



Sit Ski Instructor Manual



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1.

OVERVIEW

Adaptive sports are sports that are adapted in some way to better support individuals with intellectual or physical impairments. These adaptations can include differences in equipment, technique, or teaching techniques.

Cross-country skiing (also called Nordic skiing) is a wonderful option for people with disabilities who enjoy exploring trails or engaging in physical activity in winter environments. Some people pursue Nordic skiing for the peace and solitude, some like the fitness that comes with practice of the sport, and others enjoy pushing their bodies to the physical limit. Sit skiing is a great way for people with spinal cord injuries (SCIs), leg amputations or injuries, or mobility impairments to enjoy the sport of cross-country skiing.



As with other snow sports, the teaching progression for skiers with disabilities has evolved as instructors and students explore different and innovative approaches. Being an adaptive instructor gives you the opportunity to share what you know and love about skiing while introducing the sport to more people in your community.

We hope this manual will provide you with information that can be a base for Nordic sit ski instruction.



GUIDING PRINCIPLES FOR SUCCESSFUL TEACHING

As with any kind of instruction, the most critical piece of the process is recognizing everyone as an individual and adapting your instruction accordingly. The most effective instructors and coaches, whether for adaptive athletes or not, recognize that each person has different goals, needs, capabilities, and history. In this way, adaptive instruction is most simply an extension of best teaching practices.

Communicate Constantly communicate with your student/skier. This is important from a safety standpoint—making sure your student is comfortable in any given situation— and also so you can teach in the most effective way possible. As an instructor, you can learn a lot from a student through constant communication.

Embrace the Process Learning is a process. Most students do not fully understand concepts when learning for the first time. Finding the best methods to teach each skier is a challenge but can also be the most exciting and rewarding part of instructing. One of the instructor's main challenge is making the information accessible to each student. This might entail explaining things in a different way, showing by example, doing a drill or playing a game. Think about the elements you teach, break them down, ask others how they think about them, and challenge yourself to come up with different methods of teaching the same concept. You will learn something in the process, and you will be a better instructor for the thoughtful approach.

Be Open-Minded As a sit ski instructor, it is important that you never assume that a skier can't do something. If your student has difficulty with a skill, don't immediately assume it is a result of their disability (unless it is obvious). Remember that all skiers have different ways of processing information, and they will improve with practice. Expanding one's capabilities is one of the most rewarding aspects of learning new sport skills, and it may just take time and different teaching tactics for your student to learn those skills.

Make it Fun! Ski in groups, play games (even adults like games!), create fun challenges and races, and make attainable goals for your student. Assessing whether your students are engaged and having fun is an important skill to teaching.



CHAPTER 1 STUDENT ASSESSMENT

The first and most critical part of every ski lesson is the student assessment or evaluation. To teach a successful lesson, the instructor must first have a complete picture of the student's particular abilities and goals to help create a realistic lesson plan. This is doubly important for adaptive skiers because of their special physical capabilities, the need for adaptive equipment suited to very specific situations, the need for volunteers to assist some skiers, and the need for highly customized lesson plans. Each student must be treated like an individual, as no two students are alike, even if they have the same type of injury.

Components of the student assessment include

1. Visual Assessment
2. Physical Assessment
3. Forms/Documentation

1. The Visual Assessment begins as the student arrives for the lesson. It starts with general observations—watching how the person enters the room or facility. This becomes more specific with inquiries about the skier's disability, past experiences, medications (if any), motivations, goals, and other questions pertinent to that person. Sometimes questions need to be directed towards a parent or caregiver, depending upon the age of the student.

The following questions may help you, but use these only as a starting point. You will need to expand upon the questions as you see fit.

- Is the student in a wheelchair? Wheeling independently or in a power chair? Using a walker, crutches, or cane? Wearing leg braces or a prosthetic?
- Did the student need help opening the door? Turning a doorknob and pushing or pulling a door? This may denote a certain amount of grip strength and arm strength as well as a level of independence.
- Is the student outgoing or withdrawn, excited or fearful, unreserved or having second thoughts? Knowing a student's attitude about the lesson can be a valuable aid in selecting the appropriate teaching style and terrain.
- Does the student look strong and athletic? A student who participates in sports and works out will probably be ready for the experience of cross-country skiing. Be prepared to keep the lesson moving at a pace and to skip steps in the teaching progression if needed to maintain interest.
- Is the student dressed appropriately for the conditions? Remember, many beginner lessons do not demand a lot of moving, so make sure skiers, volunteers, and instructors are prepared with warm clothing.



2. The Physical Assessment allows the instructor to gather specific information about the student's disability and physical condition. Before conducting a physical assessment ask questions that will help you understand your student's disability. The student or caregivers are experts in his or her disability and can provide ample information. It is far better to ask questions up front than to put yourself or your student in an uncomfortable situation later.

Relevant Questions

History Does the student have any related, unrelated or hidden secondary disabilities? See Appendix B. for more information on disabilities associated with adaptive skiing.

How long has the disability been present? People with a recent injury may be weak or unaccustomed to their current situation. If they have a new amputation, their effected limb will likely not withstand pressure for too long so a lesson should be planned accordingly.

Has the student undergone major surgery within the last year? If so, the student may need a doctor's release and/or may tire easily.

Medications Is the student taking any medications and, if so, why do they take that medication and what are the side effects? When did they take their last dose and will they need to medicate during your session? Many medications are susceptible to sun, so take the appropriate precautions and do not expect they will do it.

Always ask if there is anything else you should know about their injury or other injuries before getting started.

Other considerations

Amputations When did the amputation occur? What is the present condition of the limb and is it properly wrapped and padded?

Functional musculature and strength Which muscle groups can the student use or not use? Is the student strong enough to stand and move without assistance? Is adaptive equipment needed to allow those muscles to function while moving?

Balance If in a wheelchair, have student place hands behind neck and move trunk forward then back and then side to side. This may also let you know their functional ability due to the level of injury.

Coordination Watch the student perform physical tasks, with an eye for fluidity and efficiency of motion. Watching the student move around the room, open doors, or put on a jacket will help you assess gross motor movements. Watching the student pick up small objects or write will give you an idea of the level of fine motor movements.

Flexibility and Range of Motion Adaptive students often have restricted range of movement due to joint fusion, muscle hyper tonicity (rigidity), or muscle atrophy. Ask them to reach across their body with an arm/leg then to the other side.

Motor and Sensory Deficits Use questions and simple tests to determine what parts of the body the student can feel and control. If the student has feeling in body parts with limited function, determine the types of sensations felt: heat, cold, pain, or pressure. If the student has incomplete sensation, determine the extent and consider the consequences.

Joint Fusions Ask skier about any joint fusions in their back or other areas that will limit range of motion, impact how they will be able to ski, or change how you might approach fitting the sit ski.

See Appendix C for more information on functionality at different levels of spinal cord injuries.

5.

