

DIRECT AND INDIRECT AVALANCHE EXPERIENCES AMONG BACKCOUNTRY SKIERS: RELATIONSHIPS WITH RISK PERCEPTION AND USE OF SAFETY GEAR.

Davide Marengo^{1,2,3}, Paola Dellavedova¹, Maria G. Monaci² and Renato Miceli^{2,3}

¹Fondazione Montagna sicura, Courmayeur, Italy

²Department of Social sciences and Humanities, University of Aosta Valley, Aosta, Italy

³Department of Psychology, University of Turin, Turin, Italy

ABSTRACT: A relevant factor that may affect risk perception and behaviors related to natural hazard is personal experience. Findings on recreational sports (e.g., scuba diving, rock climbing) indicate that individuals engaging in high-risk recreation tend to exhibit decreases in sensitivity to risk over time, likely due to habituation effects and changes in self-efficacy and competence. Could these results also apply to winter sports performed in avalanche terrain? The present study aimed at exploring the relationship between experiences with avalanche accidents and two measures of avalanche risk perception: fear of and perceived probability of accident involvement. We also investigated relationship with use of safety gear (avalanche beacon, probe, and shovel, and airbag device). Study sample consisted of 214 backcountry skiers from Northern Italy (84% male; age: $M = 39.55$, $SD = 10.07$), of which 15.4% reported personal involvement in at least 1 avalanche accident resulting in burial or injury (direct experience), while 31.8% reported witnessing one or more avalanche accidents involving other recreationists (indirect experience). Results indicated direct involvement in avalanche accidents to negatively correlate with recreationists' fear of avalanche accidents and positively correlate with their perceived probability of accident involvement. Use of standard safety gear positively correlated with previous indirect avalanche experiences, while participant's direct involvement in avalanche accidents correlated with use of the airbag device. Combined with previous findings on general population, the impact of avalanche experiences on risk perception and behaviors appear to be dependent on the degree of directness of such experiences.

KEYWORDS: avalanche experience, backcountry skiing, risk perception

1. INTRODUCTION

A relevant factor that may influence risk perception and self-protective behaviors related to natural hazard is personal experience (Weinstein, 1989; Slovic, 2004). Findings on recreational sports (e.g., scuba diving, rock climbing) indicate that individuals frequently engaging in high-risk recreation are prone to exhibit decreases in risk perception over time (Demirhan, 2005; Morgan & Stevens, 2008), as a result of habituation effects (Lima, 2004) and increases in self-efficacy and perceived competence in managing risk (Bandura, 1977). These findings may also apply to winter

sports performed in avalanche terrain. Recent findings on general population seem to contradict this hypothesis. In a study on a sample of Tyrol residents, Leiter (2011) found exposure to adverse consequences of avalanche events to increase individuals' sensitivity towards avalanche risk (Leiter, 2011). Results from Leiter's study are in line with findings on other natural hazards (e.g., flood, Miceli, Settanni & Sotgiu, 2008), suggesting the influence of availability heuristics (Slovic et al., 1982; Tversky & Kahneman, 1982). However, to the best of our knowledge, studies investigating the impact of avalanche experiences on risk perception and behaviors among backcountry enthusiasts are missing. For this reason, the present study aimed at exploring the relationship between experiences with avalanche accidents and avalanche risk perception and adoption of safety gear while on backcountry tours. We operationalized avalanche experiences by distinguishing between

* *Corresponding author address:*

Davide Marengo, Department of Psychology, University of Turin, Via Verdi 10, 10124, Turin, Italy. email: davide.marengo@unito.it

recreationists' personal direct involvement in avalanche accidents (*direct experience*) and their witnessing of avalanche accidents resulting in adverse consequences for other recreationists (*indirect experience*). This choice relates to the psychological literature indicating direct and indirect behavioral experiences might have different effects on attitudes and behaviors (Fazio & Zanna, 1981). Indeed, recent studies indicate that direct experiences are more important in shaping environmental knowledge, attitudes, and behaviors when compared to indirect experiences (Duerden & Witt, 2010; Viscusi & Zeckhauser, 2015). For the purpose of the present study, our hypothesis is that differential effects on participants' risk perception and safety behaviors could emerge when distinguishing between direct and indirect experiences of avalanche accidents.

