



# **Competition-Coaching Introduction Advanced (T2T)**

## **Step 7:**

# **Exercise Performance and Health**



**Reference Material  
for Dryland Workshop**



# PARTNERS IN COACH EDUCATION

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## 7.1 Common Injuries and Health Considerations

Nordic Skiing is one of the least injury prone sports for acute injuries, but that is not to say that sprains and strains do not occur. Acute injuries tend to be relatively infrequent and unless there is underlying stability issues, rarely become long-term problems. Overuse injuries however are often a concern for skiers and coaches need to be aware of these considerations when working with athletes. The following section is a brief overview of common injury considerations for skiers.



Figure 1: Injuries do happen to skiers (Photo Credit: Jen Jackson)

### a) Sprains and Strains

A sprain is a tear in a ligament, the bands of tissue that connect bone to bone at a joint and prevent excessive movement of the joint. A strain is an injury to either a muscle or a tendon. A tendon is a tough, fibrous cord of tissue that connects muscle to bone. Muscles in any part of the body can be injured. An ankle sprain is the most common athletic injury across all sports, and is not uncommon in dryland training for skiing. Sprains and strains usually respond to rest, ice, compression, and elevation (RICE) treatment, but severe injuries need to be treated by a medical professional. Physiotherapists are particularly skilled in accelerating the healing process of sprains and providing exercises that help stabilize joint weakness.

## **b) Heat-Related Illnesses**

Heat-related illnesses include:

- Dehydration (deficit in body fluids).
- Heat exhaustion (nausea, dizziness, weakness, headache, pale and moist skin, heavy perspiration, normal or low body temperature, weak pulse, dilated pupils, disorientation, and fainting spells).
- Heat stroke (headache, dizziness, confusion, and hot dry skin, possibly leading to vascular collapse, coma, and death).

Heat injuries are always dangerous but can be easily avoided with simple precautions. Coaches should ensure that athletes are wearing adequate sun protection at all practices (hat, sunscreen, t-shirt). Athletes should come to practice with large stores of water that they can bring with them for the workout. In the summer months, coaches should avoid scheduling practices during the hottest parts of the day (10:00am to 5:00pm). On hot days coaches can also schedule practice near lakes or rivers to provide a mid or post workout break from the heat. Extremely long or intense workouts should be avoided on very hot days.

## **c) Repetitive Motion (chronic) Injuries**

Painful injuries such as stress fractures (a hairline fracture of the bone that has been subjected to repeated stress) and tendinitis (inflammation of a tendon) can occur from overuse of muscles and tendons. Commonly in cross-country skiing, tendinitis occurs in the wrist and elbow from the poling motion when rollerskiing (due to the jarring impact with road surfaces). As a consideration, coaches should endeavor to ease athletes into rollerskiing, especially double poling, in the summer so as not to stress these vulnerable joints. In general coaches can reduce repetitive motion injuries by:

### **i) Focus on teaching proper techniques.**

Rather than focusing on speed and winning with young athletes coaches should emphasize proper technique before speed with athletes. Learning correct mechanics of double pole and skating movements is crucial early as poor mechanics are a significant risk factor for injury. Furthermore once athletes develop improper mechanics, they become harder to change as the athletes get older and move up in competition level. Slow the athletes down and get them completing the skill or technique properly before executing that skill at race pace.

### **ii) Do not practice through pain.**

Many sports injuries are caused by overuse, but they can often be prevented by recognizing their signs. When pain develops with no history of trauma, it is likely that too much stress is causing the pain. Rather than trying to push through that pain, athletes should take a couple of days off. Often the pain disappears with a short

period of rest. If athletes keep training despite pain, they risk making the injury worse and needing much more time off to heal. Coaches must teach athletes the difference between good pain (fatigue due to exercise) and bad pain (sharp localized pain from overuse) and ensure that they stop exercising in the presence of bad pain. Let the athlete know why training through this type of pain is detrimental to their long-term training consistency.

### **iii) Vary training modes.**

The simplest way to avoid over use injuries is vary training modes. Adding a variety of endurance-based sports such as swimming kayaking, cycling and mountain biking to the staples of running, skiwalking and rollerskiing can offer athletes the necessary physiological break to prevent overuse injuries from ever forming. These complimentary sports can distribute stress to different body parts of athletes and also provide a fun variety of training options.

### **iv) Other Considerations:**

Make sure athletes have, and consistently use, proper gear for a particular sport. This may reduce the chances of being injured. Make warm-ups and cool-downs part of your team's routine before and after practice. Warm-up exercises make the body's tissues warmer and more flexible. Cool-down exercises loosen muscles that have tightened during exercise.

