THE AVALANCHE VICTIM

K. Williams

Introduction

"The victim is a male, 27 years old, has had several years of skiing or mountaineering experience, and didn't know an avalanche from a snowball."

Thus we have a composite description of the typical American avalanche victim. Of course, not every victim will fit this profile, but, whatever his age or experience, he is making himself a "statistic" with increasing frequency -- 17 last winter, 22 the winter before, 13 the winter before that (Fig. 1). Considering that the long-term annual average for avalanche deaths in the United States is six (Williams, 1975a), this upward trend is alarming (Fig. 2). In this paper we will look at who tomorrow's avalanche victims are likely to be, what their chances of survival are, and how organized rescue groups can better prepare themselves for an avalanche emergency.

The Modern Avalanche Victim

Since 1950 in the U.S., there have been 120 documented fatal avalanche accidents that have claimed 173 lives. Data from these accident reports have been composites to draw a profile of the modern avalanche victim. Of the 173 victims, 148 (86%) were men and 25 (14%) were women. Their ages ranged from seven to 66, with a strong concentration on the 15 to 29 age group (Fig. 3). The average age was 27, perhaps a significant result reflecting youth-oriented outdoor sports, or perhaps a trivial result merely reflecting the average age of the U.S. citizenry.

Figure 4 shows the activity groups into which the avalanche victims fall. Three-fourths of the victims were pursuing some form of recreation at the time of the accident, with climbers, lift-skiers, and ski-tourers leading the list. The distinction between lift-skiers and ski-tourers, as shown in Fig. 4, should be noted. Lift-skiers pursue their sport in and around developed ski areas and rely on ski lifts to carry them uphill, whereas ski-tourers take their pleasure in the back-country, often far from any developed area. Ski mountaineers are included as ski-tourers.

The accident reports were also analyzed, where possible, to determine the experience level of the victim,
especially his knowledge of avalanches. Unfortunately, only a few reports contained this information, so that the conclusions drawn are based on a small sample. The overall experience level of the victims varied from absolutely zero to the seasoned mountaineer's thorough knowledge of mountains and their inherent dangers. In fact, a number of victims had expert knowledge of mountains and were well aware of the hazards of avalanches, yet they took one risk too many, and lost. Nonetheless, a generalization can be made: Most avalanche victims, while perhaps competent skiers, climbers or other type of winter sportsmen, had virtually no avalanche awareness training and therefore were unaware of the risks they were taking. It is among this sector of the public that lives can be saved through avalanche awareness programmes.

The Avalanche Setting

Most fatal avalanche accidents occur in the back-country. For our purposes, back-country may be defined as any area in which a group of rescuers lies more than 30 minutes away. Of the accidents studied, 78 (66%) were back-country and 40 (34%) were at, or near, developed areas. To see the effect of back-country accidents, one need only look at Table 1, which shows the average time delay in organized rescues of buried victims. The long average time required for the recovery of back-country victims by organized rescue groups usually means that this is an exercise in body recovery rather than live rescue. Only about one out of three buried avalanche victims survive (Williams, 1975b), and these odds become even longer in the back-country because of the time element.

The statistics of Table 1 are all average values and, as such, may be misleading in at least one instance. For developed areas the time until the sounding of alarm is 0.75 hour (45 minutes), a correct average figure, but one that demands clarification. In about three-fourths of the cases, the alarm was sounded in 35 minutes or less, with the average of these cases being 15 minutes. But the remaining one-fourth of the cases involved delays of one to five hours (for various reasons) until a victim was declared missing. Hence, these cases heavily biased the average. The point to be made is that, in the majority of developed-area rescues, the alarm is sounded quickly enough—15 minutes on the average—to give a reasonable chance of a live recovery.

Most killer avalanches are triggered by the victim himself, are of small-to medium-size, and usually result in only one fatality. Of 120 accidents, 88 claimed one life; 22, two lives; 4, three lives; 3, four lives; 2, five lives; and 1, seven lives. The data reveal also the danger of slab
avalanches vs loose snow (point release) avalanches. Of 69 fatal accidents that detailed the type of avalanche, 68 were slabs.

**Survival Statistics**

As a rough average, only one out of every 10 persons caught by an avalanche is killed. However, a completely buried victim has but one chance in three of survival. For the buried victim, Fig. 5 relates the chance of survival to burial time. Especially note that the 50% survival time is about 30 minutes. In other words, after a burial of 30 minutes, only 50% of the victims can be expected to survive. So pay attention, rescuers: there's less time than you think. But a word of encouragement: It must be realized that Fig. 5 was derived from a large data sample and reflects average results only. In favourable circumstances, buried victims can live for several hours beneath the snow. Rescuers, therefore, must give the victim the benefit of this longshot and never abandon a search prematurely.

Survival is also a function of burial depth. Figure 6 shows this relationship based on the same data set as Fig. 5. While a victim's odds are not good at any depth, the chance of survival diminishes rapidly with depth.

Approximately half of the avalanche reports listed the cause of death of the victim (other than "died in snowslide"). Two-thirds of the victims died from suffocation; the other one-third died from various internal injuries, with head and neck injuries leading the list. (In one other accident, the victim died of hypothermia and, in another, the victim drowned when swept into a river.)

