CANADIAN CYCLING ASSOCIATION

LONG-TERM ATHLETE DEVELOPMENT

VOLUME 1

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CCA Long-Term Athlete Development - Volume 1
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Executive Summary

In early 2005, the Canadian Cycling Association (CCA) formed the LTAD Working Group to study ways to improve the development pathway for Canadian cyclists of all ages and all levels of ability and disability. In the interests of promoting cycling in general, and improving long-term elite cycling performances in particular, the CCA reviewed the state of the cycling "sports system" in Canada and made recommendations for its improvement. This LTAD document is the product of that process.

The discussions of the LTAD Working Group revealed that Canadian cycling faces a number of challenges in the development of our athletes and the promotion of our sport. If we examine the various contexts across Canada where cycling is formally organized – such as cycling clubs, schools, provincial organizations, and training centres – we discover several key challenges:

- Canadian cycling needs a recognized, rationalized pathway for cyclists to pursue progressive, logical development in their sport.
- The various Canadian cycling organizations and forums are not always creating the maximum benefit from their partnerships and alliances.
- Limited facility development in Canada is inhibiting the growth of certain cycling disciplines.
- As a consequence of these factors, Canadian cyclists are at risk of losing ground in international competition, and participation at all ages and level of ability and disability appears to be decreasing.

In response to these and other related challenges, the LTAD Working Group has endorsed Long-Term Athlete Development (LTAD) as a cornerstone to the process of reinvigorating cycling at all levels of competition and participation in Canada. LTAD presents a progressive pathway for athletes to optimize their development and improvement according to recognized stages and processes in human physical, mental, emotional, and cognitive maturation. In the bigger picture of sport development, LTAD also has implications for the transformation of key aspects of the cycling sport system, including cycling organizations, competitions, facilities, coaching, and leadership.

Canadian Cycling: Facts & Figures

- According to published statistics, the number of cycling participants in Canada declined from 608,000 in 1998 to 549,000 in 2005

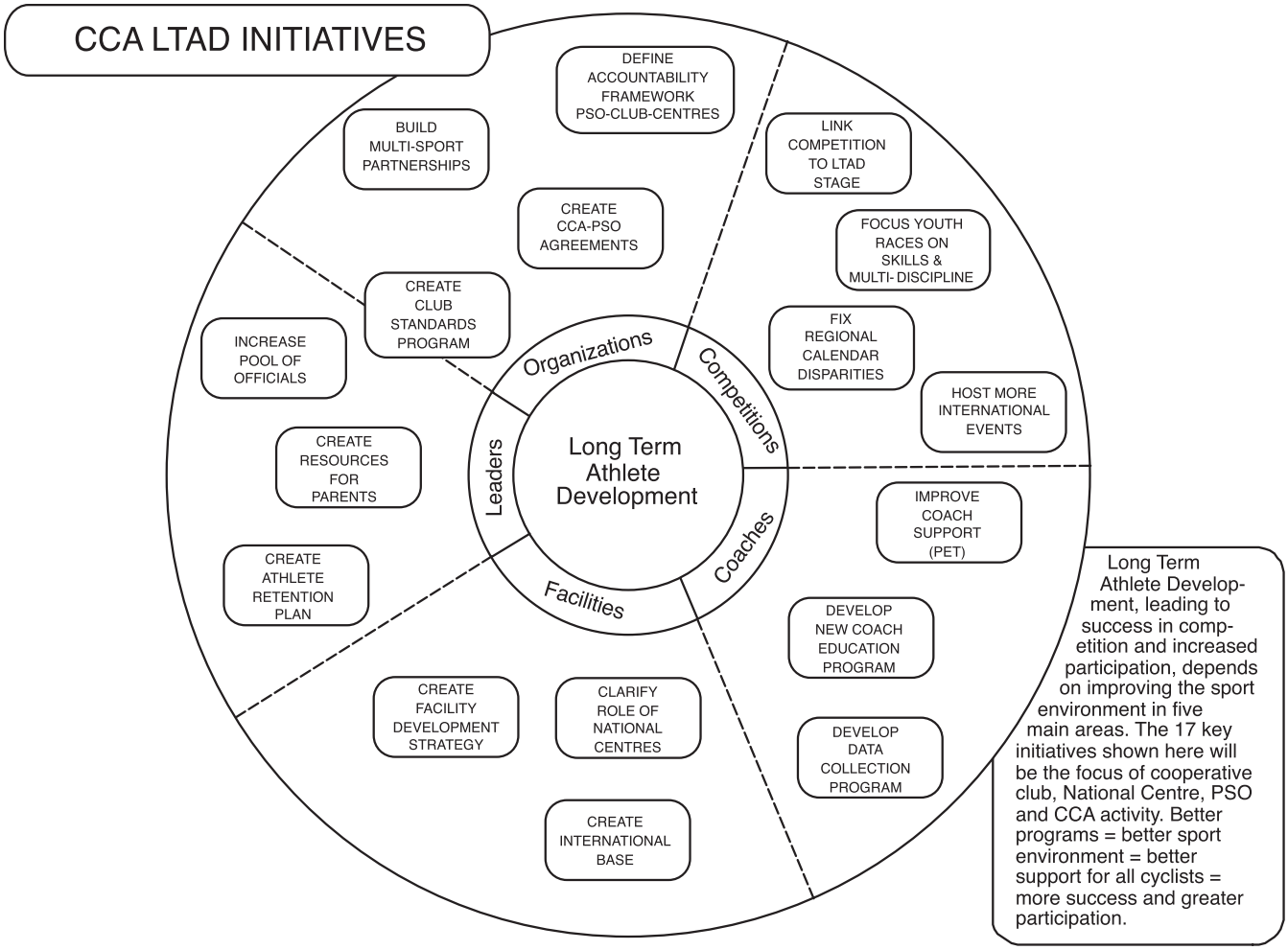
- Between 1970 and 2005, Canadian cyclists have won 120 medals in international competition: 10 Olympic medals, 34 Commonwealth Games medals, 30 Pan-Am Games medals, and 46 World Cycling Championship medals

- Excluding 5 World Championship medals won by mixed teams (MTB Team Relay), 56% of medals (64 of 115) were won by females

- At the 2004 Athens Olympic Games, the average age of a male medallist was 26.9 years (average Canadian team age was 31.2) and the average age of a female medallist was 28.8 years (average Canadian team age was 32.4)

These implications have caused CCA to endorse 17 key LTAD initiatives to improve cycling in Canada. Some highlights:

- An accountability framework needs to be defined between various cycling stakeholder groups, such as clubs, provincial organizations, and national training centres.
- Competition formats need to be matched to the requirements of developmental stages.
- Youth races should be linked to appropriate skills development and a multi-discipline approach to cycling.
- A strategy for facilities development is needed to improve the infrastructure of cycling.
- The role of the national training centres should be clarified.
- Development of a new coach education program and improvement of coaching support will increase the quality and quantity of cycling training across Canada.
- Creation of parent resources, an athlete retention plan, and club standards will support athlete development at all stages and levels of cycling.



The 17 key initiatives are designed to support the implementation and maintenance of the basic athlete-centered LTAD pathway. While the original LTAD model developed by the LTAD Expert Group at Canadian Sport Centres describes seven basic stages in the development of athletes, the cycling LTAD pathway has been modified to include 9 stages as cyclists grow and mature from childhood to adulthood.

Active Start: Learning to Ride
Ages 0-6 (M & F), 0 Sport Years

FUNdamentals: Loving to Ride Around
Ages 6-9 (M) and 6-8 (F), 0-3 Sport Years

Learn to Train: Learning Cycling Skills
Ages 9-12 (M) and 8-11 (F), 1-5 Sport Years

Train to Train: Building the Engine
Ages 12-16 (M) and 11-15 (F), 3-6 Sport Years

Learn to Compete: Entering Competition
Age 16-18 (M) & 15-17 (F) +/-, 4-8 Sport Years

Train to Compete: To the Front of the Pack
Age 18-21 (M) & 17-21 (F) +/-, 6+ Sport Years

Learn to Win: First Across the Line
Ages 19-23 +/- (M&F), 8+ Sport Years

Train to Win: Staying at the Front
Ages 23-25 +/- and up (M&F), 10+ Sport Years

Active for Life: Staying on the Bike!
Enter at any age

This pathway shows both the typical chronological age as well as "Sport Years" or years of experience in sport for each stage. Athletes can pass through stages at different ages depending on their early- or late-entry into sport, but all athletes must pass through every preceding stage to reach later stages. In BMX cycling, for example, young riders with the appropriate development and preparation can progress through stages faster than the typical chronological age for other cycling disciplines.

In recognition of the unique training and developmental needs of athletes with a disability (AWAD), the LTAD Working Group has also added two more stages at the beginning of the AWAD cycling LTAD: Awareness and First Contact. For all stages in the cycling LTAD, the definition of the developmental requirements at each of these stages enables coaches and administrators to build training, competition, and recovery programs that are appropriate to the developmental needs of the athlete, ensuring that the growth and improvement of each cyclist is optimized throughout a lifetime of participation.

The LTAD Working Group and CCA recognize that the implementation of LTAD has far reaching implications for our sport in Canada. The implementation of LTAD will produce adjustments and shifts in the cycling sport system. It is human nature to be apprehensive about change. However, in light of the great promise these changes hold for improving all aspects of cycling in our country – including increased medal and podium performances by Canadians internationally, and greater participation for lifelong wellness by Canadians of all ages and levels of ability and disability – the LTAD Working Group believes that these changes must be embraced.

Acknowledgements

The LTAD Working Group

Thanks to those who contributed to the LTAD planning meetings in 2004-2005:

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Neil Ross, Head Coach, National Cycling Centre Hamilton

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Richard Way, Sport Canada LTAD Expert Group and LTAD Advisor

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Page 28 Lister Farrar

1. Introduction

Cycling is one of the world's great activities. Whether it is transportation, recreation, or competitive sport, as BMX, Road, Mountain Bike or Track, for able-bodied or Paracycling athletes, cycling is participated in and loved by millions around the globe.

