CCBC Injury Survey & Performance Improvements

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Introduction

Over the past two years myself and CCBC coaches have undertaken a pilot injury survey with athletes on the various BC teams (BCTS, BCDS and BCST). These surveys provided feedback on the kind of injuries BC nordic athletes were experiencing. The survey has been streamlined and this year was completed online using a Google Form. Next year the plan would be to have the survey done online using the Airtable format that the other CCBC tests use. The Spring 2019 Injury survey summary is on page 4. I have attached all the results (page 19) unfortunately the format Google uses when copied to a file does not allow all the columns to be labeled.

This year a new Physiotherapy screen was also completed at the May camp with each BCST and BCDS athlete. (except the Telemark athletes due to time constraints). The screening tests format are attached as well as recommendations and comments from the tests.

Each athlete was provided with specific therapeutic exercises and advice based on the screening findings. If appropriate recommendations for followup with a local physiotherapist and personal coach were made.

I was also part of the strength testing and have some suggestions and comments on page 7.

Each athlete will be able to access their Physiotherapy Screening results on their Air Table.

Please feel free to contact me with any comments or questions.

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BCST/BCDS CCBC Injury Questionnaire May 2019 Summary

Online google form done prior to May testing camp link below:
https://docs.google.com/forms/d/e/1FAIpQLSdhw782Kz3tJmCjxj71OhyTU_GI-TJRpsvgFhrxjtbr7BkhzA/viewform?usp=sf_link

Acute injury Questions:

Primarily ankle, shin and wrist (fractures). Similar to last years survey. Some training time lost to injury; 10 athletes lost up to 1 week. 2 athletes lost 1-2 weeks and two athletes lost 3 weeks to 3 months.

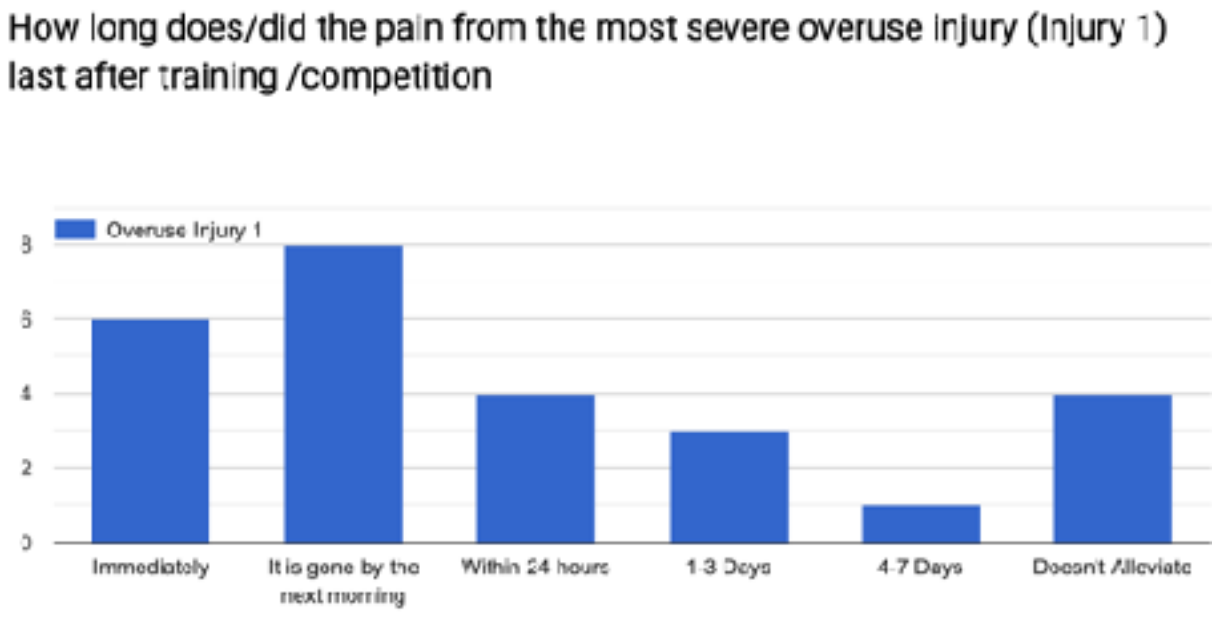
Overuse Injuries:

Foot & heel primary injury followed by achilles and knee.
Less complaints of low back pain than previous questionnaires, until more specifically asked about low back pain with ski techniques

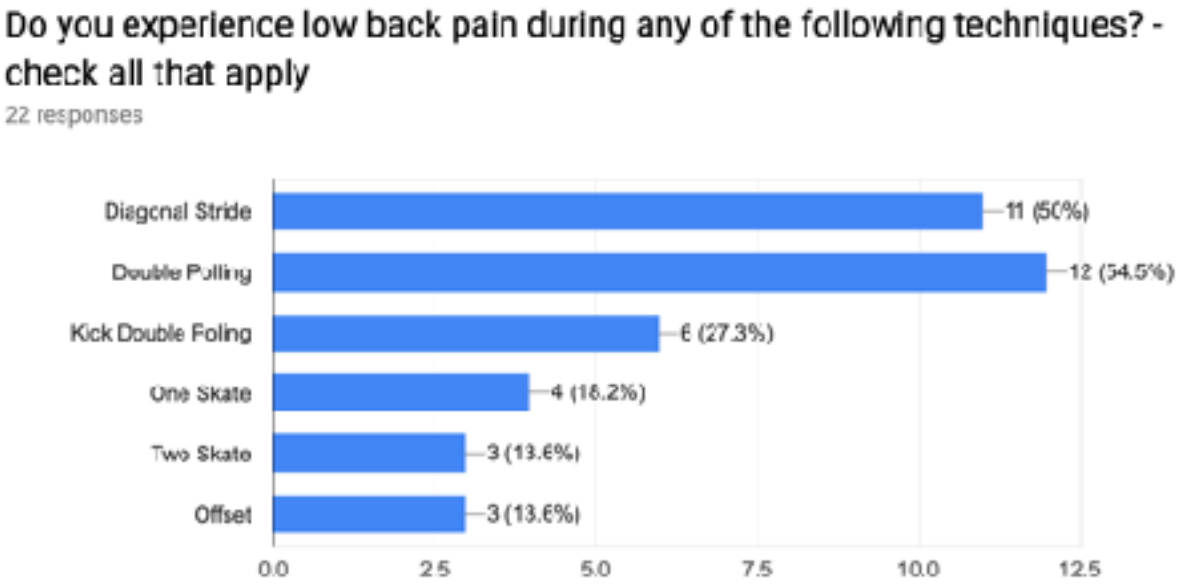
Majority of overuse injuries were during the General Prep phase (17 injuries) , followed by the rest phase. This could be an Increase in loading with starting to increase training hours. Recommend athletes monitor their 24 hour response to training load.