**Rescue: Developed Areas and Back-Country**

In and around developed areas, organized rescue groups have been, and will continue to be, an important life-saving force. With a 30-minute average survival for buried avalanche victims, the emphasis in rescue is on speed. The initial hasty search party must have adequate manpower and equipment to perform its search as rapidly as possible. Interrogating eyewitnesses, marking the last-seen point, surface scuffing for clues, and probing in likely looking locations all must be conducted with speed. These tasks require repetitive training. The hasty search party must be followed quickly by the main rescue party, whose job it is to perform a methodical coarse probe and who must be prepared to treat the victims for shock, anoxia, and perhaps serious internal injuries. Perla and Martinelli (1976) thoroughly
cover the details of modern avalanche rescue techniques. With speed and a little luck, the victim can be rescued alive.

Back-country rescues are something else. Seldom does an organized rescue group succeed in a live rescue, for time is against them. Rather, it is the training and actions of the survivors among a back-country tour group that has tangled with an avalanche that are important. The key to reducing back-country fatalities is avalanche awareness training for the recreation-minded public, for the time factor assures that virtually the only chance a victim buried in the back-country has is to be found by his companions. Knowledgeable avalanche personnel have the responsibility to make their expertise available to the public. Winter recreationists have the responsibility to seek and absorb this information. Proper training includes knowing safe travel techniques, recognizing avalanche terrain, avoiding dangerous situations, carrying rescue equipment, and knowing self-rescue and group-rescue techniques.

To summarize, speed by a well-trained rescue unit is the key to live recoveries in developed areas, whereas proper thought and preparedness beforehand and having proper rescue equipment in the event of emergency are the keys to avalanche survival in the back-country.

References


Discussion

EIGENMANN: Do your statistics include Canadian and European case histories in addition to the U.S. data?

WILLIAMS: No, we have only worked with U.S. histories.

EIGENMANN: It is quite interesting that your statistics closely resemble statistics compiled in Europe.
HETHERINGTON: It would seem that your rescue statistics depend on how you define burial.

WILLIAMS: By burial, we mean that the victim's head is under the snow, and that the victim cannot extricate himself without assistance.

STETHEM: In reviewing Canadian case histories, we noticed that several victims died in their cars due to Carbon Monoxide poisoning because they did not (or could not) turn their car engines off.

ANDERSON: We had one interesting case at Snowbird. The victim could not clear an air space with his hands so he shook his head from side-to-side, creating an air space which he thought saved his life. We have not seen this technique described in safety manuals.

GALLAGHER: With regard to updating statistics, techniques, and experiences, it is essential that reports continue to arrive at central locations. In the USA, to the USFS at Fort Collins, Colo., and in Canada, to the National Research Council, Vancouver.

BURR: It seems that we need more than a collection location. I feel there is a great need for an Avalanche Centre which not only collects reports but also acts as a clearing house for all forms of public education materials, and serves as a base for conducting avalanche schools.

WILLIAMS: Yes, I agree that we should be doing as much as possible along those lines.

GEISLER: The rescue statistics indicate that it is important to get to the site as soon as possible. We should arrange more drills to become proficient in reducing the time it takes to reach the accident site.

PERLA: Drills are important, but it is also evident from the rescue statistics that a ski area with a serious avalanche hazard must have a professional team of ski patrolmen stationed at top of the area on standby call for emergency. Good examples of this system are: Weissflujoch in Switzerland, Snowbird, Jackson, and Vail in the USA, and Whistler Mountain in Canada.

ANDERSON: It is important to drill twice per season with electronic rescue transceivers. The drills should be repeated at mid-season because the average patrolman loses the knack of using the transceiver. The drills
should be conducted under realistic field conditions using a stopwatch. We found that, without drills, there is only a 30% chance that a successful search can be made in less than 20 minutes.

WILLIAMS: Peter Lawton travelled to various ski areas and ran tests to determine the speed of rescue with transceivers. He indeed found that practice results in a significant improvement in time.
### TABLE 1

Average Delay in Organized Rescues of Buried Victims (from Perla and Martinelli, 1976)

<table>
<thead>
<tr>
<th>Location</th>
<th>Hours after accident before:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sounding of alarm</td>
<td>Arrival of rescuers at accident</td>
<td>Discovery of victim&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Developed areas</td>
<td>0.75&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.25</td>
<td>2.5</td>
</tr>
<tr>
<td>Back-country</td>
<td>5.25</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>All rescues</td>
<td>3.5</td>
<td>6.25</td>
<td>20.5</td>
</tr>
</tbody>
</table>

<sup>1</sup>See comments in text.

<sup>2</sup>In six cases, the rescue was abandoned and the victim was not found until summer. These cases have been deleted from this column.
FIGURE 1  THE NUMBER OF AVALANCHE FATALITIES IN THE UNITED STATES PER WINTER (1950-51 TO 1975-76) AND 5-YEAR MOVING AVERAGE (DASHED LINE)
Average avalanche fatalities in the U.S.,
by 5-year periods

Figure 2  Average annual avalanche fatalities in the United States by 5-year periods
FIGURE 3  FREQUENCY OF AVALANCHE VICTIMS BY AGE GROUPS (1950-51 TO 1975-76)
FIGURE 4 AVALANCHE VICTIMS BY ACTIVITY CATEGORIES (1950-51 TO 1975-76)
FIGURE 5  PERCENT SURVIVAL AMONG AVALANCHE VICTIMS VS ELAPSED TIME OF BURIAL. BASED ON A SAMPLE OF AVALANCHE ACCIDENTS IN THE U.S. FROM 1910-76
Figure 6  Percent survival among avalanche victims vs depth of burial. Same data sample as Fig. 5