The Canadian Cycling Association (CCA) has existed for over one hundred years to promote cycling in Canada, and in particular to organize competitive cycling in our country. We have a proud tradition of competitive success: every cyclist recognizes the names of Canada's greats including Torchy Peden, Jocelyn Lovell, Karen Strong, Steve Bauer, Curt Harnett, Clara Hughes, Alison Sydor, Lori-Ann Muenzer, Marie-Hélène Prémont, Jean Quévillon, Tanya Dubnicoff, Roland Green and many more, representing the entire spectrum of competition events. While we take pride in our competitive achievements, we also have a responsibility to keep our sport strong, to honour our traditions, and to help new generations of Canadians to achieve their dreams - whether that means helping them to join the ranks of our champions or simply enjoy all the pleasures and benefits of cycling. Cycling truly is a sport for everyone, and a sport for life.

Fulfilling our responsibility to our sport and our nation requires that the CCA, its members, and its partners provide the same level of commitment given by our athletes. Whether our role is that of participant or administrator, coach or official, staff or volunteer, or whether we work at the community, provincial / territorial or national level, we cannot achieve our goals without careful planning, hard work, and dedication. Our obligation is to help every Canadian cyclist fulfill their aspirations and be the best they can be. To do this, we must do two things: keep our sights set on the best in the world, and work together to meet and exceed that standard. That is the reason for this document.

As an initiative in the implementation of the Canadian Sport Policy, the federal, provincial and territorial Ministers of Sport in 2005 ratified Long-Term Athlete Development (LTAD) as the athlete development model of Canada. LTAD is more than a model - it is a system and philosophy of sport development.

- LTAD recognizes the continuum of growth and participation in sport, from the earliest stages of developing physical literacy, through high performance, to lifelong participation.

- For competitive cyclists, LTAD means optimal training, competition and recovery programming with attention to biological development and maturation.

- LTAD is athlete-centered, coach-driven, and administration-supported.

- Since athlete and participant development is at the core of the CCA's mission, LTAD is key to everything we do, whatever our role or level within the cycling system.

In the development of the Cycling LTAD, the Work Group had both a performance and a participation vision in mind:

Performance vision: Canadian cyclists on podiums!
Participation vision: To promote quality events and programs to allow as many Canadians as possible life-long participation in cycling.

Further, we recognized that attaining our vision for athlete and participant development would depend on making significant improvements in five key areas of our sport environment and structure:

- Organizations
- Competitions
- Facilities
- Coaching
- Leaders

Change can be difficult. Prior to beginning a process for change, it is essential to understand the key values and principles that are the foundation for change. Here are key principles agreed to by the LTAD planning team:

- Partnership across the sport system and within Canadian cycling
- Integration of cycling disciplines and structures to meet overall development goals
- Use of LTAD as the common "road map" supported by all partners, each with clear, agreed roles & responsibilities
- Focus on holistic athlete development - a Canadian strength
- Clear high-performance targets and improved accountability

Guide to the LTAD Plan

This document outlines Canadian Cycling's LTAD model. It is based on an extensive process of analysis; we have examined our successes and identified where gaps lie within our support structures. In the following pages, we identify where we want to be as a cycling nation, and we propose the changes that are needed in our infrastructure and programs to give the best opportunities to all cyclists whatever their goals or stage of development.

This document calls for some dramatic changes in the way we operate, and it is intended for use by associations, coaches, clubs and athletes. It is our hope and expectation that through this LTAD model:

- Everyone will see where they fit and what their role is
- Stakeholders will know how to make decisions that benefit the long term development of athletes
- Coaches will have a common guide for the design of annual plans and programs

Accordingly, this cycling LTAD plan is organized to provide important information to key groups: athletes and their parents, coaches, clubs, and provincial associations. It describes the sports science that informs LTAD in the 10 Key Factors and the 10 S's of training and Performance. It also looks at complementary cycling and non-cycling activities that assist in the development of cycling athletes and the promotion of lifelong physical activity. The interrelationship of cycling disciplines is examined to identify where synergies exist between them. Finally, the ages and stages of Cycling's LTAD model are described in a colour-coded series of tables that allows readers to review detailed information on the LTAD pathway.

Note: This document represents Volume One of the Cycling LTAD. A second volume is currently in preparation that discusses in detail the challenges and opportunities that arise in supporting the Cycling LTAD in relation to organization, competition, facilities, coaching and leadership.

2. What is Long-Term Athlete Development?

The Long-Term Athlete Development (LTAD) model is founded on the work of the LTAD Expert Group based at the Canadian Sport Centres. LTAD is the integration of sport science research, combined with experience in working with athletes and coaches to develop a comprehensive set of principles for effective athlete development. While a brief introduction will be given here, a more detailed overview can be found in the document "Canadian Sport for Life", an LTAD resource paper published by the Canadian Sport Centres (www.ltad.ca).

LTAD is based on concepts of age-appropriate athlete development, and on the premise that participants will not only be more successful in sport but healthier throughout life if they develop "physical literacy" at a young age – a wide range of skills that include movement, balance, throwing, catching, hitting, etc. The development of sound physical literacy skills, followed by ongoing learning and training introduced during optimal "windows of trainability" keyed to developmental ages and stages, is necessary for any athlete to reach his or her full potential. Missing a step, or introducing the "5 S's" (stamina, strength, speed, skill and suppleness) too early or late, restricts the athlete's potential and makes reaching the highest levels of performance more difficult.

The 10 Key Factors of LTAD

Ten key factors influencing optimal athlete development have been identified:

- The 10-Year Rule: Research has concluded it takes a minimum of 10 years and 10,000 hours of training in a structured and deliberate manner for a talented athlete to reach elite levels. There are no short-cuts.

- The FUNdamentals: Basic physical literacy is the foundation for later athletic success. All athletes, regardless of their sport, are more likely to succeed if they have developed a wide range of movement, balance and object control skills early in life.

- Specialization: Broad-based skills and abilities must be developed first. Premature specialization (prior to age 10-14 in cycling) may contribute to lack of essential skill development, overuse injuries, early burnout and early retirement from sport. For the cyclist, this means deliberate and continuous involvement in multiple non-cycling activities / sports prior to reaching the onset of peak height velocity (PHV).

- Developmental Age: Young athletes may be early, average or late maturers in a range of physical, mental, cognitive and emotional qualities. It is essential to base cycling-specific training on developmental age, not on chronological age. All too often, early maturers across all cycling disciplines are identified for special attention and development, with greater access to increased racing / travel opportunities coming at the expense of their long-term development (due to decreased focus on training / skills development). Often it is the late maturers who may have the greater potential to become top athletes, and when they mature and physically catch up, they pass their early-maturing peers and competitors. It is also important to recognize that the early physical maturer may not be mentally or emotionally prepared for the challenges they appear ready to take on.

- Trainability: Trainability is the responsiveness of individuals to training at different stages of growth and maturation. Optimal windows of trainability for the "Five S's" of stamina, strength, speed, skill and suppleness occur at different times - for example, stamina and strength trainability is linked to developmental age, while speed, skill and suppleness (flexibility) are linked to chronological age. Examples include a focus on BMX and training during the early stages of development (high skill, leg speed, and flexibility requirements) and more focused training on the road when an athlete has just completed (females) or has passed (males) their PHV and are able to develop strength and aerobic power.

- Physical, Cognitive, Mental and Emotional Development: To achieve optimal results, a holistic approach to athlete development that considers all of these factors is required. At any stage, over-emphasis on physical training and winning may not equip the athlete for the challenges of high performance or for life outside sport. Developing the whole athlete, including character, ethics, and values, should be the objective of every program.

- Periodization: Periodization is the organization of a training program by manipulating modality, volume, intensity and frequency of training over long-term (multi-year) and annual time frames using training, competition and recovery periods. LTAD, with its focus on lifelong development, sets context and direction for a sound, periodized cycling training program.

- Competition Calendar Planning: Optimal cycling-specific competition calendars are required for all stages of LTAD. Too much competition or racing at younger ages can detract from development of basic skills and fitness, since time spent racing or traveling to races reduces time available for skills and fitness development. In later stages, selection of the right kind and level of racing becomes critical for development. While it can be logistically difficult, modifying the competition calendar to meet the developmental needs of athletes is essential to LTAD.

- System Alignment and Integration: The best results can only be achieved when all organizations and individuals involved in cycling are working together in an integrated, coordinated way to support athlete development and success. This has enormous implications for planning processes within and between the various cycling partner organizations (eg club, PSO, NTC, NSO).

- Continuous Improvement: The sport of cycling is continuously evolving. Our plans and our organizations must adapt continuously to innovations, research, and changes in the sport environment. New research and practical experience will constantly enrich our understanding and approach to LTAD.

The original 5 Basic S's of training and performance were introduced in the Canadian Sport for Life: Long-Term Athlete Development document. The 5 S's are stamina (endurance), strength, speed, skill, and suppleness (flexibility) (Dick, 1985). Building on these aspects of physical development, an additional five S's create a complete and holistic training, competition, and recovery program.

Thus, there are 10 S's of training which need to be integrated when developing annual training, competition, and recovery plans for the cyclist. Each of these capacities is trainable throughout a cyclist's lifetime, but there are clearly critical periods (or sensitive periods) in the development of each capacity during which training produces the greatest benefit to each cyclist's improvements.

These critical periods vary among individuals as each athlete is unique in his or her genetic makeup. While the critical periods follow general stages of human growth and maturation, scientific evidence shows that humans vary considerably in the magnitude and rate of their response to different training stimuli at all stages. Some cyclists may show potential for excellence by age 11, whereas others may not indicate their promise until age 15 or 16. Consequently, a long-term approach to the development of cyclists is needed to ensure that athletes who respond slowly to training stimuli are not "short-changed" in their development.

The critical periods in trainability are referred to as "critical periods of accelerated adaptation to training." If cyclists are to reach their genetic potential, correct training must be provided during these critical periods when there is accelerated adaptation to training.

The 10 S's of Training and Performance

Stamina (Endurance)

The critical window for training stamina occurs at the onset of the growth spurt or PHV, commonly known as the adolescent growth spurt. Cyclists need increased focus on aerobic capacity training (continuous or aerobic interval workloads) as they enter PHV, and they should be progressively introduced to aerobic power training (anaerobic interval workloads) as their growth rate decelerates.

Strength

There are two critical windows of trainability for strength in girls: immediately after PHV and after the onset of menarche. Boys have one strength window, and it begins 12 to 18 months after PHV. Deliberate and structured strength training on and off the bike can and should be implemented around these very sensitive windows to allow the cyclist the best opportunity for future success in the sport.

