



Occupational Health
Clinics for Ontario
Workers Inc.



Snow Removal Ergonomics

2nd Edition

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Introduction

As Canadians, we're accustomed to shoveling snow whether it is required to get out of the driveway to get to work or as part of our regular job duties. **How much thought do employers and individuals put into buying a shovel or on shoveling techniques to reduce the risk of injury?**

Answer: Not much... Snow removal is often completed in a rush to get to work on time, or to finish as fast as possible.

The good news is that 15 minutes of ***light*** snow shoveling is considered moderate physical activity (ACSM, 2005). According to Canada's Physical Activity Guide we should all aim for at least 60 minutes of daily moderate physical activity of some kind.

The bad news is that research has shown an increase in the number of fatal heart attacks among individuals shoveling snow following heavy snowfalls. This rise may be due to the sudden demand that shoveling in cold weather places on an individual's heart and body. ***The first large snowfall of the year poses a major risk for those unaccustomed to exercise. The rate of heart attacks tends to be higher after the first big snowfall.***

Why not just rush out and buy a snow blower?

Not everyone who shovels snow will suffer an injury or a heart attack. Snow shoveling can be good exercise when performed correctly and with safety in mind.

Who should think twice about shoveling snow?

- People who have existing health problems, or injuries.
- Older individuals.
- People who are at risk for a heat attack, including:
 - Anyone who has had a previous heart attack.
 - People with family, or personal history of heart disease, high blood pressure or high cholesterol levels.
 - Smokers.
 - People leading a sedentary lifestyle.



If you fit any of the above criteria, or have any concerns about the effects on your body that result from shoveling snow, please consult a physician before winter begins.

Prior to Shoveling

- * Avoid caffeine and nicotine: These are stimulants that place extra stress on the heart.
- * Avoid eating large meals: This places extra demands on the digestive system and can lead to stomach cramps.
- * Drink plenty of water: Dehydration is just as big an issue in cold winter months as it is in the summer.
- * Dress in several layers: You will be able to remove a layer as needed. Ensure that you dress warmly in cold weather. Remember that extremities, such as the nose, ears, hands and feet need extra attention when it is cold outside. A scarf or other face protection can be placed over the nose and mouth to avoid breathing cold air. ***Don't forget about the wind chill!***
- * Wear proper footwear: Boots with slip-resistant soles or anti-slip cleat attachments can help to minimize the risk of slips and falls (to be discussed in further detail).

Warm up: Before beginning any snow shoveling, warm-up for five to ten minutes to get the joints moving and increase blood circulation. To do this, march on the spot, climb stairs, or go for a quick walk around the block. Taking a warm shower to loosen stiff muscles and joints can also be quite beneficial.

Stretch: After warming up, perform gentle stretches for the back (ie. knees to chest), arms and shoulders (ie. body hug), and legs (ie. forward bends from a seated position). This will ensure that your body is ready for action.

Your back is especially vulnerable when you first wake up. Back muscles stiffen while you sleep. If you attempt to exert yourself shortly after getting out of bed, you increase the risk of injury. If you plan to head outside to shovel the driveway after waking up warming up is critical. Therefore, be sure you warm up your lower back first!

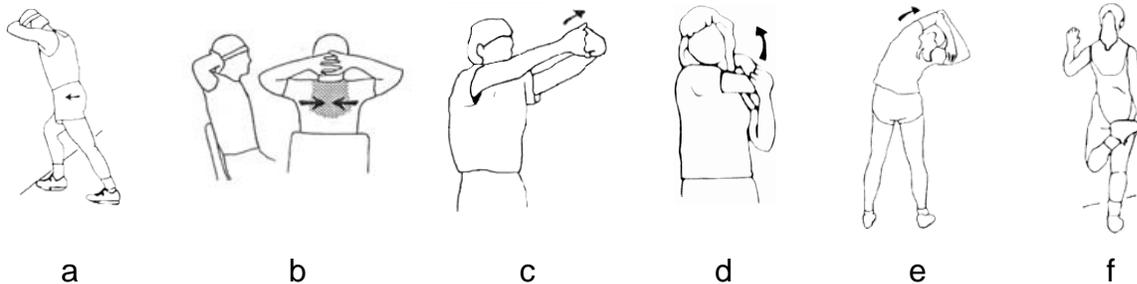


Figure 1(a), (b), (c), (d), (e), & (f): Leg, back, and arm stretches

Picking the Right Snow Shovel

The most important features of a shovel include:

Weight – Use a non-stick, lightweight polyurethane (plastic) shovel with a maximum weight of 1.5 kg (3 lbs). Avoid metal shovels as they are too heavy.

Length – Ideally, the handle should come up to the user's chest (about the height of the breast bone) in order to reduce forward bending that may stress the lower back muscles. An adjustable handle will allow for each user to obtain the appropriate height, but are very rare.

Shaft Type – Shovels with a bend in them, as opposed to the straight, broomstick style, are easier on your lower back when used correctly. The principle for this design is to adopt a more comfortable stance while the contoured handle allows you to reduce



a): Regular straight shaft
b): Ergonomic style shaft

forward bending. Studies have shown that these ergonomic shovels reduce muscle activity and loading of back muscles.

Caution must be used when considering the purchase of an “ergonomic” product. This term will frequently be used for products that only change the demands on the body rather than reducing them entirely. For example, the tools on the right are designed to reduce the amount of forward bending required to lift snow, however; each has their own specific ergonomic concerns. a) This shovel transfers the demands from the back to the shoulder and requires an awkward arm posture and forearm twisting to unload the shovel. b) This shovel requires a forceful downward pushing motion produced by the neck, back, shoulders and arms to unload the snow. These demands, though different from traditional shoveling, still present enormous risks of injury.



a): Shovel with dual handle
b): Shovel on a large wheel

NOTE: A standard shovel is still a better option than most other snow removal methods.

Handle Type – Snow shovels typically have a “D” shaped handle. Many new shovels have “odd” shaped handles that can force the wrist into awkward positions. Caution should be used with these types of handles.



(a): “D” shaped handle.
(b): New handle design

Blade size/shape – A larger, push style shovel will allow for large amounts of snow to be moved. When used first, the snow can be pushed to the sides of the driveway, thus reducing the amount of lifting that is required. **WARNING: If this style of shovel is used to lift and throw the snow, as well as in moving wet or packed snow, the larger scooping ability becomes problematic.**



SOLUTION: A smaller blade shovel (10-14") should be used for lifting and throwing snow. The smaller blade will decrease the amount of snow that is lifted, decreasing the risk of injury. If a smaller blade shovel is not available, then use a larger blade shovel and only fill it half full to avoid lifting too much snow.



Plastic shovel with a metal edge

Shovels that have a metal edge for added durability will likely dig into snow packed sections or catch on uneven surfaces (such as interlocking brick, cracked driveways, etc.). When this occurs, the shoulders, neck and back are jarred from the unexpected abrupt stop. This can lead to an injury if you are working on these types of surfaces. Also, the blade often catches and many users will bend over awkwardly to stop the blade from grabbing. This is why this type of shovel should be avoided.

Using the proper tool for the job can help to get the job done faster and easier while placing less stress on the body!

Hint: If snow is sticky, spray your shovel with Teflon or cooking oil or apply a layer of car wax to prevent the snow from sticking to it.

Snow Removal Tools

Snow scoops are effective tools that allow an individual to move large quantities of snow at one time. To avoid injury be cautious when using this type of tool:



- Push the scoop, pulling causes strain in the back and neck.
- Do not lift the scoop, pushing it forward quickly and stopping, or tilting it gently will allow the snow to slide out. Many people use their knees to help push and lift the scoop, this should be avoided.
- The handle should also allow the user to scoop in an upright position with arms bent at 90°. A bent handle is better than a standard handle.