Running once again was identified as the activity in which the overuse injury occurred (Overuse injury 1 n=20, Overuse injury 2 n=5)

The good news is that most athletes could manage their symptoms without time lost from training.



KEY POINT: Education to athletes on managing training load. It is ok for athletes to have an increase in soreness with a workout / training session as long as it is gone within 24 hours.
An increase in pain longer than 24 hours would be a warning sign if it is consistent.



Very similar findings to last year. Coaches and athletes should continue to refine technique and build core strength. The low back complaints are similar to what is reported in the ski injury literature.

Next steps

1) Refine the questionnaire further

2) Gain input from other physiotherapists working with Nordic athletes on the questionnaire

Spring 2019 BCDS / BCST Physiotherapy Screen General Comments & Recommendations

Attached is a copy of the screening exam. The screen results were entered into Airtable directly. Each athlete was provided a few individualized key exercises and/ or advice.

KEY GENERAL FINDINGS:

1) Many athletes had a positive Active Straight Leg Raise test (the athletes lays on their back with legs extended. The athlete then is asked to keep their leg straight and lift one at a time about 12" off the bed. The athlete is asked if the legs lift with the same effort or if one is heavier. If one leg is heavier, pressure can be applied to the pelvis and ribcage to help determine which core activation cue will work best. In other words this test determines under 'low load' that an athlete is not optimally activating their core muscles. Athletes would then be instructed in correct Transverse abdominus cues with progressions and instruction on how to first 'set the core' before doing other core work.

2) Hip Weakness - Typically one sided. The most common exercise prescribed is the clamshell. With the athlete on their side with the athlete rolled slightly forward both knees and hips are bent and the top knee is lifted off the other knee focusing on using the side gluteal muscles. Athlete were asked to put their fingers on the side gluteal muscles for feedback. Exercise progression can found in the strengthening training section on the next page.

3) Single leg squatting - many athletes had a hard time controlling their trunk and pelvis. Athletes were asked to do corrections using a mirror and practice single leg squat control and progressing to higher level balance exercises (using theraband or balance boards, BOSU, etc.). This is a great summer thing to work on especially with rollerskiing.

STRENGTH TRAINING Comments and Recommendations:

During the physiotherapy screening athletes were tested with an unloaded squat and hip hinge (deadlift position). Athletes also did strength testing (vertical hop, broad jump, penta-hop on one leg, bench press, bench pulls and pull-ups. Suggestions from both tests are as follows.

1) Athletes were able to correctly identify loss of low back lordosis (also termed 'butt wink') during an unloaded squat and unloaded dead lift. I have found the setup cues for squatting technique in Kelly Starrett's book 'Becoming a supple leopard' to be very helpful.

2) **Deadlifts are NOT a recommended exercise for nordic athletes.** Nordic athletes do not have the flexibility to perform dead lifts unless they are highly modified to protect the low back. Proper technique and execution would take considerable time and training. Furthermore nordic athletes do not need gluteal strength in the range that deadlifts work. 'Hip Thrusts' are a much back friendlier gluteal strengthening exercise that strengthen the posterior gluts in a range that is more ski specific. Attached is a link https://youtu.be/LM8XHLYJoYs. More posterior gluteal exercise can be found here: https://www.youtube.com/watch?v=7XrI-jzLh0s&feature=youtu.be

3) Pull-Ups - for athletes that could not complete a pull-up here are some progressions: https://youtu.be/EihD_pt2AFA https://youtu.be/MBjltlc3x8c and https://youtu.be/nRg82bKc_L0

4) For Athletes that can do pull-ups adding weight is a great strength exercise. I believe there were a few young men able to do a pull up with 40kg! The testing involves a leather belt and chain with a carabiner to secure the weights. At home a backpack loaded with water jugs (4L = around 10lbs) or other weight is a nice alternative. Nordiq Canada has a new Run Jump Pull Challenge with the attached benchmarks for pull-ups

Targeted standards for pull-ups											
Age	11	12	13	14	15	16	17	19	19	20-22	23+
Female	4	5	6	7	8	10	13	16	17	18	20
Male	4	6	8	10	13	16	19	22	25	27	30

5) As mentioned previously many athletes had a weakness in the side gluteal muscles termed the Glut Med or lateral hip muscles. Here are some Glut Med (Lateral muscles) Hip Strength progressions:

    1) Cue Hip Abduction with a clamshell https://youtu.be/7iXpLxKs1sY

    2) Clamshells with theraband https://youtu.be/eCjuSarX0vA

3) Side steps with band https://youtu.be/X0jsl2ZrXug

4) Single squats with theraband pull medial (valgus) https://youtu.be/3XKckXPtNn8