Speed

There are two critical windows of trainability for speed. For girls, the first speed window occurs between the ages of six and eight years, and the second window occurs between 11 and 13 years. For boys, the first speed window occurs between the ages of seven and nine years, and the second window occurs between 13 and 16 years. During the first speed window, training should focus on developing agility and quickness (duration of the intervals is less than five seconds, and examples include continued BMX training / competition); during the second speed window, training should focus on developing the anaerobic alactic power energy system (duration of the intervals is 10-15 seconds, and examples include continued BMX training / competition, and road training with short sprints).

Skill

Girls and boys both have one window for optimal skill training. For girls, the window is between the ages of eight and 11 years, while in boys it is between nine and 12 years. During this window, young athletes should be developing physical literacy by maintaining their involvement in other complimentary sports, as well as practicing in multiple disciplines within cycling (BMX, Track, Road and Mountain). Physical literacy is the development of fundamental movement skills and fundamental sports skills that permit a child to move confidently and with control in a wide range of physical activities and sport situations. It also includes the ability to "read" what is going on around them in a sport specific activity (e.g. cycling), as well as in a non-specific sport setting. Physical literacy is the foundation of life-long involvement in physical activity and also for high performance participation.

Suppleness
The critical window of trainability for suppleness occurs between the ages of six and 10 years in both girls and boys; however, because of the rapid growth, special attention should also be paid to flexibility during the growth spurt. Suppleness requires a deliberate and focused approach by the cycling participant well beyond these critical windows and into their adolescent and adult years in order to maintain the benefits gained early in life.

Structure / Stature
This component addresses the seven stages of growth of the human body (Phase 1: very rapid growth; Phase 2: very rapid deceleration; Phase 3: steady growth; Phase 4: rapid growth; Phase 5: rapid deceleration; Phase 6: slow deceleration; Phase 7: cessation of growth) and links them to the windows of optimal trainability. By taking measurements and tracking changes in stature (the height of a human) before, during and after maturation, coaches and parents can track the developmental age of young cyclists. Tracking developmental age then allows planning to address the critical or sensitive periods of physical (endurance, strength, speed and flexibility) and skill development. Diagnostics to identify individually relevant critical periods of accelerated adaptation to training are essential to design and implement optimal training, competition, and recovery programs. In simple terms, there should be constant measuring and monitoring of the athletes height during their participation in cycling programs, from the FUNdamentals stage through to the completion of their relative growth spurt.

(p)Sychology
Sport offers both a physical and mental challenge. The ability to maintain high levels of concentration while remaining relaxed with the confidence to succeed are skills that transcend sport and enhance everyday life. To develop mental toughness for success at high levels requires training programs which are designed specific to the gender and LTAD stage of the athlete. The training programs for cycling athletes should include key mental components identified by sport psychologists: concentration, confidence, motivation and handling pressure. As an athlete progresses through LTAD stages, the mental training aspect will evolve from having fun and respecting opponents, to visualization and self-awareness, to goal setting, relaxation and positive self-talk. To master the mental challenge of sport, these basic skills are then tested in increasingly difficult competitive environments. Ultimately the planning, implementing and refining of mental strategies for high-level competition will determine podium performances. The mental training program is critical at any LTAD stage as dealing with success and failure will determine continuation in sport and physical activity, therefore dramatically affecting an individual lifestyle.

Sustenance
Sustenance recognizes a broad range of components with the central theme of replenishing the body. This is to prepare the cycling athlete for the volume and intensity required to optimize training and competition or simply living life to the fullest. Areas addressed are nutrition, hydration, rest, sleep and regeneration, all of which need to be applied differently to training (life) plans depending on the stage within the LTAD. Underlining sustenance is the need for optimal recovery management moving the athlete to the 24/7 model which places a high degree of importance on the individual's activities away from the field of play. For proper sustenance and recovery management, there is a need to monitor recovery by the coach or parent through the identification of fatigue. Fatigue can come in many forms including metabolic, neurological, psychological, environmental and travel. While overtraining or over-competition can lead to early burn-out, improperly addressing sustenance can lead to the same result during any of the relative stages of a cycling athlete's development.

Schooling (Stress)

When designing training programs, the demands of school must be considered. This is not only limited to the demands placed by school sports or physical education classes; this includes integrating school academic loads duties, timing of exams and other stresses. When possible, training camps and competition tours should compliment, not conflict, with the timing of major schools academic events. Overstress should be monitored carefully. Overstress refers to the everyday stresses of life such as schooling, exams, peer groups, family, and personal relationships, as well as increased training volume and intensities. Interference from other school sports should be minimized, so communication is essential between coaches who are responsible to deliver the training and competition programs. A good balance should be established between all factors and the coach and the parents should be working on this together.

Socio-Cultural

The socio-cultural aspects of sport are significant and must be managed through proper planning. Socialization via sport will ensure that general societal values and norms will be internalized via sport participation. This occurs initially at the community level, but as an athlete progresses through the LTAD stages it may eventually lead to international exposure. As such, socialization through sport can generate a significant broadening of the athlete's socio-cultural perspective, including increased awareness of ethnicity and national diversity. To accommodate these developments within the athlete, recovery within the travel schedule can include education of competition location including history, geography, architecture, cuisine, literature, music and visual arts. Proper annual planning can allow sport to offer much more than a simple commute between hotel room and competition venue.

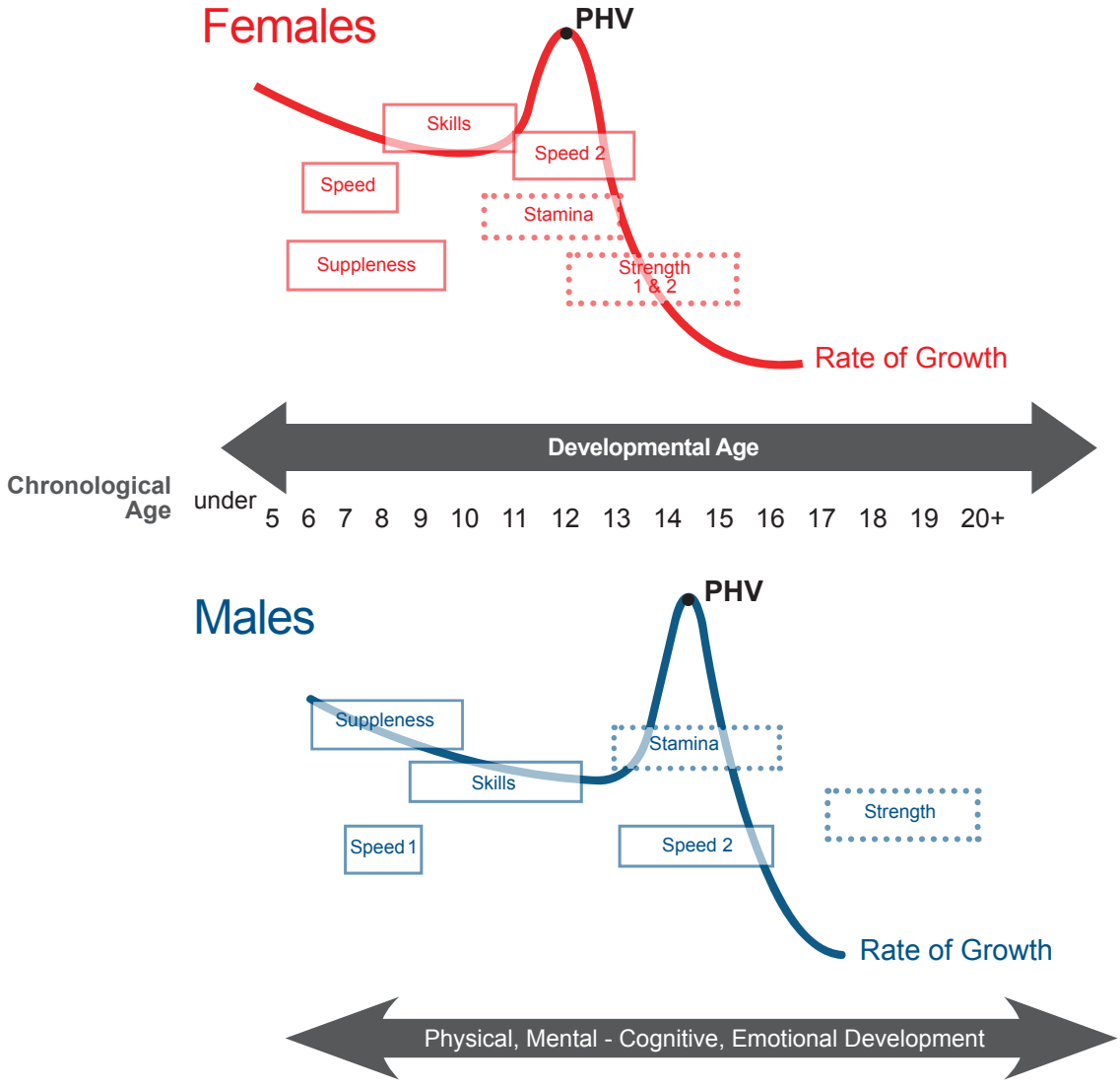
Sport socialization also must address sport sub-culture. As well, coaches and parents must guard against group dynamics that create a culture of abuse or bullying. Ethics training should be integrated into training and competition plans at all stages of LTAD.

In summary, overall socio-cultural activity is not negative distraction or interference with training and competition activities. It is a positive contribution to the development of the person and the athlete.

Critical Periods of Development

The developmental stages are critical in the life of every athlete. The time of Peak Height Velocity (PHV) - the maximum rate of growth during the adolescent growth spurt - represents an optimal "window" for training some of the five S's of stamina, strength, speed, skill and suppleness (see diagram). It is therefore essential that training that targets these capacities is introduced according to developmental age, not chronological age. Development occurs at different times for different young athletes. If the window is missed, the athlete may not develop to his or her full potential. This underlines the importance of youth recruitment, age-appropriate programs, and optimal coaching and competition calendars in cycling. Coaches especially must have the expertise to identify the stage of maturation of the athlete and the programs and systems that will allow that athlete to train and compete appropriately to his or her potential. However, even if windows are missed, all systems are always trainable.

Since the optimal window of trainability for stamina and speed occurs between the ages of 11 and 13 for females and 12 and 14 for males, it is essential to use age-appropriate training and competition programs to develop young Canadian cyclists. Given the typical late entry age of Canadian cyclists, the challenge of recruiting and training cyclists at younger ages is critical (See Appendix 2).