### **d) Exercise induced Asthma**

Like it sounds, exercise-induced asthma is asthma (narrowing of the airway) that is triggered by vigorous or prolonged exercise or physical exertion. This causes symptoms like wheezing (a whistling sound when you breathe), coughing, shortness of breath, chest tightness, and trouble breathing. Nordic skiers are at a high risk of developing exercised induced asthma due to the cold dry air that permeates winter training and intense burst of exercise performed in skiing. Fortunately exercise-induced asthma can be controlled allowing athletes to complete training and racing normally.

Asthma inhalers or bronchodilators used prior to exercise can control and prevent exercise-induced asthma symptoms. Taken 10 minutes before exercise, these medications can prevent the airways from contracting and help control exercise-induced asthma. Inhalers must be prescribed by a doctor and athletes who display symptoms of asthma should see their doctor for treatment. In addition to taking medications, an extended warming up prior to exercising and cooling down after exercise is extremely effective in exercise asthma prevention. Coaches with athletes suffering from exercise induced asthma should develop a robust warm-up strategy for the athlete, insuring gradually increasing intensity. On cold days athletes should cover their mouth and nose with a buff or scarf to warm the air before it enters the airway. For those with allergies and asthma, exercise should be limited during high pollen days or when temperatures are extremely low and air pollution levels are high.

e) **Compartment Syndrome**

The occurrence of Chronic Exertional Compartment Syndrome (CECS) is very prevalent in Cross Country Ski athletes. Compartment syndrome is caused by an abnormal and excessive increase in muscle compartment pressure during exercise. Compartment syndrome results in muscle pain that ranges from mild to severe, and, occasionally, neurologic symptoms such as numbness, tingling, and weakness. The most common compartment to be involved is the anterior lower leg compartment, which is located in the front of the leg next to the shin bone (tibia).

Cross-country skiers with CECS of the anterior compartment often experience a “dead leg” sensation in the front of the lower leg that occurs more commonly in skating technique. While exceptions exist, those afflicted with symptoms often fall into a category defined by athletes with muscular builds, with specific reference to the calf muscles. It is often the case that these athletes have very tight calf muscles, and physical imbalances including but not limited to weak hips, inward canting knees, and foot problems such as plantar fasciitis, weak arches, pronation, or supination. These imbalances can be detected with a functional screening by a physical therapist, or by the well-training eye of a coach.



Figure 2: Aftermath of Compartment Syndrome Surgery (Photo Credit: Alex Jospe)

i) **Chronic Exertional Compartment Syndrome Symptoms:**

- Strong desire to remove boots or loosen buckles/laces during exercise.
- Diffuse tenderness and possibly a tense swollen appearance of the symptomatic muscles immediately following exercise that resolves with rest.
- Inability to flex ankle / drive knees while skiing with intensity.
- Inability to turn sharply.
- Dead-leg sensation.

- Inability to glide sufficiently on a skate ski.
- Mild to excruciating pain in the muscles next to the shin (more common) and/or calf pain (less common).

## **ii) Prevention:**

- Regular stretching of both the gastrocnemius and soleus calf muscles.
- Ice baths following intensity sessions, strength, or long runs or roller skis.
- Self or professional massage of both calf and shin muscles. A foam roller can be used for the calf muscles, and stick massage rollers are effective for treatment of sore shins. These are also effective warming-up methods.
- Thorough warm-up for all dry land and on snow workouts, including active exercise, and stretching / self-massage.
- With regards to technique, static positions are very hard on the muscles, and may lend to muscle swelling and decreased blood flow. To prevent this, practice active, fluid movements. In skating, be sure to completely finish the final portion of the kick in order to release the affected muscles. Finishing the kick should provide the musculature with a short recovery phase. Consider a wider foot stance that initiates an immediate and active kick and weight transfer as well.

## **iii) Diagnosis**

CECS is diagnosed by performing compartment pressure testing before and after exercise. Compartment pressure testing involves placing a needle attached to a pressure transducer into the aggravated compartment. It is important to remember that many different diagnoses can mimic CECS. Therefore, a thorough evaluation to determine what is causing the leg pain is required.

## **iv) Treatment:**

Patients with CECS are often sent immediately to surgery without exploring the underlying cause of the condition. While the operation can be successful, if biomechanical and/or training risk factors that contributed to the development of the condition are not identified and addressed, the CECS will often return. Therefore, even if an athlete opts for surgical treatment, it is important to identify and correct risk factors to prevent recurrence. It is recommended that all non-surgical options be exhausted with the professional help of a physical therapist before considering surgery.





