

ORIGINAL RESEARCH

Risk of Avalanche Involvement in Winter Backcountry Recreation: The Advantage of Small Groups



Benjamin Zweifel, MSc, PhD; Emily Procter, MSc; Frank Techel, MSc; Giacomo Strapazzon, MD, PhD; Roman Boutellier, Prof

From the WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland (Dr Zweifel and Mr Techel); the EURAC Institute of Mountain Emergency Medicine, Bolzano, Italy (Ms Procter and Dr Strapazzon); the Department of Sport Science, Faculty for Sports Science and Psychology, University of Innsbruck, Innsbruck, Austria (Ms Procter); and the Swiss Federal Institute of Technology, Zurich, Switzerland (Dr Boutellier).

Objective.—Avalanches are the primary hazard for winter backcountry recreationists and cause numerous deaths and injuries annually. Although recreationists usually travel in groups, there is little empirical knowledge on group-related risk factors. This study aims to explore the relative risk of avalanche accidents with respect to group size and to discuss underlying reasons for different risk levels.

Methods.—We compared backcountry usage data in regions in Switzerland and Italy with avalanche accident data in these regions.

Results.—We found higher avalanche risk for groups of 4 or more people and lower risk for people traveling alone and in groups of 2. The relative risk of group size 4, 5, and 6 was higher compared with the reference group size of 2 in the Swiss and Italian dataset. The relative risk for people traveling alone was not significantly different compared with the reference group size of 2 in the Italian dataset but was lower in the Swiss dataset.

Conclusions.—These findings are in accordance with avalanche safety recommendations regarding the higher risk of large groups but not regarding lower risks of people traveling alone in avalanche terrain, which is not recommended and requires great caution. Further studies on backcountry usage are necessary to improve our understanding of human behavior and risk factors. New techniques (eg, video monitoring) may be useful for acquiring reliable data on backcountry usage.

Key words: avalanche prevention, backcountry skiing, outdoor recreation, recreational monitoring, avalanche accidents

Introduction

Recreational activity in avalanche terrain such as backcountry skiing or riding, snowmobiling, or snowshoeing has increased in recent decades due to higher mobility of recreationists and improvements in equipment. The risk of being involved in an avalanche and the associated mortality are high compared with other risks of backcountry recreation such as falls or hypothermia.^{1,2} Based on avalanche accident statistics and user surveys, the majority of recreationists travel in avalanche terrain in groups and only few people travel alone.^{3,4} Group size and the related risk factors play a crucial role in avalanche risk management.

Characterizing recreation groups by group size has been widely discussed for avalanche risk reduction initiatives. Previous work suggests that the risk of being involved in an avalanche increases with increasing group size.^{5–8} Accordingly, small groups are considered a risk reduction factor in the Risk Reduction Method of Munter, and traveling in small groups and/or keeping distances between single group members are also risk reduction factors in many avalanche decision making tools such as Stop or Go, Snowcard, or Avaluator.^{9–12} Larger groups may have higher risk due to higher load on the snow cover or human factors (eg, decision making or communication).⁵ However, these avalanche safety practices are based on avalanche accident statistics or surveys examining basic demographics, travel behavior, avalanche expertise, or rescue equipment.^{4,13–18} The aim of this study is to estimate the relative risk of avalanche

Corresponding author: Benjamin Zweifel, MSc, PhD, WSL Institute for Snow and Avalanche Research SLF, Flüelastrasse 11, 7260 Davos Dorf, Switzerland (e-mail: zweifel@slf.ch).

accidents with respect to group size by comparing the relative frequency of groups in the field with the relative frequency of accidents in these groups. For the first time, we can estimate relative frequency of groups with data from direct in-field surveys and new social media sources.

Materials and Methods

To analyze backcountry usage we applied 2 datasets from in-field surveys and 1 dataset from in-field observations. Both methods have been established in recreational monitoring.¹⁹ Further, social media sources were used as data source. Social media are now frequently used by recreationists to report tours and travel conditions (eg, the mountaineering website *bergportal.ch*).¹⁹ We included backcountry skiers and snowshoers and excluded other winter recreationists such as sidecountry skiers or riders (they ascend using mechanized transportation in ski areas, whereas backcountry skiers ascend by their own means), hikers, ice climbers, mountaineers, and snowmobilers. All datasets included group size, date, location, sociodemographics of group members, and activity type.

The ethic committee of the South Tyrolean medical service approved the research protocol.

RECREATION GROUPS IN THE FIELD (USAGE DATA)

Swiss usage data (self-registration boards, in-field observations, and social network data)

The first usage dataset was collected in a 3-year field campaign (winter 2004–05 to winter 2006–07; each winter from December through April). Voluntary self-registration boards with survey sheets were installed at Tschuggen in the Flüela valley and at Monstein near Davos, Switzerland, 2 popular starting points for backcountry skiers and snowshoers (Figure 1).^{20,21} A second dataset was collected from observations of 10 avalanche experts from WSL Institute for Snow and Avalanche Research SLF, who counted backcountry skiers and snowshoers in the field between December 2013 and May 2014 while they were on their own backcountry trips. A third usage dataset was taken from the social network website *bergportal.ch*. We analyzed all entries with known group size from a 5-year period (winter 2010 to winter 2014), as also applied by Techel et al.¹⁹

Italian usage data (in-field observation)

In a 1-week field campaign in February 2011 a questionnaire was administered to all skiers and snowshoers departing on a backcountry tour at 22 popular tour



Figure 1. Registration board at Tschuggen in the Flüela Valley, Davos, Switzerland.

starting points in South Tyrol, Italy.³ The locations were based on the most frequented locations in a 1-day pilot survey at 143 starting points in 2010.²²

NATIONAL ACCIDENT DATABASES (ACCIDENT DATA)

In order to have representative datasets, accident data were collected over a 10-year period and not only the period of the usage datasets. However, the usage data stems from a period covered by the accident datasets.

Swiss avalanche database

The Swiss avalanche database contains all recorded avalanches in Switzerland that produced a material or economic damage or damage to persons. Data are reported from rescue organizations, mountain guides, SLF observers, or backcountry recreationists. We extracted accidents with single groups involving backcountry skiers and snowshoers in a 10-year period (winter 2003–04 to winter 2012–13).

Italian avalanche database

The Italian avalanche database contains all recorded avalanches in Italy. Data were collected by the regional avalanche warning services and sent to a central database that is managed by an association (Associazione Interregionale Neve e Valanghe, AINEVA). We included all avalanche accidents involving backcountry skiers and snowshoers in a 10-year period (winter 2004–05 to winter 2013–14) in South Tyrol, Italy.

DATA ANALYSIS

Avalanche risk is defined as the ratio of the total number of accidents to the total number of exposed individuals.

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