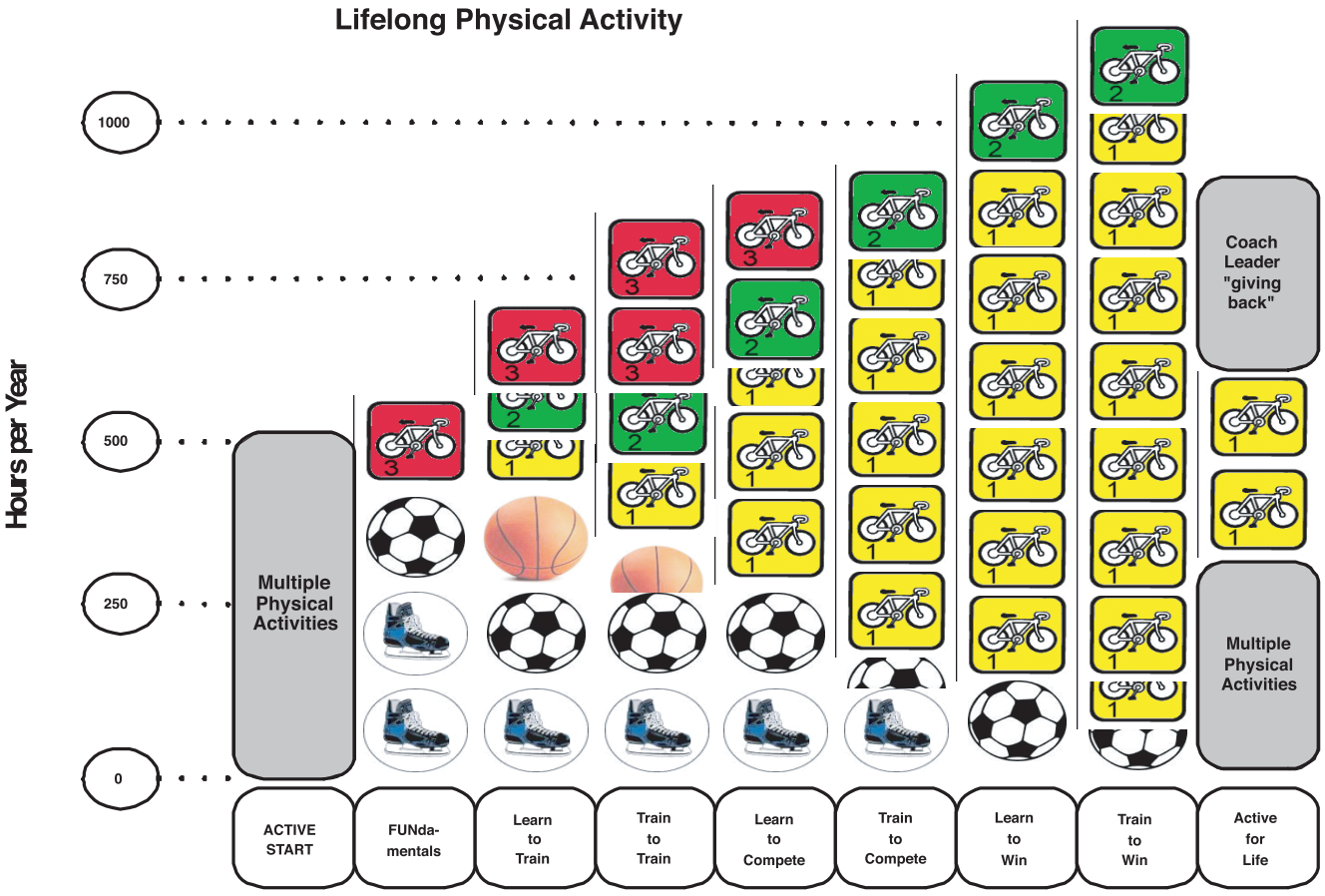


Complementary Cycling Disciplines and Lifelong Physical Activity

The primary goal of LTAD is for participants to have a physically active life which will result in a host of health and social benefits. With the right foundation and preparation, participants may also go on to become high performance athletes. Physical literacy developed in the Active Start and FUNdamentals stages (see Ages and Stages of Cycling's LTAD, following pages) is a prerequisite for high performance, and this is best developed through participation in a number of sport activities that help develop the five basic S's: stamina, strength, speed, skill, and suppleness.

The graph below illustrates how an individual progresses through multiple sport activities, as well as disciplines within a specific sport. "Hours per year" is the estimated total hours spent in all forms of physical activity. After enjoying a wide range of unstructured activities in the Active Start stage, the individual enters several organized sport programs in the FUNdamentals stage, including cycling. Additional cycling disciplines are added in the Learn to Train stage to enhance skill development and promote choice. Although the entry cycling discipline (Cycling 3) is preferred in the Train to Train stage, it is ultimately dropped to allow specialization in Cycling 1 in the Train to Compete stage. Note also that other complementary non-cycling sports are included throughout – for example, speed skating or cross-country skiing are compliments to road, endurance track or MTB XC cycling. Finally, in the Active for Life stage, time is set aside for "giving back" as a coach or leader.

The lesson for cycling is to encourage multi-sport and multi-discipline participation, especially in the early stages when broad physical literacy and skill development will lay a foundation for later high performance. Migration between complementary cycling disciplines, as shown on the next page, should also be encouraged.

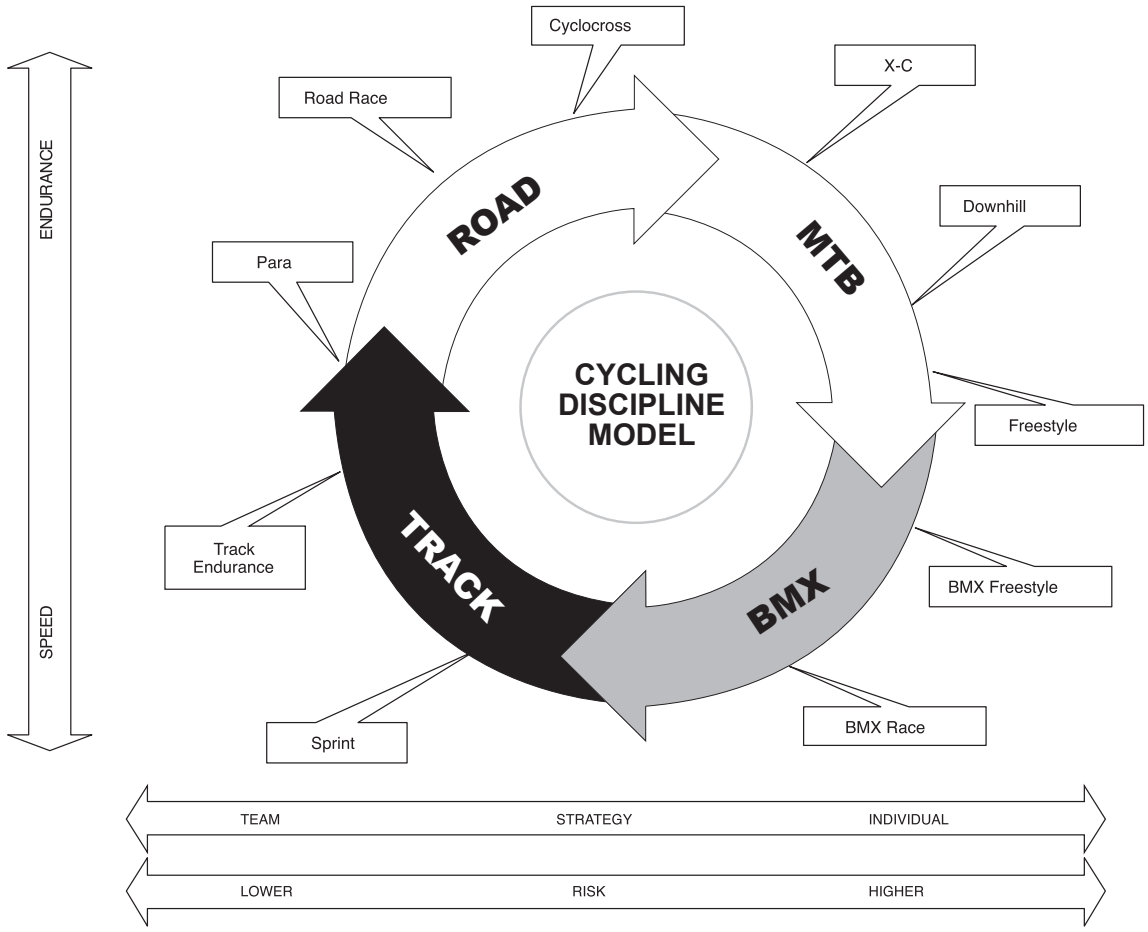


Interrelationship of Cycling Disciplines

When athletes are ready to emphasize cycling, it is important that they participate in a variety of cycling disciplines for the same reason: to facilitate development of a range of cycling skills and to promote choice. Participation in different discipline events with similar profiles may allow a cyclist to maximize his or her success, while participation in events with different profiles may allow for enhanced skill and capacity development.

The diagram below shows how disciplines complement each other. Disciplines and events on the right side are higher risk (higher requirement for technical motor skills, spatial judgment, etc.) and tend to be based on individual strategies and tactics. Meanwhile, disciplines on the left tend to require team or multi-rider strategies and tactics. Disciplines closer to the top are more endurance-based (maximal aerobic power) while those at bottom are more speed-based (anaerobic power and capacity).

It is beneficial for cyclists to train and compete in multiple disciplines through to the Learn to Win and Train to Win stages when greater specialization is required. Coaches, clubs, and parents should facilitate this multi-discipline approach to encourage young athletes (particularly in the Learn to Train and Train to Train stages) to participate in multiple disciplines for balanced physical, skill and technical / tactical development. Athletes may also migrate from one preferred discipline to another as they mature.