All of these factors will influence how you conduct the lesson. In addition to these physical issues, ask about the student's prior experience with skiing, and other sports. Did the student ski or participate in some other sport before becoming disabled? Prior athletes are likely to have good body awareness, which is an advantage when learning to ski with adaptive equipment. If the student currently participates in another sport, you can usually draw similarities to help the student learn Nordic skiing.

By the time a thorough student assessment has been completed, the instructor will have gained a lot of important insights into the physical abilities, special needs, attitudes and personality traits of the student. Such insights are needed to help tailor a specific approach in terms of equipment and teaching style. Assessment never stops throughout the lesson. What you learned initially may determine how you start a lesson, but always be ready to change your approach as you learn more when teaching.

3. Forms and Documentation

Depending on the organization hosting the clinic, documentation such as liability waivers, medical information, and medical history might be required. Check with all parties involved to make sure you have the appropriate paperwork. This is important for both liability and safety for everyone involved.

CHAPTER 2 EQUIPMENT & FIT

After the student assessment, the instructor should be able to adequately fit the skier with equipment, but remember that finding the best equipment and fit could take time and a lot of trial and error. This is something that can be done inside, putting sit ski with skis on a protected carpeted area. If weather is bad and/or if you anticipate your student may need a lot of modifications, this is recommended. But ultimately, remember that the fit will be an evolving process and they will need to get experience in the sit ski to know what works for them.



The Sit Ski

A sit ski consists of a bucket or seat attached to a frame, that is then attached to a pair of skis via the bindings. The sit ski should hold the skier in a dynamic yet comfortable position that allows effective use of the musculature. The bucket should be a snug fit to ensure that the sit ski will respond to the skier's movements.

The skier's stability and range of mobility will determine what type of seat to use.

Fitting the Ski & Equipment

General Guidelines

- There are no hard and fast rules to what type of sit ski will work for a specific group of people.
- Finding the right position is an evolving process and requires trial and error, and constant communication between instructor/coach and skier. It is common for the fit or position to change as the skier becomes more skilled.
- There are no "race" positions and "recreational" positions. The best positions for racing are what those athletes have found to be the most powerful and efficient. These are the same qualities that are going to help a recreational skier have the most fun, control, and independence.
- The sit ski may have modifications that allow for better assistance; this is critical for less experienced skiers or skiers that need or want assistance. Examples of modifications may include a tether system for pulling or braking, handles on the bucket for instructor to hold onto, or a place for an instructor's pole tips to allow for them to push the skier.
- Sit skiers with prosthetic legs will generally have a better fit and experience if they remove their legs to ski.



7.



A



B



D

Body Position

An ideal position is achieved by altering these primary aspects of body position.

- Torso position when poling (upright or forward)
- Leg position (angle between femur and torso, foot position, or knee angle)

Three types of seats are commonly used to alter body position. The following three main types are described by the angle of the femur in relation to the torso.

1. Angled downward / Wide angle (Photo A)

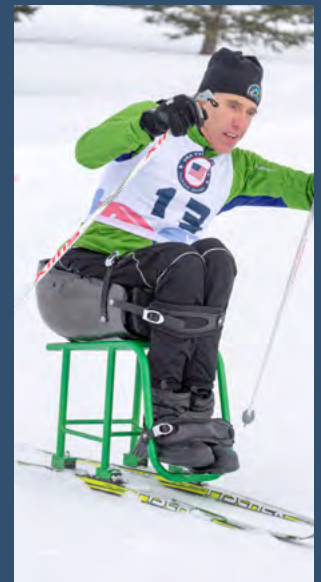
- A position where the femur bone is angled down from the hips (with hips sitting high) is a powerful poling position. People with full core function often prefer this position.
- Skiers with mid to high level spinal cord injuries usually find this position difficult to sustain and therefore not efficient.
- This position is most common among people with single or double leg amputations, and occasionally experienced skiers with low spinal cord injuries. Those with a single amputation will tuck their leg under the seat, securing it to frame of the sit ski to reduce movement. (Photo B)

2. Neutral / 90 Degree angle (Photo C)

- A neutral position (flat seat without any angle) is the most common and versatile position.
- This position is common among many beginners as it provides comfort of sitting in a chairlike position, yet still offers the ability to generate power from poles.

- Athletes in this position can choose between having feet resting on a bar just in front of the frame, a few inches above the tops of the skis, or tucking their legs under the seat in a position similar to wheelchair racing. Tucking legs is most common among people with low to mid level spinal cord injuries.

- Skiers who want to try a slightly more aggressive position can achieve this by adding padding under the back of the seat in a neutral sit ski.



C

3. Angled back (“dump”) / Acute angle (Photo D)

- This position drops or “dumps” the hips below the femur, providing more spinal support and stability.
- This is recommended for people with high spinal cord injuries as it provides the most support. It is not typically recommended for other skiers as it reduces the ability to use full core strength to create as powerful a pole stroke. For those skiers with higher injuries, this is the most powerful position they can be in because they are not wasting energy just by keeping themselves upright.



Seat / Bucket

You don't have to have a large selection of seats/buckets to find a good position. You can do a lot with extra straps, a variety of padding and some ingenuity.

- The fit of the skier into the seat should be as snug and comfortable as possible. You want as much of the power the skier creates to translate into forward movement as possible, and this requires a secure fit.
- Padding may be necessary to enhance performance and comfort, and to prevent pressure sores. The students who require extra seat padding can use foam, which we recommend the instructor have available. Padding used in kayaks or a thick yoga mat custom cut on the spot can make a simple and effective difference in the fitting process. Some skiers may also chose to use their wheelchair padding, although this is typically too thick to fit comfortably in most buckets.
- Pressure sores are common in people with spinal cord injuries. They are dangerous and often hard to detect if the skier lacks feeling in parts of the body. It might be critical to check body position and ski fit often, to make sure seat, padding, straps, or clothing is not creating unwanted pressure. Communication is important, as student might have a history of pressure sores and know how to prevent them.



Seat Back Height

- A seat back that is too high will limit range of motion and impair balance, rotary movements, and angulations.

Frame Height (seat height off the ground)

- To brake and turn the sit ski, it is helpful for the student to be able to touch the ground with both hands at the same time.
- In general, skiers with higher SCIs should be lower to the ground.
 - A frame lower to the ground enhances control and stability and makes it easier to right the equipment after a fall.
- Higher frames require more core stability because center of gravity is higher.
 - This makes it possible to have longer poles, and therefore the ability to produce a more powerful pole stroke.
 - Keep in mind that maneuvering is more challenging since center of gravity is higher.

Note: for competition, there is a height limit on how high a sit ski frame can be. Refer to appendix D. for a link to the most current rules.





Straps

Straps augment the fit and enable efficient transfer of the skier's movements into forward momentum. Always make sure that straps do not cross a collection bag or catheterization tube. Be aware that straps with rough edges may increase the possibility of skin break down in that area, especially for people with SCIs. Be sure those straps are not too tight, and add some padding under them if necessary.