Acute injury prevention

Incorporate balance and Kinaesthetic drills into dry land training. Warm up programs like the PEP and FIFA 11+ have been shown to reduce acute injuries in team based field and gym based sports. These programs also include instruction on controlling the knee motion (i.e. keeping it from turning inwards) while jumping, cutting and pivoting.
Balance exercises with and without equipment have been shown to reduce acute knee injuries by 54% and ankle injuries by 50% (Hübscher et al Neuromuscular training for sports injury prevention: a systematic review. (Med Sci Sports Exerc. 2010 Mar; 42(3):4)

One drawback to these programs is that the entire warm-up program takes 15-20 minutes to complete. My recommendation would be to include some progressive dynamic warm-up activities, which should include side-to-side and backwards running drills as well as some dynamic balancing. Static stretching while included in the PEP program should not be emphasized, and would be of little benefit.

Lower extremity Injury prevention research:

Exercises to prevent lower limb injuries in youth sports: cluster randomised controlled trial
BMJ 2005; 330 doi: https://doi.org/10.1136/bmj.38330.632801.8F (Published 24 February 2005) Cite this as: BMJ 2005;330:449

PEP PROGRAM – designed for soccer injury prevention includes a variety of dynamic warm up, stretching, strengthening and plyometric activities
Links:

http://la84.org/a-practical-guide-to-the-pep-program/

https://www.youtube.com/watch?v=7Lag8uNU6AQ

FIFA 11+ Program (Soccer based, researched to reduce acute injuries)

http://www.sportsphysiotherapy.org.nz/documents/Injury%20prevention/fifa%2011.pdf https://www.youtube.com/watch?v=bCtGhVaQRFk

Running

Running technique improvement suggestions (Working with a running coach?)

- https://youtu.be/PJvNOlFeuQA
- *https://youtu.be/GSGzqkjrWRA*
- *https://www.youtube.com/watch?v=-AASu9CNFoM (I especially like the running mistakes part of the video)*

Key Points:

Increase running cadence (180-220 steps per minute). A nice overview can be found on this website: *http://rosecitypt.com/run-cadence-is-180-a-magic-number/*

Technique: Forward Lean from the ankles

Chest Tall, arm pump

Foot strike not too far ahead of the body (control length of stride). Heel strike vs forefoot strike is debatable, I would suggest the athletes should do what is natural but focus on soft landing with high cadence.

Knee drive up and forwards

Coach downhill running to minimize loading.

- *Salomon TV: How to downhill Run (https://www.youtube.com/watch?v=YLScRlispoo)*
- *Kiliian Jornet (one of the best trail runners in the world running downhill at the 2018 Mont Blanc marathon) https://youtu.be/UBxvn9yEdIY*

General:

- Run 'softly', minimize foot impact sounds. One drill would involve running in socks without shoes on a rubber track to help 'feel' how to minimize impact.
- Minimize vertical oscillation, i.e excessive up and down motion
- Minimize 'braking' i.e. sheering forces. The best runners spend very little time with their feet on the ground.
- Run on softer trail surfaces instead of pavement.

Control the loading - gradually increase in running volume and frequency after ski season, like any training a gradual overload to allow tissue adaptation is key.

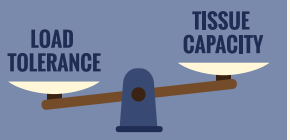
Recommendations for

RUNNING INJURIES

Based on Physio Edge podcast 059 with Tom Goom (@tomgoom), Greg Lehman (@greglehman) & Dr Christian Barton (@DrChrisBarton - La Trobe Sport & Exercise Medicine Research Centre, Bundoora Australia)

Load tolerance

1 Runners become injured because they exceed their tissue capacity to tolerate load

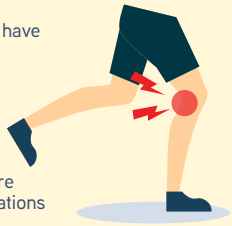


2 A runner needs to be strong enough to manage the load experienced when running. Ground reaction force when running is 2.5-3x body weight and peak muscle load of soleus is 6-7 x body weight.

3 Strength and conditioning in runners may improve load tolerance, improve performance and reduce injury risk.

Load management

4 Running should be stopped when it will have a negative long term impact on recovery. The length of time out of running should be kept as short as possible. If bone stress or more complicated presentations eg. female triad are suspected, longer time away from running may be required



5 Use the 24 hour pattern to monitor the runners reaction to load. If the pain is does not settle within 24 hours then the running volume should be reduced

Biomechanics

6 Changing foot strike pattern may be appropriate in anterior compartment syndrome, chronic degenerative knees and achilles tendinopathy. Avoid extremes of both rearfoot and forefoot strike

7 Running retraining should start simple and expand over a period of time. Make small gradual adjustments, avoiding sudden large changes.

8 Changes to running technique do not need to be permanent. A temporary change in style may let symptoms settle and allow continued running

9 Running shoes are less important than load management & biomechanics

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clinicaledge.co @davidkpope

Minimizing Low Back Complaints

Another theme that is reported is lower back pain, particularly while double poling (and kick double poling) as well as diagonal striding. Some strategies to lower the incidence of lower back pain in Nordic athletes include:

- Choose core strength exercises that are back friendly (See Team Telemark Core Strength Program version 2.1 updated for 2018 file)

- Ski Technique improvement and monitoring especially with double pole and diagonal stride

- General strength technique needs constant monitoring. Athletes need constant queuing and review to perform exercises correctly! Key exercises that require good technique are squats and dead lifting.