2. METHODS

2.1 *Sample recruitment*

Participants were recruited online by publishing the link to a dedicated research page on both the website and Facebook page administered by Fondazione Montagna sicura, a nonprofit foundation dedicated to the study of safety issues in high-altitude mountain environments based in the Valle d'Aosta, Courmayeur, Italy. The research page included a link to an online questionnaire. Questionnaire administration took place between April and May 2015. All participants gave informed consent before filling the questionnaire. Inclusion criteria for the research were the following: legal age (Age \geq 18 years) and involvement in backcountry or freeride skiing activities during the last winter season. Professional mountain guides and avalanche professionals were excluded from participation in order to ensure that the sample only represented amateur backcountry recreationists. Eventually, 214 participants remained (84% male; age: $M = 39.55$, $SD = 10.07$, ranging from 20 to 68 years). Sixty-three percent of participants reported participating in up-to-9 backcountry tours during the previous winter season, 27% reported involvement in 10-to-20 tours, and 10% participated in at least 21 backcountry tours.

2.2 *Avalanche experience*

Participants were asked to report about previous exposure to avalanche accidents while performing backcountry recreational activities. Direct experiences were investigated by asking participants to report the number of times they had been personally involved in avalanche events resulting in direct consequences for themselves (i.e., partial burial, complete burial and avalanche accident resulting in personal injury). In turn, indirect experiences were investigated by asking participants to report the number of times they witnessed avalanche events resulting in consequences for other persons (i.e., partial/complete burial, injury or death). For each case, table 1 reports the percentage of participants indicating involvement in 1 or more avalanche event. For the purpose of this study, two dichotomous indicators of direct and indirect experience of avalanche accidents were obtained (Coded as: No involvement=0; Involvement in one or more event=1). Participants reporting previous direct involvement in avalanche accidents accounted for 15.4% ($N=33$) of the sample, while 31.8% ($N=68$) of participants reported indirect involvement. Direct and indirect involvement in avalanche experiences showed a moderate positive correlation ($r=.29$, $p<.001$).

Tbl. 1: Participants' involvement in avalanche accidents with personal and other persons' consequences

<i>Consequences</i>	<i>1 or more avalanche event</i>
Self	
<i>Partial burial</i>	13%
<i>Complete burial</i>	3%
<i>Injured</i>	3%
Others	
<i>Partial burial</i>	29%
<i>Complete burial</i>	12%
<i>Injured</i>	11%
<i>Death</i>	5%

2.3 *Avalanche risk perception*

The questionnaire consisted of nine statements describing potential consequences of avalanche accidents resulting in varying degrees of outcome severity. Using a 5-point Likert scale ranging from

1-low to 5-high, participants were asked to rate the probability of their involvement in each situation, as well as the degree of fear elicited by each event. The items' statements are presented in Figure 1, along with their average sample score (in white). On average, being involved in an avalanche accident resulting in personal death was rated by participants as both the less likely and more fear-inducing event. In turn, being required to perform early rescue operations (e.g., other persons buried in or injured by an avalanche) was perceived as the more likely and less fearful situation. By summing participants' scores on the item, two total scores were obtained (Perceived probability: $M=20.70$, $SD= 6.96$; Fear: $M=35.43$, $SD= 7.43$). The scales showed adequate internal consistency (Perceived Probability: $\alpha = 0.91$; Fear: $\alpha = 0.89$), and a small positive correlation ($r=.13$).