Figure 3: Training in the mud and injuries are not uncommon for skiers (Photo Credit: Fasterskier)

## 7.2 **Disease and Sanitation**

Many athletes have a risk of acquiring and spreading diseases while taking part in intense athletic activity. For athletes trying to achieve peak performance at races and train consistently, limiting sickness is an important consideration for athletic success. Athletes interact closely with teammates, opponents, and team staff. In addition they frequently share training and gym equipment, facilities, training rooms/grounds, accommodation, housing, towels, water bottles and supplies and commonly undertake both domestic and international travel. All of these factors can lead to the spread of disease. In general the categories of potential risk factors for spreading infection are:

- ✓ Sharing of equipment, training facilities.
- ✓ Skin injury.
- ✓ Close contact – at practice, accommodation.
- ✓ Away from the practice site– travel, personal activities.

Infections can be transmitted by person-to-person contact, by common source exposure or by vector-borne transmission. To prevent infections athletes can take simple precautions in the form of solid personal hygiene measures. The first step to good personal hygiene is regular hand washing, which is key in preventing spread of infection. Hand washing with soap for 15-30 seconds, 30 seconds rinse with water followed by complete drying with a towel is necessary. The use of rinses and gels with concentrations of 50-95% alcohol takes 15 seconds to use and is also effective at killing infectious organisms. Beyond hand washing other personal important hygiene measures for athletes include:

- ✓ Immediately showering after each practice or competition.
- ✓ Washing all athletic clothing worn during practice or competition daily.

- ✓ Cleaning and disinfecting equipment and/or travel bags if the athlete is carrying dirty workout gear home to be washed and then bringing clean gear back to practice in the same bag (note: this problem can also be prevented by using disposable bags for practice laundry).
- ✓ Washing athletic gear (such as boots and gloves) periodically and hang to dry.
- ✓ Refraining from sharing towels or personal hygiene products with others.
- ✓ All skin lesions and abrasions should be covered before practice or competition to prevent risk of infection to the wound and transmission of illness to other participants.
- ✓ All new skin lesions occurring during practice or competition should be properly diagnosed and treated immediately.
- ✓ Athletic lockers should be sanitized between seasons.
- ✓ Weight room equipment – including benches, medballs, hurdles, bars and handles – should be cleaned and sanitized daily.

**a) Biohazard precautions:**

Cuts and scrapes, or taking blood for lactate testing exposes coaches and athletes to biohazards and potential infections. All blood, body fluids and secretions except sweat, non-intact skin, and mucous membranes may contain transmissible infectious agents. To prevent the spread of infection from these sources simple infection prevention practices should be observed by coaches and athletes regardless if there is a suspected or confirmed infection status. When dealing with biohazards coaches and athletes should:

- ✓ Wear gloves when touching biohazardous material such as open skin, body fluids or mucus membranes.
- ✓ Wash hands with soap and hot water after contact with above, even if gloves are used.
- ✓ Clean surfaces thoroughly with diluted bleach (10% solution).
- ✓ Place sharps in a biohazard puncture proof container (lactate testing).
- ✓ Cover any wound before returning to practice.

**b) Immunization**

Immunization is an important aspect of prevention of infection for all skiers, especially considering that racing season coincides with peak cold and flu season. Athletes should get the flu shot annually and ensure that all childhood vaccinations are up to date.

**c) Return to practice guidelines for illness:**

All athletes will at one time or another get sick or injured, and many times questions arise as to the appropriate time for them to return to practice and training. This can be a tough question for coaches and it is recommend that you follow the recommendations of a medical professional. However if you do find yourself in a position to determine the whether an athlete should train or not, the following are some simple guidelines.

### **i) Common Cold/Upper Respiratory Tract Infection:**

- Colds are the most common type of infection and account for 50% of all acute illness in the general population. A cold is an infection of the nose and upper airways caused by a virus. They are extremely common. An adult can expect 2-4 colds a year. Many different viruses can cause a cold. This is why colds reoccur, and immunization against colds is not possible.
- Return to Practice: The Neck Check: If symptoms only display in the neck or above athletes can attempt easy exercise for 10min or and evaluate symptoms. If symptoms get worse the athletes should stop exercising, if symptoms remain the same the athlete can continue to exercise at a reduced level. If symptoms display below the neck (e.g. deep cough) the athlete should rest until those symptoms are resolved.

### **ii) Fever:**

A fever is a sign that the body is fighting an infection. One of the best ways to help the immune system fight a cold or flu is by resting and giving oneself time and energy to recover. The higher the fever the more prone athletes are to dehydration and exercise might make this worse. If athletes are running a fever they should not train, and should focus their energy on rest and rehydration with plenty of water and fluids. By staying away from practice athletes also help prevent the spread of a cold or flu to their teammates.