3. Ages and Stages of Cycling's LTAD

Active Start: Learning to Ride
Ages 0-6 (M & F), 0 Sport Years

FUNdamentals: Loving to Ride Around
Ages 6-9 (M) and 6-8 (F), 0-3 Sport Years

Learn to Train: Learning Cycling Skills
Ages 9-12 (M) and 8-11 (F), 1-5 Sport Years

Train to Train: Building the Engine
Ages 12-16 (M) and 11-15 (F), 3-6 Sport Years

Learn to Compete: Entering Competition
Age 16-18 (M) & 15-17 (F) +/-, 4-8 Sport Years

Train to Compete: To the Front of the Pack
Age 18-21 (M) & 17-21 (F) +/-, 6+ Sport Years

Learn to Win: First Across the Line
Ages 19-23 +/- (M&F), 8+ Sport Years

Train to Win: Staying at the Front
Ages 23-25 +/- and up (M&F), 10+ Sport Years

Active for Life: Staying on the Bike!
Enter At Any Age

The LTAD model divides athlete development into a series of stages as they grow and develop. Within each stage, it is essential that training and competition are designed to be appropriate to the developmental requirements at that stage. Only by following age-appropriate activities and building a foundation in each stage for the next can athletes optimally prepare to progress toward their goals.

The original LTAD model developed by the LTAD Expert Group at Canadian Sport Centres featured seven basic stages (see page 4); the cycling model has been modified to 9 stages, adding the Learn to Compete and Learn to Win stages to provide extra detail. The ages and stages of cycling's LTAD model are outlined on the left.

For athletes with a disability (AWAD), two more stages are added at the beginning: Awareness and First Contact (see chart, p 26). These stages emphasize the need to make access to sport known to people with a disability, and then to ensure that the sport environment and the first exposure to the sport are positive and welcoming.

Phase: **Active Start** Ages: 0 to 6 (F & M), 0 Sport Years
Key Objective: **Develop movement literacy**

DEVELOPMENT

Physical
- Movement literacy
- Focus on learning proper movement skills i.e. running, jumping, wheeling, twisting, kicking, throwing, and catching
- Fundamental movement skill development
- Movement development (ABC's: RJT, etc.)
- Speed, power and endurance through FUN and games
- Anaerobic power: children have limited capacity
- Aerobic power: incidental development through fun and games

Motor and Mental
- Motor learning integrated into games
- Focus on motivating and FUN activities
- Emphasize trying new activities

Tactical Skills
- No tactics in this stage

Technical Skills
- Exploration of risk and limits in safe environments
- Active movement environment combined with well-structured gymnastics and swimming programs mid- to late-stage
- Typically children learn to ride a bicycle near the end of this stage - see Sprockids, Can-Bike and other skills and safety programs

Other
- Daily physical activity
- Not sedentary for more than 60 mins except when sleeping
- Respect for others and fair play
- Parental support and involvement: focus on healthy development

SPORT ENVIRONMENT

Coaching
- Community Initiation coach
- Parent or recreation leader

Delivery
- School
- Parent
- Recreation program
- BMX Cycling

Competition Framework (for BMX only):
- Limited introduction to competition: focus on basic skill development
- Skill and ability games
- Observe racing
- Development through fun and games

SPORT PARTICIPATION

- Participate in as many physical activities as possible
- Some organized physical activity late in stage
- Minimal to no competition in this stage (BMX- late in stage only)

TESTING & TALENT ID

Talent ID:
- None in this stage

Phase: **FUNdamentals** Ages: 6 to 8 (F), 6 to 9 (M), 0-3 Sport Years
Key Objective: **Develop movement literacy**

DEVELOPMENT

Physical
- Movement literacy
- Fundamental movement skill development
- Movement development (ABC's: RJT, etc.)
- Speed, power and endurance through FUN and games
- Strength: Introduction to core strength and stability through fun games
- Warm up/cool down: intro to concept
- Anaerobic power: athletes have limited capacity
- Aerobic power: incidental development through fun and games

Motor and Mental
- Motor learning integrated into practices
- Focus on motivating and FUN activities
- Emphasize effort, doing one's best, finishing

Tactical Skills
- Basic BMX tactics
- Basic concepts of racing: mass-start, time trial, etc
- Introduction to basic sport rules, tactics and ethics

Technical Skills
- Introduce and develop basic cycling skills (e.g. Sprockids)
- Introduce BMX racing skills
- Intro position and pedal stroke, use of gears, basics of cornering, climbing, descending, braking, accelerating, avoiding obstacles

Other
- Basics of diet, rest and recovery
- Respect for others and fair play
- Parental support and involvement: focus on character development through participation

SPORT ENVIRONMENT

Coaching
- Community Initiation
- BMX: Introduction to Competition
- Parent or Recreation Leader

Delivery
- School
- Recreation program
- BMX Cycling Club
- Cycling Club

Competition Framework:
- Limited introduction to competition: focus on skill development
- BMX racing
- "Kids races" e.g. Timbits challenge
- Skill and ability games
- Observe senior racing

SPORT PARTICIPATION

- Up to 160 cycling hours per year
- Less than 4 hrs/week
- Up to 5 sessions/week
- Longest session 1 hour
- Up to 12 events per year or 3 races per month
- No periodization
- Competes in up to 1 discipline
- May participate in up to 4 other sports

TESTING & TALENT ID

Talent ID:
(Note: intent is to motivate and collect benchmark data)
- Timed cycling skills circuit
- Basic anthropometry

Phase: **Learn to Train** Ages: 8 to 11 (F), 9 to 12 (M), 1-5 Sport Years
Key Objective: **Develop cycling literacy**

DEVELOPMENT

Physical
- Fundamental sport skills
- Peak motor development (ABC's: RJT, etc.)
- Speed, power and endurance through FUN and games
- Strength: Continue core strength and stability, intro ankle and knee stability through fun games, swiss ball, own body weight
- Warm up/cool down: Introduction to concept
- Anaerobic power: athletes have limited capacity, incidental development only
- Aerobic power: incidental development through fun and games. Some specific development

Motor and Mental
- Motor learning integrated into practices
- Focus on motivating and FUN activities
- Emphasize effort: doing one's best, finishing

Tactical Skills
- Specific BMX tactics
- Introduction to bicycle racing (other disciplines)
- Introduction to sport rules, ethics
- Introduce racing skills (BMX, MTB, road, track)
- Refine position and pedal stroke, use of gears, cornering, climbing, descending, braking, accelerating, avoiding obstacles

Technical Skills
- Refine basic cycling skills (Sprockids)
- Introduce racing skills (BMX, MTB, road, track)
- Refine position and pedal stroke, use of gears, cornering, climbing, descending, braking, accelerating, avoiding obstacles

SPORT ENVIRONMENT

Other
- Introduce: cultural / lifestyle habits; nutrition / hydration; recovery / regeneration
- Off bike skill development during cycling training sessions

Coaching
- Community Initiation
- BMX: Introduction to Competition
- Parent or Recreation Leader

Delivery
- School
- Recreation program
- BMX Cycling Club
- Cycling Club

Competition Framework:
- Focus: skill development
- Regional Games
- Provincial-regional series (regions within province) e.g. Québec
- School championships
- Sprockids
- BMX only: provincial championships
- Observe senior racing

RACING AND PRACTICE

- Up to 240 training hours per year
- Less than 6 hrs/week
- Up to 6 sessions/week
- Longest session 1:45
- Up to 15 events per year or 4 races per month
- Competes in up to 2 disciplines
- May participate in up to 3 other sports
- Single periodization- follow seasonal schedule

TESTING & TALENT ID

Talent ID: (non-competing)
- Timed cycling skills circuit
- Basic anthropometry

(If competing) **Semi-annual testing of:**
- Anthropometry
- Vertical jump
- Performance: Discipline-specific test

Annual testing of:
- Medical check-up

Phase: **Train to Train** Ages: 11 to 15 (F), 12 to 16 (M), 3-6 Sport Years
Key Objective: **Physical & Skill Dev't : Window of Opportunity**

DEVELOPMENT

Physical
- Building the engine- major fitness development
- Advanced sport specific drills
- Speed, power: Intro to plyometrics
- Strength: Key development window for females at onset of menarche. Continue core strength and stability, diagnose for ankle and knee stability, intro free weights
- Warm up/cool down- athlete specific routine
- Anaerobic power: emphasis in competition phase only
- Aerobic power: Emphasize via specific training and complementary sports

Motor and Mental
- Motor learning integrated into practices
- Develop mental preparation; appropriate attitude to competition, being the best you can be, belief in the process
- Profile mental qualities (BMX, MTB, road, track)
- Incorporate cross training

Tactical Skills
- Specific BMX tactics
- Introduction to bicycle racing (other disciplines)
- Introduction to sport rules, tactics and ethics

Technical Skills
- Develop advanced cycling skills (Skills Academy)
- Introduce group riding, drafting, pacing etc
- Rules and ethics

Other
- Develop: cultural / lifestyle habits; nutrition / hydration; recovery/regeneration, tapering and peaking
- Parental education, involved in lifestyle management
- Intro career planning, use of training diary
- Selection of competitions- prioritize competitive sports near end of phase

SPORT ENVIRONMENT

Coaching
- BMX, MTB, Road: Introduction to Competition

Delivery
- Cycling Club/Team
- Sport school (link with National Centre)

Competition Framework:
- Provincial Champs & Provincial/regional Games
- Provincial calendar, Regional calendar
- For BMX only: National champs
- Exposure to multiple disciplines

RACING AND TRAINING

- 120-400 training hours per year (M), 100-320 (F)
- 6 – 12 hrs/week
- 3 - 7 sessions/week
- Sessions 2:00 – 3.30 hrs
- 10 to 25 events per year or 3-6 races per month
- Competes in up to 3 disciplines
- May participate in up to 2 other sports
- Single periodization- follow seasonal schedule

TESTING & TALENT ID

Talent ID:
- CCA 0.4 mi anaerobic test (post-puberty)

Semi-annual testing of:
- Anthropometry
- Predicted MAP
- CCA 0.4 mi anaerobic test (post-puberty)

Annual testing of:
Medical check-up

Regular testing of:
- Performance: discipline specific TT

Phase: **Learn to Compete** Ages: 15 to 17 +/- (F), 16 to 18 +/- (M), 4-8 Sport Years

Key Objective: **Optimizing the engine**

DEVELOPMENT

Physical
- Optimizing the engine
- Advanced sport specific drills
- Speed, power: Develop plyometrics, specific sprint training
- Strength: Athlete specific core strength and stability, ankle and knee stability, free weights. Sport specific strength in specific preparation phase
- Warm up/cool down- integral, specific to training and competition
- Anaerobic power: specific prep and competition phases, targeted development
- Aerobic power: Specific training and complementary sports.