Team Telemark Core Strength Training V2.1

Courtesy Ross McKinnon, PT, FCAMPT, CGIMS, CMT, FMSC
Kelowna Manual Therapy Centre
Team Telemark Physiotherapist

Key Points - Highly recommended to work with a Physiotherapist or other health professional to teach the correct techniques!!!
Cues:
-Contract stomach muscles pulling the belly button towards the spine to engage core muscles throughout the exercises. The stomach muscles, especially the Rectus Abdominus should not bulge out.
-Keep breathing with each repetition and exercise, emphasize rib cage breathing.
-Controlled and smooth movement of the limbs
-If your back is arching the exercise is too difficult, there should be no low back pain with any exercise.
-Quality exercise technique is key

Lateral Abdominals	1 minute
Neutral Spine Crunches	1 minute
Oblique Crunches	1 minute
Heel Touches	1 minute
Side Plank Left	1 minute
Side Plank Right	1 minute
Quadruped Pointer	1 minute
Front Plank with Leg Lifts	1 minute
Sidelying Leg Lifts Left	1 minute
Sidelying Leg Lifts Right	1 minute
TOTAL TIME	10 minutes

EXERCISE 1 LATERAL ABDOMINALS

Athletes and coaches can find which level of the exercise is most appropriate for their level of core strength, using the above mentioned cues.
-1 minute.
Level 1 Start with both feet on the ground with knees bent to 90° lift one leg at a time, alternate leg lifting and lowering. 1 minute

Level 2 Start with both hips and knees bent at 90°. Lower one knee at a time, so the foot touches the ground, return to the leg to the starting position. Repeat with opposite leg. 1 minute

Level 3 Start position as above, touch one foot down then slide the heel on the ground to extend the leg, then return the leg to the start position. Repeat with the opposite leg. 1 minute

Level 4 Start position as above, with heel touch. 1 minute

Level 5 Dead-bug. Start with arms as well as hips and knees flexed to 90°. Lower opposite arm and leg to the floor. Repeat with opposite arm and leg. 1 minute

EXERCISE 2 NEUTRAL SPINE CRUNCHES

-Hands under lower back to maintain 'neutral spine'
-Focus on ribs coming towards the pelvis / hips
-No rectus abdominus bulge
-Only raise high enough that shoulder blade comes off floor. Raise for 3 seconds, hold for 3 seconds lower for 3 seconds. 1 minute.

EXERCISE 3 OBLIQUE CRUNCHES

-Focus on ribs coming towards opposite pelvis / hip
-No rectus abdominus bulge
-Only raise high enough that shoulder blade comes off floor
-Raise for 3 seconds, hold for 3 seconds, lower for 3 seconds. 1 minute.

EXERCISE 4 HEEL TOUCHES

-Crunch motion so that shoulder blades come up off the floor, hold this position while side bending the trunk (through the thoracic spine) reaching towards the ankles with the hands, alternating sides. 1 minute.

EXERCISE 5 SIDE PLANK

Athletes and coaches can find which level of the exercise is most appropriate for their level of core strength, using the above mentioned cues.
-Grade exercise by both knees bent or knees straight
-Watch that whole body stays in line the shoulder shouldn't pop forward
-1 minute.

Level 1 Support the body at the knees rather than the feet.
Raise for 2 counts, hold for 6 counts, lower for 2 counts and repeat.

Level 2 Support the body at the feet, trunk raise.
Raise for 2 counts, hold for 6 counts, lower for 2 counts and repeat. Work up to 1 minute hold.

Level 3 Supported at the feet, trunk raised arm overhead, The foot of uppermost leg slowly touches in front of and behind lower leg. 1 minute

Level 4 Supported at the feet, trunk raise plus slowly raise and lower the uppermost leg to the ceiling. 1 minute.

EXERCISE 6 QUADRUPED POINTER

-Belly button into the spine - this is critical that the athlete feels tension through the abdominals throughout
-No low back twisting or arching
-Alternating opposite leg and arm raises, bring opposite knee and elbow to touch.
-Alternate arms and legs hold for 6 counts. 1 minute

EXERCISE 7 FRONT PLANK WITH LEG LIFTS

-Front support on elbows
-Keep back from arching by lifting belly button towards your spine.
-Alternating lifting each foot of the ground using the glut muscles, lift only 2” off the ground. lift leg for 3 counts, hold for 3 counts, lower for 3 counts.
-1 minute

EXERCISE 8 SIDE LYING LEG LIFTS

-Position yourself side lying with your spine and pelvis in neutral alignment.
-The lower leg is slightly flexed for support.
-The uppermost leg is extended and slightly outwardly rotated (toes to the ceiling).
-Lift the top leg to the ceiling keeping it straight.
-Avoid allowing the hip to flex forward (this is the most common source of error), avoid the trunk moving backwards, don't allow the pelvis to hike upwards.
-Lift for 3 seconds, hold for three seconds and lower for three seconds. Continue for one minute.
-1 minute, repeat with opposite leg.

The whole program with 8 exercise should take 10 minutes, as the side plank and side-lying leg lifts take 1 minute per side.

Fundamental Stage – ages 12 and under. Core strength and stability exercises can be introduced to develop strength, stability and coordination. The neutral spine position can be introduced. The exercises can be reduced to 15-20 seconds and performed one time weekly during training sessions.