### **iii) Gastroenteritis:**

- Gastroenteritis is an infection of the gut (intestines). The severity can range from an upset stomach for a day or two with some mild diarrhea, to severe diarrhea and vomiting for several days or longer. Many viruses, bacteria and other microbes can cause gastroenteritis.
- Return to Practice: After a bout of gastroenteritis or a fever athletes should only return to practice if they no long display any symptoms or signs of infection. This includes a cessation of diarrhea and vomiting and a return to normal eating habits. Athletes should also give themselves time to rehydrate before they start training again as dehydration is a common symptom of gastroenteritis and fever.

In general the first workout after any kind of illness should be very light, with no intensity or extreme volume. Athletes should progress slowly as they return toward a normal routine, gradually returning to practice with 1 day of reduced exercise per day of sickness/rest. It can take up to seven to 10 days after significant illness for athletes to resume normal train loads and another week or more before performance returns to pre-illness levels. Ensure that your athletes understand this and take a patient and measured approach when returning from illness. Failure to do so can lead to diminished performance levels for significant periods of time and an increased likelihood of contracting another illness in the near future.

## 7.3 Medical monitoring

### a) internal parameters:

Two to three times per year athletes should be assessed by specialists examining blood and hormone variables. These factors can have a significant effect on training if left unchecked. Athletes and coaches must also be aware of nutrient and hormone levels in the body as variation in these parameters can have dramatic effect on training and eventually overall health. Athletes training year round for performance in skiing should contact their doctor and get their Ferritin, B12 and complete blood count levels tested at least twice a year.

#### i) Ferritin (Iron)

Ferritin an intercellular protein which stores and releases iron, the amount of ferritin stored reflects the amount of iron stored in body. Iron is required in hemoglobin, the primary component of red blood cells, to bind to oxygen for transport to working muscles. Low ferritin levels indicate that there is not enough iron available to make red blood cells, hindering the transport of oxygen through the body. Athletes with low red blood cell counts are not able to train effectively. An emphasis is often placed on female athletes and their susceptibility to low iron [anemia] but the truth is ALL endurance athletes are susceptible to low iron levels.

#### Deficiency Symptoms:

- ✓ Diminished aerobic capacity, including decreased VO<sub>2</sub>max
- ✓ General fatigue and weakness
- ✓ Concentration trouble
- ✓ Hair loss
- ✓ Brittle and/or spoon-shaped (inverted) nails

#### Factors That Can Deplete Iron Levels:

- ✓ Heavy training (esp. endurance exercise!)
- ✓ Menstruation
- ✓ Vegetarianism, veganism
- ✓ High carb/low protein/ processed diets
- ✓ Use of Advil, Aspirin and some antibiotics
- ✓ Low stomach acid/use of antacids
- ✓ Excessive bran, coffee, tea

The Canada Sport Institute Ontario has found that the ideal ferritin level for cross country skiers is >80 ug/L. What may be considered “normal” for the average person is unacceptable for endurance athletes. Skiers require much higher values to meet the demands of our sport.

## ii) Vitamin B12

The body uses vitamin B12 to make DNA and support the nervous system and is needed for carbohydrate metabolism (those with low levels have lactate build up in the blood).

### Factors That Can Deplete B12:

- ✓ Frequent antibiotic use
- ✓ Vegetarianism, veganism
- ✓ Malabsorption (celiac, colitis...)
- ✓ Hypochlorhydria (low stomach acid)

### Deficiency Symptoms:

- ✓ General fatigue and weakness
- ✓ Depression and memory loss
- ✓ Peripheral neuropathy (tingling/numbness) |
- ✓ Impaired immune function

The Canadian Sport Institute - Ontario has found that the ideal B12 level for cross country skiers is >500 pmol/L.

## iii) Complete Blood Count (Complete Blood Count)

This test measures immune system activity, circulation (hemoglobin), inflammation and blood clotting. Though these levels are not necessarily something that need to be changed, it is important for athletes to have values on the record and make sure they are in the prescribed range and useful for trouble shooting potential future health issues.

## b) Return to Play for low Ferritin & B12

Addressing Iron and B12 deficiencies will depend on how low these levels have become. Ferritin levels below 15ug/L and B12 levels below 150pmol/L will require supplements to reverse the deficiency. Athletes should contact their doctor for specific supplementation protocols. Training with deficiencies in these areas needs to proceed at a reduced level until all symptoms of fatigue have been resolved. Athlete should avoid intensity training and keep volume training to short duration with ample recovery. Once Iron and B12 levels have returned to normal level, training can resume with a gradual progression to normal volumes and intensity. It is important to consult with medical professional to ensure that athletes are cleared to resume normal training protocols.