Mental
- Decision making
- Refine mental preparation
- Social psychology and team dynamics

Tactical Skills
- Refine competition skills and test various strategies
- Develop team event tactics
- Continue sport rules, tactics and ethics

Technical Skills
- Refine advanced cycling skills (Skills Academy)
- Experiment with techniques: cornering, single track, group riding, drafting, pacing etc

Other
- Optimize: cultural / lifestyle habits; nutrition / hydration; recovery / regeneration, tapering and peaking
- Parental education, involved in lifestyle management
- Introduce career planning
- Introduce travel strategies near end of phase
- Refine use of training diary
- Discipline specialization near end of phase
- Selection of competitions- prioritize competitive sports

SPORT ENVIRONMENT

Coaching
- BMX, MTB, Road: Introduction to Competition or Competition Development

Delivery
- Cycling Club/Team
- Sport school (link with National Centre)

Competition Framework:
- National Championships
- National Series
- East-West Region Series
- Provincial Championships, Provincial Cup, Provincial Games
- Regional / club & High School races
- Brief national exposure
- Up to 4 disciplines, not specialized

RACING AND TRAINING

- 300-640 training hours per year (M), 240-500 (F)
- 10 – 14 hrs/week
- 4 - 9 sessions/week
- Sessions 3.00- 4:15 hrs
- 20 to 45 events per year or 4-8 races per month
- Competes in up to 4 disciplines
- May participate in up to 2 other sports
- Single periodization- 1 main competition with multiple sub peaks

TESTING & TALENT ID

Talent ID:
- CCA 0.4 mi anaerobic test

Semi-annual testing of:
- Anthropometry
- Blood- Hct, HB, Iron
- Predicted MAP
- CCA 0.4 mi anaerobic test

Regular testing of:
- Performance: discipline specific TT

Phase: **Train to Compete** Ages:17 to 21 +/- (F), 18 to 23 +/- (M), 6+ Sport Years

Key Objective: **Optimizing the engine**

DEVELOPMENT

Physical
- Optimizing the engine
- Advanced sport specific drills
- Speed, power: Develop plyometrics, specific sprint training, max power
- Strength: Athlete specific core strength and stability, ankle and knee stability, free weights. Develop sport specific strength.
- Warm up/cool down- integral, specific to training and competition
- Anaerobic power: periodized, targeted development
- Aerobic power: Develop pre-season, maintain during season

Mental
- Decision making
- Refine mental preparation
- Distraction management
- Social psychology and team dynamics

Tactical Skills
- Optimize competition skills and test various strategies in competition
- Develop team event tactics; select competitions for development purposes
- Continue sport rules, tactics and ethics

Technical Skills
- Refine advanced skills
- Master techniques: cornering, single track, group riding, drafting, pacing etc

Other
- Optimize: cultural / lifestyle habits; nutrition / hydration; recovery / regeneration, tapering and peaking
- Career planning
- Travel strategies
- Media training
- Regular monitoring and testing
- Discipline specialization; fitting other life goals within HP quest
- Incorporate cross training

SPORT ENVIRONMENT

Coaching
- BMX, MTB, Road: Competition Development

Delivery
- Cycling Club / Trade team
- Provincial Team
- Nat Center Team

Competition Framework:
- Jr/U23 World Champs, International, National competition: National Champs, Canada Cup & Canada Games
- Provincial competition: Prov Champs, Prov Cup & Regional Games
- Brief international exposure
- 2 main cycling disciplines

RACING AND TRAINING

- Road: 450-700 training hours/year (M), 400-600 (F)
- MTB: 400-600 hr/year (M). 350-550 (F)
- 11 – 17 hrs/week
- 4 - 9 sessions/week
- Sessions 3.30- 5:00 hrs
- 20 to 50 events per year or 5-10 races per month
- Competes in up to 3 disciplines
- May participate in up to 2 other sports
- Single periodization- 1 main competition with multiple sub peaks

TESTING & TALENT ID

Quarterly testing of:
- Anthropometry
- Blood- Hct, HB, Iron
- Direct MAP test
- Efficiency: HR/Wattage/HLa

Regular testing of:
- Performance: discipline specific TT

Phase: **Learn to Win** Ages: 18 to 23 +/- & up (F), 19 to 23 +/- & up (M), 8+ Sport Years
Key Objective: **Maximizing the engine**

DEVELOPMENT

Physical
- Maximizing the engine
- Speed, power: Develop plyometrics, specific sprint training, maximum power
- Strength: Athlete specific core strength and stability, ankle and knee stability, free weights. Develop sport specific strength and maximum power
- Warm up/cool down- integral, specific to training and competition
- Anaerobic power: periodized, targeted dev't
- Aerobic power: Develop pre-season, maintain during season

Mental
- Focus on target results
- Refine decision making
- Advanced mental preparation
- Distraction management
- Social psychology

Tactical Skills
- Refine tactics
- Optimize competition skills and test various strategies in competition
- Optimize team event tactics in competitions
- Optimal integration of technical and tactical elements
- Continue sport rules and ethics

Technical Skills
- Master advanced cycling skills and techniques.
- Optimize technique - correct weaknesses

Other
- Maximize: cultural / lifestyle habits; nutrition / hydration; recovery/regeneration, tapering and peaking
- Career planning
- Refine travel strategies
- Media training
- Regular monitoring and testing
- Event specialization; fitting other life goals within HP quest
- Incorporate cross training

SPORT ENVIRONMENT

Coaching
- BMX, MTB, Road: Competition High Performance

Delivery
- Trade team
- National Center Team
- National Development Team

Competition Framework:
- World Champs & World Cup
- Continental Cup
- International & National Championships
- Domestic National Series.
- Up to 2 cycling disciplines

RACING AND TRAINING

- Road: 550-700 training hours/year (M), 450-650 (F)
- MTB: 450-650 hr/year (M). 400-600 (F)
- 15 – 22 hrs/week
- 4 - 9 sessions/week
- Sessions 5:00- 6:00 hrs
- 40 to 60 events per year or 5-14 races per month
- Competes in up to 3 disciplines
- Participate in 1 sport
- Single or multi-periodization - multiple competition peaks

TESTING & TALENT ID

- Anthropometry
- Blood- Hct, HB, Iron
- Direct MAP test
- Efficiency: HR/Wattage/HLa; use of SRM
- Performance: discipline specific TT

Phase: **Train to Win** Ages: 23-25+/- and up (F), 23-25+/- and up (M), 10+ Sport Years

Key Objective: **Maximizing the engine**

DEVELOPMENT

Physical
- Maximizing the engine
- Speed, power: Refine plyometrics, specific sprint training, maximum power
- Strength: Athlete specific core strength and stability, ankle and knee stability
- Develop sport specific strength and maximum power.
- Methods tailored to individual
- Warm up/cool down- integral, specific to training and competition
- Anaerobic power, Aerobic power: Maintenance with development following quadrennial plan

Mental
- Focus on results
- Refine decision making
- Advanced mental preparation
- Distraction management
- Social psychology and team dynamics

Tactical Skills
- Innovating tactics
- Optimize competition skills and test various strategies in competition
- Optimize team event tactics in competitions
- Optimal integration of technical and tactical elements
- Continue sport rules and ethics

Technical Skills
- Master advanced cycling skills and techniques
- Optimize techniques - focus on strengths

Other
- Maximize: cultural / lifestyle habits; nutrition / hydration; recovery/regeneration, tapering and peaking
- Career planning
- Refine travel strategies
- Media training
- Regular monitoring and testing
- Prioritize events; fitting other life goals within HP quest
- Incorporate cross training

SPORT ENVIRONMENT

Coaching
- BMX, MTB, Road: Competition High Performance

Delivery
- Trade team
- National Team

Competition Framework:
- Olympics, major Games
- World Champs & World Cup
- Trade team events
- Up to 2 cycling disciplines

RACING AND TRAINING

- Road: 600-1200 training hrs/year (M), 500-1000 (F)
- MTB: 500-1000 hr/year (M). 450-900 (F)
- 16 – 30 hrs/week
- 4 - 9 sessions/week
- Sessions 5:00- 7:00 hrs
- 40 to 120 events per year or 6-20 races per month
- Competes in up to 2 disciplines
- Participate in 1 sport
- Single or multi-periodization - multiple competition peaks

TESTING & TALENT ID

Regular testing of:
- Anthropometry
- Blood- Hct, HB, Iron
- Direct MAP test
- Efficiency: HR/Wattage/HLa; use of SRM
- Performance: discipline specific TT

Phase: **Active for Life** Ages: Enter at any age
Key Objective: **Maintain activity, give back**

DEVELOPMENT

(If competing) Physical
- Advanced sport specific drills
- Speed, power: Develop via specific sprint training
- Strength: Athlete specific core strength and stability, ankle and knee stability, free weights. Develop sport specific strength
- Warm up/cool down- integral, specific to training and competition
- Anaerobic power: periodized, targeted dev't
- Aerobic power: Develop pre-season, maintain during season

Mental
- Decision making
- Refine mental preparation
- Distraction management

Tactical Skills
- Optimize competition skills and test various strategies in competition
- Demonstrate leadership in sport rules, tactics and ethics

Technical Skills
- Refine advanced cycling skills
- Techniques: cornering, single track, group riding, drafting, pacing etc

Other
- Optimize: cultural / lifestyle habits; nutrition / hydration; recovery / regeneration, tapering and peaking
- Use of training diary

SPORT ENVIRONMENT

Coaching
- Community Ongoing

Delivery
- Recreation program
- Cycling Club

Competition Framework:
- Competition if desired: from club racing to Masters-level

SPORT PARTICIPATION

General
- Minimum of 60 minutes moderate physical activity daily or 30 minutes of intense activity for adults
- Transfer from one sport to another
- Move from highly competitive sport to recreational activities
- Give back by participating as a coach, official or leader

Competition (if desired)
- 300-640 training hours per year
- 10 – 14 hrs/week
- 4 - 9 sessions/week

TESTING & TALENT ID

- Testing as appropriate to level of competition, if desired
- Anthropometry
- Blood- Hct, HB, Iron
- Predicted MAP

CCA Development Model for Athletes with a Disability (AWAD - Paracycling or Handisport)