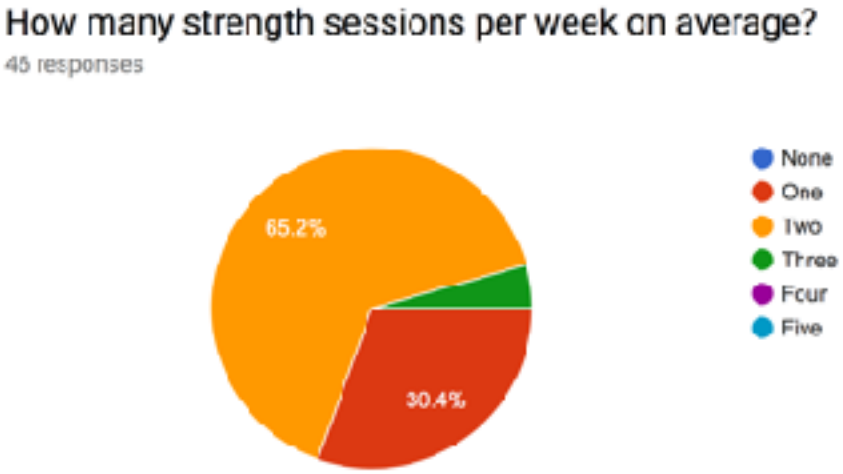
L2T – One set, with a break between sets. Do the exercises once or twice weekly.
T2T– One to two sets with a break in between sets. These exercises should be performed two to three times weekly during year. A competitive skier should reduce the exercises to once weekly during the race season
L2C / T2C - Up to 2-3 sets without breaks.

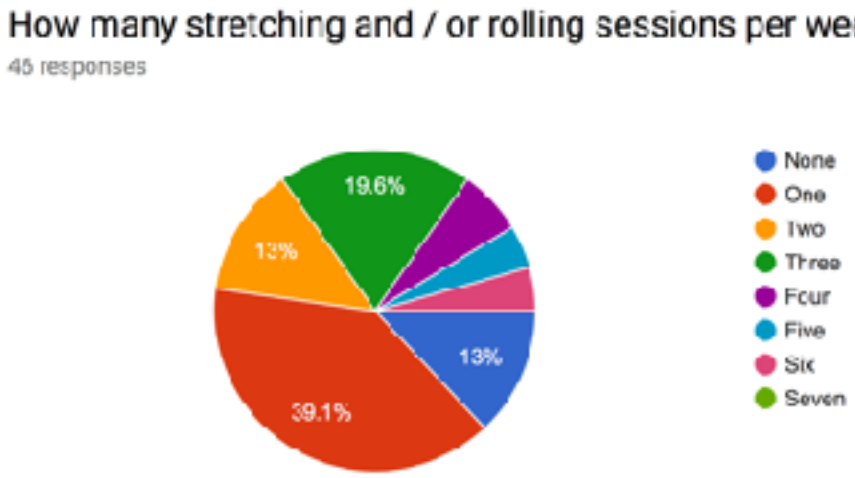
It is advisable that anyone starting a core stability/strength program that is not already doing strength training start at the T2T level.

BCST/BCDS CCBC Injury Questionnaire May 2019

Online google form done prior to May testing camp link below:
https://docs.google.com/forms/d/e/1FAIpQLSdhw782Kz3tJmCjxj71OhyTU_GI-TJRpsvgFhrxjtbr7BkhzA/viewform?usp=sf_link

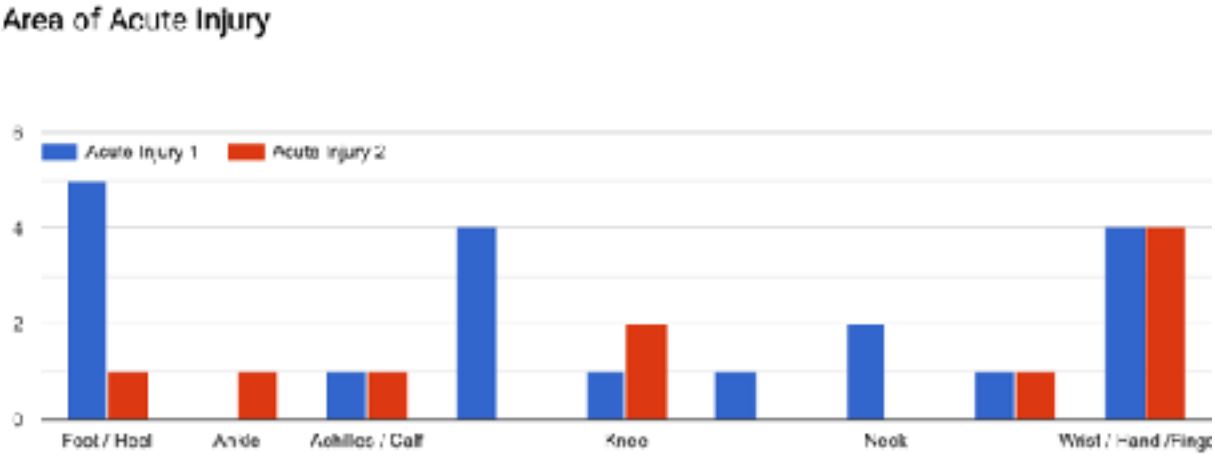
General Questions:

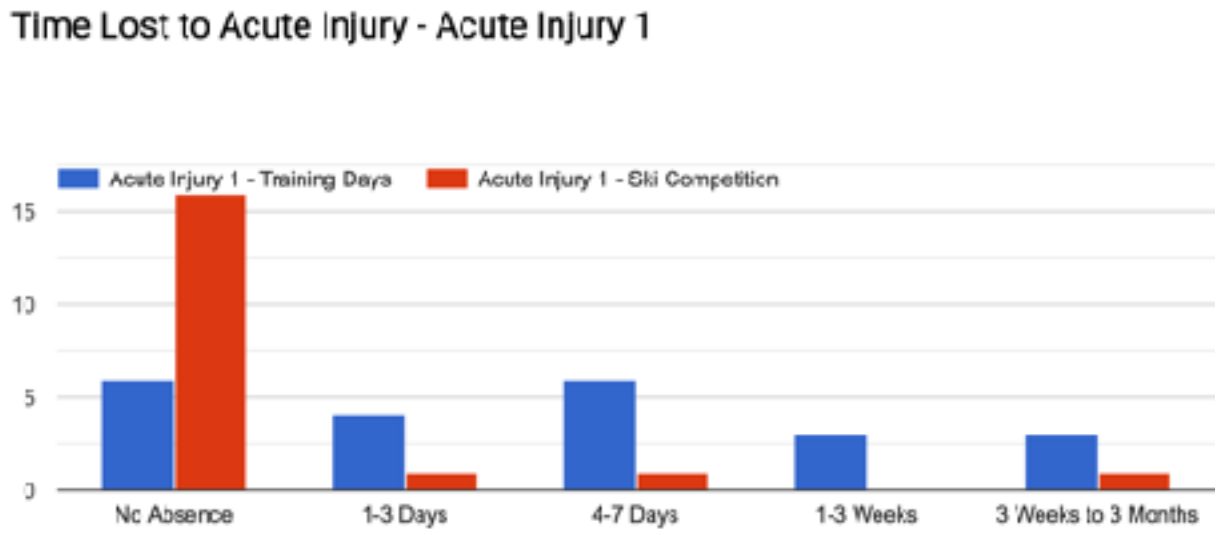




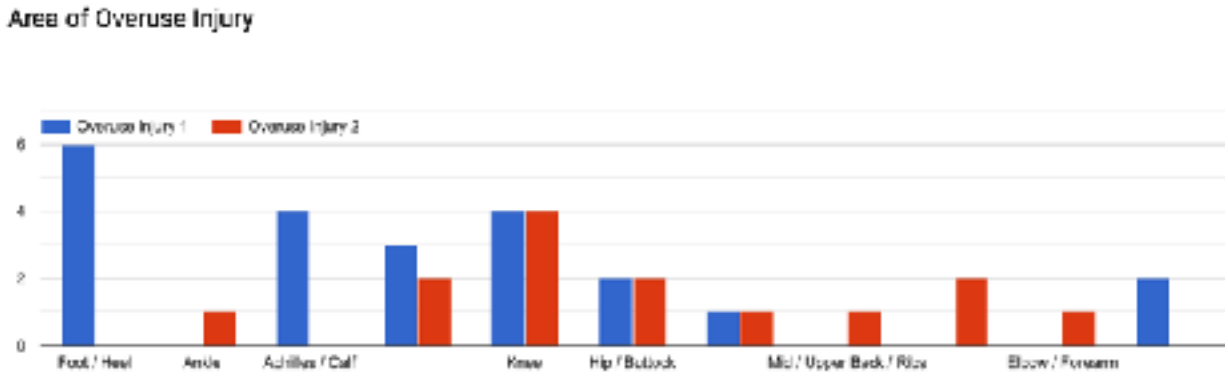
Acute injury Questions:

Primarily ankle, shin (blue line between calf and knee) and wrist (fractures)



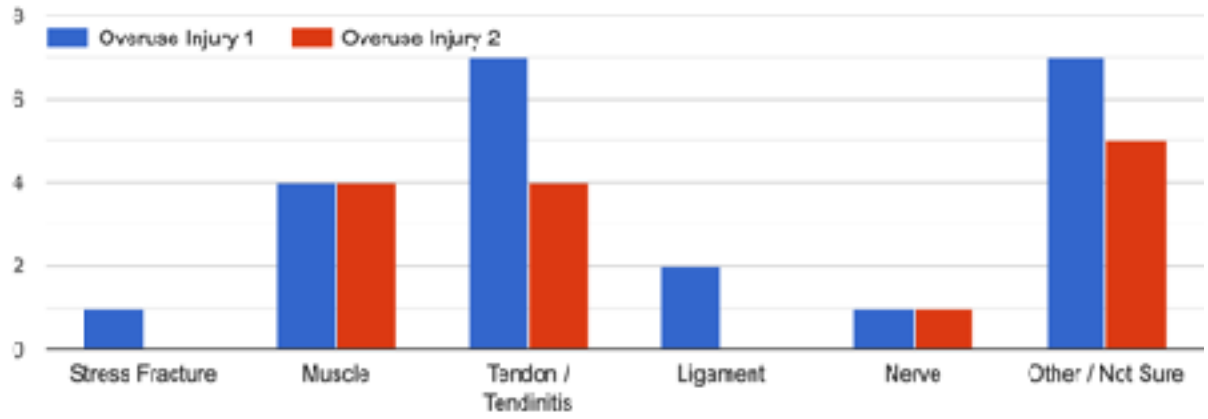


OVERUSE INJURIES

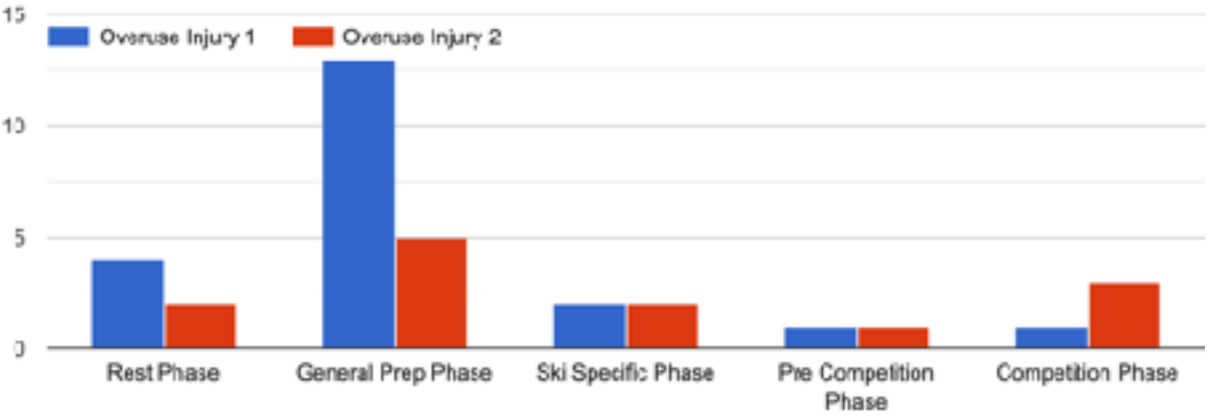


Foot & heel primary injury followed by achilles and knee.
Interesting less complaints of Low back than previous questionnaires