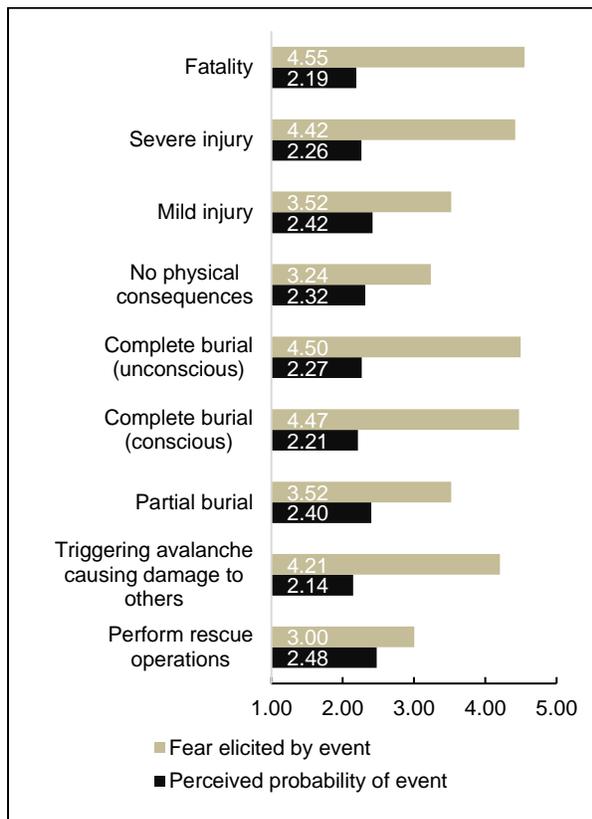


Fig. 1: Average perceived probability and fear scores for avalanche-related consequences (1= Low; 5=High)

2.4 Use of safety gear

Participants were asked to report the frequency of use of the following safety gear during their backcountry tours (2015 winter season): avalanche beacon, standard rescue equipment (beacon, probe, shovel), and airbag (floatation) device. Participants reported frequency of use of safety gear using the following 3-point rating scale: 1-Never, 2-Some of the times, 3-During all backcountry tours. Table 1 reports the percentage of participants indicating use of safety gear during all backcountry tours.

Tbl. 2: Percentage of participants' reporting use of safety gear during all backcountry tours

Equipment	Used safety gear during all tours
Avalanche beacon	88%
Standard rescue equipment (Beacon, Shovel, Probe)	82%
Airbag	14%

3. DATA ANALYSIS

Relationships between the study measures were examined by means of Pearson's correlation coefficient. Association between variables was deemed significant when $p < .05$.

4. RESULTS

Correlation analyses revealed the existence of several significant association among the study measures (Tbl. 3). Direct involvement in avalanche accidents showed small positive associations with participants' perceived probability of being involved in avalanche events, and their frequency of use of the airbag device while in backcountry territory. Direct avalanche experiences also showed a small negative correlation with participants' reported fear of avalanche events. In turn, participants' indirect experience with avalanche accidents (i.e., experience of avalanche events which did not involve them directly, but had consequences for other persons) show positive small correlations with use of avalanche beacon,

as well as the full standard rescue equipment (beacon, probe, shovel) while in avalanche terrain. No significant associations emerged between the measures of avalanche risk perception and participants' use of safety gear (results not presented in the table).

Tbl. 3: Correlations between avalanche experiences, avalanche risk perception and use of safety gear

	Avalanche experiences	
	Indirect	Direct
Avalanche risk perception		
Perceived probability	0.12	0.17*
Fear of avalanche events	-0.08	-0.14*
Use of safety gear		
Avalanche beacon	0.18**	-0.01
Standard rescue equipment	0.16*	-0.04
Airbag	0.11	0.17*

* $p < .05$, ** $p < .01$

5. DISCUSSION

The aim of the present paper was to explore associations between backcountry skiers' experiences with avalanche accidents, their perceptions of avalanche risk, and use of safety gear while in avalanche terrain.

In line with findings on general population (Leiter, 2011), we found that past direct involvement in avalanche accidents was positively associated with recreationists' cognitive appraisal of potential personal involvement in avalanche accidents. This finding support the hypothesis that availability of personal negative experiences might have a positive impact on recreationists' perception of avalanche-related risk and behaviors directed at increasing personal safety (Slovic, 1982). In our study, this potential protective effect was also reflected in the presence of a positive association between availability of direct experiences and the use of the airbag safety device while skiing on avalanche terrain. At the same time, we found a negative association between direct experiences with avalanches and participants' affective appraisal of avalanche risk. In fact, when compared with partic-

ipants with no previous direct experiences with avalanches, more experienced skiers were significantly less fearful of avalanche accidents and their potentially adverse consequences. Consistent with what reported for other high-risk recreational sports (Demirhan, 2005; Morgan & Stevens, 2008), this finding suggests the existence of habituation and confidence-enhancing effects related to avalanche survival experiences. As a whole, these findings seems to indicate that the availability of previous direct avalanche experiences is associated with an increase in recreationists' awareness of personal exposure, as well as in a decrease in their affective response to avalanche risk.