Responsible	Time Required	LTAD Stage	Key Objectives
IPC/UCI ISMWSF, IBSA CP-ISRA, CCA, CPC	650-900 hrs/year + 2 to 3 National Training Camps 5 years + experience	Stage 6: "Train to Win" PERFORMANCE National Team Coach Level 3 or 4	- Paralympic Games, Para Pan-Ams - World Championships for Para Cycling - Commonwealth Games - World Specific Disability Games, World Cup - European Championships - Circuit EHC Europe
PSO's AWAD PSO's CPC	350-700 hrs/year 4 Training camps "PSO's Team" 3 to 5 years experience	Stage 5: "Train to Compete, Learn to Win" PROVINCIAL DEVELOPMENT *1 Provincial Team Coach Level 3	- Regional Cup events (ie. Defi Sportif) - Canadian Championships - Provincial Championships - Integrated Provincial Circuit - Canadian AWAD Games (to come)
Local club integration, AWAD sport club, AWAD PSO's, PSO's	100-400 hrs/year 1 to 3 years experience	Stage 4: "Train to Train, Learn to Compete" DEVELOPMENT *2 Local club and personal training Coach Level 2 : AWAD cycling competence	- Integrated Provincial Championships - Integrated Provincial Circuit - Provincial Games - Events in Canada and USA (Marathon, festival, etc.)
AWAD PSO's Local cycling club AWAD sport club	Up to 200 hrs/ year 0 to 2 years experience	Stage 3: "Learn to Train" INITIATION Local club and personal training Coach Level 1, Skills Instructor (retired or active athlete)	Initiation to competition by observing high performance athletes and participation in PSO' clinics
AWAD PSO's AWAD Associations Rehabilitation Center	Up to 100 hrs/ year Rehabilitation 0 to 1 year experience	Stage 2: "FUNdamentals" INTRODUCTION Initiation into sport by other athletes, Rehabilitation Center, Specific AWAD associations and small activities Coach, physical educator, physical therapist, Federation leader	No competition at this stage, give information on stages of development, other sports
Family, friends, Rehabilitation Center	Basic sports knowledge or environment No experience	Stage 1: "Awareness & First Contact" PRESENTATION Demonstration and initiation into sport by Rehabilitation Center, publicity, Specific AWAD associations, and Special activities Physical educator, physical therapist, friends, family, volunteers...	Need to make access to sport known. Ensure a positive environment and introduce to many sports

*1: Missing/weak link

*2: Person with sport background can go directly

4. Summary

LTAD presents an opportunity to transform Canadian cycling. For our sport and our athletes, we must seize this opportunity. Perhaps now more than at any other moment in recent years, the Canadian cycling community has the power to take a giant step forward by committing to a rational athlete development system that can bring out the best in our athletes while promoting lifelong wellness and the development of our sport in general.

Through the LTAD planning process, the Canadian Cycling Association has been able to take stock of both its assets and challenges, identify opportunities and propose initiatives. Our conclusion is that optimal athlete development for Canadian cyclists can only occur if we improve cycling's sport environment in five key areas: organizations, competitions, coaching, facilities, and leaders. By building a stronger support and development system we will help Canadian cyclists reach the visions of "Canadian cyclists on podiums", and "quality events and programs to allow as many Canadians as possible to participate life-long in cycling."

Now our success depends on partnership and teamwork. Across Canada, in our different disciplines- BMX, road, track, MTB and paracycling- in our different organizations and facilities, including CCA, National Cycling Centers, provincial cycling associations, clubs, and facilities- we have a wealth of experience, expertise and passion for cycling. We need to harness that expertise far more effectively to attain our goals. We need better cross-discipline cooperation and more shared programs, as well as better coordination between levels- community, provincial/ territorial and national. We need to agree on roles and responsibilities, and we need to direct our resources in the most effective way to fulfill those responsibilities. We need to communicate more effectively so we can share what we have learned and collaborate to make our efforts more successful. We need to set higher standards, to demand more of ourselves. We need to make the most of what we have.

LTAD provides the pathway through which we can show our commitment to improving our athletes and the development of cycling as a whole. Whether we are cyclists, administrators, coaches or officials, staff or volunteers, we can know that we are participating in an integrated cycling system that is moving everyone forward together. Through LTAD, the CCA, its members, and its partners will be able to fulfil our joint responsibility to our sport and our nation.

Let's go!

5. References

Balyi, I., Way, R., Norris, S., Cardinal, C. and Higgs, C. (2005). Canadian Sport for Life. Canadian Sport Centre – Vancouver

Higgs, C., Balyi, I., Cardinal, C., Norris, S. and Way, R. (2005). No Accidental Champions. Canadian Sport Cenre – Vancouver

Dick, F.W. Sports Training Principles, London, Lepus Books, 1985

Coaching Athletes with a Disability: Coaching Association of Canada, 2005

Thibault, G. Athlete Development Model: Canadian Cycling Association, 2002

Appendix 1: Glossary of Terms and Abbreviations

ABCs: Agility, Balance, Coordination (movement literacies).

Abstract Thinking – Thinking about processes, objects and events that may or may not have real world representation.

Adaptation refers to a response to a stimulus or a series of stimuli that induces functional and/or morphological changes in the organism. Naturally, the level or degree of adaptation is dependent upon the genetical endowment of an individual. However, the general trends or patterns of adaptation are identified by physiological research, and guidelines are clearly delineated of the various adaptation processes, such as adaptation to muscular endurance or maximum strength.

Adolescence is a difficult period to define in terms of the time of its onset and termination. During this period, most bodily systems become adult both structurally and functionally. Structurally, adolescence begins with an acceleration in the rate of growth in stature, which marks the onset of the adolescent growth spurt. The rate of statural growth reaches a peak, begins a slower or decelerative phase, and finally terminates with the attainment of adult stature. Functionally, adolescence is usually viewed in terms of sexual maturation, which begins with changes in the neuroendocrine system prior to overt physical changes and terminates with the attainment of mature reproductive function.

Aerobic Endurance - Ability to exercise for long durations using aerobic energy systems. MAP (see below) is the index of aerobic endurance.

Agility - The ability to move quickly in three dimensions while remaining in control of the movement.

Aiming/Hitting - Hitting a target with an object.

Ancillary Capacities refer to the knowledge and experience base of an athlete and includes warm-up and cool-down procedures, stretching, nutrition, hydration, rest, recovery, restoration, regeneration, metal preparation, and taper and peak.

The more knowledgeable athletes are about these training and performance factors, the more they can enhance their training and performance levels. When athletes reach their genetic potential and physiologically cannot improve anymore, performance can be improved by using the ancillary capacities to full advantage.

Anthropometry: Measurement of body lengths and girths. In early stages height and weight should be measured regularly to help in determining Peak Height Velocity (growth spurt). Later, body fat measurement should be added.

Balance - Ability to remain upright while moving. Includes static balance and balancing while moving or gliding.

CCA 0.4 mi Anaerobic Test: A maximal cycling test performed over a simulated 0.4 mile distance on a Compu-Trainer; these are calibrated in miles only.

Childhood ordinarily spans the end of infancy — the first birthday — to the start of adolescence and is characterized by relatively steady progress in growth and maturation and rapid progress in neuromuscular or motor development. It is often divided into early childhood, which includes pre-school children aged 1 to 5 years, and late childhood, which includes elementary school-age children, aged 6 through to the onset of adolescence.

Chronological age refers to "the number of years and days elapsed since birth." Growth, development, and maturation operate in a time framework; that is, the child's chronological age. Children of the same chronological age can differ by several years in their level of biological maturation. The integrated nature of growth and maturation is achieved by the interaction of genes, hormones, nutrients, and the physical and psychosocial environments in which the individual lives. This complex interaction regulates the child's growth, neuromuscular maturation, sexual maturation, and general physical metamorphosis during the first 2 decades of life.

Coordination - Moving several parts of the body serially or simultaneously to achieve movement.

Critical periods of development refers to a point in the development of a specific behaviour when experience or training has an optimal effect on development. The same experience, introduced at an earlier or later time, has no effect on or retards later skill acquisition.

Community Initiation: A National Coaching Certification Program context describing coaches of entry-level pre-competitive athletes.

Development refers to "the interrelationship between growth and maturation in relation to the passage of time. The concept of development also includes the social, emotional, intellectual, and motor realms of the child."

The terms **"growth"** and **"maturation"** are often used together and sometimes synonymously. However, each refers to specific biological activities. Growth refers to "observable, step-by-step, measurable changes in body size such as height, weight, and percentage of body fat." Maturation refers to "qualitative system changes, both structural and functional in nature, in the organism's progress toward maturity; for example, the change of cartilage to bone in the skeleton."

Fine Motor Skills - Movements controlled by small muscles, eg hand or finger movements.

Goal Setting - The ability to set targets for future behaviours or outcomes.

Gross Motor Skills - Large movements of the limbs and body using multiple joints and muscle groups.

HB: Hemoglobin, in blood.

Hct: Hematocrit (% of red cells in blood).

HLa: Lactic acid concentration.

Introduction to Competition: A National Coaching Certification Program context describing coaches of early-stage competitive athletes.

Iron: Serum iron (or ferritin) level- testing is important to detect anemia, particularly in female athletes.

MAP: Maximal aerobic power.

Memory - Ability to retain and recall instructions, information, and experiences.

Mental Models - Ability to understand and manipulate mental models of real-world processes.

Movement Literacy: The competence of an athlete in a wide range of physical activities; a foundation for all sport development.

Periodization: A training program broken down into phases (periods) to promote progressive development.

Performance TT: Test of actual cycling performance, usually a time trial (TT) over a fixed distance appropriate to discipline.

Peak height velocity (PHV) is the maximum rate of growth in stature during growth spurt. The age of maximum velocity of growth is called the age at PHV.

Peak strength velocity (PSV) is the maximum rate of increase in strength during growth spurt. The age of maximum increase in strength is called the age at PSV.

Peak weight velocity (PWV) is the maximum rate of increase in weight during growth spurt. The age of maximum increase in weight is called the age at PWV.

Physical literacy refers to the mastering of fundamental motor skills and fundamental sport skills.

Post-natal growth is commonly, although sometimes arbitrarily, divided into 3 or 4 age periods, including infancy, childhood, adolescence, and puberty.

Puberty refers to the point at which an individual is sexually mature and able to reproduce.