Type of Overuse Injury

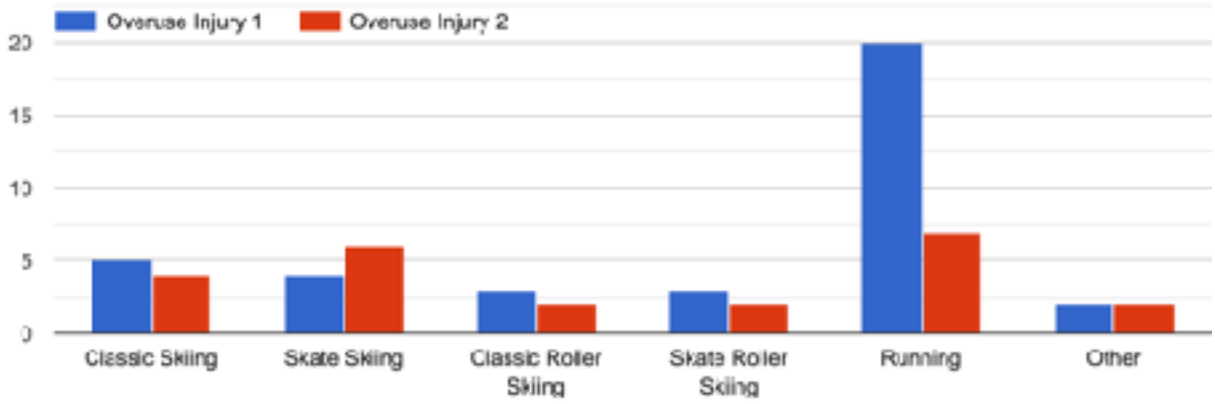


When did the Overuse Injury First Occur?



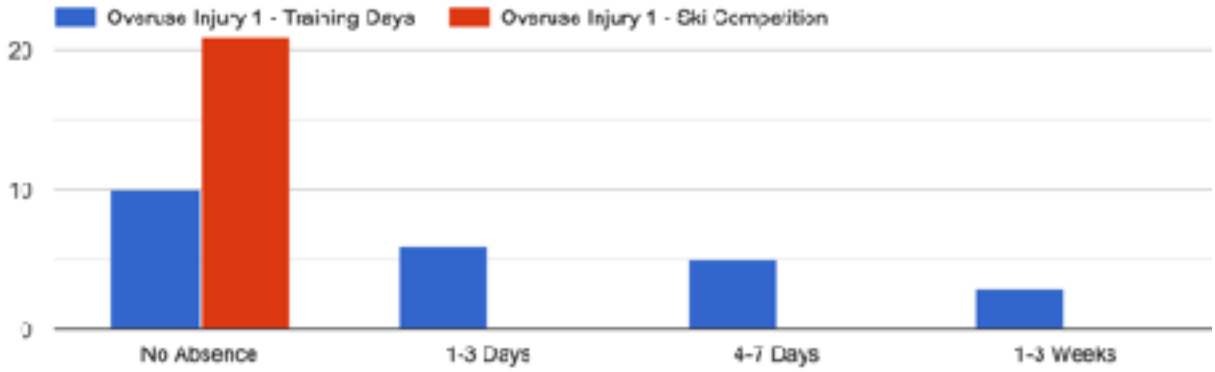
Increase in loading with starting to increase training hours? Recommend athletes monitor their 24 hour response to training.

During which Sport(s) do the Overuse Injury Symptoms Occur? - Check all the boxes that are appropriate

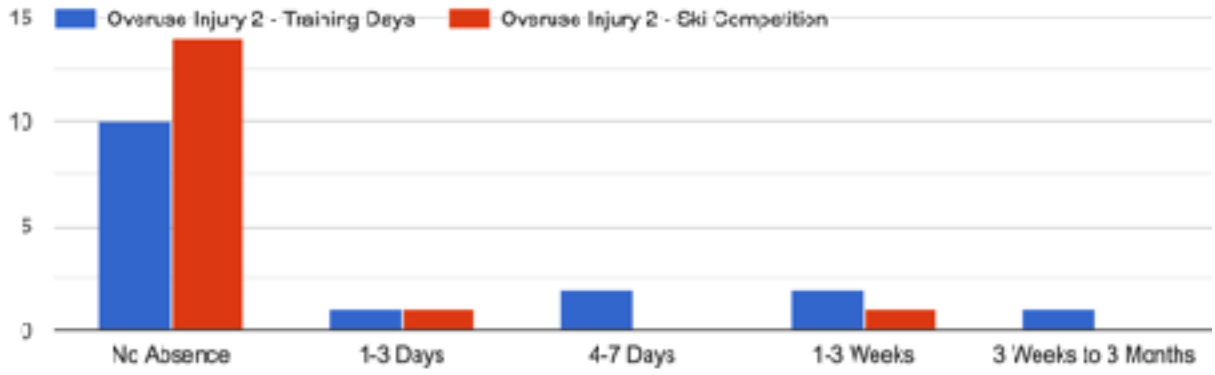


Running injuries primary for both overuse injury 1 & 2 - See Running section for recommendations.