- Skiers with higher spinal cord disabilities may require a wide, flexible chest strap, depending on their ability to sit erect on their own but having a supportive, well fitting bucket will achieve this much more effectively.
- A wide strap across the lap is common, keeping the skier secure in the bucket or seat and ensuring effective transfer of power.

Skis

- Type: Use skate or waxable classic skis (no fishscales/waxless skis, and don't put on kick wax!)
- Classic skis are easier to get in and out of tracks because of their higher, flexible tips.
- More advanced skiers may find they like different types of skis in different snow conditions. Encourage skiers to try different things as they get more comfortable with the sport as they will get better at understanding what works for them.
- Length & Flex: Ski length and type are a matter of personal choice as skiers advance.
- The majority of the skis adult sit skiers use are between 170-190cm.
- Longer skis (185 to 200 cm) provide extended glide at the expense of maneuverability.
- Shorter skis are easier for beginner/novice students but do not hold well at high speeds.
- When the student is seated, the mid-section of the skis should contact the snow.
- Short stiff skating skis may not allow full contact with the snow, resulting in reduced control.
- Softer skis are generally better for control and edging.
- If a skier is having a lot of trouble with maneuvering, it may be helpful to try a different length, type, or flex of ski.
- Ski Bases & Waxing: Skis should be waxed regularly to enhance glide. Spray or rub-on glide waxes are convenient, fast, and require little equipment and are a great solution for between hot waxes (which is recommended at least every 10 sessions).



- The better the ski, the better the base and easier it will be to glide. Touring skis tend to be slow and therefore harder to propel forward.
- No matter how nice the skis are, if you don't wax them regularly, they will be slow. Waxing is a simple thing that can greatly improve the experience for a sit skier.





Bindings

Sit skiers use the same bindings used by stand-up cross country skiers. Many styles have two pairs of bindings instead of one to secure the frame to the skis or one pair for the front and a rear block system. (see photos)

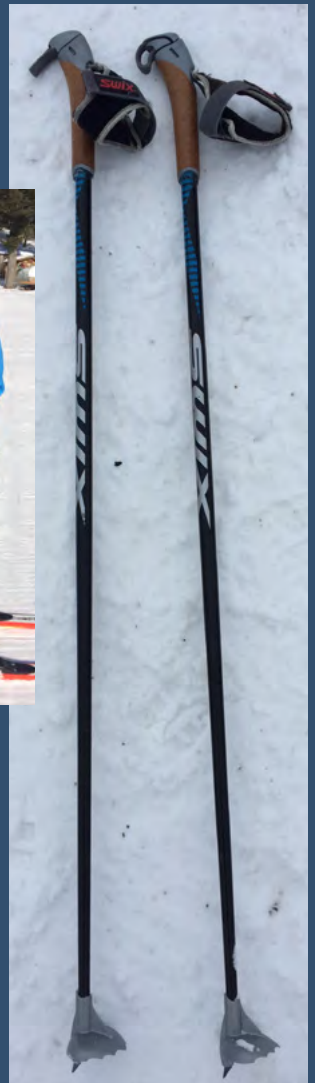
- The bindings are generally mounted with the front binding in a similar place as a stand-up skier.
- Because of the quick release system, these bindings allow for ease of storage, transport, and ski waxing.
- If you have multiple sit skis, we recommend all having the same binding system so skis can be used interchangeably.



Poles

Poles are the means of transferring power from the skier's upper body into the snow, and thus propelling the skier forward.

- Pole Length & Fit: Appropriate pole length varies depending on terrain, the skier's strength and ability, and personal preference.
- To measure for pole length, have the student sit in the frame with the tip of the pole in the snow. The top of the grip should reach between the chin and top of the head.
- Try different lengths to determine what size works best (usually 105cm-125cm). Keep in mind that longer poles are generally better on flats and shorter poles on uphill so everyone will need to find their ideal length for the type of skiing they will be doing and their individual ski styles.
- Longer poles can provide better power, especially on flatter terrain. Be aware that as poles get too long, they can increase stress on the shoulder or change poling mechanics in a way that can reduce efficiency.
- Shorter poles are generally easier for beginners. They allow for a faster turnover rate and are easier to use on uphill.
- Durability is an important consideration when choosing poles. Sit skiers apply more force to poles than stand-up skiers. Overly fragile "high-performance" poles, while reducing weight, may not hold up. Aluminum poles are more durable and less expensive, and are recommended for beginners.
- Pole straps should be snug on the skier's hands to provide proper control.
- Depending on the skier's ability to use his or her hands, the skier should be able to briefly relax grip in the follow-through phase of poling (hands behind ski), while maintain control of poles. If straps are too loose, poles will drag on the snow in this phase.



CHAPTER 3 TERRAIN & ENVIRONMENT

Choosing Appropriate Terrain

One of the most important factors when planning a lesson is selecting appropriate terrain. Appropriate terrain means choosing terrain that is within the skier's comfort level and allows the skier to accomplish his or her short-term goals. The terrain should not impede one's ability to learn, or practice, a new skill, so it is important to be able to identify different types of terrain and determine when and how to use this terrain. To fully understand how terrain affects sit skiing, try it out for yourself. This will give you insight to how the slightest terrain change make a big difference, and you will gain perspective on how to choose appropriate terrain. Keep in mind how people in wheelchairs or with prosthetic legs will access the snow as you are choosing the ideal location for beginners.

Generally, pick a wide open, flat area to teach beginners. This will allow for good visibility as well as few terrain obstacles. Ideally, there are some small hills nearby, so your students can easily access more terrain as their skills progress. When learning downhill skills, it is important to choose hills with a good run-out zone and no trees/obstacles, to make the lesson as safe as possible. Avoid side hills as much as possible, as these are the most difficult terrain feature for sit skiers to navigate.



Utilizing Classic Tracks

Introducing tracks is part of the teaching progression, but most skills can be learned on a flat surface (without tracks) first. They are not a necessary component of the initial lesson, although sit skiers can learn to negotiate tracks with or without assistance (details in progression 5 on page 20). Generally, skiers with less core function prefer using tracks as a means of greater ski control. Advanced skiers will move in and out of the tracks regularly, looking for the most optimal line or faster snow.

Environment Considerations

Always consider winter conditions, including temperature, precipitation, sun, and snow conditions. Successful learning requires a productive environment, so try to limit environmental challenges. If the forecast looks grim, consider rescheduling a clinic! Always check grooming/snow report to make sure the trails will be in good shape for beginners to enjoy being on skis. As we know, the first impressions impact our experience, so creating a pleasant, positive, and inspiring environment is imperative to a successful lesson.



CHAPTER 4 ASSISTANCE

Cross-country skiing, especially in a sit ski, is a physically demanding sport. Depending on the disability, fitness level, and type of snow and terrain, many students will need assistance. Some skiers may require assistance to ski, some may just need help getting started, some may not need any assistance while skiing.

