Issues Facing Ski Safety Research

An Interactive Qualifying Project Report

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Abstract

This Interactive Qualifying Project investigates what is discouraging ski safety research from being conducted in America's ski areas. By interviewing ski area executives, communicating with skiing safety and ski law experts, and reviewing appropriate literature, the underlying factors contributing to the lack of research are identified.

Executive Summary

Through proper ski injury research studies, we believe there are a significant amount of injuries which can be prevented. Yet, there are few proper injury studies being conducted at America's ski areas. The leading injury study is being conducted by Carl Ettlinger and Jasper Shealy at Sugarbush Mountain in Warren, Vermont. In order to promote ski injury research the original objective of our group was to establishing an injury study emulating Ettlinger/Shealy study. However, ski areas were uncooperative in allowing injury research on their mountain. The objective of this Interactive Qualifying Project is to identify what is discouraging ski injury research, primarily across the United States.

In order to accomplish this objective, the opinions of ski area executive and experts in ski safety and ski law were taken into account to understand the skiing industry's view of injury studies. Furthermore, past ski injury court cases and legal articles were reviewed to gain knowledge of the liability against a ski area operator in skiing accident cases.

The results of this project show that most ski areas are not cooperative in conducting injury studies. Ski areas feel that the publishing of their injury statistics could be used against them in litigation and in business. Also, they feel there is no proven return on investment for the cost of research. Instead of trying to prevent injuries, the ski industry is largely focused on reducing their liability to injuries. The underlying misconception of the ski industry is that injury studies are viewed as a negative. If injury studies were embraced by ski areas their liability, business, and insurance rates could all benefit.

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1. Introduction

1.1. Objective

The objective of this report is to find out what is discouraging ski injury research, primarily across the United States.

1.2. Rationale

This is important because we believe that there are still a significant number of ski injuries that could be reduced though proper research. Through proper studies conducted throughout ski areas, researchers would be able to identify injury trends and problematic areas. By reaching the intended objective of our research, a better understanding of why the ski industry is discouraging the use of ski injury surveys at resorts can be identified.

1.3. Approach

Initially the objective of this report was to expand the ski safety study at Sugarbush Ski Area conducted by Carl Ettlinger, Dr. Jasper Shealy and Dr. Robert Johnson to other ski areas. We visited Sugarbush to meet with Ettlinger and learn about the injury survey and then set out to start satellite surveys at other ski areas. However, other ski areas were uncooperative to conducting an injury survey at their resort, thus altering our objective to discover why they are uncooperative. To achieve the new objective we used the knowledge gained while meeting with ski area executives as well as research into the legal issues facing ski areas.

2. State of The Art

The purpose of this section is to inform the reader on past and current issues influencing the objective of this paper.

2.1. Ski Injury Research

After World War II the sport of skiing gained popularity in the United States, mostly due to the abundance of cheap army surplus skiing equipment. Popularity also increased because the Interstate Highway system was built, allowing easy access to ski mountains. The sport quickly evolved into the $12 billion business it is today. As skiing evolved, so did the injuries associated with it. Early skiers often experienced lower leg trauma. Injury research began and during the 1970s, ski equipment began to be redesigned in order to prevent fractures and sprains to the lower leg, which was the most common serious injury at the time (Johnson, 1997). Lower leg injuries have been decreasing since the 1970s, but meanwhile injuries to the knee has increased. Many current research projects are concentrated on these knee injuries.

2.1.1. Ettlinger/Shealy Sugarbush Study

Beginning in 1972, Carl Ettlinger, Jasper Shealy and Robert Johnson have conducted a comprehensive study which is designed to document all skiing injuries that occur at Sugarbush North in Vermont. The findings of the survey are regularly updated in the *Skiing Trauma and Safety* publication. For each skiing accident that occurs at Sugarbush the study records observations of the specific injury, the skier, the equipment being used, and the environmental conditions present at the site of the accident. Concurrently, a control group sampling of the general skiing population is made for comparison.

2.1.1.1. Methods of Research

Since the 1972/1973 skiing season a clinic in the base lodge at Sugarbush North has been running with a medical staff on duty during all hours of operation from December 15 through April 15 of each year. The study includes all skiers who requested any form of medical assistance from the clinic. Not included are skiers who arrived under their own power more than 48 hours after their injury occurred. Injuries that did not require any medical treatment (minor cuts, frostbite) are also not included. The location of the clinic ensures that the vast majority of serious skiing injuries pass through the clinic (Johnson, 1997).

Each participant in the survey is asked a series of about 50 questions concerning their skiing ability, physical qualities and the description of the accident. The questions also address the age, previous performance and maintenance of the equipment they were using at the time of the injury. The diagnoses of the injury by the medical staff are recorded as well as the treatment provided. A separate facility in the ski shop is used to test the equipment involved in the accident. The test method used for the equipment is based on ASTM Method for Measuring Release Moments of Adult Alpine Ski Bindings. The technique is designed to simulate a range of different falls using a simulated tibia and foot. An example of the clinical survey can be seen in Appendix B.

To establish a control group to be compared to the injury group, a sampling of skiers are surveyed every season. The control survey is similar to the injured skier survey, but lacks the questions pertaining to an injury sustained on the mountain. An example of the control data form can be seen in Appendix C. An abbreviated form of the control survey

is used for "parking lot surveys." This survey is meant to be conducted quickly as skiers walk through the parking lot of Sugarbush.

Ettlinger and Shealy decided to report the number of injures in terms of "mean days between injures" or MDBI. The higher the MDBI number is the lower the injury rate is. MDBI is calculated as seen below (Johnson, 1997):

$$MDBI = \frac{skier\_visits}{number\_of\_injuries}$$

2.1.1.2. Contributions to Skiing Safety

The Ettlinger and Shealy survey has been used to show injury trends in skiing. The study has found that the overall MDBI rose from 231 in 1972/73 to 435 in 1999/2000 (Johnson, 2000). This is an overall injury rate decrease of 46%. By breaking injury rates into specific body parts injured the study has been able to identify the particular injuries that are rising or falling through the years. They have found that anterior cruciate ligament (ACL) injuries MDBI has fallen from 6474 in 1972/73 to 1605 in 1999/2000, a 300% increase, while lower leg injuries MDBI have increased from 935 to 6250, an 85% decrease. Most of that decrease came in the first 10 years of the study, with lower leg injury rates remaining stagnant since.

The information gained through the survey can be used to reduce future injures. Carl Ettlinger and Jasper Shealy have been able to link the increase in anterior cruciate ligament (ACL) sprains to new changes in boot and ski, not the binding (Ettlinger, 1995). In testing the theory, a group of several thousand ski area employees were trained to recognize the events leading to ACL injury and to avoid it. The training showed a 75%

drop in ACL injuries for the trained skiers. Since this study, Ettlinger has been trying to inform the general skiing population of the strategies for avoiding ACL injury by distributing pamphlets and a video titled "ACL Awareness – Tips for Knee-Friendly Skiing." The skiing guidelines given in the pamphlet and video are the only proven method to reduce ACL injures.

The study can also be used to evaluate changes in equipment technology. For example, the release/retention functions in newer ski-binding-boot systems have been shown to reduce injuries more than 85% (Shealy, 1999). The survey was also used to show how dangerous ski-boards are in comparison to traditional skis. Ski-boards were shown to have an overall injury rate 118% higher than alpine skis. Lower-leg injury rates in ski-boards were 286% higher than alpine skis (Shealy, 2000).

In order to accurately measure the release torque of the alpine ski/boot/binding equipment for the survey, calibration equipment was developed. The release calibrator tests the forces required to release alpine ski bindings in forward lean and twist (Vermont Ski Safety Equipment, Inc., 2005). Bindings can be tested to ensure they are set to the proper torque range for a specific skier's ability and body type. This test is commonly performed by professionals throughout the industry in calibrating and testing the performance of ski bindings.

2.1.2. Other Research Efforts

There are numerous other research efforts that have being conducted outside of Sugarbush, but few have the meticulousness of the Ettlinger/Shealy study. The Swedish Ski Lift and Ski Area's Organization (SLAO) are attempting to measure the injury trends in the entire country of Sweden. Since the 1981/1982 season they have been using registration cards filled out by ski area staff to document for each case of an injured skier needing assistance off the mountain. Ski area staff is encouraged to fill out the forms by using a lottery where the staff can win prizes if their registration form is picked (Sandegard, 1991).

An Italian study, reported injuries treated at the trauma department of Cavalese Hospital in Trentino, Italy, located near a large ski resort (Molinari, 1996). It is noted by the researchers that this method fails to capture any injuries which are not treated at that hospital, most likely minor injuries such as those to the thumb or wrist.

From 1996 to 1998 the Norwegian Ski Lift Association conducted an injury survey on the slopes of four major Norwegian ski resorts: Hemsedale, Trysil, Norefjell, and Hafjell. Injuries requiring assistance from Ski Patrols were recorded. The comparison for the number of skiers on the mountain was based on the number of times a lift is ridden. 10 lift rides constitutes a ski day (Ekeland, 2000).

There are serious drawbacks in the methodology of the research projects described above to the Ettlinger/Shealy research. None of the surveys mentioned did any scientific testing on the equipment involved in the accidents recorded. Also, none of the surveys include a

noteworthy control group for trend comparison in injuries. For these reasons, we believe that future injury research should be conducted in accordance with the Ettlinger/Shealy method.

2.2. Legal and Legislative Issues

In 1951 the first personal injury lawsuit was brought against a mountain. The case, Wright v. Mt. Mansfield Lift, Inc., entailed a woman who suffered a broken leg when her ski struck a snow-covered tree stump on a run at Stowe. Mt. Mansfield Lift was cleared of liability for the accident because the court reasoned that "a skier accepts those obvious and necessary dangers that inhere to the sport." This principal of "inherent danger" was accepted by courts throughout the country. For the next 25 years ski mountains could view litigation as a mere trepidation (Sanders, 1992).

The case Sunday v. Stratton changed quickly changed ski areas views of litigation. Mr. Sunday was a 21-year-old novice skier skiing the bunny hill at a slow speed when he fell near the edge of the wide slope and struck a boulder off the trail. The fall, which allegedly was caused by underbrush on the trail, rendered him a quadriplegic. Stratton argued that the skier had assumed the risk for the injury, but this was rejected by the court and Sunday was awarded $1.5 million. The court held that Stratton had an absolute duty to properly maintain its novice slopes free of known hidden dangers. The case caused insurance rates at Ski Mountains to double then triple. In turn lift ticket prices were drastically raised.

Sunday v. Stratton brought about lobbying efforts by the ski industry to enact statutes to enumerate the duties and risks of skiers and ski area operators. By the end of the 80's at least 24 states had adopted such laws (Sanders, 1992). In general, "Failure to mark the level of difficulty, the boundary of slopes and danger areas, or to warn in accordance with the applicable act can be the basis of actionable negligence by a skier against a ski area operator" (Chalat, 1998). Four general categories of legislation have developed among the states:

- "General Assumption of Risk" – Skiers must accept as a matter of law the obvious and necessary dangers of the sport. This category of law does not specifically list skier risks and ski area duties. Vermont follows this legislation.

- "Delineated Skier Risk" – Specifically defines those risks that are inherent in skiing. For injuries resulting from a risk not defined a jury must decide who is liable. Utah and Michigan follow this legislation.

- "Enumerated Ski Area Duty" – Sets forth the duties of a ski area operator. In order for a plaintiff to recover damages from a ski area those duties must have been breached. New Mexico and California follow this legislation.

- "Enumerated Risk and Duties Balancing Test" – Sets forth the responsibilities of the skier and the ski area and permits jury discretion in assessing liability based on the facts of each case. Colorado and New York follow this legislation.

These state laws have mostly worked in favor of ski areas, reducing their liability in skiing accident cases. The ski areas are still not completely protected by state laws, as seen in Peer v. Aspen Skiing Co. This and other cases can be seen in the ski lawsuit timeline in Appendix A.

3. Methods

3.1. Method Overview

The methodology to perform our original objective of expanding the Sugarbush Injury Study to other locations consisted of visiting Sugarbush to see the survey in action then use that knowledge to spread the survey. We first contacted Carl Ettlinger who runs the study at Sugarbush Resort and soon after visited the survey site. Once we talked to Mr. Ettlinger and witnessed the injury survey in action we then formulated a basic design of how we could try to initiate new injury studies at resorts across the region. After making initial contact with other resorts we soon realized there was little to no interest in creating new injury studies. A shift in focused occurred where we changed our objective to try to understand what is discouraging ski injury research across the United States. The knowledge gained from the Sugarbush experience taught us what good research is, and why it would be difficult to emulate. The experience interviewing a ski area executive gave us the industry's perspective on safety research. Research was then conducted into the underlying reasons the ski area gave for not conducting safety research. Also, professionals in the fields of ski law and ski safety were contacted to gain their perspective.

3.2. Objective Development

The rationale behind contacting Vermont Ski Safety was that they are the longest running continuous extensive study of skiing injuries and the equipment involved. By initially contacting Carl Ettlinger, we were able to obtain comprehensive access to the study as well as insight as to how the study is conducted. We learned how in depth the survey

truly is and how difficult it would be to implement a similar survey at another location without similar facilities. The survey retained information above just the type of injury but went as far as to how many times the skier had been on each lift that day, the settings and size of the equipment along with the cause of the injury. The survey also utilized two control groups, one control group used an extensive survey, similar to the one used on the injured skiers. And a second which was similar but much less extensive, usually done more frequently and conducted in the parking lot. From our onsite visit we witnessed the process that each injured participant undergoes which includes compiling the ski patrol report and clinician administered questions, testing and analysis of the equipment involved and examination of injury at the medical clinic. The visit of the Ettlinger and Shealy survey gave us the knowledge needed to try to expand the survey to new ski areas as well as the costs associated with running a survey.

3.3. Objective Modification

Before we concluded that changing our research objective was necessary we sat down with Bruce Schmidt, General Manager of Okemo Mountain Resort in Ludlow, VT. We discussed with him the idea of expanding the surveys to Okemo which we then discussed the reasons why the resort was not interested. It was an insightful discussion where we concluded the possibility that any resort in the region which would be interested in an injury study would be highly unlikely. To make sure we then contacted David Crowley, General Manager at Wachusett Mountain. We explain the intent we had in creating an injury study at Wachusett Mountain and that we were from WPI but we never were able to reach him again.

At that point it was apparent we needed to adjust our objective and try to understand why we were not able to convince ski areas of the need for safety research. We felt, based on the information we had already collected, that trying to understand what was inhibiting the progress of ski injury studies across the country was the best course of action.

3.4. Research

To better understand the legal issues surrounding this we conducted research at the Worcester Law Library, exploiting their vast legal references. Initially we began by focusing our research on legal texts and papers which were written on ski injuries. A great resource turned out to be two papers by Jim Chalat entitled "Liability of Ski Area Operators for Skiing Accidents" and "Liability of Skiers for Collisions with Another Skier." These articles were found through searches of *American Jurisprudence Proof of Facts*. Next, we established an extensive list of influential rulings past down from different states regarding ski injury. We then concentrated on what has caused significant change throughout the industry. A timeline of significant court decisions was constructed. State statutes pertaining to ski injury liability were also researched and consolidated to one chart for easy reference.

3.5. Contacting Experts

The amount of information we found was limited but a few experts did emerge from the field. Through the communication of email, Dr. Mike Langran was contacted. Dr. Langran is UK National Secretary for the International Society for Skiing Safety and a committee member of the British Association of Ski Patrollers. Dr. Langran was found by the group at his website, http://www.ski-injury.com. After reading his two papers, Jim

Chalat was contacted through email as well. Chalat is a well regarded practicing lawyer out of Colorado and recognized as a national authority on skiing accident law. Chalat gave us his opinions and also directed us to Peter Rietz, who is in general litigation counsel for Intrawest and Vail Resorts and could possibly deliver information from the ski area's point of view. Rietz, unfortunately, did not reply to multiple emails and phone calls.

4. Results

4.1. Costs of Ski Injury Research

In order to perform an injury study similar to the Ettlinger/Shealy study, several expenses are required. These costs may be a deterrent to ski areas when a proposal for a ski injury survey is brought to them. The costs are listed in the chart below.

Required for Ski Injury Survey	Estimated Cost
Clinic Facility	All Ski Areas have a form of a Clinic/First Aid Station, therefore the cost can be neglected.
Clinic Staff	Also already present at Ski Areas, costs neglected.
Vermont Release Calibrator	$2,999.00*
Components and Accessories for Release Calibrator	Mechanical ARM - $595.00* Standard LEG - $395.00* Adult FOOT - $295.00* Junior FOOT - $285.00* Tilt Vise - $1,395.00 * Torque Limiting Screwdriver - $185.00* Short Ski Adapter - $65.00* Dead Hammer - $75.00*
Testing Technician	Salary - $14,400 per year (based on $15/hr wage paid for entirety of ski area operation for a year – approx. 120 days)
Control Group Surveyor	$1000 per year (based on collecting 200 control test subjects – ½ hour to administrate a survey, $10/hr wage)

* Prices Provided by Vermont Ski Safety

Table 1 – Costs of running a Ski Injury Survey

The first cost associated with a ski injury survey is a clinic or first aid station where all injured skiers needing medical assistance can visit. In this facility is where the actual questioning of an injured skier will occur. From the experience of our group, we assume that nearly every notable ski area has some sort of clinic or first aid station. The assumption shouldn't be perceived as far-fetched since the ski area operator and the ski patrol are obligated to exercise the reasonable standard of care in the industry. That standard is set forth in the standards underlying certification for Winter Emergency Training, or Outdoor Emergency Training (Bowman, 1996). With almost all ski areas equipped with a first aid station, a ski area should not need to build a new building or purchase any medical equipment for the purposes of the injury survey.

The assumption that a ski area already has medical personnel working in the clinic can be made for the same reasons as above. Since the medical staff is already employed by the mountain there is no further cost needed for the survey. This medical staff will actually be administering the survey to injured skiers.

The next cost associated with an Ettlinger/Shealy-type injury survey is the actual test equipment used to take measurements on ski equipment involved in an accident. The main component is the Vermont Release Calibrator. This device tests 3 release points: twisting, forward lean and backward lean. These parameters are tested for the ski-binding-boot system involved in the accident. Several other components are also needed for testing. These were listed in Table 1.

A technician is also needed to use the Vermont Release Calibrator to test the equipment. This technician will need to be trained to use the calibrator; instruction videos are available through Vermont Ski Safety for $45. Since the technician will only be needed when a new injury occurs, he can also be used as the administrator of the survey files. In order to estimate the salary of the technician we assumed that the wage paid is $15 per hour. A technician will need to be on duty during all operational hours of a ski area, so it is also assumed that the average operation time is 8 hours per day. The number of days that a New England ski area is in operation per year is assumed to be 120 days. Based on these parameters the salary of a technician will be $14,400 per year.

The last expense associated with an injury survey is for taking the control surveys. People are needed to administrate the "parking lot" surveys which provide a control group to be compared to the injured skier group. Based on the length of the form, we estimate that the survey will take approximately 30 minutes per interviewee to complete. It is desired to give as many control surveys as possible. Ettlinger averages around 200 control surveys given per year. Based on this number we estimate it will take approximately 100 hours per year to get the control survey results. Ettlinger usually uses colleges students or whatever ski area employees he can find to administrate the survey, paying $10 per hour. So for 100 hours needed, we estimate $1000 per year are needed for the control survey.

The total cost of an injury survey is estimated to be $15,500 per year in labor and $6,289 in equipment.

4.2. Ski Area's Reaction

In order to gain insight and outlook ski resorts had on injury studies we interviewed to Bruce Schmidt, General Manager of Okemo Mountain Resort in Ludlow, Vermont. Bruce provided us with an in depth look at how a ski area view injury studies. Schmidt was uncooperative in allowing our group to be involved in any type of safety research at Okemo. When questioned why safety research was a taboo subject, Schmidt gave the following reasons:

- Safety research would release injury information to the public which could be compromising to Okemo both in business and in the event of a lawsuit.
- The costs associated with safety research provide no proven return on investment.
- Current insurance policies disallow safety research.

To elaborate on the first bullet point, Schmidt saw the publishing of injury data as damaging to Okemo. In the event of a lawsuit holding Okemo liable for an injury, a prosecutor would have documented evidence of how an injury occurred and a history of previous injuries that could be similar. If similar injuries are found to the one Okemo is being prosecuted for the argument that the injury was inherent to the sport may be thrown out. On the business side, the publishing of injury statistics on a mountain provides a comparison of safety between Okemo and other mountains surrounding it. If it was found that Okemo has higher injury rates than surrounding mountains then it could be labeled as "dangerous" by the public and thus lose business.

The next point Schmidt brought up against safety research is that there is no proven return on investment; in fact it may just cause more expenses. The costs associated with trying to make a safer mountain have not proven to attract new skiers, in his opinion. Also, Okemo would be obliged to try to curb injury trends on the mountain, or face litigation. In Schmidt's opinion, by knowing what injuries are occurring you only create more expenses to try to erase them.

The last point that Schmidt made against safety research is that it may not be allowed by Insurance companies. Although Schmidt was not clear exactly why it is not allowed, it can be speculated that insurance rates may rise if every injury were being reported and published. Contacting an insurer of a ski area was not accomplished and our speculation was not able to be verified.

To make sure we could accurately picture the attitude ski resorts had we talked with David Crowley, General Manager of Wachusett Mountain. We contacted him on the phone and informed him of our interest in performing ski safety research at his ski area. However, after the initial contact we were unable to communicate with Crowley again so we speculate that Wachusett Mountain has absolutely no interest in performing ski safety research and no interest in sharing its opinions on why they would not perform research.

4.3. Liability and Law

Ski Areas commonly cite liability for skiing injuries as a reason for not cooperating with ski injury research, as seen in our experience at Okemo. This section defines injuries that ski areas could be held liable for and gives opinions of ski law professionals on how litigation effects the decisions of ski areas.

In personal communication with Jim Chalat of Chalat Hatten Law Offices in Denver Colorado, ski areas, in general, can be held liable for an injury when it involves an injury that occurs due to "improper marking of known hazardous conditions on a trail or when a trail is open under poor conditions." This stems from the "inherent danger" rule which was defined from a decision in 1929 involving a Coney Island Amusement Park (Sanders, 1992). The case, Murphy v. Steeplechase Amusement Co., involved a man getting hurt on an amusement park ride. The man was unable to collect any damages because the court decided that he had assumed a foreseeable risk of injury inherent in the amusement activity he had voluntarily undertaken. This case was cited in the first ski injury lawsuit, Wright v. Mt Mansfield Lift, Inc, which is explained in more detail in the State of the Art Section.

According to Chalat, the "inherent danger" rule has protected ski areas from most injury lawsuits, but some cases have been won by skiers, the first being the case Sunday v. Stratton. These cases where a ski area is held liable for injuries have sparked ski area operators to lobby state legislation to decrease their liability in injuries. States were

happy to protect the multi-million dollar ski industry, since they generate great amount of revenue for the state(Sanders, 1992). Currently, all but three states with a significant ski industry have statutes protecting ski areas from injury lawsuits. Although the statutes vary state to state, they can be broadly defined as being in one of four categories: General Assumption of Risk, Delineated Skier Risk, Enumerated Ski Area Duty, and Enumerated Risk and Duties Balancing Test. These were explained in the Background Section.

Most ski statutes provide specific duties that must be undertaken by the ski area operator. Some common duties seen in states include failure to mark the level of difficulty, the boundary of slopes and danger areas (Chalat, 1998). If a ski area can be found guilty of one of these cases a they can be found guilty of negligence. These laws vary greatly from state to state though, so an injury case that occurs in one state could be decided differently in another state. Some states go into great detail in defining the duties of a ski area. Colorado, for example states in its statute that ski area operators "shall mark hydrants, water pipes and all other man-made structures on the slopes and trails which are not readily visible from a distance of at least one hundred feet shall adequately and appropriately cover such obstructions with a shock-absorbent material that will lessen injuries" (Chalat, 1998). Table 2 gives a description of the ski safety laws for various states.

State	Statute
Alaska	Ski Area Operators cannot be held liable for inherent risks of skiing. Operator duties include providing notice of inherent risks and the risks' limiting effect on operator liability to skiers.
Arizona	The skier is held to have assumed all inherent risks that are an "integral part of the sport of skiing, excluding acts of ordinary or gross negligence, or reckless or intentional conduct on the part of the ski area operator." Inherent risks expressly include "collisions with other skiers." Operators must meet signage and notice requirements, as well as safety feature compliance on tramways and other equipment.
California	No Ski Law Statute
Colorado	Ski area must mark hydrants, water pipes and all other man-made structures not clearly visible from 100ft away. Snowmobiles must be operated with lighted headlamp and flag. Collisions with snowmobiles are not an inherent danger. Collisions with ATVs are not an inherent danger
Connecticut	Operator duties provide for conspicuous markings around the property
Idaho	Operators duty to provide signage, equipment markings, and a ski patrol. Operators have no duty to make the area safer from "inherent risks," but if they electively do so, such does not create a heightened standard of care. Operators have no liability for skier/skier collisions.
Illinois	No Ski Safety Statute
Maine	Excepting negligence in an operator's execution of their maintenance, warning, and sign duties, skiers assume all "inherent risks" of skiing, including slope design and condition, impact with natural or man-made stationary objects, and collisions with other skiers.
Massachusetts	Upholds that there are “inherent dangers” associated with the sport that operators are not liable for, however proper warnings and signs should be posted.
Michigan	Each skiing participant accepts the dangers that "inhere in the sport" insofar as they are "obvious and necessary."
Minnesota	No Ski Safety Statute
Montana	An operator owes certain warning, marking, and notice duties to skiers, "consistent with the duty of reasonable care owed." Skier assumes all inherent risks including certain avalanches.

Table 2 - State Statutes pertaining to Ski Injury Liability (Chalat, Revised 2006)[13]

New Hampshire	Skier is responsible for all “inherent risks” and hazards of skiing.
New Jersey	Skiers assume all of the "inherent risks" of their sport. This includes obvious, man-made hazards that are impracticable for the operator to remove.
New Mexico	It is the general duty of a ski area operator to warn of or correct particular hazards known to the operator where feasible to do so.
New York	Operators must also inspect run conditions twice a day and pad lift towers. Skiers must maintain general "control" and ski within their abilities, having first familiarized themselves with the course.
North Carolina	Operators must mark trails and known, hidden dangers, provide a ski patrol, and must not engage in any conduct that wilfully of negligently contributes to injury of another person or another's property.
North Dakota	Operator duties include signage and warning requirements. Skiers assume all “inherent risks” of their sport.
Oregon	Skiers assume the "inherent risks of skiing" as long as they are "reasonably obvious, expected, and necessary" parts of the sport, including skier/skier collisions and failure to ski within one's ability.
Rhode Island	Skiers have the primary responsibility for avoiding collision with "obstructions," man made or otherwise, and are solely responsible for determining their own skiing ability. Operators must operate ski areas in a "reasonably safe condition or manner.”
Utah	Skier assumption of the inherent risks of skiing, together with warning and notice posting requirements of operators. Operators remain liable for negligence and must exercise reasonable care in eliminating risks that can be reasonably eliminated.
Vermont	Participants in any sport assume, "the dangers that inhere therein insofar as that are obvious and necessary."
Washington	Lists enumerated duties of skier and operator, with most falling on skiers. Operators are responsible for signage and minimum insurance requirements.
West Virginia	Ski area operators are immunized only for the “inherent risks” of skiing which are essentially impossible to eliminate.
Wisconsin	Participant in any recreational activity, including skiing, accepts the inherent risks of which the ordinary prudent person is or should be aware.

Table 2(cont.) - State Statutes pertaining to Ski Injury Liability (Chalat, Revised 2006)[13]

5. Discussion

5.1. Costs of Ski Safety Research

In Table 1 in the Results Section the total costs of a running a Ettlinger/Shealy injury survey were estimated to be $15,400/year in wages and $6,289 in equipment. It is certainly reasonable to assume that this price is too high for a ski area to spend on safety research. Bruce Schmidt told us in the interview that Okemo has very small profits each year and putting money into research is probably not feasible, at least at this point. Keep in mind that this could vary for different ski areas, especially the larger, consolidated ski companies who boast greater revenues.

Aside from monetary costs, time may be another important factor in the decision of a ski area to start ski injury research. In personal contact with Mike Langran, the UK National Secretary of ISSS, he expressed that injury surveys are "very time consuming to do properly - especially the collection of control data." Jim Chalat also brought up the issue of lack of time which ski areas have to perform safety research. According to Chalat, "ski area operators concentrate they're time in other issues such as modernization, real estate and marketing."

5.2. Ski Area's Stance on Safety

From the reasons given by Bruce Schmidt, General Manager of Okemo Mountain, it can be assumed that ski areas do not view safety research at their mountain favorably. This is confirmed in the cold-shoulder response given when safety research was proposed to Wachusett Mountain. The reasoning behind their unfavorable view of safety research

stems mostly from the publishing of injury statistics. Schmidt explains how these can be damaging to a ski area in a legal, business and insurance sense. The response of ski areas seems to suggest that any knowledge of what could be unsafe on the mountain will hurt them. This theme of ignorant self-interest is expressed in the comic strip seen in Figure 1. In the comic, Calvin's attitude toward "knowing things" is analogous to ski area's attitude towards knowing safety issues on their mountain. As more injury information is known by a ski area, a greater amount of changes are needed to be made to a ski areas layout and policies. These changes are difficult and expensive. So if ski areas were not to do any safety studies on their mountain, the less difficult and expensive changes there will be.

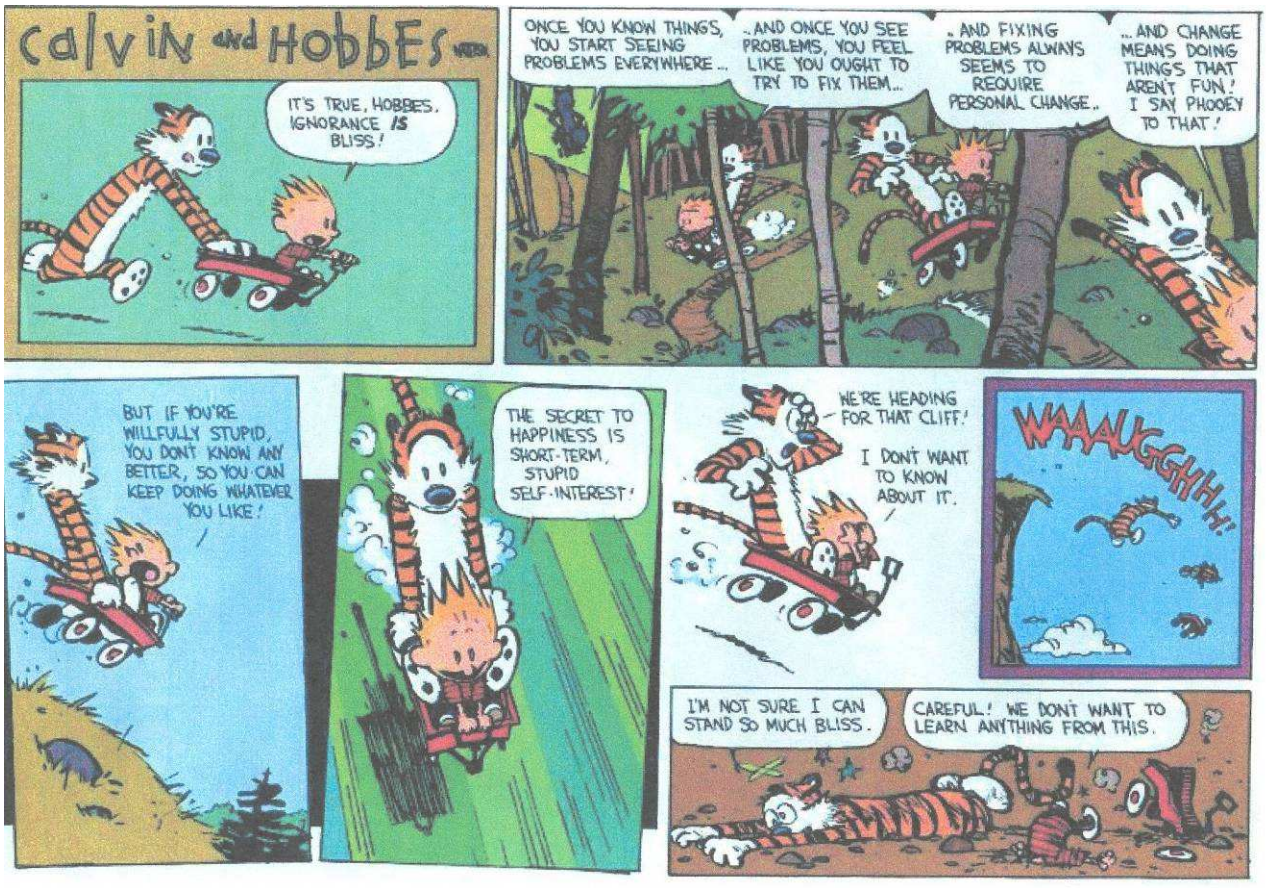

Figure 1 - Calvin and Hobbs Comic Illustrating the Ski Area Operator Attitude (Watterson, 2005)

As seen in the cartoon, not making personal changes eventually causes problems. In Calvin's case he gets hurt. In a ski area revenue and market share may be lost if safety issues are not addressed.

It is a possibility that not all ski areas express the same views as Okemo and Wachusett. It would be noteworthy to continue proposing ski safety research to other ski areas around the country and recording their reaction. In particular, state owned ski areas and ski areas that have trails on federal land. These ski areas may be more apt to allow ski injury research because of the Freedom of Information Act (Chalat, 1998).

5.3. Ski Area's Skewed Perception of Safety Research

Not all consequences of ski safety research involve difficult and expensive changes as currently believed by most ski area operators. In fact many of the aspects that are viewed as negatives can be turned around and viewed as positives.

5.3.1. Legal

Currently, ski areas believe that research into ski injuries on their mountain will make them vulnerable to lawsuits because each injury is well documented and can be used in court. Dr. Mike Langran offers a different view of what safety research can do for a ski area. Dr. Langran asserts that "showing that they have an interest in safety is to [the ski area's] benefit if and when they get a lawsuit. I suspect the problem is bound to be worth in the USA due to the larger influence of litigation."

5.3.2. Business

Currently, ski areas believe that ski safety research will allow the public to see the amount of injuries that happen on the mountain and extrapolate that skiing at their ski area is dangerous. In reality, skiing is a much safer recreational activity than swimming or bicycling. In 1995 there were 17 drowning deaths per million swimming participants and 7.2 deaths per million bicycling participants (Chalat, 1998). Skiing only had 3.5 deaths per million participants (Johnson, 1997). Publishing this type of data can be valuable to the skiing industry who, as told to us by Jim Chalat had been struggling to bring more skiers to the slopes. In order to increase the amount of skiers buying lift tickets, the ski industry can try to market different groups of people. The ski industry has historically marketed to the male-thrill-seeking group, but a push to market to women

with children could bring many more families skiing for their vacations (McDowell, 1997). "The ski industry is just beginning to wake up to the importance of the women's market," said Charles R. Goeldner, a professor of marketing and tourism at the University of Colorado in Boulder. In order to market to women and children, the increased safety awareness that is added by doing injury research can be exploited. A safety marketing ploy can be speculated to "woo women" back to skiing since historically the rate of injury in women is more than 50 percent higher than for men's (McDowell, 1997).

5.3.3. Insurance

Although Mr. Schmidt did not give many details on the insurance situation ski areas are in if injury information is known, it can be speculated that he believes rates will go up. However, as the skiing industry has enjoyed economic growth and consolidated into larger companies the have stronger bargaining power over insurers (Chalat, 1998). In recent years liability insurance in relation to total revenue has increased from only 3.1% to 4.3%, even though the potential for a serious injury or death on an individual case can amount to profound damages. In fact, insurance rates have remained relatively constant since the late1970s and early1980s when Sunday v. Stratton caused rates to double and triple (Sanders, 1992). So looking at the industry in this manner, it can be speculated that insurance companies should not be a great concern to ski areas.

5.4. Liability and State Statutes

Since the Sunday v. Stratton decision ski areas have been lobbying state legislatures to protect them from ski injury liability. Table 2 in the Results Section shows that nearly every state with a ski area within its borders adopted a policy that there are "inherent

risks" associated with skiing and a ski area should not be held liable for injuries caused by those risks. Most states go farther than the "inherent risks" rule by defining what duties need to be performed by a ski area, such as providing signage for unexpected obstacles in the trail. Colorado has the most well defined duties by actually explaining that man-made obstacles must be properly marked if not easily visible from 100 feet away. Ski areas desire these well-defined duties because it is easier to protect themselves from lawsuits.

We speculate that state statutes could be made that protect a ski area operator from litigation springing from injury research being conducted at the mountain. Ski areas believe that injury research will show trends in injuries relating to the practices of a mountain which could lead to lawsuits brought against them. For example, if it is documented by an injury survey that a certain trail is producing the same type of injury continuously, there may be a case that something in that trail is not an "inherent risk" of skiing. If this is proved the ski area can be held liable for the injuries in most states. If state statutes are written which prohibit a lawsuit stemming from published information from a injury survey then ski areas would be more likely to participate in safety research. The statute would eliminate the main fear of ski areas and insurance companies—lawsuits.

As with previous state statutes restricting the liability of a ski area, the constitutionality of a statute protecting an area from litigation stemming from injury research could be a problem. When the Colorado Ski Safety Act was challenged, the court upheld its constitutionality in Pizza vs. Wolf Creek Ski Development Corp. against an equal

protection challenge. The court took the position that a skier merely needed to show evidence of the operator's negligence as outweighing the presumption that the skier was solely responsible for an accident (Chalat, 1998). These unsuccessful attempts at proving unconstitutionality suggest that further safety statutes would be held by the state. It may be best to try the statute in a state friendly to ski areas, like Colorado. These states heavily depend on the revenue generated by the multi-million dollar ski industry and are susceptible to lobbying (Sanders, 1992).

6. Conclusions

- Most Ski Areas are not cooperative in allowing ski injury research on their mountain.

- Overall, Ski Areas believe that the publishing of injuries on their mountain are undesired due to legal, business and insurance reasons.

- The cost, both in time and money, associated with performing ski safety research is discouraging research.

- States statutes have been used to help protect the ski industry from litigation.

7. Recommendations

- Propose ski injury research to other ski areas and record their reaction.
- When proposing a new skiing safety research project to a ski area, emphasize the positives that they may be overlooking.
    - Safety awareness could be valuable in court when fighting injury lawsuits.
    - Ability to market new safety awareness to women.
    - Insurance rates have stayed relatively steady since the 1980s.
- Lobby states to pass statutes that allow safety research to occur at ski areas without the risk of increased litigation.

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Appendix A – Ski Injury Legal Timeline

1951 -- **Wright v. Mt Mansfield Lift, Inc.**

State: Vermont
Case: Skier suffered broken leg when ski struck a snow-covered tree stump.
Verdict: In favor of Mt. Mansfield because the accident was an inherent danger to skiing.

1976 -- **Leopold v. Okemo Mountain, Inc.**

State: New Hampshire
Case: Skier lost control and crashed into unpadded lift tower, fatal.
Verdict: In favor of Okemo, the tower found to be an obvious danger to the sport.

1978 -- **Sunday Vs. Stratton Corp.**

State: Vermont
Case: Sunday was critically injured when he tripped over an obscured piece of under growth.
Verdict: Stratton found guilty for negligence. $1.5 million awarded to plaintiff.

1979 -- **Colorado Ski Safety Act** (24 other states follow)

1985 -- **Pizza v. Wolf Creek Ski Development Corp.**

State: Colorado
Case: Skier fell on a slope that intersected with a snow-covered service road, landed on neck and back and was paralyzed as a result
Verdict: Found in favor of the mountain, Colorado laws prove to be difficult for plaintiff to overcome.

1991 -- **Peer v. Aspen Skiing Co.**

State: Colorado
Case: Skier hit a transition in the terrain and went airborne, and he was paralyzed as a result
Verdict: Found in favor of the skier, $5 million awarded. Landmark case since factually identical to Pizza v. Wolf Creek yet verdict was opposite.

1992 -- **Hoar v. Great Eastern Resort management, Inc.**

State: Virginia
Case: Skier slid over embankment on the edge of a trail under construction which was not properly marked.
Verdict: Found in favor of the skier for 6.2 million dollars, the biggest verdict in history

1995 -- **Graven v. Vail Associates, Inc.**

State: Colorado
Case: Skier fell in to a ravine adjacent to a ski trail. The court said the ravine was inherent to the sport and Vail had no duty to mark the danger area. The supreme court reversed the decision, saying ski areas must operate under reasonable care.
Verdict: Found in favor of the skier.

1997 -- **Harmon v. Mt. Hood Meadows, Ltd.**

State: Oregon
Case: Skier was injured in a chairlift accident. Since the skier(s) signed a wavier that released the mountain of “any and all claims”, the court found that the wavier was valid.
Verdict: Found in favor of the mountain.

Appendix B – Clinical Data Form

SUBJECT NAME_____ **#**_____
P#_____

CLINICAL DATA FORM

NORTH [ ] **SOUTH** [ ] **TECH**_____ **SOURCE** [ ] SUBJECT [ ] PATROL REP [ ] WITNESS [ ] HOSP [ ]

POSSIBLE LEER [ ] YES (Alerted VSR at 496-5612) [ ] YES (VSR off duty) [ ] NO
EQUIPMENT LOCATION [ ] SECURED [ ] SUGB RENTAL [ ] NOT AVAILABLE [ ]_____

SEVERITY OF INJURY

[ ] MINOR cuts, contusions, abrasions, no M.D. attention required
[ ] MODERATELY SEVERE grade 1 spr, lac, w/sutures; M.D. att. Required
[ ] SEVERE grade 2&3 spr, fx, concussion, organ damage, poss. hosp.

ABBREVIATION CRITERIA (optional)

[ ] 3 or more pts. in fac. (drop *questions on every other MINOR)
[ ] 6 or more pts. in fac. (drop *questions on every other MINOR and MODERATE)

Enter or circle the subject's response to the questions that follow.

SKIER INFORMATION

1. SUBJECT NUMBER __ __ __ __ __ __ __ a)*ABBREVIATED c) COMPLETE

2. AGE AT LAST BIRTHDAY __ __

3. SEX – 1) MALE 2) FEMALE

4. DOMINANT HAND – 1) LEFT 2)RIGHT 3) AMBIDEXTROUS

5. HEIGHT (to nearest inch) __ __ __

6. WEIGHT (to nearest lb.) __ __ __

7. *MEASURED FOOT LENGTH (mm) __ __ __

8. SEASONS SKIED (SNB) PRIOR TO THIS ONE __ __ __ ?) NRS

9. AVG NUMBER OF DAYS SKIED (SNB) EACH PRIOR SEASON __ __ __ ?) NRS

10. NUMBER OF DAYS SKIED (SNB) THIS SEASON __ __ ?) NRS

11. HIGHEST SPEED AT WHICH YOU NORMALLY SKI – 1) SLOW 2) MOD FAST 3) FAST ?) NKS

12. WHAT TYPE OF SLOPE DO YOU NORMALLY SKI – 1)GENTLE 2)MOD STEEP 3) STEEP

13. SKIER'S (SNB) ESTIMATE OF OWN ABILITY – 1)BEG 2) NOV 3) INT 4) ADV INT 5) EXP ?)NKS

14. HOW LONG HAVE YOU SKIED (SNB) TODAY (decimal hours) __ __ . (.00) (.25) (.50) (.75)

15. NUMBER OF LIFTS TAKEN (taken from last page) __ __ ?) NRS

16. TYPICAL TRAIL SKIED (SNB) TODAY – 1) GREEN 2) BLUE 3) BLACK 4) DBL BLACK ?) NKS

17. HOW MANY TIMES HAVE YOU FALLEN TODAY __ __ __ ?) NRS

18. TIMES YOU FELL LAST FULL DAY SKIED (SNB) __ __ __ 77) NEVER SKIED (SNB) BEFORE ?) NRS

19. TIME IN TERRAIN PARK TODAY – 1) NONE 2) 10% OR LESS 3) 50% OR LESS 4) 90% OR LESS

20. TOTAL HOURS OF SKI (SNB IF ON SNB AT INJURY) INSTRUCTION __ __ __

21. TOTAL HOURS OF SKI (SNB) INSTRUCTION THIS SEASON __ __ __

22. *HAVE YOU EVER RECEIVED INFORMATION ABOUT KNEE INJURIES IN SKIING? 1) YES 2) NO

23. *(if yes) DID YOU LEARN HOW THE RISK OF KNEE INJURY MIGHT BE REDUCED? 1) YES 2) NO

24. *(if yes) WHAT DID YOU LEARN? (explain)-
_____
_____
_____
_____

INJURY INFORMATION

25. DATE ACCIDENT OCCURRED __ __ / __ __ / __ __

26. WHAT WAS THE CAUSE OF THE ACCIDENT

1) STRUCK (OR STRUCK BY) SKIER (SNB)
2) STRUCK UNSEEN, UNAVOIDABLE OBJ.
3) INAD. REL. OPP. SIDE
4) INAD. REL. INJ. SIDE
5) INAD. REL. OTHER
6) CAUGHT INSIDE EDGE- INJ. SIDE (SNB- TOE)
7) CAUGHT OUTSIDE EDGE- INJ. SIDE (SNB HEEL)
8) **CAUGHT INSIDE EDGE- OPP. SIDE
9) **CAUGHT OUTSIDE EDGE- OPP. SIDE
10) DELIBERATE FALL
11) JUMPING
12) LOST CONTROL
13) **CROSS TIPS
14) TECHNIQUE OTHER
15) STRUCK BY LIFT
16) OTHER_____
17) NO SPECIFIC ACCIDENT EVENT
?) NRS

27. WHAT WAS THE CAUSE OF INJURY

1) OTHER THAN COLL
2) COLL W/ LIFT, SNO MAKER
3) COLL W/ FENCE, POLE
4) COLL W/ GATE
5) COLL W/ TREE
6) COLL W/ ROCK
7) COLL W/ SKIER
8) COLL W/ SKI
9) COLL W/ SKI POLE
10) OTHER COLL
11) IMPACT WITH SKIING SURFACE
12) NO SPECIFIC INJURY EVENT
13) COLL W/ SNOWBOARDER
14) COLL W/ SNOWBOARD

28. INJURY EVENT AFTER INITIAL FALL

1) DIDN'T FALL
2) INJURED PRIOR TO FALL
3) INJURED AT TIME OF FALL
4) WHILE WIND MILLING
5) AFTER SLIDING
6) WHILE GETTING UP
7) OTHER_____
9) NO SPECIFIC INJURY EVENT
10) NRS

29. SKIER'S (SNB) SPEED AT TIME OF ACCIDENT

1) NOT MOVING
2) VERY SLOW
3) SLOW
4) MODERATELY FAST
5) FAST
6) NO SPECIFIC INJURY EVENT
7) NRS

30. *DIRECTION SKI (SNB) TRAVERSING RELATIVE TO FALL LINE PRIOR TO ACCIDENT
1) TO RIGHT
2) TO LEFT
3) IN FALL LINE
4) OTHER
5) NOT MOVING
6) NO SPECIFIC INJURY EVENT
?) NRS

31. *DIRECTION OF FALL RELATIVE TO BODY
1) DID NOT FALL PRIOR TO INJURY
2) FELL BACKWARD
3) FORWARD
4) TO RIGHT
5) TO LEFT
6) FORWARD, RIGHT
7) FORWARD, LEFT
8) BACKWARD, RIGHT
9) BACKWARD, LEFT
10) NO SPECIFIC INJURY EVENT
?) NRS

32. DIRECTION OF FALL RELATIVE TO FALL LINE
1) DID NOT FALL PRIOR TO INJURY
2) UPHILL
3) DOWNHILL
4) PERPENDICULAR TO FALL LINE
5) NO SPECIFIC INJURY EVENT
?) NRS

33. *IF LOWER EXTREMITY, WERE YOU BEARING WEIGHT AT TIME OF INJURY
1) NOT LOWER EXT.
2) YES DEFINITELY
3) YES PROBABLY
4) NO DEFINITELY
5) NO PROBABLY
6) NO SPECIFIC INJURY EVENT
?) NRS

34. *IF LOWER EXTREMITY, WHICH WAY WAS INJURED LEG ROTATED
1) NOT LOWER LEG EXT.
2) INWARD
3) OUTWARD
4) DID NOT ROTATE
5) NO SPECIFIC INJURY
6) NRS

35. HOW MANY SKI (SNB) INJURIES HAVE REQUIRED M.D. ATTN. __ __ ?) NRS

36. X- RAY NUMBER __ __ __ __

37. SIDE INJURED
1) RIGHT
2) LEFT
3) MIDLINE
4) 1ST RIGHT, 2ND LEFT
5) 1ST LEFT, 2ND RIGHT
6) 1ST RIGHT, 2ND MIDLINE
7) 1ST LEFT, 2ND MIDLINE
8) 1ST MIDLINE, 2ND RIGHT
9) 1ST MIDLINE, 2ND LEFT

38. FIRST DIAGNOSIS (_____) __ __ __

39. SECOND DIAGNOSIS (_____) __ __ __

40. *WHEN DID BINDING RELEASE
1) DID NOT RELEASE
2) BEFORE INJURY
3) AFTER INJURY
4) AT TIME OF INJURY
5) NO SPECIFIC INJURY
?) NRS

41. SKIING (SNB) ACTIVITY WHEN INJURED – 1) NORMAL TERRAIN 2) TERRAIN PARK 3) OFF TRAIL

42. TRAIL DESIGNATION AT ACCIDENT SITE – 1) GREEN 2) BLUE 3) BLACK 4) DOUBLE BLACK

43. *SNOW CONDITIONS AT SITE OF ACCIDENT

1) DRY POWDER
2) WET HEAVY
3) PACKED POWDER
4) HARD PACKED
5) ICE
6) FROZEN GRANULAR
7) CORN
8) WIND BLOWN.
9) SLUSH
10) CRUSTED
11) CHUNKY
12) EXPOSED GROUND
13) OTHER_____
14) NO SPECIFIC ACCIDENT EVENT
?) NRS

EQUIPMENT INFORMATION

44. X1P. EQUIPMENT TYPE- 1) ALPINE 2) FREE-HEEL 3) SNOWBOARD 4) SKI BOARD

45. EQUIPMENT OWNERSHIP
1) ALL OWNED
2) BORROWED
3) SUGB RENTAL
4) BOOT OWNED/ SKI (SNB) RENTAL
5) SKI (SNB) OWNED/ BOOT RENTAL
6) OTHER RENTAL
7) OTHER_____
?) NKS

46. **WHO LAST ADJUSTED YOUR BINDINGS – 1) PROFESSIONAL 2) SKIER 3) RELATIVE 4) OTHER ?) NKS

47. **LAST BINDING ADJUSTMENT/ INSPECTION BY A PROFESSIONAL
1) NEVER
2) SAME DAY
3) LESS THAN 1 WK
4) 1 – 4 WK
5) 1 – 3 MO
6) 4 – 6 MO
7) 7 MO – 1 YR
8) MORE THAN 1 YR
9) NON- RELEASE BINDING
10) RENTAL
?)NRS

48. AT LAST INSPECTION OF BINDINGS BY A PROFESSIONAL, WHAT TYPE OF SKIER WERE YOU CLASSIFIED AS
1) TYPE I
2) TYPE II
3) TYPE III
4) NOT ASKED
5) TYPE I-
6) TYPE III+
?) NRS
T/H) __ __ __/ __ __ __

49. *DO YOUR BINDINGS RELEASE WHEN YOU FALL
1) NEVER
2) SELDOM
3) OFTEN
4) ALWAYS
5) NEW EQUIPMENT
6) RENTAL
?) NRS

50. * DO YOUR BINDINGS RELEASE WHEN YOU ARE SKIING IN CONTROL
1) NEVER
2) SELDOM
3) OFTEN
4) ALWAYS
5) NEW EQUIPMENT
6) RENTAL
?) NRS

51. BINDING – MAKE MODEL_____
7) ATOMIC/ ESS
10) LOOK
11) MARKER
9) ROSSINGOL/ GEZE
13) SALOMON
15) TYROLIA
2) BESSER
3) BURT
4) CABLE HEEL
5) CUBCO
6) DOVER
8) GERTSCH-HEAD
12) MOOG
14) SPADEMAN
16) OTHER_____
17) NAVA
18) SNB- SOLE FIXATION_____
19) SNB- BUCKLE FIXATION (SOFT BOOT)_____
20) FREE- HEEL_____
21) NON-RELEASE SKIBOARD_____
22) NKS (OR EXAMINER

41. *AGE OF BINDING (years) __ __ ?) NKS (OR EXAMINER)

42. E30. RELEASE INDICATOR VALUE (nearest .5) T __ __ __.__ __ H__ __ __. __ __

43. *BOOT SOLE LENGTH (mm) __ __ __

44. **TYPE OF BOOT

1) FRONT CLOSURE	3) MID ENTRY	?)NKS
2) REAR ENTRY	4) OTHER_____	

45. *BOOT – MAKE MODEL_____

1) ALPINA	6)DYNAFIT
5) DOLOMITE	7) GARMONT
12) LANGE	9) HEIERLING
15) NORDICA	11) KOFLACH
33) ROSSIGNOL	13) MUNARI
17) RAICHLE	14) NAVA
18) SALOMON	19) SAN MARCO
21) TECHNICA	22) TRAPPEUR
34) TYROLIA/HEAD	24) LEATHER
	28) OTHER ALPINE_____
2) CABER	29) OTHER FREE-HEEL_____
3) DACHSTEIN	31) SOFT- SNOWBOARD_____
4) DALEBOOT	32) HARD- SNOWBOARD_____
?) NKS	35) OTHER_____

46. *AGE OF BOOT (years) __ __ ?) NKS (OR EXAMINER)

47. HOW TIGHT WAS YOUR BOOT BUCKLED AT INJURY

1) TIGHT	3) LOOSE	?) NRS (OR PATROL)
2) SNUG	4) TOP BUCKLE(S) OPEN	

48. SKI (SNB) LENGTH (CM) __ __ __ MAKE/
MODEL_____

49. ***SNB- LEAD FOOT – 1) LEFT 2) RIGHT

50. ***SNB- FEET ATTACHED AT TIME OF INJURY – 1) YES 2) NO

51. WAS A HELMET WORN AT TIME OF INJURY – 1) YES 2) NO

52. WERE WRIST GUARDS WORN AT TIME OF INJURY – 1) YES 2) NO

Appendix C – Control Data Form

[SB4-1/11/02]

CONTROL DATA FORM

NORTH [ ] SOUTH [ ] TECH. _____ NOTES:_____

Enter or circle the subject's response to the questions that follow.

X1. EQUIPMENT TYPE - 1) ALPINE 2) FREE-HEEL 3) SNOWBOARD (SNB) (drop **) 4) SKIBOARD

X2. PASS - 1) TICKET 2) SEASON PASS 3) EMPLOYEE

1. SUBJECT NUMBER _ _ _ _ _ _ _ _ _

2. DATE _ _/_ _/_ _

2a. DATE LAST SKIED (SNB) AT SB _ _/_ _/_ _

2b. APPROXIMATE NUMBER OF RUNS ON THAT DATE _ _

2c. DID YOU SUSTAIN AN INJURY - 1) YES 2) NO

2d. HOW DID YOU REPORT THE INJURY
1) NO INJURY 2) TO THE PATROL 3) TO THE CLINIC AT SB 4) TO BOTH

3. AGE AT LAST BIRTHDAY _ _

4. SEX - 1) MALE 2) FEMALE

5. DOMINANT HAND - 1) LEFT 2) RIGHT 3) AMBIDEXTROUS

6. HEIGHT (to nearest inch) _ _ _

7. WEIGHT (to nearest lb.) _ _ _ ?)NKS

8. FOOT LENGTH (mm) _ _ _

10. SEASONS SKIED (SB) PRIOR TO THIS ONE _ _ ?)NRS

11. AVE. NUMBER OF DAYS SKIED(SB) EACH PRIOR SEASON _ _ _ ?)NRS

12. NUMBER OF DAYS SKIED(SB) THIS SEASON _ _ _ ?)NRS

13. HIGHEST SPEED AT WHICH YOU NORMALLY SKI - 1) SLOW 2) MOD FAST 3) FAST ?)NKS

14. WHAT TYPE OF SLOPE DO YOU NORMALLY SKI - 1) GENTLE 2) MODERATELY STEEP 3) STEEP

15. SKIER'S(SB) ESTIMATE OF OWN ABILITY - 1) BEG. 2) NOV. 3) INT. 4) ADV. INT. 5) EXP. ?) NKS

16. HOW LONG HAVE YOU SKIED(SB) TODAY (decimal hours) _ _. (.00) (.25) (.50) (.75)

17. NUMBER OF LIFTS TAKEN (copy from last page) _ _ ?) NRS

18. AVERAGE DESIGNATION OF TRAILS SKIED(SB) TODAY - 1) GREEN 2) BLUE 3) BLACK ?) NKS

19. HOW MANY TIMES HAVE YOU FALLEN TODAY _ _ _ ?) NRS

20. TIMES YOU FELL LAST FULL DAY SKIED(SB) _ _ _ 77) NEVER SKIED(SB) BEFORE ?) NRS

21. SNOW CONDITIONS AT SITE OF LAST FALL

1) DRY POWDER
2) WET HEAVY
3) PACKED POWDER
4) HARD PACKED
5) ICE
6) FROZEN GRANULAR
7) CORN
8) WIND BLOWN
9) SLUSH
10) CRUSTED
11) CHUNKY
12) EXPOSED GROUND
13) OTHER_____
14) NO SPECIFIC ACCIDENT SITE
?) NKS (OR PATROL)

23. WHAT WAS THE CAUSE OF YOUR LAST FALL

1) STRUCK (OR STRUCK BY) SKIERS(SB)
2) STRUCK UNSEEN, UNAVOIDABLE OBJ.
3) INAD. REL. OPP. SIDE
4) INAD. REL. INJ. SIDE
5) INAD. REL. OTHER
6) CAUGHT INSIDE EDGE-INJ SIDE (TOE)
7) CAUGHT OUTER EDGE-INJ SIDE (HEEL)
8)**CAUGHT INSIDE EDGE-OPP. SIDE
9)**CAUGHT OUTSIDE EDGE-OPP. SIDE
10) DELIBERATE FALL
11) JUMPING
12) LOST CONTROL
13)**CROSS TIPS
14) TECHNIQUE OTHER
15) STRUCK BY LIFT
16) OTHER_____
17) NO SPECIFIC ACCIDENT EVENT
?) NRS

26. SKIER'S(SB) SPEED AT TIME OF LAST FALL

1) NOT MOVING
2) VERY SLOW
3) SLOW
4) MODERATELY FAST
5) FAST
6) NO SPECIFIC INJURY EVENT
?) NRS

27. DESIGNATION OF TRAIL AT FALL SITE - 1) GREEN 2)BLUE 3)BLACK ?) NKS

28. DIRECTION SKI(SB) TRAVERSING RELATIVE TO FALL LINE PRIOR TO FALL

1) TO RIGHT
2) TO LEFT
3) IN FALL LINE
4) OTHER
5) NOT MOVING
?) NRS

29. DIRECTION OF FALL RELATIVE TO BODY

1) NEVER FELL
2) FELL BACKWARD
3) FORWARD
4) TO RIGHT
5) TO LEFT
6) FORWARD, RIGHT
7) FORWARD, LEFT
8) BACKWARD, RIGHT
9) BACKWARD, LEFT
?) NRS

30. DIRECTION OF FALL RELATIVE TO FALL LINE

1) NEVER FELL
2) UPHILL
?) NRS
4) PRPNDCL TO FALL LINE
3) DOWNHILL

33. WHEN DID BINDING RELEASE

1) DID NOT RELEASE
2) BEFORE FALL
3) AFTER FALL
4) AT TIME OF FALL
?) NRS

34.**WHO LAST ADJUSTED BINDINGS - 1) PROFESSIONAL 2) SKIER 3) RELATIVE 4) OTHER ?) NKS

35.**LAST BINDING ADJUSTMENT/INSPECTION BY PROFESSIONAL

1) NEVER
2) SAME DAY
3) LESS THAN 1 WK
4) 1 - 4 WK
5) 1 - 3 MO
6) 4 - 6 MO
7) 7 MO - 1 YR
8) MORE THAN 1 YR
9) NON-RELEASE BINDING
10) RENTAL
?) NRS

36.**WHEN YOUR BINDINGS WERE LAST INSPECTED BY A PROFESSIONAL, WERE YOU CLASSIFIED AS A 'I', 'II', OR 'III' TYPE SKIER (if different T/H)

1) I 2) II 3) III 4) NOT ASKED 5) NEVER INSP. 6) I- 7) III+ ?) NRS T/H) _ _ _/_ _ _

37. DO YOUR BINDINGS RELEASE WHEN YOU FALL

1) NEVER
2) SELDOM
3) OFTEN
4) ALWAYS
5) NEVER FELL
6) RENTAL
?) NRS

38. DO YOUR BINDINGS RELEASE WHEN YOU ARE SKIING UNDER CONTROL

1) NEVER
2) SELDOM
3) OFTEN
4) ALWAYS
5) NEW EQUIPMENT
6) RENTAL
?) NRS

39. EQUIPMENT OWNERSHIP

1) ALL OWNED
2) BORROWED
3) SUGB RENTAL
4) BOOT OWNED/SKI(SB) RENTAL
5) SKI(SB) OWNED/BOOT RENTAL
6) OTHER RENTAL
7) OTHER_____
?) NKS

40. BINDING - MAKE MODEL _____

7) ATOMIC/ESS
10) LOOK
11) MARKER
9) ROSSIGNOL/GEZE
13) SALOMON
15) TYROLIA

2) BESSER
3) BURT
4) CABLE HEEL
5) CUBCO
6) DOVER
8) GERTSCH-HEAD
12) MOOG
14) SPADEMAN
16) OTHER _____
17) NAVA
18) SNB-SOLE FIXATION _____
19) SNB-BUCKLE FIXATION (SOFT BOOT) _____
20) FREE-HEEL _____
21) NON-RELEASE SKIBOARD _____
22) NKS (OR EXAMINER)

41. *AGE OF BINDING (years) _ _ ?) NKS (OR EXAMINER)

E30. RELEASE INDICATOR VALUE (nearest .5) T_ _ _._ _ H_ _ _._ _

42. *BOOT - MAKE MODEL _____

1) ALPINA
5) DOLOMITE
12) LANGE
15) NORDICA
33) ROSSIGNOL
17) RAICHLE
18) SALOMON
21) TECHNICA
34) TYROLIA/HEAD

2) CABER
3) DACHSTEIN
4) DALEBOOT
6) DYNAFIT
7) GARMONT
9) HEIERLING
11) KOFLACH
13) MUNARI
14) NAVA
19) SAN MARCO
22) TRAPPEUR
24) LEATHER
28) OTHER ALPINE _____
29) OTHER FREE-HEEL _____
31) SOFT-SNOWBOARD _____
32) HARD-SNOWBOARD _____
35) OTHER _____
?) NKS (OR EXAMINER)

43. TYPE OF BOOT

1) FRONT CLOSURE
2) REAR ENTRY
3) MID ENTRY
4) OTHER_____
?)NKS

44. HOW TIGHT WAS YOUR BOOT BUCKLED AT LAST FALL

1) TIGHT
2) SNUG
3) LOOSE
4) TOP BUCKLE(S) OPEN
?) NRS (OR PATROL)

45. AGE OF BOOT (years) _ _ ?) NKS (OR EXAMINER)

49. HOW MANY SKI(SB) INJURIES HAVE REQUIRED M.D. ATTN. _ _ ?)NRS

SB1.***LEAD FOOT - 1) LEFT 2) RIGHT

SB2.***FEET ATTACHED AT INJURY - (1) (2)

H1. HELMET - 1) YES 2) NO

W1. WRIST GUARDS - 1) YES 2) NO

E9. BOOT SOLE LENG. (mm) _ _ _

E16. SKI(SB) LENG. (cm) _ _ _ MAKE/MODEL _____

E16d. AGE OF SKI(SB) (years) _ _ ?) NKS

E16a. WID TIP (mm) _ _ _ E16b. WID WAIST (mm) _ _ _ E16c. WID TAIL (mm) _ _ _

E16e. IN THE OPINION OF THE SKIER IS THIS SKI - 1) CONVENTIONAL 2) SHAPE ?)NKS

L1. TOTAL HOURS OF SKI (OR SB IF INJURY WAS ON SB) INSTRUCTION _ _ _

L2. HOURS OF SKI (OR SB IF INJURY WAS ON SB) INSTRUCTION THIS SEASON _ _

L3.**HAVE YOU RECEIVED ANY FORMAL ORIENTATION IN THE USE OF SHAPE SKIS
1) YES, AT SB 2) YES, NOT AT SB 3) NO INSTRUCTION

Ask the following questions to all Alpine injuries and controls.
Note: Do not read options to subject -- interpret the subject's response.

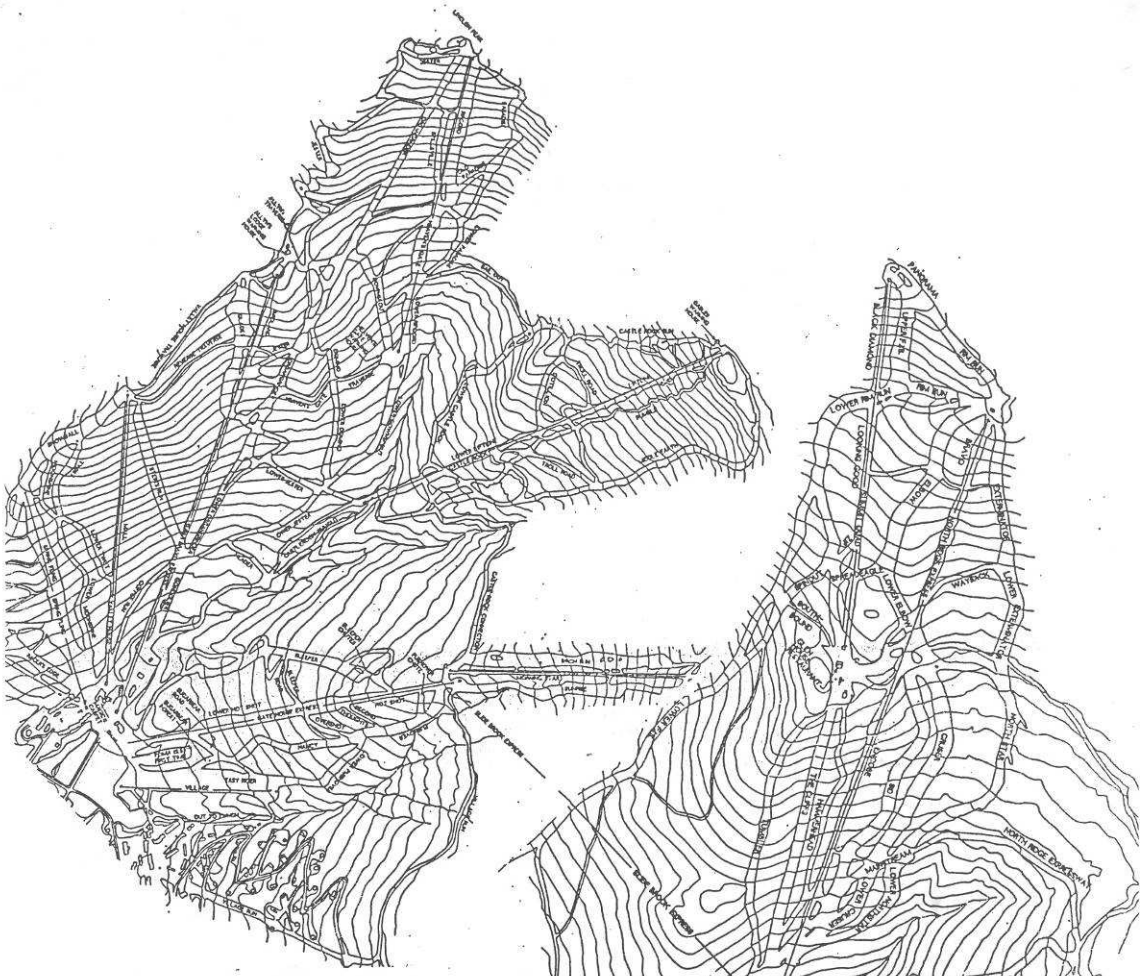
A1. *HAVE YOU EVER RECEIVED INFORMATION ABOUT KNEE INJURIES IN SKIING? 1) YES 2) NO
---------- (If NO -- End questioning here) ----------

A2. *(If YES) WHAT WAS THE SOURCE? (Check up to three)
1) MAGAZINE OR NEWSPAPER ARTICLE
2) MAGAZINE OR NEWSPAPER ADV.
3) PAMPHLET - "TIPS..."
4) TV BROADCAST OR VIDEOTAPE
5) SKI SCHOOL - SUGARBUSH
6) SKI SCHOOL - OTHER
7) OTHER ORGANIZED ACTIVITY
8) WORD OF MOUTH - PROFESSIONAL
9) WORD OF MOUTH - OTHER
10) "ACL AW... TR..." (Inst/Patrol - current/former)
?) NRS

A3. *DID YOU LEARN HOW THE RISK OF KNEE INJURY MIGHT BE REDUCED? 1) YES 2) NO
---------- (If NO -- End questioning here) ----------

A4. *(If YES) WHAT DID YOU LEARN? (Check up to three)
1) PRESEASON CONDITIONING
2) USE A CERTAIN BRAND OF BINDING
3) USE A CERTAIN BRAND OF BOOT OR SKI
4) ANY CORRECT REFERENCE TO "TIPS"
5) CORRECT BUT INARTICULATE REF. "TIPS"
6) INCORRECT REFERENCE TO "TIPS"
7) RELAX, DON'T FIGHT THE FALL
8) OTHER UNSUBSTATIATED THEORIES
9) INCOHERANT RESPONSE
10) "KINESTHETIC" SENSE OF DANGER
11) PRESEASON EQUIPMENT INSPECTION
?) NRS

Give the subject (or control) a "Tips" pamphlet <u>after</u> completing questions.



17. # of trips on each lift and Total Lift Equivalents .

A.	SPRING FLING	T	(2) X ____ = ____
B.	VALLEY HOUSE	D	(3) X ____ = ____
C.	SUPER BRAVO	Q	(4) X ____ = ____
D.	MAGIC CARPET		(1) X ____ = ____
E.	HEAVEN'S G	T	(3) X ____ = ____
F.	CASTLE ROCK	D	(4) X ____ = ____
G.	GATEHOUSE	Q	(2) X ____ = ____
H.	NORTH LYNX	T	(2) X ____ = ____
I.	BEGINNER	P	(1) X ____ = ____
J.	VILLAGE	D	(1) X ____ = ____
K.	SLIDE BROOK	Q	(0) X ____ = ____
L.	BEGINNER TOW		(1) X ____ = ____
M.	SUNSHINE	D	(1) X ____ = ____
N.	GREEN MT	Q	(2) X ____ = ____
O.	SUMMIT	Q	(3) X ____ = ____
P.	NORTH RIDGE	Q	(4) X ____ = ____
Q.	INVERNESS	Q	(3) X ____ = ____
R.	GMVS	P	(2) X ____ = ____

TOTAL = _____