty sets in.
- Some windows of optimal opportunity for physiological change close and others open.
- The pattern of these changes is strikingly similar for both genders, although chronologically asynchronous, as it is for individuals.
- The opportunity to perfect performance related capabilities occurs during and mostly after puberty.
- The timing and duration of the windows of opportunity are dependent on both PHV and transit time.

### Training Effects During Development:

- When training modes are matched to developmental opportunities, athletic development is optimised.
- Only trainable capabilities can be optimized in this way.



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## Part 2: Growth, Development and Sport

### Recreational Sport vs. Elite Performance

#### Mission Statements:

- Biathlon Canada will achieve consistent international podium performance by leading, promoting, developing and governing biathlon in Canada to the highest standard of excellence.
- The purpose and focus of all our programs, services and action is directed at the holistic development and support of the athletes and their performance.
- Only a small minority of the athletes affected by the Biathlon Canada LTAD are mature, elite performers.
- Competition is necessarily at the core of the Biathlon LTAD

#### Competition as Play:

- Sport is playful competition. Programs based on this LTAD should preserve this principle into adulthood.
- The reward system is intrinsic to the atmosphere and behaviour that supports this sense of play in sport.

#### Appropriate Competition Styles for Developmental Stages:

- Children's sport competition must be play-like, engaging, fun, participatory and group or team oriented.
- Competition for pubertal athletes should be based on competition between athletes with similar, matched, performance characteristics.

- Competition for recreational athletes should be based on competition between athletes with similar performance characteristics.
- Elite athletes should compete at the level that is at the edge of their personal performance envelope.
- Appropriate competition structure(s) and the competition reward system are crucial for young adults.

#### Selection by Predictive Testing:

- In a late maturing endurance sport, predictive testing of young children holds out small hope for success in talent identification.
- Predictive testing may be useful for talent ID in mid to late pubertal athletes who have acquired appropriate endurance sport skills from other sports.

#### Competition as a Talent Identification Tool

- In late maturing endurance sports like Biathlon, post pubertal selection by competition is most likely to identify the elite.
- In late maturing endurance sports, selection based on competition performance is not appropriate for pre-pubertal and pubertal children.

#### Selection by Election:

- The LTAD Program should provide opportunities for exposing large numbers of children to Biathlon.
- The LTAD Program should provide for asynchronous recruitment and suitable competition opportunities for cross-over athletes.

## Maturation Phases vs. Sport Development Phases

### Sport Skills vs. Developmental Stage:

- Skills and abilities should be taught and trained only at the appropriate times in an individual's sport career.

### Biathlon Skills vs. Developmental Stage:

- The best opportunities for training the athletic skills underlying shooting and skiing occur before puberty.
- Physical skills for shooting and skiing should be trained by late childhood, before puberty.
- Physical capabilities necessary for elite competition train best in late puberty or early adulthood.
- Mental skills that support elite competition, such as goal setting, commitment, patience, etc. only mature gradually during the transition into adulthood.

## Part 3: Biathlon Skills and Developmental Chronology

This section documents the chronological opportunities for training skills and physiological characteristics for Biathlon. This is laid out in table form with a rating scale (1 to 4) used to indicate optimal training opportunities.

### Shooting Skills vs. Development Stage

This section documents the chronological opportunities for training various shooting skills. This is laid out in table form with a rating scale (1 to 4) used to indicate optimal training opportunities.

- The basic shooting skills needed to compete in Biathlon are clearly available by Late Childhood.
- The basic shooting skills needed for biathlon should be trained before Early Puberty.
- Children have the basic shooting skills needed to participate in summer or winter biathlon.
- Shooting training should be timed to the windows indicated by the range 1-4 in the table.
- Firearm regulations and safety concerns are a barrier to training lots of children in biathlon.

### Skiing Skills vs. Developmental Stage

This section documents the chronological opportunities for training various skiing skills. This is laid out in table form with a rating scale (1 to 4) used to indicate optimal training opportunities.

- The basic running, bounding and skiing skills needed for Biathlon should be trained before Late Childhood.
- Children have the basic physical skills needed to participate in summer or winter biathlon.

