

Decision Making In Avalanche Avoidance and Survival

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Introduction

Avalanches kill approximately 15 people a year in Canada. However, 29 people were killed during the 2002/2003 season, principally because two accidents killed 7 people each rather than usual 1-2 people (see Figure below). In response, a new Canadian rule-based decision support tool for amateur recreationists – the Avaluator Avalanche Accident Prevention Card (Haegeli & McCammon, 2006) – was developed and paid for by public funds from Search and Rescue Secretariat Canada. However, our independent review as well as analyses of accident records revealed that the risk reduction values are not replicable – they are vastly inflated due to the Avaluator's authors' failure to consider the meaning of missing values and the consequences of deleting 82% of accidents from their collection (the risk reduction values in the Avaluator are based on only 252 accidents rather than 1,400 accidents claimed in the Avaluator). The figure below shows that, if anything, the second season with the Avaluator ended with as many accidents (14) as the season that gave rise to its development. Fortunately, in contrast to the 2002/2003 season, the last season did not see large number of deaths in any one accident.

We examined human factors – human behavior prior to, during, and after the avalanche as well as behavioral contributions to the avalanche accident outcomes including injuries and deaths.

Objectives

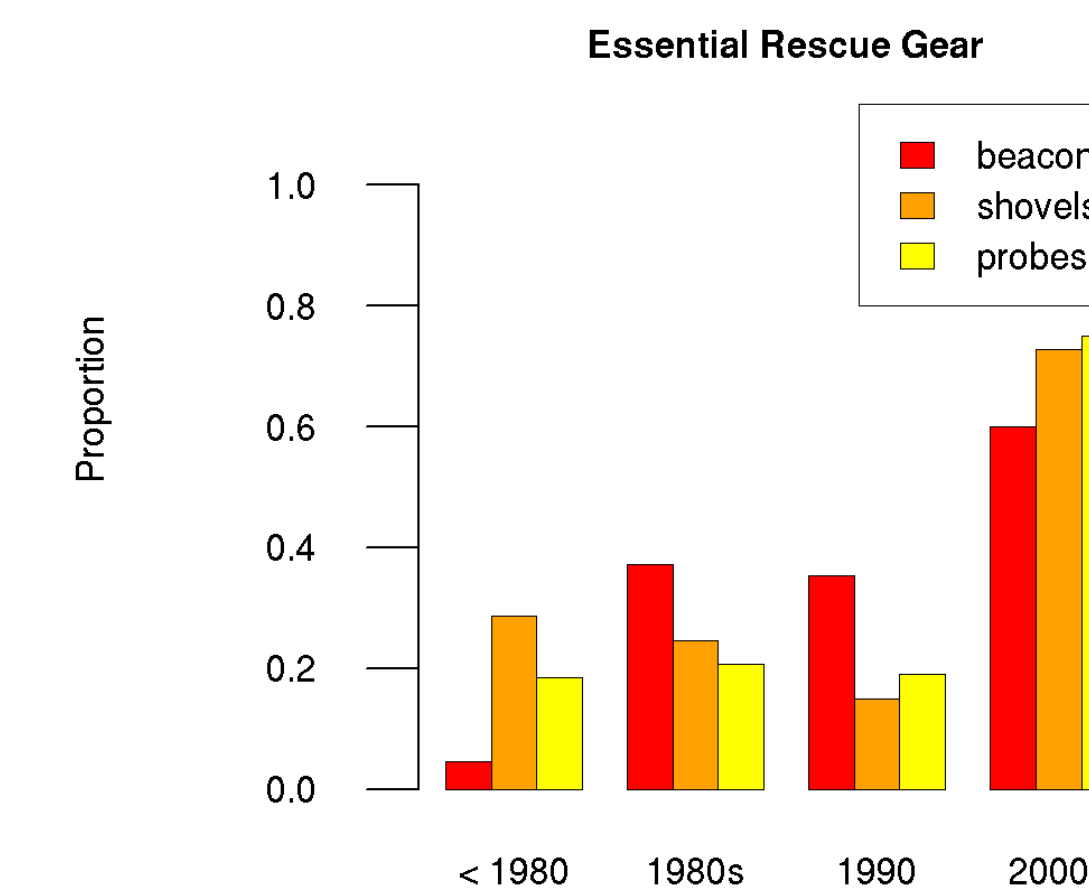
1. What are the most common human decision making errors committed by individuals traveling in the backcountry?
2. Are individuals traveling to the backcountry prepared for accidents? Do they carry the necessary self-rescue tools such as a beacon, probe and shovel?
3. Are avalanche-trained professionals more competent in avoiding avalanche accidents? According to a widespread view, avalanche-trained professionals are more competent in avoiding avalanches and human errors that lead to accidents than amateur recreationists. Surprisingly, evidence for this claim is lacking.

Method

We collected historical accident records from several sources including Snowy Torrents 1980-1986, Avalanche Accidents in Canada Vol. 4 1984-1996, and Avalanche Center (www.avalanche-center.org). For each accident, we coded features of weather, terrain, snowpack, avalanche, participants, avalanche/participant interactions, and participants' behavior prior to, during, and after the avalanche.

Beacons, Shovels, & Probes

Proportions of parties with beacons, shovels, and probes by decade. Proportions of parties carrying the essential rescue gear has increased. However, the substantial proportion of parties still do not carry it. In particular, snowmobilers are far less likely to carry beacons, shovels, and probes than backcountry skiers.

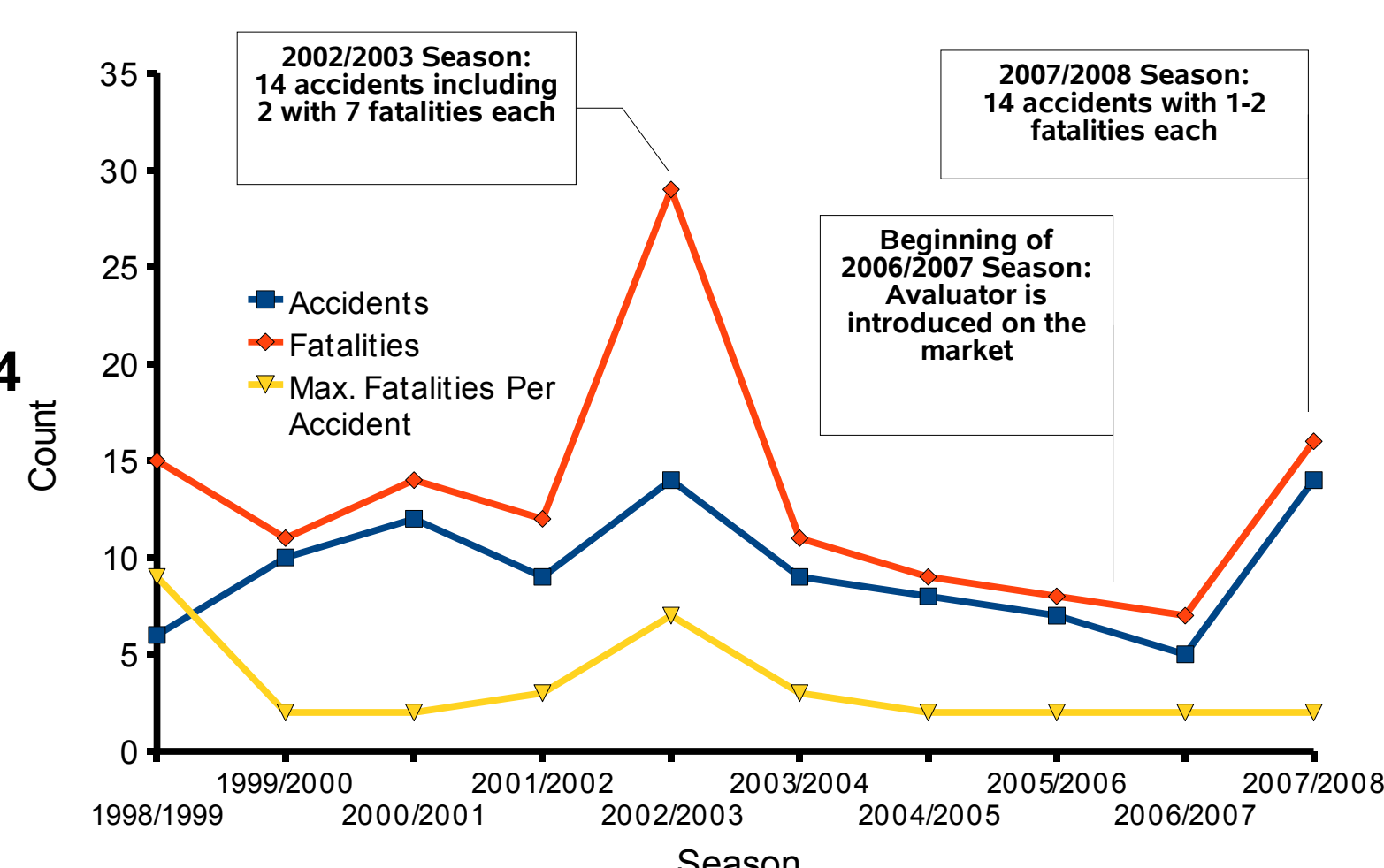


Trends in Avalanche Accidents in Canada

Number of accidents with fatalities, total number of fatalities, and maximum number of fatalities in any single accident.

The 2002/2003 “exceptional season” is not that exceptional: the number of accidents is comparable to previous seasons. However, two accidents contributed 14 deaths in total (see below).

The 2nd season with the Avaluator, 2007/2008, has so far resulted in as many accidents as the “exceptional” 2002/2003 season.



Durand Glacier Avalanche (January 20, 2003)

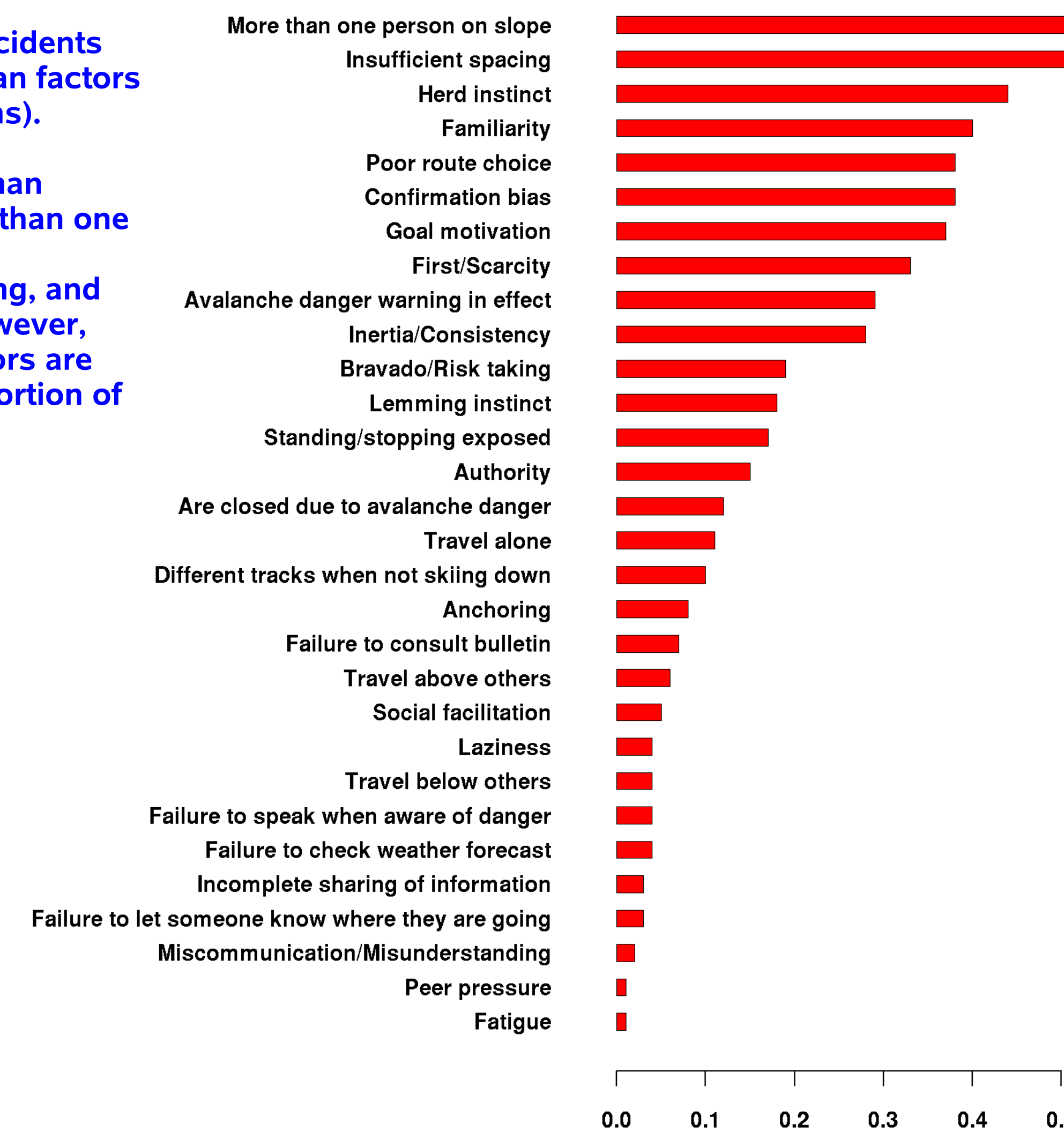
The photo (by Frank Baumann) of the La Traviata couloir with approximate tracks and positions of 21 skiers including guides from Selkirk Mountain Experience. The skiers were split into two groups, one ahead of the other in the same couloir. When the avalanche was triggered by the first group (according to the coroner's report), the avalanche swept down the bottom group as well as several skiers from the top group. In total, seven people died. Several human factors likely contributing to the tragedy are illustrated here: one group was travelling above another group, 21 people were on the slope at the same time, spacing of the skiers within each group was insufficient, and the skiers traveled all together bunched up.



Human Factors

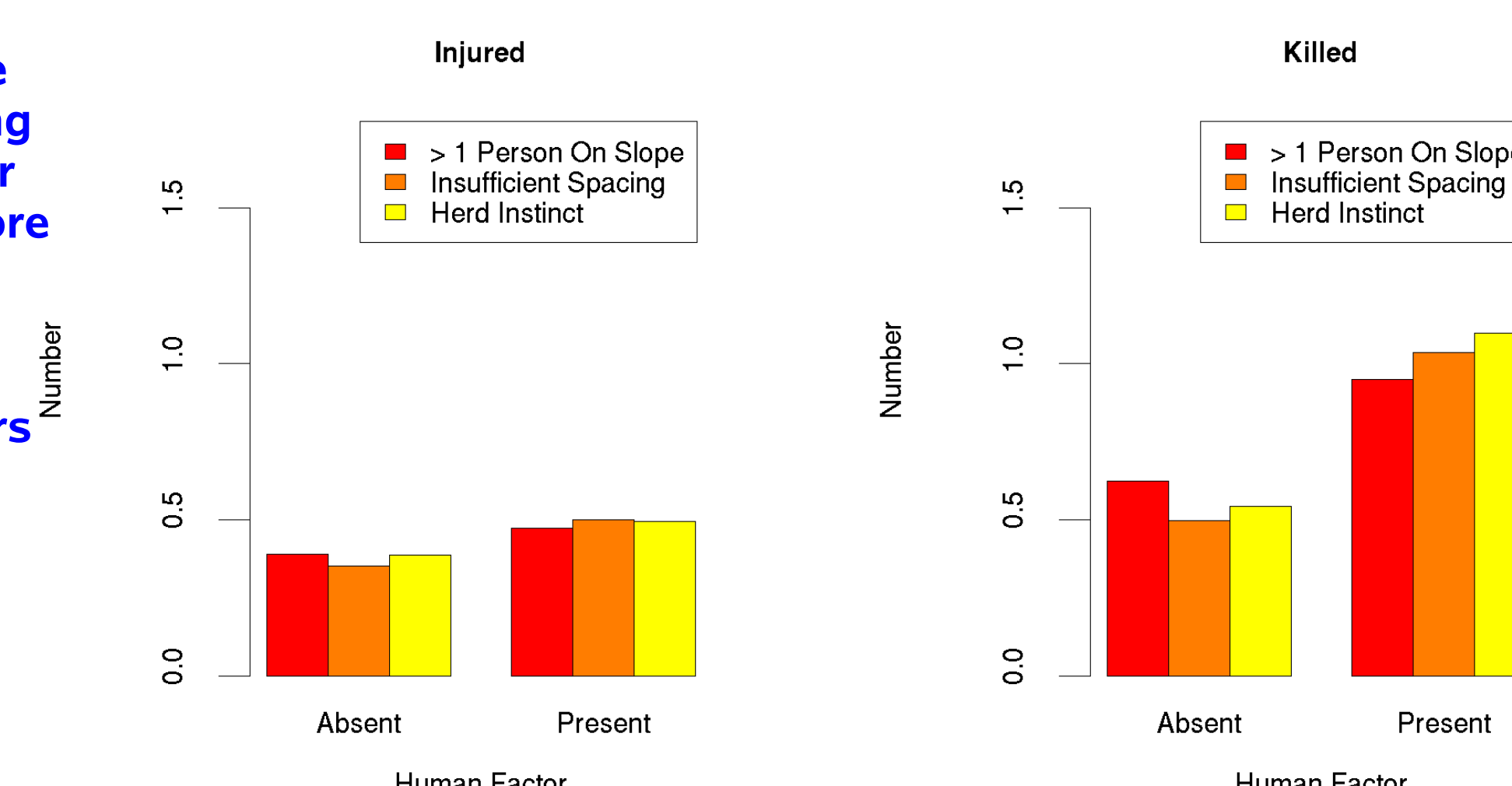
Proportions of accidents with various human factors present (minimums).

The top three human factors are: more than one person on slope, insufficient spacing, and herd instinct. However, other human factors are present in large portion of accidents.



Number of injured and killed by absence/presence of the three leading human factors (for accidents with more than 2 persons only).

These three factors approximately double number of people killed.



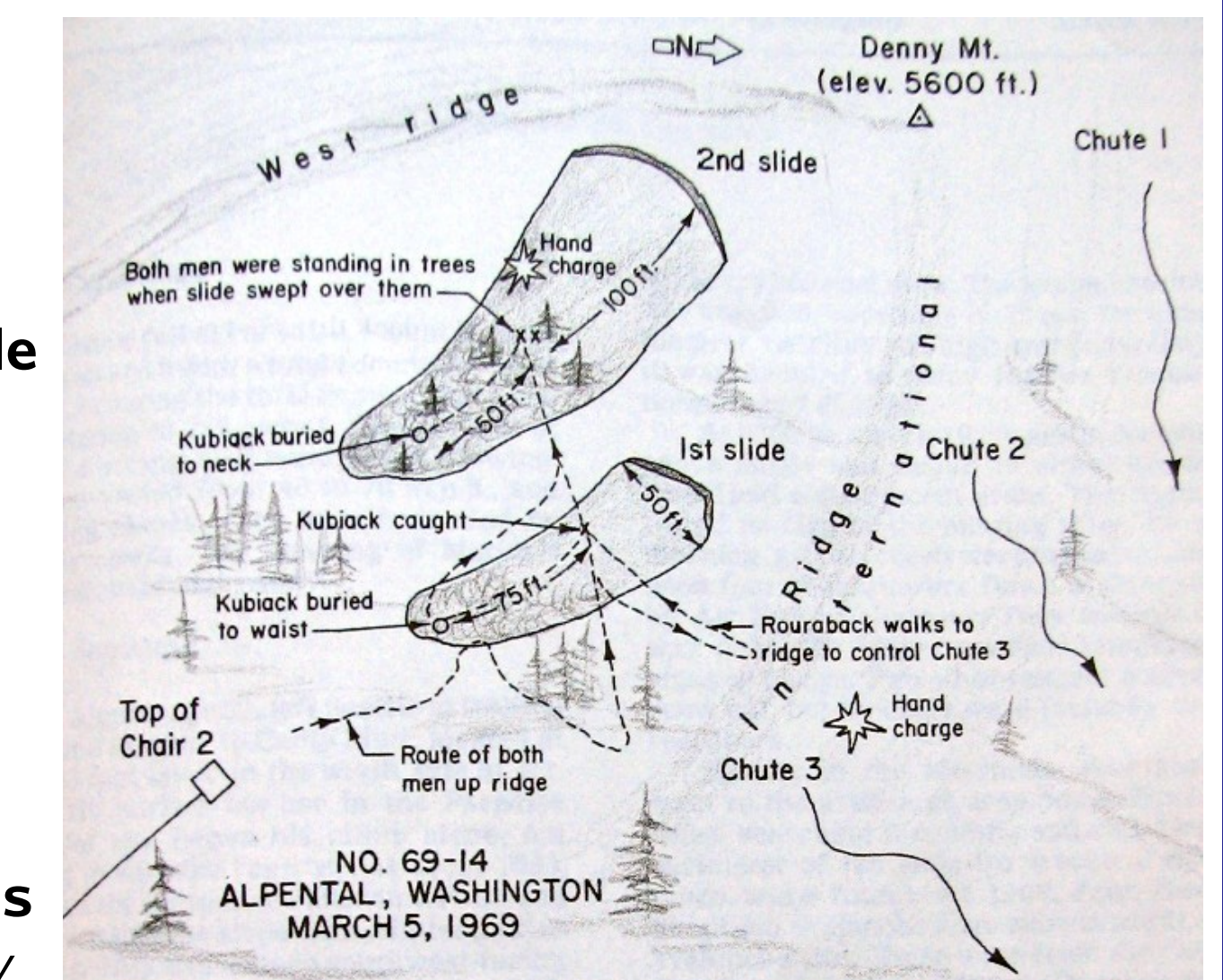
Amateurs vs. Professionals

It is often assumed that avalanche professionals (mountain guides, snow rangers, avalanche control professionals, etc.) expose themselves to less danger and make better decisions than amateurs. Contrary to this assumption, accident records reveal decisions inconsistent with presumed expertise of professionals.

Example of Decision Making by Professionals: Two pro patrolmen on their avalanche control route. High hazard day... Many avalanches in area... Triggered and got partially buried by one avalanche already... Able to dig himself out...

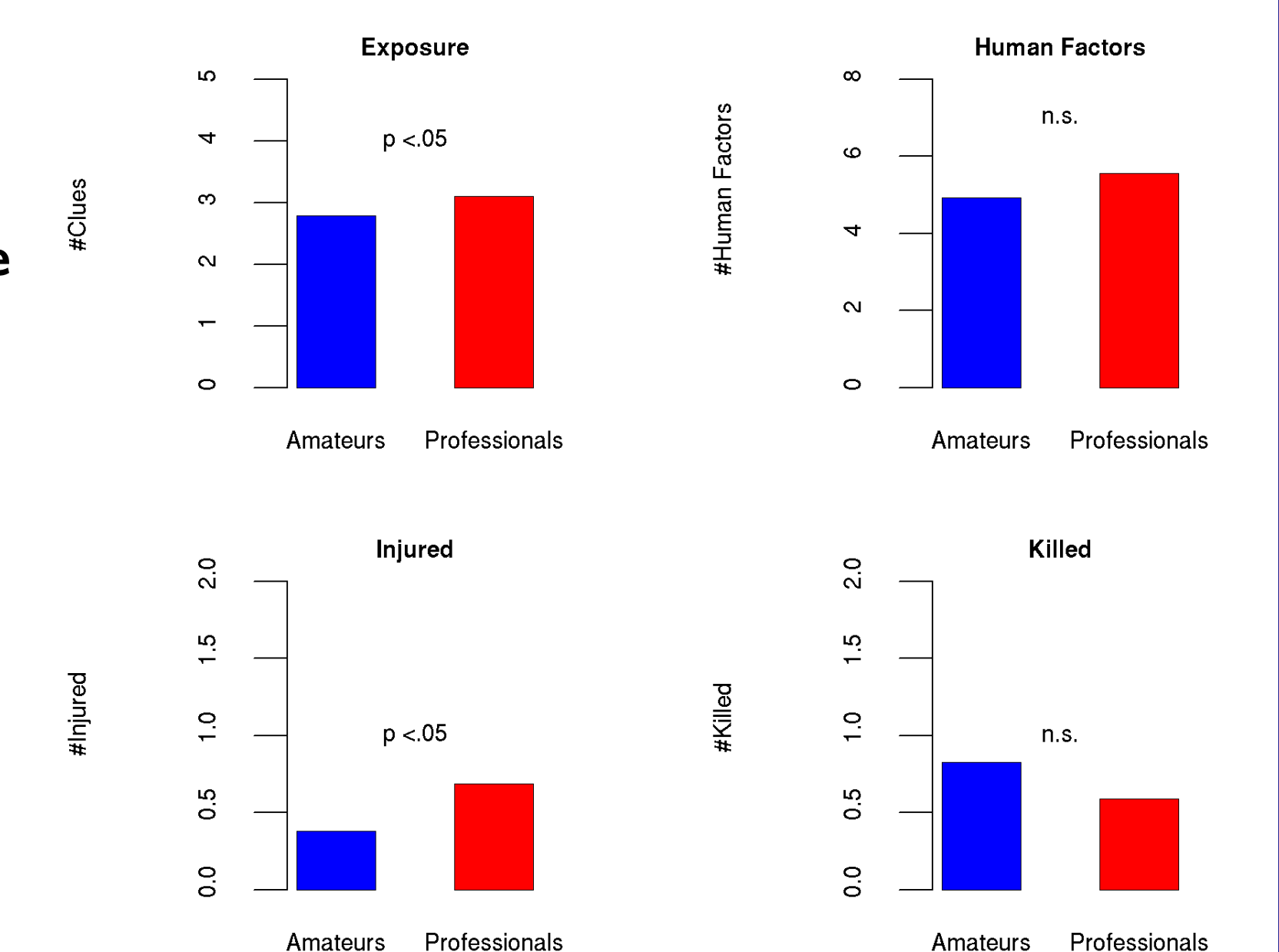
Throws hand charge up a heavily loaded 45 degree lee slope above and both men decide to hang onto trees while waiting for the explosion and forthcoming avalanche...

Avalanche obliges, descends upon them, takes one off the tree, and buries him to his neck 50 ft lower... (from Snowy Torrents)



Amateurs vs. Professionals: Exposure, Human Factors, Number Injured, and Number Killed. Our analysis of historical records show that groups with at least one professional (e.g., guide, patrol) exposed themselves to more danger and had more injuries.

We found no evidence for widely held belief that professionals expose themselves to less danger and make better decisions. However, professionals were more likely to carry beacons, shovel, and probes.



Conclusions

Avalanche accident victims often commit numerous avoidable errors such as unnecessarily loading slopes, maintaining insufficient spacing, and traveling all together bunched up. These errors are associated with poor accident outcomes: more people killed.

Essential rescue gear -- beacons, shovels, and probes -- is still missing in many parties even though proportion of parties with all members equipped with this rescue gear has increased.

Contrary to popular beliefs and assumptions, we found no evidence that groups with professionals vs. amateurs expose themselves to less danger, commit fewer human errors, and make better decisions.