Assisting Sit Skiers

Transferring Skier into Sit Ski

Whether a skier uses prosthetics, crutches, or is in a wheelchair, he or she might need assistance getting into the ski. If lifting is necessary, make sure to have enough people to transfer the skier in a safe and efficient manner. Communication is key to a smooth transfer! Make sure to talk with the skier to understand how he or she would like to be lifted and moved so as to avoid injury and/or discomfort. With all types of assistance, always ask if the skier wants help and how they want to be assisted. Skiing independently is a great goal, so encouraging skiers to figure out things on their own when possible is often a great way to encourage independence.

Pairing Skiers with Assistants

As you evaluate each student, it is important to appropriately match assistants with skiers, so the volunteer can adequately assist the skier. This assistance might include transferring skier into the sit ski, help with configuring equipment (poles, straps, etc.), maneuvering the ski, pushing or pulling the skier, or helping to right the sit ski after a fall. It is equally important to protect the sit skiers and assistants. Depending on the sit skier, assisting can be very physically demanding, so it is important to plan ahead and anticipate challenges for both parties. Always remember safety first! It is better to have more people on hand to help during a clinic or lesson, and making sure volunteers are prepared (and comfortable) to assist.

When matching assistants with sit skiers, consider the following

Experience More experienced skiers will be more comfortable with challenging or complicated situations.

Physical Attributes Consider the physical size and strength of volunteers and any limitations they might have.

Students with the need for the most assistance will require the fittest and strongest instructors with the best ski skills.

Maneuvering the Ski

The easiest way to turn a skier in a sit ski is by grabbing hold of the ski tips, keeping the skis low to the ground, and rotating.

Methods of Assisted Propulsion

Often, the more preferential way to assist the skier in moving forward is for the instructor to push the sit ski from behind with his or her ski pole. The most effective way to do this is to attach an apple corer to the frame of the sit ski, just below the seat. This creates a large target for an instructor's pole tip. Unlike the photo, this would be even more effective if the corer were fixed to the back of the seat rather than hanging loosely.



13.

If that method does not produce ample results, the volunteer may wear a belt with a shock cord/bungee rope and attach to the ski in a secure place (foot-rest, etc). Once attached, the volunteer skis or walks in front of the student while assisting in forward propulsion. If pulling a sit skier by a bungee, make sure it is centered on the sit ski frame, as it may otherwise make it more difficult for skier to remain upright.



Instructors can help to control speed by holding the back of the student's bucket, and situating their skis on the outside of the sit ski and snowplowing and turning as the terrain dictates. In this situation, the sit skier should either give poles to instructor temporarily or keep them tucked under their arms and not maneuver at all until the instructor releases them.



CHAPTER 5 TEACHING SIT SKIING

Teaching sit skiing is a unique and creative process, because of the wide range of physical abilities. This teaching progression should provide a general framework for teaching beginning sit skiing, and is not a concrete approach. A given lesson might focus on sections of this progression, and remember that skiers will move through skills at very different paces. Adaptation and creativity are key to successful and enjoyable lessons!

Refer to the Terrain & Environment chapter when thinking about where to teach your beginning lesson.

Miscellaneous Equipment for Lesson

Before heading out on the trail, whether for an hour or more, bring the following:

1. Water & snacks for student and volunteer
2. A pack with extra warm/dry clothing for longer outings
3. Spare gloves, as sit skiers use their hands frequently in the snow for turning and balance
4. Warm footwear or a foot/leg blanket
5. Sunglasses, sunscreen and lip balm
6. Trail map
7. Bungee system (even for strong skiers, in case of a broken pole or injury).
8. Hand warmers
9. Cones for drills/learning progressions
10. Radio or cell phone (for longer trips to check in with base lodge)
11. It is recommended that the volunteer carry any tools that may be necessary to adjust the sit ski.
12. If going out on a longer ski, it is recommended that the instructor carry an extra ski pole in the case of a broken pole. A simple way to do this is to tape a sit ski pole to the center of the instructor's pole so it does not impact the ability for the instructor to pole normally.
13. An iPad or video camera for video review can be a great way for skiers to see themselves and improve their skills.

Technique & Skills Progression Overview

1. Getting Started
2. Double Poling & Braking
3. Falling & Getting Up
4. Turning & Maneuvering
5. Negotiating Tracks
6. Uphills
7. Sidehills
8. Downhills



1. Getting Started

Skier Goals Understand athletic position, find balance limits, test balance limits, rock up on ski edge.

Skills Progression

- A. Basic body position
- B. Balancing front to back
- C. Balancing side to side

To be done on flat terrain. These can also be done inside on a carpet as part of sit ski fitting/student assessment in the case of cold temperatures or hesitant students.

Methodology

A. These initial steps provide good opportunities for the instructor to identify each skier's capabilities. Have skiers relax their arms with poles in hand and shrug their shoulders a few times to get relaxed.

- Posture should be upright or slightly forward.
- Shoulders relaxed; head should be level with eyes forward.
- Arms shoulder width apart, with elbows just over 90 degree angle, and poles planted, torso angled slightly forward.

B. If possible, have them lean forward and touch the ground, then return to neutral. A skier's ability to touch the ground and return to upright will help you determine how you should teach them to brake. It is ideal if they can touch both hands to the ground, but other braking methods are also possible.

C. Next, without poles, have them stretch their arms out to the sides and rotate torso ("helicopter" motion). The purpose is to play around with moving their center of gravity* in different ways, which will be necessary to maneuver. There are many ways to achieve this, but will originate from moving hips, shoulders, or torso in different ways. Have them practice moving torso/weight to left, then right. Have them brace with poles, see how far skiers can lean to left and right while staying balanced, on a flat ski. Using hip engagement, they can lean further, tipping the ski up on edge. Repeat on each side. After skiers are comfortable with this motion, have them hold an edge for a few seconds. Some skiers could try balancing on ski edge without using poles to brace. How long can the skier hold this position?

*Since each skier's body composition, musculature, and sit ski set-up are unique, the center of gravity and the ability to move and hold that center of gravity will also be different for everyone. This process will get them thinking in terms of their own center and explore generating movement from this place.



Additional Drills

Interactive Partner-Lean Drill Have two sit skiers sit shoulder to shoulder in opposite directions. One will remain stationary, as a support. The other leans past balance point and tip up on edge, bracing against stationary skier. Hold. Repeat on other side. This allows skiers to interact with each other and test their limits. The support skier must balance and brace, which is also good practice for them.



2. Double Poling & Braking

Skier Goals Use basic double pole technique to move ski forward and brake on flat terrain.

Skills Progression

- A. Stationary double pole
- B. Double pole moving forward
- C. Braking

Best done on flat terrain.