## Mental Skills vs. Developmental Stage

In this section, mental skills are subdivided into various sub-skills in order to illustrate the developmental chronology. The tables represent a broad spectrum of skills that might be subdivided into more or fewer sub-parts. While the end purpose of the skiing and shooting development processes are self-evident, the goal of mental training is to provide the athlete with the tools to master the 3 P's while performing the other two skill sets.

- Most mental skills take a long time to mature, although some are available early.
- Children have the level of mental skills needed to participate in non-competitive summer or winter biathlon.
- Most mental skills needed for participation in biathlon can be trained before Early Puberty.
- Mental training should be timed to the windows indicated by the range 1-4 in the table.
- Mental skills required for elite performance are largely learned skills, and only available in older athletes.

## Bibliography

Appendix 1: Community Sport and Elite Athlete Development

Appendix 2: Summary of Training Recommendations Based on Growth and Development

Appendix 3: The Role and Nature of Competitions in the Developmental Phases of LTAD



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## Balyi's Stages

Balyi uses the following hierarchy of terms to describe sport progressions for endurance sports like Biathlon, where athletes reach peak performance as adults:

### Active Start: Very early childhood

Nurturing, play and games that foster repetitive rehearsal and learning. Foundations for the ABC's. This is the stage in which movement patterns evolve from child-like to adult-like. Active nurturing, to pre-school and kindergarten. Repetition: running, jumping, tumbling, wrestling, throwing, falling and trying again.

### FUNDamentals: Early Childhood

Play and games that foster repetitive rehearsal (FUN) are the key developmental strategies. The stage at which children learn the fundamental skills that support athletic performance: the ABC's (Agility, Balance, Coordination, Speed), RJT (Run, Jump, Throw) and the neurological and mental skills necessary for adult movement patterns. Language skills and the social development necessary to group play also develop.

### Learning to Train: Late Childhood

This is the time where children can be introduced to more formal forms of play, including child-adapted adult sports. The stage at which children elaborate on earlier physical skills to develop KGBS (Kinesthesia, Glide, Buoyancy, Striking with implement) and CPKS (Catching, Passing, Kicking, Striking with hand). Neurological, neuromuscular and mental development continues. Children in this stage will enjoy formal practice sessions aimed at developing particular sport skills. Exposure to a variety of sports that encompass KGBS and CPKS is required for long term athletic success. The elements of play and games is still essential to development at this stage.

### Training to Train: Early and Mid Puberty

This is the stage where practicing for sport becomes a more formalised activity. It is the point at which boys and girls begin to diverge both in chronology and in physiological and psychological characteristics key to sport. Pubertal children begin to compete for supremacy, to discover and establish their place in the pecking order. Organised sport will be used to this end by the participants. It is a time of rapidly changing abilities and psychological instability.

From a sport perspective, pubertal children are at a stage where they can be taught how to train, and where this training can be used to build on developmental windows of opportunity. Sport

training can also be used to direct development into avenues that will build self-confidence, which leads to life long benefits. Unfortunately for the sport system, boys and girls, both as individuals and as genders, enter and progress through these stages at different times.

### Training to Compete: Late Puberty, Young Adult

The stage in sport development where training is more focused on learning competitive skills and less on learning to train. Training becomes more intense and focused on performance characteristics. Adolescent and adult biathletes who participate in Biathlon part time or for recreation may remain in this stage for some years.

Children who are progressing towards elite performance in Biathlon will be invited to participate in enriched athletic programs at Provincial and National levels. They will be trained in advanced competitive skills: physical, mental, technical, and tactical. Development of raw athletic ability will begin to peak and the emphasis will shift towards development of elite sport performance in competition.

### Training to Win: Adult

Typically elite athletes close to the pinnacle of their careers. Training is intense, year-round and focused on refining competitive skills to the point where the athlete can consistently perform at the elite level in competitions. Training is for performance on demand, rather than to increase raw athletic or technical ability. Dedicated recreational athletes may also reach this phase at lower performance levels, e.g. Masters National Championships, Masters World Championships.



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