## c) Functional Movement Screen

The Functional Movement Screen (FMS) is an excellent evaluation tools that should be employed by coaches to assess the movement capabilities of their athletes. The FMS is a series of simple movement tests with a grading system that allow sport professionals to detect movement pattern limitations or asymmetries in healthy

athletes. The test is comprised of seven movements that require proficiency in balance, mobility and stability.

The FMS puts athletes in extreme positions where weaknesses and imbalances become noticeable if appropriate stability and mobility is not used. Individuals who are highly successful in cross country skiing still can show significant limitations in this screen, which indicates that they are compensating during competition using improper movement patterns. These weaknesses, if not addressed, will lead to chronic injuries down the road as skiers progress to higher volume training. Many physiotherapists, athletic therapists and strength and conditioning coaches have been trained to perform functional movement screens and can recommend exercises to address observed weaknesses and imbalances.

**The FMS consists of:**

- ✓ Deep Squat with a dowel held overhead
- ✓ Hurdle Step
- ✓ Active Straight Leg Raise
- ✓ In-Line Lunge
- ✓ Active Straight-Leg Raise
- ✓ Trunk Stability Push-Up
- ✓ Shoulder Mobility
- ✓ Rotary Stability



Figure 4: Athlete Performing a Functional Movement Screen (Photo Credit Swift Current Sports X-Press)

**d) General medical exam**

Also known as physicals or a check up, a general medical exam is a useful precautionary procedure for young athletes. These exams are performed by a family

physician and review many aspects of health. There are no set procedure for general medical exams, doctors may be thorough or brief depending on the athletes circumstances and time available. In general an complete medical exam will include a blood pressure evaluation, heart health check, respiration and lung function exam, head and neck check (sinuses, eyes, tonsils), an abdominal exam (liver, bowels), neurological exam (reflexes, balance, mental state) and dermatological exam. Gender specific tests may also occur at this point depending on the age of the athlete.

A general medical exam establishes a baseline for future changes in health and also allows doctors to catch any nascent health problems that have not manifested themselves to the athlete. These exams are also an opportunity to have blood work done, either by the family physician or by having them recommend a lab to carry out the procedure. Good rapport with a family physician is critical for developing athletes as they will be able to be treated and examined quickly and effectively should injuries or health problems arise in the future.

#### **7.4 Travel and health considerations**

When traveling to competition with a team the chances of sickness and spread of disease between teammates increases significantly. This is a direct result of increased stress, both from travel and racing and from living and interacting with a large group of athletes and support staff dealing with similar stress considerations. Coaches can mitigate these concerns with proper planning and education of the athletes. The following is a list of suggestions to help keep your team healthy when travelling on race trips.

- a) **Hygiene protocols.** Refer to the disease and sanitation section of this document for a detailed list. Athletes should be educated on these procedures and put them into practice before and during a trip.
- b) **Travel:** When planning travel to the race site ensure that adequate space is provided for athletes and equipment. Athletes should not be jammed into vehicles with little space. Frequent stops should be made during the trip to allow athletes to stretch their legs and get out of the car. Whenever possible departure times should allow for athletes to get a good night sleep before the trip.
- c) **Accommodation:** Although accommodation is a major cost consideration, athletes should be given there own bed whenever possible. Extreme close quarters can be very stressful and increases the chances of a poor night's sleep or disease spread between athletes. Furthermore accommodations should afford athletes space and privacy so that athletes can have time to recover or rest away from other teammates. Coaches should also encourage athletes to set aside part of the day as down time, where music and noise are keep to a minimum to allow for naps and rest. Standards of cleanliness should be observed by all athletes at the accommodations, this includes keeping athlete equipment and dirty clothes stored in appropriate places. It is recommended that a cleaning schedule be kept to ensure

that common areas (in condos or chalets) remain clean for the duration of the trip. If athletes become sick during a competition they should be placed into separate accommodations away from other athletes as disease can quickly spread to others compromising their racing performance.

- d) Food:** Ensure that athletes are eating well throughout the competition and have snacks that they are familiar with at all times. Often consistent nutrition can be overlooked during with travel to and from race venues. Athletes need to be able to address their nutritional needs properly to ensure optimal performance and recovery. Coaches can aid athletes in their nutritional preparation by having them prepare a meal schedule before the trip or recruit parent volunteers to cook meals and buy team food.



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