Findings on previous indirect avalanche experiences indicate the absence of significant association with recreationists' perception of personal exposure to avalanche risk. In turn, indirect experiences showed a significant positive association with adoption of avalanche beacon and the full standard rescue equipment (i.e., beacon, shovel, probe). These findings suggests that the exposure to avalanche accidents with adverse consequences for other persons could be related to an increase in the adoption of behaviors directed at improvising both personal and other peoples' safety while on avalanche terrain.

Overall, findings from this study support the hypothesis that direct experiences may have a stronger association with attitudes related to risk when compared to indirect experiences (Duerden & Witt, 2010; Viscusi & Zeckhauser, 2015). At the same time, the directness of avalanche experiences might influence their relationship with the adoption of safety behaviors, and whether the impact of such behaviors are intended at improving personal safety or extending to other that of other persons in their party. These are interesting results that suggest that differential effects of avalanche experience may emerge when direct and indirect experiences are investigated separately (as opposed to being assessed using a single measure).

Still, the present study has some limitations. First, the recruited sample was not representative of the target population, thus caution should be applied in interpreting and generalizing the results. Another limitation concerns the lack of longitudinal data. For this reason, no causal relationship

should be inferred among the investigated construct based on the results of the present study. Future studies tracking recreationists' behaviors and attitudes over time might provide insightful information concerning the way personal experiences shape recreationists' attitudes and behaviors related to avalanche risk, as well as the potentially mediating effect of risk perception.

CONFLICT OF INTEREST

No competing financial interests exists.

ACKNOWLEDGEMENTS

The authors would like to thank the Snow and Avalanche Warning Service of the Valle d'Aosta Region, Italy (Ufficio neve e valanghe - Regione Autonoma Valle d'Aosta – Assessorato opere pubbliche, difesa del suolo e edilizia residenziale pubblica – Dipartimento difesa del suolo e risorse idriche – Assetto idrogeologico dei bacini montani) and Elisabetta Ceaglio, Michèle Curtaz and Jean Pierre Fosson (Fondazione Montagna sicura, Cormayeur, Italy) for their help in the implementation of the research.

REFERENCES

- Demirhan, G., 2005: Mountaineers' risk perception in outdoor-adventure sports: a study of sex and sports experience. *Perceptual and Motor Skills*, 100 (3c), 1155-1160.
- Duerden, M. D. and P.A Witt, 2010: The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. *Journal of Environmental Psychology*, 30(4), 379-392.
- Fazio, R. H. and M.P. Zanna, 1981: Direct experience and attitude-behavior consistency. *Advances in Experimental Social Psychology*, 14(C), 161-202.
- Lima, M. L. (2004). On the influence of risk perception on mental health: living near an incinerator. *Journal of environmental psychology*, 24(1), 71-84.
- Leiter, A. M., 2011: The sense of snow? Individuals' perception of fatal avalanche events. *Journal of Environmental Psychology*, 31(4), 361-372.
- Miceli, R., Sotgiu, I. and M. Settanni, 2008: Disaster preparedness and perception of flood risk: A study in an alpine valley in Italy. *Journal of Environmental Psychology*, 28(2), 164-173.
- Morgan, C. and C.A. Stevens, 2008: Changes in perceptions of risk and competence among beginning scuba divers. *Journal of Risk Research*, 11(8), 951-966.

Slovic, P., Fischhoff, B. and S. Lichtenstein, 1982: Facts versus fears: Understanding perceived risk. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases*. Cambridge: Cambridge University Press, pp. 463e489.

Slovic, P., Finucane, M. L., Peters, E. and D.G. MacGregor, 2004: Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, 24(2), 311–322.

Tversky, A. and D. Kahneman, 1982: Availability: A heuristic for judging frequency and probability. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases*. Cambridge: Cambridge University Press, pp. 163-178.

Viscusi, W. K. and R.J. Zeckhauser, 2015: The relative weights of direct and indirect experiences in the formation of environmental risk beliefs. *Risk Analysis*, 35(2), 318-331.

Weinstein, N. D., 1989: Effects of personal experience on self-protective behavior. *Psychological Bulletin*, 105(1), 31.