Prior planning, conditioning will help reduce injuries on the slopes

Since its inception in the 1960s, snowboarding has become a popular alternative to alpine skiing. In fact, of the more than 19.7 million Americans in 2010 participating in "sliding snow" sports, 41% were snowboarders—aka "riders" or "shredders." While both sports share the snowy slopes, there are differences when it comes to injuries, age, experience and gender, according to an 18- year study recently published in the *American Journal of Sports Medicine* (AJSM). Knowing and understanding these differences gives snowboarders, skiers, equipment manufacturers, ski resorts and medical personnel important insight that ultimately will help make the sports safer and more enjoyable.

The study, a first of this magnitude and duration for these sports, collected information between 1988-2006 on injured snowboarders and skiers in a Vermont ski resort base-lodge clinic. It also allowed researchers to assess whether the introduction of terrain parks in 1998 increased the incidence of injury compared to standard slope terrain.

In keeping with findings from previous studies, the Vermont study researchers found wrist injuries (contusion, sprain, fracture) the most common for all snowboarders (28%), but only 3% for skiers. Conversely, skiers' No. 1 injury (28 %) involved knee ligaments (anterior and posterior cruciate [ACL/PCL], and medial and lateral collateral ligaments [MCL:/LCL]), whereas only 6% of snowboarders' injuries involved knee ligaments. Of those snowboarders with knee ligament injuries, 33% occurred when only one foot was attached to their board. This is significant when compared to all other snowboarding injuries (7%) when only one foot was attached to their board. Also, a majority of ACL injuries (60%) in snowboarding occurred in terrain parks.

Clavicle (collarbone) fractures comprised 4% of all the Vermont study snowboard injuries and only 2% for skiers. Snowboarders in terrain parks accounted for 44% of the clavicle fractures most commonly caused by hitting the snow following a failed jump. Male snowboarders incurred the most fractures (94%). They also had a majority of snowboarding injuries (68%).

The researchers' trend analysis revealed an increased incidence of clavicle fractures and a decrease in MCL and ankle injuries among snowboarders over time. Skiers had a decrease in thumb metacarpophalangeal-ulnar collateral ligament (MCP-UCL) injuries and MCL knee injuries over time. They also found a decrease in serious closed head injuries, or traumatic brain injuries, believed to be because of the increase use of helmets over time

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Unrelated to the Vermont study, but supported by other past studies, is that physical conditioning can impact injury rates—that is, the better shape a skier/snowboarders is in, the less frequent the injuries. If you are planning a ski/snowboarding trip, or just going to enjoy the sport on a nearby run, consider adding specific conditioning exercises now. Incorporating a few extra exercises to your weekly routine can help increase your strength and endurance and minimize injuries. For example, exercises such as single leg squats, tuck jumps, plank reaches and side lunge high knee crossovers will help strengthen leg muscles to help protect your ACL.

If you want to work on more general conditioning, add upper and lower body exercises. For better balance and to increase the exercise difficulty, include single leg exercises to your routine. Also, do as many repetitions as you can. Increase time or add resistance as you progress. To improve your core, add exercises such as planks and side planks for time varying arm and leg movements as you increase difficulty and the length of time you perform the exercises. Remember, before starting any exercise or conditioning program, or even getting on the slopes, you need to warm up thoroughly. Hitting the slopes when muscles are stiff or fatigued is an injury waiting to happen.

Snow conditions also can affect injury patterns. Hard pack snow generally yields high-speed and impact injuries. Powder and heavy snow is associated with more twisting injuries. Quick changes in snow conditions, such as hitting the line between groomed and ungroomed snow, may cause a fall that leads to an injury.

Another factor contributing to snowboarding and skiing injuries is equipment. Boot binding is the most common cause of equipment-related injuries for skiers. When you rotate and torque your leg at the same time, the force is transferred from the ski and boot through the stiff binding to the next moveable joint—the knee—making it most susceptible to injury. Newer bindings that release in a multidirectional pattern have decreased the incidence of fractures by more than 80%, but knee ligament injuries have actually increased over the last 20- 30 years. Bindings continue to improve, so if you have only one piece of equipment that is new it should be your ski binding.

Bindings for snowboarders are different from those of skiers. On skis, each leg moves and twists independently of the other leg. A snowboarder has both feet attached to the same board and therefore most twisting forces that occur will turn the whole body as one—both legs and trunk moving in the same direction limiting the amount of torsion on the lower extremities. Because the

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body usually turns as one, a snowboarder is more likely to fall to the side resulting in a natural tendency to extend a hand contributing to more wrist/hand and shoulder injuries in riders compared to skiers. To minimize this risk, snowboarders should wear wrist guards—either standalone guards or as an integrated glove/guard system. Their effectiveness in preventing wrist injuries is supported by an overwhelming amount of research evidence.

For skiers, poles can influence thumb and hand injuries. When falling on an outstretched hand that is holding a ski pole, a skier may tear the ulnar collateral ligament of the thumb. It is important not to wear your ski pole straps. The best way to prevent this injury is to drop your pole when you fall. This allows the pole to fall away when you drop it. In deep powder snow, this may not be as important.

Boots are less important for ski injury prevention, though you should be mindful of their proper fit and the amount of external wear on your boots. When buying boots, be sure to get a proper fit from a knowledgeable salesperson. Check that the toe and heel of your boots have little external wear and are clean. This will allow proper release from the binding.

In snowboarding, the risk of sustaining an ankle injury is related to the kind of boot worn. There are three types—soft, hard shell, and a hybrid. Hard shell boots are usually worn by more experienced shredders since they provide better protection for the ankle. Beginners usually choose soft boots because they allow some movement that helps a less experienced rider maneuver the board. However, they do not offer any ankle protection. Hybrid snowboard boots are made either with soft leather or synthetic outer shell and a stiff inner boot, or by combining a hard shell base with a softer upper component.

Ski/board lengths also may affect injury potential. Shorter skis/boards are easier to turn and control but may be less stable at high speeds. Newer skis have more sidecut (the curve on the sides of your ski). This helps skiers of all ability levels carve turns more easily. Some research suggests that this feature may cause more twisting injuries to the knee. Regardless, it is important to keep your ski edges in good condition to allow for proper carving of a turn and to control your speed, especially on hard pack or icy conditions.

For snowboarders, there are a few things to consider besides length. The waist (width) of the boards also is an important consideration. On a properly sized snowboard, your boots hang over the edges just slightly, but not enough to hit the snow when the board is on edge causing a fall.

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Extending the toes and heels slightly over the edges of the snowboard allows you to apply leverage to the board and modulate pressure with your ankles.

Other key considerations include the type of boarding you will be doing and the terrain, its shape and its flex. A knowledgeable salesperson will be able to assist you assess the variables to ensure you not only purchase the right size snowboard, but also one that will be best suited for the type of snowboarding you plan to do.

Clothing, goggles and head gear are important as well. Dress in layers to allow for adjustment to changing weather conditions and wear goggles or sunglasses to protect your eyes from UV radiation, wind, snow and other hazards you may find on the slope. The use of helmets is increasing, as the Vermont research showed, but head injuries are still occurring. Head injuries are the most common cause of death from skiing collisions and boarding falls, so wearing a helmet is the most important thing anyone can do to help prevent a serious or fatal injury. Furthermore, if you are teaching your children to ski or snowboard, be their example and make sure everyone wears a helmet, including you.