Readiness refers to the child's level of growth, maturity, and development that enables him/her to perform tasks and meet demands through training and competition. Readiness and critical periods of trainability during growth and development of young athletes are also referred to as the correct time for the programming of certain stimuli to achieve optimum adaptation with regard to motor skills, muscular and/or aerobic power.

RJT: Run, Jump, Throw (movement literacies).

Skeletal age refers to the maturity of the skeleton determined by the degree of ossification of the bone structure. It is a measure of age that takes into consideration how far given bones have progressed toward maturity, not in size, but with respect to shape and position to one another.

Speed 1 - Speed increases due to improvements in neuromuscular coordination.

Speed 2 - Speed increases due to improvements in energy systems, anaerobic alactic and lactic.

Strength 1 - Strength increases due primarily to increases in neuromuscular coordination, not growth.

Strength 2 - Strength increases due primarily to increases in lean muscle mass - hypertrophy.

Talent ID: Talent identification tests used to direct athletes into activities based on their potential. Talent ID must NOT be used to compare athletes (e.g. for selection).

Trainability refers to the genetic endowment of athletes as they respond individually to specific stimuli and adapt to it accordingly. Malina and Bouchard (1991) defined trainability as "the responsiveness of developing individuals at different stages of growth and maturation to the training stimulus."

Appendix 2- Critical Periods of Development

This chart shows how physical and mental qualities have their own window of optimum trainability, on a range from 1 "limited trainability" to 4 "maximum trainability". For definitions of the physical and mental qualities, see the Glossary. These qualities are applicable to all sports and are vital to physical literacy and overall development.

LTAD Stage	Active Start	FUN	Learn to Train	Train to Train	Learn to Compete	Train to Compete	Learn to Win	Train to Win
Approximate Developmental Stage	Early Child	Mid Child	Late Child	Early Puberty	Mid Puberty	Late Puberty	Early Adult	Adult
Goal setting					2	3	4	3
Strength 2					2	3	4	3
Speed 2					2	4	3	2
Abstract thinking					3	4	3	2
Aerobic endurance		2	3	4	4	3	2	1
Mental models		1	3	4	3	2	2	1
Speed 1	1	2	3	4	2	1	1	1
Strength 1	1	2	3	4	3	2	1	1
Fine motor skills	1	2	3	4	2	1	1	1
Aiming & hitting	1	2	3	4	3	2	1	1
Visual acuity	2	3	4	1	1	1	1	1
Memory	2	3	4	3	2	1	1	1
Coordination	2	3	4	3	2	1	1	1
Balance	2	3	4	3	2	1	1	1
Agility	2	3	4	3	2	1	1	1
Gross motor skills	4	4	3	3	2	2	1	1

Development of Skills and Abilities Across LTAD Stages – from Biathlon Canada LTADM, 2006

Appendix 3: Cycling Values Matrix

The development of values and ethics is essential in every sport, and in cycling a number of new programs, such as FQSC's "Roulez Gagnants au Naturel" are being adopted. This table expresses values and ethical coaching appropriate to each of cycling's LTAD stages. It is based on the work of True Sport, Canada's national movement for values-based sport, and on the True Sport principles: Go for it!, Play fair!, Respect others!, Keep it fun!, Stay healthy!, and Give back!

Ethical Literacy and Sport for All	Stage	Go for it!	Play fair!	Respect others!
	Active Start	• Proper emphasis on participation • Maintaining a commitment • Enthusiasm for attempting new physical experiences • Reward and recognize effort-"good try!"	• Everyone gets to participate equally • Cultivate sharing habits (people/attention) • Develop listening skills through activities • Introduction to rules • Introduction to sportsmanship (Shaking hands)	• Encourage co-operation • Putting away equipment
	FUNdamentals	• Proper emphasis on participation • Building definition of winning/losing • Finish what you started • Direct effort toward goals = Fun • Attempting new physical experiences • Increase in problem solving abilities (complex games)	• Everyone gets to participate equally – play and compete • Sharing equipment • Develop listening skills through activities • Defining the rules • Display sportsmanship (Shaking hands, abiding by decisions) • Learning responsibility	• Respect facilities and equipment • Introduction of teamwork and co-operation • Differentiation between fairness and justice • Introduce communication with team-mates, coaches • Legitimize feelings and challenges • Win with dignity and lose with grace
	Learn to Train	• Develop focus & concentration • Building definition of excellence, understand winning = doing one's best • Articulate goals, set objectives • Understand personal excellence • Cultivate athlete responsibilities • Support failure as a step to success	• Everyone gets to participate - earn opportunity to compete • Playing by the rules - encourage moral discussions • Demonstrate sportsmanship (actualized)	• Respect by all towards officials, athletes, coaches, parents • Teamwork building • Understand the consequences of their actions • Encourage expression of opinions (debate moral issues) • Respect facilities and equipment • Win with dignity and lose with grace

	Stage	Go for it!	Play fair!	Respect others!
	Train to Train	• Excellence defined • Documenting goals • Skill Mastery • Acquire mental skills	• Playing by the rules - reflection on actions • Playing by the rules - controlling emotions	• Respect by all towards officials, athletes, coaches, parents • Encourage debate surrounding sport strategy • Win with dignity and lose with grace

Ethical Literacy and Sport for All	Stage	Keep it fun!	Stay healthy!	Give back!
	Active Start	• Unstructured games, play • Enjoyment of physical movement and activity • Introduction of co-operative activities • New friendships - interpersonal development	• Be active daily • Use of proper equipment and teaching methods for children	• Helping the coaches (collect equipment, etc) • Introduction of junior athletes as role models
	FUNdamentals	• Positive attitude • Encourage special interest • Encourage multi-sport involvement • Co-ordination of structured games and activities	• Be active daily • Skill introduction • Introduction to proper eating and rest habits	• Helping the coaches (collect equipment, etc) • Introduction of junior athletes as role models and coaches • Provide opportunities for giving and caring
	Learn to Train	• Ability to define "Fun" and verbalize it • Work ethic, satisfaction of effort	• Recognize moods, begin to deal with emotions • Teach body image messaging • Basics of nutrition and recovery	• Fundraising activities • Volunteer activities • Respect equipment and facilities
	Train to Train	• Encourage social giving • Look at team interaction, connection	• Introduction of fitness training concepts • Learn to use sport as a stress reducer • Educate surrounding body changes and doping education • Discuss necessary components for sport nutrition, recovery • Empower athletes regarding positive imagery, self esteem • Use of appropriate training techniques (specific)	• Volunteer activities • Respect equipment and facilities

Ethical Literacy and Sport for All

Stage	Go for it!	Play fair!	Respect others!
Learn to Compete	• Goal-based training and competition • Refine mental skills • Acquire decision making skills	• Playing by the rules - reflection on actions • Playing by the rules - controlling emotions • Identify sportsmanship in others	• Respect towards officials, athletes, coaches, parents • Encourage debate about sport training methods • Win with dignity and lose with grace
Train to Compete	• Encourage rational and reasoned training • Refine decision-making • Mastery of mental & emotional elements • Use team tactics	• Playing by the rules - rationalize behaviour • Playing by the rules - using emotional energy to channel emotions • Identify sportsmanship in others	• Respect towards officials, athletes, coaches, parents • Willing to be critical of themselves (use energy positively) • Win with dignity and lose with grace
Learn to Win	• Reasoned training based on self-knowledge • Master decision-making • Mastery of mental & emotional elements • Refine team tactics	• Playing by the rules - rationalize behaviour • Playing by the rules - using emotional energy to channel emotions • Modeling sportsmanship	• Respect towards officials, athletes, coaches, parents • Cooperative with media, organizers, sponsors • Willing to be critical of themselves (use energy positively) • Encourage debate about sport system • Win with dignity and lose with grace
Train to Win	• Reasoned training based on self-knowledge • Establish «stretch» goals • Master team tactics • Endeavour to push envelope of ability	• Playing by the rules - rationalize behaviour • Playing by the rules - using emotional energy to channel emotions • Modeling sportmanship	• Respect by all towards officials, athletes, coaches, parents • Cooperative with media, organizers, sponsors • Win with dignity and lose with grace
Active for Life	• A clear definition of the sporting experience	• Teach others the proper messages through sport • Tolerant of multiple abilities • Playing by the rules - applying them consistently (individually) • Playing by the rules - teaching them to others (collectively)	• Respect by all towards officials, athletes, coaches, parents

Ethical Literacy and Sport for All

Stage	Keep it fun!	Stay healthy!	Give back!
Learn to Compete	• Social connections (in and out of sport) - balance • The enjoyment of meeting challenges, achieving goals • Development of tools to overcome challenges • The thrill of competition	• Use sport as a stress reducer • Educate about body changes and doping education • Discuss necessary components for sport nutrition, recovery • Empower athletes regarding positive imagery, self esteem • Master appropriate training	• Encourage taking a stand (critical thinking) • Volunteer activities • Respect equipment and facilities
Train to Compete	• Social connections (in and out of sport) - balance • The enjoyment of meeting challenges, achieving goals • Development of tools to overcome challenges • The thrill of competition	• Use sport as a stress reducer • Educate about body changes and doping education • Master sport nutrition, recovery • Empower athletes regarding positive imagery, self esteem	• Encourage taking a stand (critical thinking) • Volunteer activities • Respect equipment and facilities
Learn to Win	• Social connections (in and out of sport) - balance • The enjoyment of meeting challenges, achieving goals • Development of tools to overcome challenges • The thrill of competition	• Thinking about future sporting life (career planning) • Optimize sport nutrition, recovery • Travel management • Comprehensive understanding of anti-doping: importance, process • Body image messaging, proper use of equipment	• Role-modeling opportunities as athletes • Volunteer activities • Respect equipment and facilities
Train to Win	• Enjoy the experience of participating in the event • Enjoy team support and atmosphere • Enjoy socio-cultural benefits of sport, travel	• Thinking about future sporting life (creating opportunities) • Optimize sport nutrition, recovery • Travel management • Comprehensive understanding of anti-doping: importance, process • Body image messaging	• Role-modeling opportunities as athletes • Volunteer activities • Respect equipment and facilities
Active for Life	• Participation for the enjoyment of it! • Social Connectivity	• Positive work-life-play balance • Participation for health benefits of an active lifestyle • Healthy eating	• Respect equipment and facilities • Knowledge transfer back to communities • Act as mentors, coaches, community sport leaders, role models

LONG-TERM ATHLETE DEVELOPMENT

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