Methodology

A. Explain the double pole technique but have the skiers try this without moving first. Skiers should hold poles in front, hands shoulder width apart and eye level. Elbows should be bent just over 90 degrees. Have skiers practice stationary pole planting: lift and plant poles, contracting abdominal muscles as poles hit snow. Repeat. Next, move into full double-pole motion: Arms swing from the shoulder and have a relaxed follow through after pole plant. Upswing back up to the forward starting position should be relaxed and recovery. Have them repeat this, while feeling the core contraction that should happen with the initiation of the pole stroke.



B. Now, a skier can move forward using double pole technique. Have them double pole across a flat area where their speed can naturally run out. As they get comfortable, have them try holding arms at different angles to see what is most comfortable. Generally, athletes with full or high core function will use very similar mechanics to standing skiers. Skiers with higher SCIs will typically have more of an elbow bend during the pole stroke since they don't have the core contraction to help them power their stroke. This will result in pulling poles toward them as their elbows bend, then pushing them down, as their arms extend. Skier with more core function should minimize this bending as it reduces the power they can get from their core.

C. When skiers are accustomed to poling, have them practice braking by dropping the tops of their pole handles to the ground and digging them into the snow to reduce speed. Skiers who can't reach the ground with their hands can also practice braking by dragging their pole tips behind them, keeping elbows close to torso and even leaning back slightly to apply more pressure.

3. Falling & Getting Up

Skier Goals Understand how to protect oneself during a fall; gain confidence falling safely; get up from a fall, either with help or unassisted.

Skills Progression

- A. Falling safely
- B. Getting up from a fall with assistance
- C. Getting up from a fall unassisted

Methodology

A. Falling is part of skiing, and sit skiing is no different in this regard. Learning to fall and get up is near the beginning of the lesson to allow the student and volunteer to practice in a controlled situation. It will be easiest to have the volunteer start with skis off. It is challenging to practice falling with speed, but you can talk about the important principles of safe falling: keep elbows close to the body to protect shoulders and always prioritize protecting body before equipment. If falling seems inevitable, skier can also fall intentionally so they can limit speed and control the location and situation of the fall.



B. To practice getting up from a fall have skier fall using above principles or have volunteer(s) help lower the skier onto side. While volunteer supports the sit ski and controls the “fall,” the skier can cross brace with opposite pole, lowering onto hand, bracing body with arm. Skier then lowers hip to ground, moves to elbow, and lies on side. Volunteer can brace ski the upper side of the sit ski bucket and help control speed of this process. To get up, reverse the process. With their own skis off, the volunteer can help pull sit skier up by placing one hand at the top of the bucket, and another pushing down on the upper ski, while the skier goes onto elbow, then cross braces with poles, keeping elbow close to torso, pushing up to hand, and finally tipping the ski back to neutral. Skier should keep their head tilted down until the very last step. This will help to keep the hips, and thus center of gravity, higher and in a better position to move to an upright position. You will find that having a snug fit in the bucket is important for a skier and assistant to be able to effectively get the skier upright.

C. If skier is comfortable and able, have him / her repeat Step B, but unassisted. If falling to left, use right pole to cross-brace, then drop left hand, left hip, and left elbow until lowered to ground. Practice getting up. Remember, before trying to get up from a fall, the ski should be perpendicular to the fall line. The volunteer can help the skier rotate if needed, but first practice on a flat area so this is not a factor.



4. Turning & Maneuvering

Skier Goals Start making turns by using poles and shifting weight. Begin to feel how the edge of the ski works to control the ski; edging to turn.

Skills Progression

- A. Windshield wipers
- B. Make ski turn using pole plant and weight shift
- C. Backward poling
- D. Turning on edge*

*This is an advanced skill so is recommended for skiers with more experience or beginners who will not get discouraged from falling a lot. It is a great challenge and one that many skiers will enjoy to practice and try to master.

Best done in a flat groomed area, outside of classic tracks.

Methodology

When teaching skiers to turn, remember that it is easier to turn a sit ski with some speed. Set up a “slalom course” with cones. Make sure the cones are wide enough, so the skier can make very gradual turns.



A. This drill shows how the torso and lower body can initiate movement, while the poles brace; this lower body control will help when turning and maneuvering the ski. The skier starts by making a wide pole plant, a foot or so outside of their bindings. If making a turn left, push and rotate against the pole by using shoulder, core, torso and hip strength. Turn the ski 45 degrees, or as far as possible to the left, and then push the other direction to move right, like windshield wipers. Try this leaning forward and back to see if this helps or hinders the ski to rotate. Note that doing this drill on a hard packed trail is best. Skiers might find it difficult to do in soft deep snow.

B. Angle outside pole with basket angled to the outside of the turn and pushing away from the inside of the turn as they complete the pole stroke. This should feel like a continuation of the windshield wiper drill so remind them to use the skills they learned doing that. Have them practice planting poles at different angles and also poling with different tempos. How does this change how ski turns? What is most effective? Does it change according to terrain? Have the skiers repeat the course a few times, playing around with leaning to the inside of the turn and then the outside the turn. Remember that leaning can be initiated from the shoulders, hips, or both. What makes turning easiest on this terrain? How does it change to have the body leaning forward or back? Once skier is comfortable with how to initiate turns, have them ski through the slalom course, trying out different methods of pole planting and leaning to see what creates the best result. This is a great drill to frequently come back to, as maneuvering technique is likely to change with different snow conditions, and it is easy to increase difficulty as skills improve.

C. Have skiers try to push themselves backward with their poles, planting poles toward the ski tips and pushing against the snow. This should not be used as a braking method, as it could be dangerous at a higher speed; this skill is more for maneuvering the ski, backing up, and getting comfortable maneuvering.

19.

D. Now explain how incorporating an edge into turning can help the ski maneuver. At this point, turning is a combination of weight shift, poling, and now edging. Have skiers repeat the slalom course, and on each turn they should try to get on edge for a split second. If skier can't edge, just see what happens when he or she shifts weight left to right while going around the cones. What happens to the sit ski? Have skiers play around with the timing of their poling, when they edge, and how to keep fluidity through the turns. Eventually, they can try to ski the course only edging, moving from edge to edge through the turns. This is an advanced skill and will take a lot of time and practice to master. This step is not recommended for a beginner lesson, but when the skier is ready for more of a challenge this is a great next step of this progression.



This is an advanced skill and will take a lot of time and practice to master. This step is not recommended for a beginner lesson, but when the skier is ready for more of a challenge this is a great next step of this progression.

Additional Drills

Helicopter Turns This drill reinforces how poling and body position can turn the ski. Set up a single cone for each skier to circle around in one direction, then other direction. Skiers can start with a bigger circle and try to make the circle tighter until the ski is turning in place. Have them notice what they have to do with poles to make it 360 degrees. Try it in different directions. Next put down two cones and do figure 8s. Skiers need some speed to accomplish this drill so may need to take a few pole strokes to gain momentum before initiating the turn.

Semi-Circle/S-Turn Drill This drill allows skiers to apply their turning skills while also thinking about speed, tactics, and adaptation. Set up a semi-circle/turn with cones on flat terrain. Have skiers work the corner, trying different approaches and lines. Now, have them work the corner from different starting points and see if/how this impacts maneuvering. Using cones, close off part of the turn and make a sharp direction change (S-turn). How does this affect how they take initial corner? Have them try it a few times, slowly adding speed. Have skier try it head to head, making passes. Once you see what most common line is, put a cone here to make them avoid. How do they react?



5. Negotiating Tracks

Skier Goals Apply maneuvering skills learned outside of tracks to move in and out of tracks and maintain balance to stay in tracks on corners.

Skills Progression

- A. Enter the track
- B. Exit the track
- C. Cornering in the track

Methodology

Consider terrain when deciding when to use tracks and when/how to introduce tracks into your drills. Tracks can make skiing easier for the student but they can also add another challenge when negotiating challenging terrain.

A. First, if there is a break in the tracks, it is usually the easiest place for a sit skier to glide into them. However, a skier might need to drop into a track from the side. Have skier approach the track at a slight angle, giving a push with the poles just before the center of the skis are over the tracks to straighten out the ski and drop it into the tracks. Angling the outside pole in a maneuvering technique can be effective in this case. Skiers with good core and leg control can also twist hips or push outside leg forward, against frame or strap, to achieve the necessary movement to drop into the tracks. Every sit skier will inevitably miscalculate this and end up with one ski in the track and one out. In this case, options are to try to get out of the tracks and try again or look ahead to see if there is a gap in the tracks where they can easily exit. Often it is best not to fight this as it can take a lot of energy to get out of the tracks in this position.

B. Most skiers will need assistance exiting the track, at least initially. With the sit skier stopped in the tracks, have volunteer put his/her ski across the track at an angle, so skier can push the rig over the ski; the volunteer's ski acts as a sort of ramp, or method of leverage. When the skier's center of gravity passes over the instructor's skis, they can do a maneuvering motion with poles or hips to turn out of the tracks.

C. Once the skiers are comfortable skiing in straight tracks, choose a moderate corner to practice poling and leaning to keep the ski in the track. Typically, it is helpful to pole to the outside of the turn with the outside pole. Some skiers like to lean forward. This lowers center of gravity, adding stability, but also moves weight forward which may not be ideal in all situations. Try different areas and see what techniques are helpful in each place. See lesson 8 for downhill cornering in the track.



Additional Drills

Popping out of Tracks Once skiers have good maneuvering skills, they can try lifting themselves out of tracks. Ideally in a flat area with straight tracks, skiers can get speed up in the tracks and then in place of a normal pole stroke, they can lock their elbows to their torso and push down on their poles as they contract their core and lift or “pop” out of the tracks. This movement needs to be done quickly and fluidly to be effective. It is best to start in shallow or softer tracks to begin, and work up to deeper or hard set tracks. Once a skier has this skill down, they can challenge themselves to see how many times they can pop in and out of tracks in a certain section of trail. Try it on a corner next. When is it easier to do on a corner and when is it harder?

6. Uphills

Skier Goals Learn how to adjust poling technique and tempo to adjust to variable terrain.

Skills Progression

- A. Uphill double poling
- B. Changing tempo

Methodology

A. Skiers should adjust arm position for uphill double pole by decreasing the elbow angle (arms are not as extended in front). Remind skiers to use available core for 'crunch' motion to power double pole. Core, shoulders, and arms all work together for power.

B. Have skier increase tempo as hill steepens; arms will be closer to body as hill gets steeper. Decrease follow through but still relax hands briefly. Choose a hill and divide into sections with cones. Assign different tempos to each section (ex- higher tempo as hill gets steeper). Change up sections so skier has to adjust and force different cadences.



Additional Drills

Locked-arm double pole Skier keeps elbows at a set angle, close to the body, and practice using shoulders/core to power double pole. Arms should remain rigid. Try on different pitches. This is a great drill to do to remind skiers how to best use their core. It can also be done on a flat as part of a beginner lesson progression.

7. Side Hills

Skier Goals Apply maneuvering skills to optimize balance and efficiency on terrain with side hills. Skier will also learn to choose best line by recognizing and using fall line/trail aspect.

Skills Progression

- A. Side hill body position
- B. Side hill poling
- C. Fall line approach

Methodology

Side hills are a challenging aspect to sit skiing, because the slope of the hill tends to pull the ski downhill, often in a direction the skier does not want to go. It should be noted, however, that sometimes side hills can be helpful to a sit skier if it does push them in a direction they are going. If it does not, the skier must counteract the slope by both technique and approach to the terrain.



A. To counteract the effects of a sidehill, a skier should lean into the hill, angling their torso, often planting low side pole at a slant to provide more leverage against the slope of the course. Choose a slight sidehill and have skiers play around with angles of the torso. How much of an angle is needed to keep the ski from sliding downhill?

B. The low side pole basket should be angled away from ski, much as it would while working a corner. Have skiers ski back and forth across a section, so they can practice both sides. Have skiers try out different poling tempos, as they cross the side hill. How does this effect the direction of the ski?

C. When choosing a line to ski down the course that has a side hill, the most direct approach (which would usually be used by standing skiers), is often not the best option. An indirect line which take side hill into account may be a longer distance but will help to keep skier in control and skiing efficiently. In a place with a gradual downhill with a side hill that has a open run out, have skier start by moving down the hill without poling or maneuvering to feel and see where the terrain naturally takes them. This will help them understand the concept of a fall line and get them accustomed to looking for it. Now they can approach a sidehill section from different angles, thinking about all possibilities in terms of their relation to the fall line. A line that makes a "V" pattern may be a more effective way to ski from one point to another (rather than a straight line) if it uses the fall line or side hill to help maneuver. What is most comfortable? Fastest or most efficient? Once they are comfortable with their best line, challenge them to try a line that is less than ideal. What do they have to do to compensate?



8. Downhills

Skier Goals Maintaining balance and control as speed increases on downhills; using hands or poles to slow/break ski; turning or cornering on a downhill.

Skills Progression

- A. Balance carrying speed
- B. Braking with poles/hands
- C. Downhill cornering

Methodology

A. Find a short, gradual hill with a long run-out and no obstacles or side hills. Skiers should let the skis run/glide, without trying to turn or brake. Have them repeat the downhill, playing around with leaning forward and backward. What position is most stable? Which direction does the ski naturally go, without any maneuvering? If a skier understands where the terrain wants to take them, they will be better equipped to understand where they need to line up for the downhill, either to avoid a terrain feature or use the feature to help them complete the downhill most effectively. As they get comfortable with the downhill, have them try it with more and more speed.

B. As they did in the beginner progression on a flat area, have skier try braking/slowing the ski by using either the top of the pole handle or baskets, dragging as much as necessary to brake or stop. If skier needs to use this braking technique on a corner, the skier should use the inside hand to brake and the outside pole to push to the outside of the corner, so the ski simultaneously slows and turns. Quick stabbing motions can be more effective for tight corners, but skiers should try different techniques and find what works best in different situations.

C. Downhill cornering can be approached in many ways, depending on ability and experience. On a very slight downhill, have skiers build up speed, shift weight over each side/ski without edging. Does anything happen to the sit ski? Have the skier play around with their hand position while going around the corner, like keeping inside hand reaching in front or laterally on the inside. Encourage the skiers to feel how different positions carry speed around the corner, or help or hinder stability. Skiers should start to see their sit ski move as they hold an edge. It is important to keep in mind that when maneuvering, especially when unpredictable things happen, momentum is often helpful, although counter-intuitive. When a sit skier becomes out of balance, the instinct is to slow down. However, most situations can be resolved by having the skier put in a few strong pole strokes to stabilize. This also has the added benefit of maintaining the best possibility to maneuver out of tricky situations. Braking puts a skier in a position where their options are limited. This is one of the trickiest things to learn so frequent reinforcement is often necessary.



Additional Drills

Cone Drill Now, place a cone in the run-out zone of the hill you have been working on (in steps a, c), and have the skier turn the ski around the cone while carrying some speed. Make sure skiers start low on the hill, so they are not carrying too much speed for the first few attempts. Skiers can combine turning on edge, poling turns, and breaking with baskets or grips to negotiate turn. There will be an infinite number of ways to approach a turn, so have skiers try out different techniques. This will require a lot of trial and error. As the skiers hone their skills and gain confidence, have them move their starting point up the hill, so they are carrying more speed as they approach the cone and make a turn. You can continue to add cones, creating a downhill slalom course to reinforce the concepts. Make some turns closer together and have skier test out how they might employ different maneuvering, braking or poling techniques depending on all the different variable of each turn.

Note on Progressions

This teaching progression covers a lot of the basic skills required for ski skiing. As you plan lessons or clinics, you will probably want to focus on a few aspects of this progression; often, it is better to spend more time doing fewer things, allowing the skiers to gain confidence and feel they have improved. That being said, some skiers will progress quickly, so be prepared to advance through steps faster than anticipated. Hopefully, this manual will provide you the tools to instruct and plan sessions that are engaging and fun for everyone involved.



CONCLUSION

Hopefully this manual has provided a glimpse into Nordic sit skiing and can be a resource for you moving forward. Of course, the best way to hone your skills as an adaptive instructor or coach is to get hands-on experience. Regional and local skiing organizations are a great resource. General ski technique skills will help you become a better skier and instructor and give you more tools to experiment with in a sit ski. We can't emphasize how important it is to get comfortable in a sit ski yourself. Along with regular communication with your sit ski student, there is nothing better you can do to improve your understanding of the sport. These organizations and programs often provide volunteer and instructor training as well as other opportunities for you to use your new skills.

As you continue on this path, don't forget the benefits of sharing what you know and learning from others. Take some time to ski with people with different skills, or work with a coach or instructor who might have different teaching methods or strengths than your own. Expanding your own skill base is a great way to improve as an instructor. Try teaching a fellow instructor a new concept or method before bringing it to a lesson. Collaborating and working through a process will only help you further understand how best to facilitate learning.

As an instructor you will experience a wide range of interest and abilities. Hopefully, you will come across skiers who want to continue learning and pursuing the sport. See Appendix A for more info on organizations that will provide avenues for pursuing both the sport of sit skiing and instructing sit skiing.

APPENDICES

Appendix A. Para Sports Organizations

The International Paralympic Committee (or IPC) is the international governing body for Paralympic sports. The Paralympics are the highest level of sports competition for people with physical disabilities. Some types of impairments necessitate completely different categories within competition (i.e. sit skiing), while other adaptive athletes could compete in both mainstream and adaptive classes. The national governing body for para Nordic skiing is U.S. Paralympics Nordic Skiing. The Nordic National Team competes in both cross-country and biathlon competitions. More information on camps, competitions, qualification, and other resources can be found at www.teamusa.org/US-Paralympics/Sports/Nordic-Skiing

National Adaptive Organizations with Local/Regional Chapters:

U.S. Paralympic Regional Organizations & Local Paralympic Sport Clubs
<http://findaclub.usparalympics.org/>

Disabled Sports USA – Chapter Information
<http://dsusa.org/chapter.html>

Appendix B. Common Disabilities Associated with Para Nordic Skiing

AMPUTATIONS Congenital, surgical or traumatic loss of a limb or part of a limb.

Look for the hidden causes: if due to cancer, recent or current, chemotherapy may cause fatigue or impaired temperature control. If amputation is due to Diabetes, the individual may lack sensation in other areas (often hands or feet), plus may need to eat or take medication on a certain schedule. Injuries resulting in amputation may encompass other hidden disabilities for example, minimal brain damage, need for a bladder control device, or hearing impairment. The residual limb (stump) needs to be protected while skiing. An ace wrap should be applied to prevent swelling and/or the limb should be padded and covered to avoid damage from falls or cold. Deciding whether or not to ski with a prosthesis is determined by considering the length of the residual limb in addition to advice from a prosthetist to be sure it is strong enough to withstand the stresses of skiing.

AK: Above knee - usually skis without prosthesis.

BK: Below knee - An agreed upon guideline is if the stump is four inches or longer and the skin is in good condition, the individual may ski with prosthesis.

AE: Above elbow

BE: Below elbow

Hip Disarticulation: Amputation at the hip joint, this preserves the pelvis and the soft tissue to the buttocks - usually skis without prosthesis

Syme's: Amputation at the ankle.



HP: Hemipelvectomy - The most severe level of amputation. This amputation includes half of the pelvis and the limb leaving, only the soft tissue of the buttocks.

Shoulder Disarticulation: Amputation at the shoulder joint.

Bilateral: Amputations on both sides. This can include: 1) amputation of both legs, 2) amputation of both arms, 3) amputation of an arm on one side and leg on the other (arm and leg amputees usually ski on one ski with one outrigger).

MULTIPLE SCLEROSIS (MS) A progressive disease that causes the myelin sheath around nerve cells to disappear so that they no longer transmit the necessary signals. The disease may go into remission, but generally worsens over time (varies from individual to individual). It occurs more often in women than men; initial onset is usually in the late twenties or early thirties. Fatigue and heat tends to make the symptoms worse. Muscle paralysis may be partial or full in any limb and loss of sensation may also be partial or full in any area. Visual problems are very common.

MUSCULAR DYSTROPHY (MD) A progressive degeneration of muscles. Caused by a defective gene that is passed from parent to child. MD is more prevalent in boys.

Duchenne Type: The most common and most severe form of MD. Onset is usually between ages 3 - 10. Males are affected more than females. Generally a delay in learning to walk with frequent falls. A waddling gait is usually apparent by 6 years of age.

Facio-Scapular-Humeral Type: The most common form of MD in adults. Symptoms do not appear until adolescence and are not recognized until adulthood. Prognosis is good. The disease may arrest itself at any stage. Effects facial, shoulder, and arm muscles.

Limb Girdle Type: This type may occur at anytime from age 10 or after. The onset usually occurs during the second decade. Both genders are equally affected. Effects movement in upper/lower extremities including ability to move.

Mixed Type: Rapidly progressing and usually fatal within five years. Affects all voluntary muscles.

NEUROMUSCULAR DISEASES A group of central nervous system diseases affecting the motor system, causing weakness or clumsiness with voluntary motion and involuntary movement. These diseases include: Huntington's Disease, Parkinson's Disease, Friedreich's Ataxia, Amyotrophic Lateral Sclerosis (ALS), Guillain-Barre Syndrome, and Myasthenia Gravis.

POLIO Muscle weakness or paralysis in any specific muscle or muscle groups caused by the polio virus. The involvement is specific to each person.

POST POLIO SYNDROME A progressive, degenerative disease impacting nervous and skeletal systems. The disease can be disabling since resulting problems are added to preexisting damage that occurred at the initial polio infection. There is no cure. Symptoms include: fatigue, muscle atrophy, muscle spasms, disc disease, and nerve damage resulting in muscle weakness, scoliosis, and other symptoms.

STROKE Cerebrovascular accident (CVA) Interruption in circulation to the brain that diminishes oxygen supply and commonly causes serious brain damage. Typically individuals will suffer from hemiplegia (one-sided paralysis) of either upper or lower extremities or both. Balance may also be an issue. Some stroke victims have difficulty speaking or processing auditory input.

SPINA BIFIDA A birth defect resulting in abnormal development of the spinal column during the early stages of pregnancy. The covering over the spinal column forms a sac-like pouch, the vertebrae fail to enclose the spinal cord, which may affect the connection between the brain and the spinal cord. Damage may occur anywhere along the spinal canal. Disability may range from weakness in the legs to full paraplegia with trunk weakness.

SPINAL CORD INJURY Spinal cord damage due to some type of insult to the spinal cord, such as trauma, infection or tumor. Individuals are classified as complete or incomplete based on preservation of function in the S4/5 spinal segment. *See Appendix B for more specific information on levels of functioning

Paraparesis: Partial paralysis affecting the lower limbs.

Paraplegia: Paralysis of lower portion of the body and of both legs.

Quadriplegia (also called Tetraplegia): Paralysis of all four extremities and usually the trunk.



Appendix C. Spinal Cord Diagram and Injuries

The Spinal Column is divided into five regions.

1 Cervical Region (Neck) This region contains the first seven vertebrae and the first eight spinal nerves.

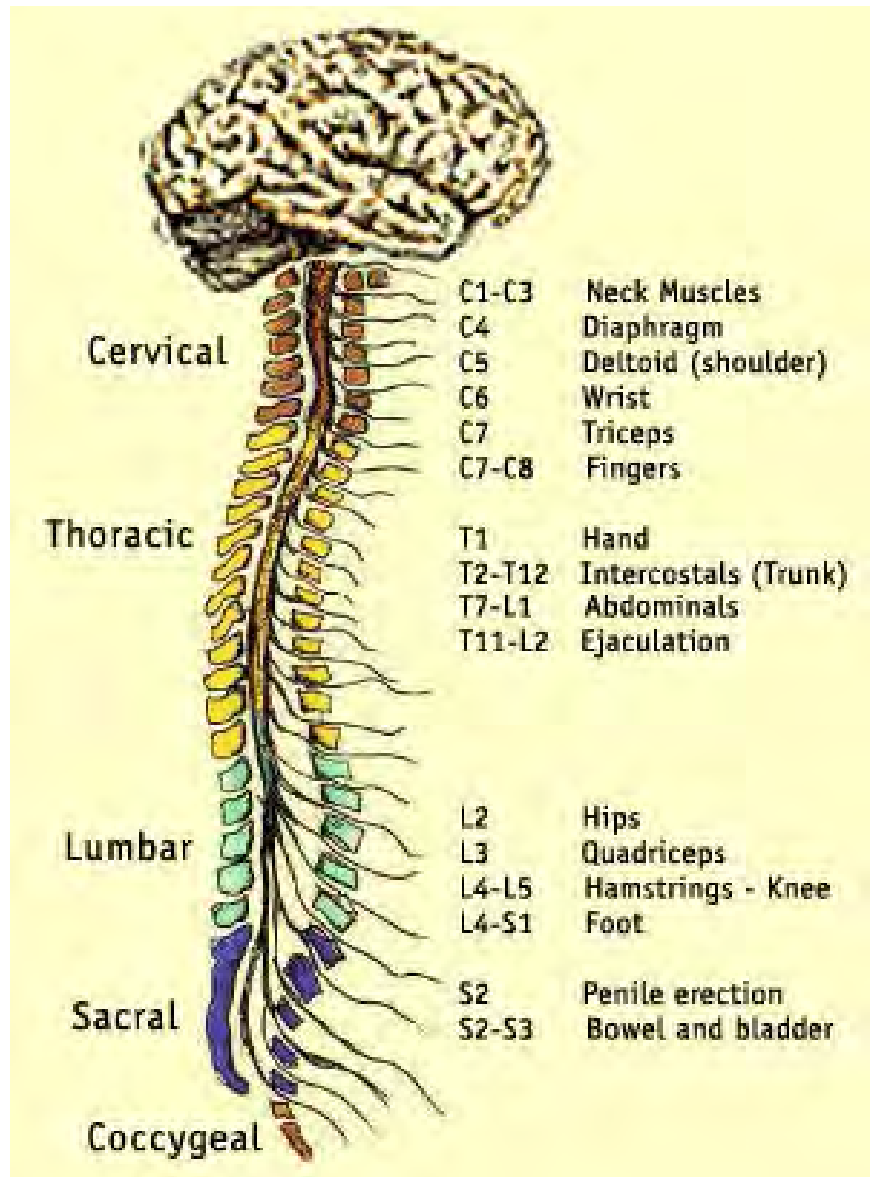
2 Thoracic Region (Chest) This region contains the next twelve vertebrae and the next twelve spinal nerves.

3 Lumbar Region (Lower Back) This region contains the next five vertebrae and the next five spinal nerves.

4 Sacral Region (Tail Bone) This region contains the next five vertebrae fused into one and the last six spinal nerves.

5 Coccyx This region contains four vertebrae fused into one and no spinal nerves.

Damage that occurs in the cervical region is described as quadriplegia. Damage in either the thoracic, lumbar or sacral region is considered paraplegia. Approximately 50% of all spinal injuries cause quadriplegia.



Individuals are classified as complete or incomplete based on preservation of function in the S4/5 spinal segment. However, the function of each individual will vary depending on the level and severity of the injury and the spinal segment where it occurs.

Some of the most common levels of injury are C5-C6, T6-T7 and T12-L1.

Appendix D. Link to World Para Nordic Skiing rules and regulations

<https://www.paralympic.org/nordic-skiing/rules-and-regulations/rules>

NOTES