- When working with wet or packed snow, do not fill the scoop, as the weight of this type of snow will make a full scoop much harder to move.
- Some of these shovels come with a metal strip on the edge to help scrape ice and packed snow. Scraping should be avoided at all times with this type of shovel, use a smaller shovel designed for scraping.
- Take frequent breaks every 15 minutes
- Start piles as far back as possible early in the winter.

Ice choppers are another commonly used tool that presents a unique set of demands.

- Repeated forceful contractions and vibrations are generated in the arms and shoulders.
- The best way to avoid injury using this tool is to take frequent breaks, and break-up tasks rather than trying to chop all the ice at once.
- Use salt to soften, or reduce ice before chipping, or wait until the sun has come out as this may soften the ice.
- Use 2 hands to chop ice. This will reduce overuse and excessive force on one arm because the work is shared by both arms.



Ice chopper

Shoveling Techniques

What is the recommended rate for shoveling?

According to the Canadian Centre for Occupational Health and Safety (CCOHS), the recommended rate for continuous shoveling tasks is considered to be around 15 scoops per minute. Tasks involving continuous shoveling at this rate should not last for longer than 15 minutes at a time, followed by a rest break of at least 2-3 minutes in optimal weather conditions and up to 15 minutes for very cold weather.

What is the recommended weight to be lifted?

The load lifted should be adjusted according to the shoveling rate. For a high rate of shoveling (15 scoops per minute) the total weight (shovel plus a shovel load) should



not exceed 5 to 7 kg (about 10 to 15 lbs). For a lower rate (less than 10 scoops per minute), the load can be increased to a maximum of 11 kg (about 24 lbs).

Remember to adjust the amount of snow shoveled depending on the type of snow, as well as the weather conditions. For wet or compacted snow, reduce the shovel load and amount of scoops per minute since this type of snow can be very heavy.

For example if an individual were to clear a 16ft by 30ft driveway covered in one foot of wet snow, they would be moving approximately four tons of snow!

Weight of Snow per Cubic Foot				
	Light/Dry Snow	Wet/Heavy Snow	Compacted Snow	Ice
Snow Density (lb/cu ft)*	<i>3 lb/cu ft</i>	<i>21 lb/cu ft</i>	<i>30 lb/cu ft</i>	<i>57 lb/cu ft</i>
Snow removal guidelines for each snow type.	<i>Follow CCOHS guidelines. Take breaks, cold stress can still be harmful.</i>	<i>Follow CCOHS guidelines. Take frequent breaks, get help if needed, and do not lift full shovel loads.</i>	<i>Follow CCOHS guidelines. Take frequent breaks, get help if needed, and do not lift full shovel loads.</i>	<i>Follow CCOHS guidelines. Break up ice, do not move full loads or large chunks of ice.</i>

(* lb/cu ft: pounds per cubic foot)

What is the recommended throw height and distance?

The throwing height should not exceed 1.3 meters (approximately 4 feet). The optimal throw distance should be no further than 1 meter (approximately 3 feet). The load should be reduced if the task requires a longer, higher, or an accurate throw.

What are guidelines for shoveling?

The Canadian Center for Occupational Health and Safety (CCOHS) has created guidelines for shoveling. These guidelines apply to any type of shoveling and are particularly helpful in illustrating how snow should be thrown. These guidelines should be taken into consideration especially when dealing with packed snow, wet snow, or ice.

			
Keep feet wide apart. Place front foot close to shovel.	Put weight on front foot. Use leg to push shovel.	Shift weight to rear foot. Keep load close to body.	Turn feet in direction of throw.

Safe Snow Removal Tips

Clear snow early and often.

- When possible, shovel throughout a snowfall. Snow is usually lighter and easier to move after it has just fallen.

Pace yourself.

- There is a huge amount of physical stress placed on your body and heart from shoveling in cold weather – starting slow and maintaining a steady pace will help reduce physical stress.
- Do not try to lift or move heavy loads of snow at one time. Lift smaller amounts when snow is heavy, and take rest breaks every 15 minutes!!!
- **DO NOT HOLD YOUR BREATH WHEN LIFTING.** Breathe in while lifting and blow out while throwing.

Watch your footing.

- Keep your feet hip width apart for balance and keep the shovel close to your body.

- Avoid trying to throw snow too far in slippery conditions as it is easy to lose your balance/footing.
- Look out for ice patches and uneven surfaces under the snow or on the ground that can cause you to slip and fall.
- Anti-slipping footwear/cleats may be beneficial to those who are prone to losing their footing or falling during winter months.

Push, rather than lift.

- Push snow away rather than lift it, especially when wet, or heavy.
- One of the best techniques is to push the snow from the center of the driveway to the sides and lift the snow from there. This reduces additional strain on the back from lifting and throwing.
- Push snow with a wide blade shovel and lift and throw with a small blade shovel

Use your legs.

- When lifting snow, fill your shovel no more than half full. *Avoid using your back to lift.*
- Bend your knees, keep the back straight, tighten your stomach muscles and lift with your legs. Scoop small amounts and walk to where you want to dump it.

Avoid awkward throwing postures.

- DO NOT TWIST!!
- Do not reach back to push snow (i.e. walking backwards while pushing or lifting snow).
- If you need to move the snow to one side, reposition your feet to face the direction the snow will be moved.
- Always face the snow you are shoveling.



Shoveling stairs.

- Avoid twisting to access the snow or throwing it to the side or over the shoulder.
- Stand lower than the step you are shoveling and pull the snow towards you. Repeat this until you reach the bottom step. This will give you adequate space to safely scoop and lift the snow.



Shoveling Decks.

- Avoid throwing snow over railings. To remove snow from deck push it to the steps and then follow the procedure for shoveling stairs.
- Avoid using a snow blower on your deck. They are usually very heavy and injuries can occur from lifting them, especially if you are alone. **DO NOT USE OR MAKE RAMPS.**

Clearing off rooftops.

- Prevents ice and snow build up that can lead to roof leaks and roof collapse.
- Snow is typically removed through the use of roof rakes or, by getting on top of the roof and shoveling.
- Using a roof rake eliminates the risk of falling from the roof but, places a large demand on the shoulders, arms and neck.
- When shoveling on a roof the same body mechanics should be used as when on the ground with an added emphasis on pushing rather than lifting the snow.
- Extra care must be given to the footing while working on a roof to avoid falls. ***The use of a fall arrest system is highly recommended to avoid falling off of the roof.***

Roof Rakes

- Pulling snow, shaft length, and awkward design of the rake cause excessive strain while working overhead.
- ***Remove snow as soon as possible from your roof. Do not let it pile up. This will allow for a reduction in the physical demands on the body each time snow is removed.***
- Remember to take frequent breaks, and stretch the arms, neck and shoulders before, during and after this activity.
- Avoid using a roof rake from a ladder. Instead, pile up snow to stand on as this is a much safer alternative.



Shovel Smart!

- ❄️ **Listen to your body.** If you begin to feel sore while you are shoveling, you may be overdoing it. Take a break and come back to the task. If you become sore after shoveling, take a hot bath, get a massage, or take a pain reliever. If you still do not feel well, see your doctor.
- ❄️ **Watch for signs of a Heart Attack.** Many people die from heart attacks because they did not seek medical attention quickly enough. Be familiar with the signs and symptoms of a heart attack. If you experience any of the following symptoms, stop shoveling and contact your physician immediately, or call 911.
 - Shortness of breath and difficulty breathing (#1 sign)
 - Pain
 - Sudden pain or discomfort that does not go away with rest. The pain may feel like: burning, squeezing, heaviness, tightness or pressure
 - The pain may be in the chest, neck, jaw, shoulder, arms or back
 - Tingling, pain, or numbness in the left arm.
 - Chest pain or discomfort that is brought on with exertion and goes away with rest
 - In women, pain may be more vague
 - Nausea
 - Sweating (i.e. cool, clammy skin)
- ❄️ **See what you are shoveling.** Do not let a hat, scarf or foggy glasses block your vision. Use protective eyewear such as sunglasses or safety glasses in windy conditions, or when using a snow blower.
- ❄️ **Take frequent breaks.** Stop shoveling, move around to stay warm or go inside if necessary. Make sure you drink water or a sports drink to stay hydrated.
- ❄️ **Ask for help with large amounts of snow.**



- ❄️ **Pay attention to weather reports.** Get important details on snowfall such as: how much is expected, when it is expected, what time it will occur, and how cold it will be while you are outside.
- ❄️ **Think ahead of time.** Plan where you can put shoveled snow to avoid large piles later on in the winter. Packed snow is much heavier than fresh snow, and high snow banks will force you to throw snow higher and farther.
- ❄️ **Give yourself time.** Get up earlier on workdays to avoid rushing to shovel your driveway to get to work on time. Rushing can reduce your attention to detail and cause injury from slipping on ice, lifting improperly, lack of rest breaks, etc.
- ❄️ **Snowplow tricks.** Shovel the snow at the end of your driveway as soon as the snowplow passes by. The sooner the slush, snow and ice from the snowplow are removed the easier it will be to move. If you wait, the snow can turn to hard packed ice and will be harder to move. Remember to take frequent breaks when shoveling the end of the driveway since the snow is heavier. At most, lift half-filled shovels and walk to where you want to place it.
- ❄️ **Cool Down.** Just as you would after a workout, follow your shoveling session with a cool down. Stretch the same muscle groups as in the warm up, paying extra attention to any muscles that feel sore or tight.

A Word on Snow Blowers

If you are using a power driven snow blower, operate it at a speed that allows you to maintain control and a good body position as you walk behind it. Ensure that you are standing upright with a neutral back posture and let the snow blower do the work.



If the snow blower is not self propelled, stay behind it while pushing it forward; avoid pushing out to the sides or pulling; let

the machine set the pace, do not try to move more snow than it can handle.

Keep the following safety tips in mind when snow blowing:

- Never use your hand to clear the chute, or blades of a snow blower.
- Do not attempt to lift or tip a large or heavy snow blower alone – get help. If it gets stuck, get help to move it.
- Point the chute away from yourself and any bystanders.
- Do not operate a snow blower on a sloped surface, and be aware of ditches, curbs, and other changes in elevation while removing snow.
- With electric blowers be mindful of where the power cord is at all times.
- ***Follow all warnings, and manuals supplied by the manufacturer!***



Other factors to keep in mind:

- Snow blowers can create harmful vibrations when in use. To reduce vibration exposure, take breaks every 10 – 15 minutes, or if any discomfort is experienced.
- Avoid bending forward while operating a snow blower.
- Earplugs are recommended when using a snow blower.
- Do not rock the snow blower back and forth if stuck as this increases the risk of arm, neck and back injuries.
- Make sure that your arms are slightly bent at the elbow, and that the wrists are straight.

Important Note: *A study in Detroit identified 43 heart attacks after a series of snowstorms. These heart attacks were all attributed to physical exertion, and 36 occurred while removing snow. Several of these heart attacks occurred while using a snow blower...*

This helps to illustrate that while snow shoveling can lead to a heart attack, using a snow blower does not eliminate the possibility of suffering a similar fate while removing snow.

Take Home Message...

Snow removal is an inevitable part of life for many Canadians. It can be a great physical activity, but it can also become a very dangerous activity if not prepared for, or done properly. Planning ahead of time is necessary to ensure safe snow removal. Make sure that you, warm up first, take your time (especially after the first big snowfall), have the proper tools, dress properly, take frequent breaks, stay hydrated, and know when to stop. By planning ahead of time and being prepared for all possible conditions snow removal can be great exercise. Before you shovel snow, or use your snow blower this year, remember to be prepared. Have a well thought out snow removal plan to ensure a safe and healthy winter. Consider starting a physical training program, or consulting a physician before winter begins to ensure that your body is prepared for the demands of snow removal.

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