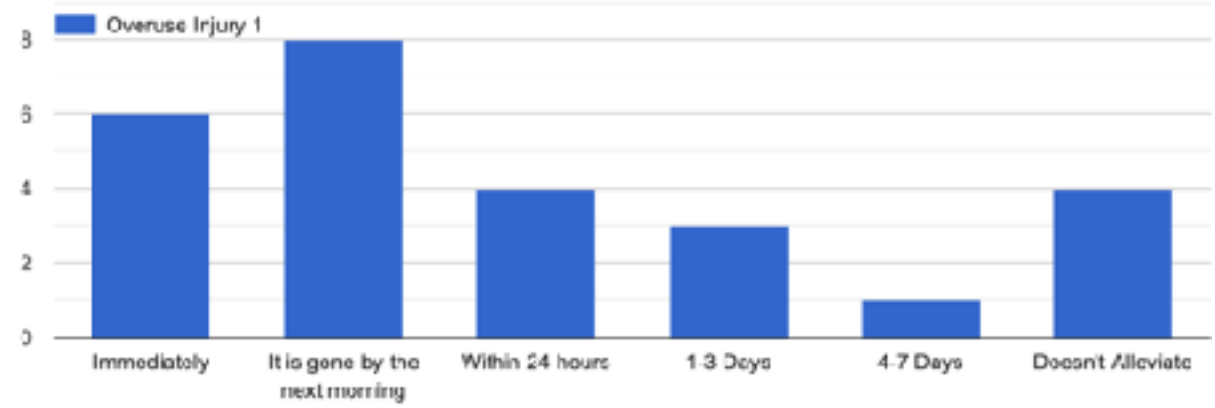
Time Lost to Overuse Injury - Overuse Injury 1 - Check one box in each column



Time Lost to Overuse Injury - Overuse Injury 2



How long does/did the pain from the most severe overuse injury (Injury 1) last after training /competition



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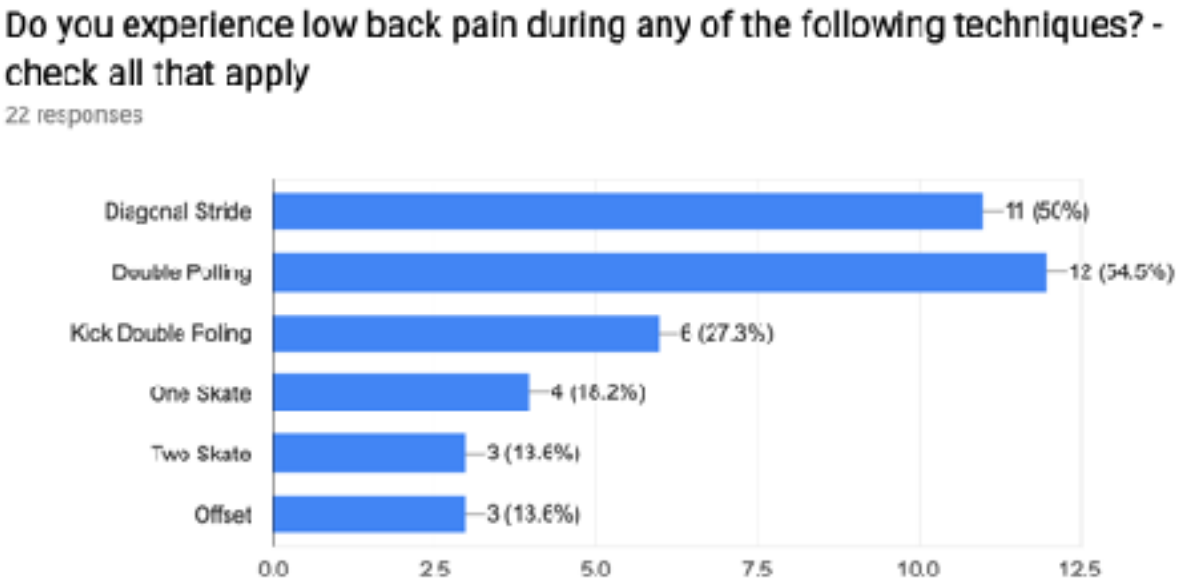

Very similar findings to last year. Coaches and athletes should continue to refine technique and build core strength.

Next steps

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2019 CCBC CROSS COUNTRY SKI EVALUATION

2019 Injury Survey Completed: Y/N

Name:

Present Complaints:

Previous Injuries:

OBSERVATION

Head:

Shoulder:

Pelvis:
Spinal Curves:

Hip:

Knee:

Foot/Ankle:

SIDELYING HIP ABDUCTION MANUAL MUSCLE TEST	
Left	/5
Right	/5

ACTIVE STRAIGHT LEG RAISE	
Left	Y/ N
Right	Y/ N

DEADLIFT RANGE OF MOTION		
Maintains Lordosis		
Floor to wrist crease		cm

STAR EXCURSION BALANCE TEST					
	Right			Left	

Leg Length		cm	Leg Length		cm
	Score	Normalized Score		Score	Normalized Score
Right Ant			Left Ant.		
Right Post-Med			Left Post-Med		
Right Post-Lat			Left Post-Lat		
Composite Score			Composite Score		

Simulated Double Pole Position & Single Leg Squat:		
Keep trunk level with weight transfer		
Hip flexion greater than 65°		
Hip abd/ add less than 10°		
Knee valgus / varus less than 10°		
Pelvis stays level through squat		
TOTAL SCORE	/5	/5

SQUAT POSITION	
Maintains Lordosis	Y/ N
Keeps Knee Alignment	Y/ N
Keeps Trunk Parallel to shins	Y/ N
Can attain 90 degree thigh angle	Y/ N

RECOMMENDATIONS

Recommend follow up with local physiotherapist Y/N

Requires Dead lift technique Correction / Modification Y/N

Requires Squat technique Correction / Modification Y/N

Comments & Recommendations: