MANAGEMENT OF AVALANCHE RISK FACED BY BACKCOUNTRY SKIERS[1]

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Abstract.--A survey of backcountry skiers in Banff National Park revealed that the skiers, although aware of the avalanche danger and generally well informed as a result of courses, reading material and information obtained from the Parks Canada management program, possess a disappointingly low knowledge of the avalanche hazard.

INTRODUCTION

Winter backcountry recreation has become popular in the mountains during the last decade Villa (1980) Ward (1980) Parks Canada (1984). With this larger number of people in areas subject to avalanches there has been an increase in the numbers of avalanche accidents Williams (1978) Daffern (1983). Many of these accidents occurred during periods when professional forecasters were aware of the high avalanche risk Gallagher (1967) Stetham and Schaerer (1980) but the backcountry travellers either were unaware of the danger or ignored it for some reason.

While there is an extensive literature on snow behaviour, snow stability, avalanche release, control and rescue, limited data exist on human behaviour as related to avalanches. Little is known about the users awareness, perception and knowledge of the avalanche hazard, of how they assess avalanche risk and the extent to which existing backcountry information and management programs are effective.

During the winter of 1984-1985 backcountry skiers were interviewed on 4 popular ski trails possessing varying degrees of avalanche danger in the Rocky mountains of Banff National Park Alberta, Canada.

This paper presents the results of the study. It describes the skiers awareness, perception and knowledge of the avalanche hazard and their knowledge, opinions and use of existing management programs aimed at reducing the number of backcountry accidents and deaths. The implications of these findings for managing the avalanche hazard are discussed.

THE SURVEY

Banff National Park has a great variety of trails used for cross country skiing. Kunelius (1977) lists 72 in his guidebook.

Four popular ski trails with different levels of avalanche risk were chosen for this research and 365 randomly selected skiers were interviewed at or close to the trailheads. The response to the survey was excellent, most of the interviewees were genuinely interested in the questions and only one person declined to be interviewed.

The four trails chosen were Bow Hut, Mosquito Creek, Red Earth and the Pipestone. Bow Hut is an advanced trail which is very prone to avalanches and is rated as a difficult ski mountaineering trail. Mosquito Creek is a moderately difficult trail with no and moderate avalanche risk over much of its length and extensive areas of high avalanche risk in the open alpine meadow areas at its termination. Red Earth Creek trail is one with no or moderate risk over almost its entire distance with only small areas of high avalanche risk in the upper sections. The Pipestone trail has no avalanche risk and is an easy skiing trail.

From December 1984 to April 1985, 5254 people were recorded travelling along the four trails using electronic counters installed at the trail heads. There was some variation in usage between the trails with 1583 people recorded on Red Earth Creek trail, 1350 on

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Mosquito Creek, 1262 on Pipestone and 1059 on the Bow Hut trail.

The degree of avalanche risk along different sections of the trails was mapped and zones of no risk, moderate risk and high risk identified. The Pipestone trail for example has no avalanche risk while most above treeline areas were rated as having a high avalanche risk.

The skiers were categorized depending upon which risk zone they used. The assigned risk level for the skiers was based on the zone of maximum avalanche risk that the person intended to pass through on the day of the interview. There was a surprisingly even distribution of users in the three risk zones with 138 skiers being put in the high risk group, 105 in the moderate and 115 in the no risk group.

The skiers as a whole did not conform to the national average for Canada in terms of age, education and wealth. The group can be described in general as consisting of predominantly male, well educated, relatively affluent, young professionals. Seventy five percent of those interviewed were male, 88 percent were between 21 and 50 years old, 81 per cent were white collar professionals and some 28 percent had an occupation in the natural sciences or engineering. Three quarters of the skiers came from Calgary, Edmonton, Banff or Lake Louise and 87 percent from Alberta and British Columbia.

The skiers on average had spent 20 days backcountry skiing during the previous two seasons with almost 40 percent having been on a backcountry winter camping trip involving 2 days or more.

AWARENESS AND PERCEPTION

Most of the skiers were aware of the danger from avalanches and 60 percent mentioned avalanches as a major concern when travelling in mountain areas without knowing that the study was about avalanches. As might be anticipated more of the respondants in the high risk group were worried about avalanches than those in the moderate or no risk groups. Interestingly, when asked to describe avalanches, the interviewees provided generally accurate descriptions involving large masses (22.4%) of snow sliding (81.4%) at high speeds (11.0%). The descriptions were factual rather than emotional and avalanches do not appear to invoke the same emotional responses of apprehension and fear in people as does the risk from bears.

KNOWLEDGE

Obtaining a real and objective understanding of the backcountry users knowledge of the avalanche hazard and the ways they adjust to the danger is essential in developing and implementing any avalanche management program.

There are a number of key questions which need to be answered.

- How much does the user really know about avalanches and how accurate is this knowledge?
- What is the backcountry travellers ability to rate and assess the avalanche risk?
- What sources does the skier use to obtain information and to improve his knowledge?
- Do knowledge levels vary between skiers using trails and zones with different avalanche risk levels?

These questions are answered in the following sections on assessment and hazard rating skills and sources of information.

Assessment and Hazard Rating Skills

The backcountry skiers overall knowledge of avalanches and the accuracy of their assessment and ability to rate the avalanche danger was evaluated in a number of ways.

First, the skiers were asked to give an avalanche hazard rating for the day in question and to explain the reasons for their rating. The rating was compared with the official Parks Canada avalanche hazard warning and based on the accuracy of the rating and the reasons given the skier was classified as having low, moderate or good knowledge.

Second, users were asked to identify the avalanche risk zones along the path they intended to travel. Again based on their replies they were categorized as having low, moderate or good knowledge.

Third, a simple test was used to determine the skiers ability to select a route across an obvious avalanche slope. A sketch was shown to the users and they were asked to select a safe route and explain their reasons for choosing this route. Again depending on their answers they were categorized as having low, moderate or good knowledge.

Almost half (42 percent) of the skiers rated the hazard danger the same as Parks Canada, while 38 percent placed it lower and 20 percent thought it was higher. There were some variations between skiers travelling different trails. Three quarters of the users of the Pipestone (no risk trail) placed the avalanche risk lower than the Parks Canada rating, while about 1/3 of the users of the trails with high risk zones placed the risk lower than Parks Canada.

The general knowledge level of the skiers based on their hazard rating was disappointing. Less than half the skiers were classified as having good knowledge and one third had low

Table 1. Avalanche rating knowledge versus risk zone used

	No risk zone users	Moderate risk zone users	High risk zone users	Total
Low Knowledge	41.5%	44.0%	21.1%	34.2%
Moderate Knowledge	4.7%	19.0%	29.3%	18.6%
Good Knowledge	53.8%	37.0%	49.6%	47.2%

knowledge (Table 1). Even when considering soley the users of the high risk zone only 50 per cent showed a good knowledge.

The backcountry users in general (75%) were confident that they knew where the avalanches danger areas were on the trails they intended to travel. Ninety one percent of the users of the high risk zone, 71 percent in moderate risk group and 62 per cent of the no risk group described where avalanches were likely to occur. However actual knowledge levels showed the reverse trend with 86 percent of the no risk users having good knowledge, 38 percent of moderate risk users and only 25 per cent of high risk users. The very low knowledge levels of avalanche danger zones by the high risk users, most of whom had used the same trail many times, is especially remarkable.

The ability of the skiers to select a safe route to the cabin as tested with the avalanche sketch (Fig. 1) was also disappointing. Approximately half the respondants had moderate route selection knowledge, while only one quarter could be classified as possessing good knowledge (Table 2). However an encouraging result was that the high risk group of skiers had the largest percentage in the good knowledge category (34%).

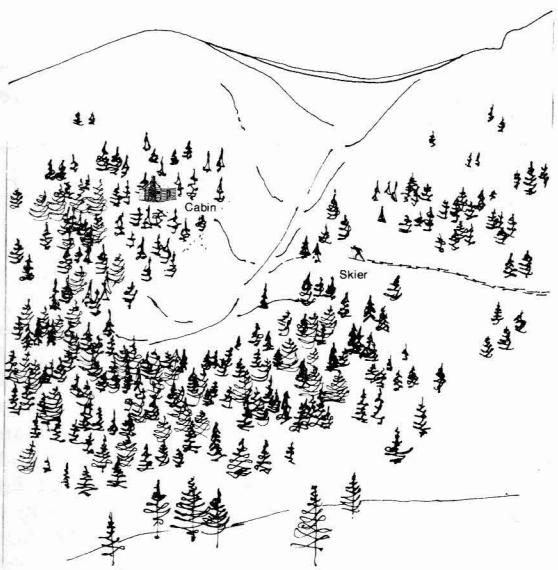

Figure 1.--Route Selection Exercise

Overall the knowledge levels of the users of the high risk areas causes perhaps the most concern as these are the individuals most at risk. Only half had a good knowledge of avalanche hazard rating, while one third had good route selection abilities as shown in the exercise and only one quarter had a good knowledge as to the location of avalanche danger areas on the trails they intended to use.

Sources of Information

Important questions that have implications for avalanche management are how do people build up their knowledge of the avalanche hazard and what use do they make of existing programs.

Avalanche Courses and Literature

Two of the main ways in which people obtain background information on avalanches is by taking courses and reading the great wealth of avalanche literature which is available. Fifty five percent of the skiers interviewed had attended some type of avalanche course. Some 68 different courses were mentioned with the principle ones being given by the Alpine Club, Canadian Ski Patrol, the City of Calgary, the British Columbia Institute of Technology, University of Calgary and Parks Canada. Over 60 percent in the high risk group had taken courses as compared to 32 per cent in the no risk category. Cross tabulations showed that having taken a course increased the skiers ability to give a more accurate avalanche hazard rating and to select a safer route. Over 57 percent of those who had taken a course were rated as having a good knowledge of avalanche hazard ratings, as compared to 38 percent who had not and thirty six percent of those who had attended a course were placed in the good route selection category as compared to 15 percent who had not.

A broad spectrum of literature was cited as having been read ranging from pamplets and newspaper articles to well known scientific books dealing with avalanches.

Over 80 percent of the respondents had read some literature on the avalanche hazard with one third mentioning specific books (Table 3). Users of the high risk zone had read more deeply about the avalanche hazard as compared to the users of the other two zones. A significant relationship was found between reading and avalanche hazard rating and route selection knowledge. Two thirds of those who had read

Table 2.--Knowledge of avalanche locations versus risk zone used.

	No risk zone users	Moderate risk zone users	High risk zone users	Total
Low Knowledge	31.6%	21.9%	10.9%	10.7%
Moderate Knowledge	57.0%	51.4%	55.1%	54.6%
Good Knowledge	11.4%	26.7%	34.1%	24.6%

Table 3.--Literature read versus risk zone used.

	No risk zone users	Moderate risk zone users	High risk zone users	Total
No Material Read	29.6%	21.2%	8.8%	19.1%
Only General Material	57.4%	51.0%	35.8%	47.2%
Specific Books	13.0%	27.9%	55.5%	33.7%

specific avalanche books were rated as having good avalanche hazard rating knowledge as compared to twenty nine percent who had read no material. Further 45 percent of those who had read books had good route selection knowledge as compared to the 11 percent who had read no material.

Avalanche courses and the literature strongly encourage people travelling in avalanche country to carry as standard equipment shovels, beacons, probes and snow study equipment. Only twenty percent of skiers in the no risk group, thirty percent in the moderate risk and eighty percent in the high risk carried avalanche safety equipment. It was encouraging to find that the high risk group of skiers were better equipped then those travelling in the other two zones with 40 percent carrying beacons, shovels and probes and another 40 percent carrying one or two items of beacons, shovels or probes.

Obtaining Current Avalanche Risk Information

A surprising large number of skiers (77 percent) stated that they generally obtained information about the avalanche danger before setting out. Ninety percent of the high risk group, 78 percent of the moderate risk group and 63 percent of the no risk group reported seeking information.

The Parks Canada avalanche hazard report was mentioned by the greatest number, 31 percent of the respondents, while 22 percent obtained a weather forecast, 19 percent made some visual observation of the weather, 18 percent carried out some form of snow stability test and 16 percent obtained a snow or ski report. The most common sources of information were

- Park Canada Wardens 59 percent
- Telephone recording 10 percent
- Parks Canada Information Center 9 percent
- Commercial radio stations 8 percent
- Friends 8 percent

As Table 4 shows the Parks Canada Wardens were the chief source of information for people in the moderate and high risk groups.

Interestingly, the Parks Canada information center showed a reverse trend with the travellers in the high risk zone using it least. Many individual negative comments were recorded about the quality of the information given at the information center.

Table 4. Sources of information versus risk zone used.

	No risk zone users	Moderate risk zone users	High risk zone users	Total
Wardens	46.3%	52.1%	71.0%	58.8%
Telephone Recording	3.0%	7.0%	15.0%	9.4%
Information Center	14.9%	12.7%	2.8%	9.0%
Radio Stations	10.4%	9.9%	5.6%	8.2%
Friends	3.0%	4.2%	13.1%	7.8%

Cross tabulations showed that 53 percent of those who obtained information were more accurate in their avalanche hazard ratings as compared to 25 percent who had not while 30 percent of those who obtained information were categorized as possessing good knowledge in the route selection exercise as compared to the 7 percent who had not obtained information.

SUMMARY AND DISCUSSION

The typical backcountry skier in the Canadian mountain parks is a young well educated professional person who usually skis 10 days a winter and three out of four are male. The skiers are in general cognizant of the danger from avalanches and four out of five seek information about avalanche conditions prior to setting out. In contrast to other natural hazards, 4 out of 5 users have read some material on avalanches while many especially the users of the high risk zone have studied the technical literature and over half have attended an avalanche course. Nearly one third of the users know about the existing Parks Canada avalanche report and more than half of these (60 percent) listed the wardens as the prime source of information. A much lower percentage roughly 10 percent each, were aware of the avalanche telephone recording and the Parks Canada Information Center.

However, the knowledge level of the backcountry users when objectively assessed was disappointing. Of the high risk group only one half were found to have a good knowledge of avalanche hazard rating, only one quarter knew where the avalanche risk areas were on the trails they intended to use (although 91 percent confidently stated they did and most had used the trails before) and only one third had good route selection abilities.

A positive trend was that the high risk group of skiers in general were more knowledgeable, better informed and better prepared than those in either the moderate risk group or no risk group. In turn the moderate group were better informed, more knowledgeable and better prepared than those in the no risk group.

The results of the study indicate that a higher level of skier education should be the aim in avalanche management programs. This might be accomplished by establishing a backcountry ski information center which is readily accessible to all the users and staffing it with well qualified personnel such as wardens. From the answers given by the respondants it was clear that the wardens are viewed as the most credible and reliable source of information and that the present information center in Banff is not well regarded. Another possible solution would be the posting of avalanche ratings and advice at the trail heads.

On average 2.7 people die in avalanches in Banff Park each year. If we consider that over 5000 people used the 4 trails we monitored and that there are 72 trails in the park, then the the mortality rate is not excessively high. This suggests that the existing programs are working reasonably well and that what is needed are improvements and adjustments rather than a major restructuring of programs.

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