



Should Airbags be Mandatory Avalanche Safety Equipment?

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Outline

- Current ICAR guidelines
- How well do airbags work?
- Barriers from universal use
- Recommendations to Consider

Premiered at ISPO in 1985





Internationale Kommission für Alpines Rettungswesen IKAR
Commission Internationale de Sauvetage Alpin CISA
International Commission for Alpine Rescue ICAR

ICAR - IKAR - CISA Statement
(Avalanche Rescue, Terrestrial Rescue and Medical Commissions)

Avalanche Safety Devices and Systems

Kranjska Gora, Slovenia

October 14, 2006

Considering the ongoing development of avalanche safety devices in recent years the above commissions of ICAR–IKAR-CISA update their statement of 1999 concerning these devices and systems by highlighting the following points:

- C. If caught, some safety systems/devices may increase one's chances of survival. Survival depends upon quick rescue. The efficiency of the transceiver in combination with probe and shovel, and of airbag systems has been proven. At this time support for other systems is based upon personal opinion and case reports.
- However, no device or system guarantees against either injuries to or death of avalanche victims.



MOUNTAIN MEDICINE AND TECHNICAL RESCUE

The admixture of mountain medicine and technical rescue has long been a logical and practical combination of skills and knowledge. Recreational climbers and professional mountain rescue personnel alike may find themselves in unintended scenarios in remote, technical, or high altitude environments. This book provides readers with current best practice when the need to be self-sufficient and broadly versed in the skills of mountain medicine and rescue is essential.

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MOUNTAIN MEDICINE AND TECHNICAL RESCUE

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Rodway, Weber, McIntosh, eds. Carreg, 2016.

WILDERNESS & ENVIRONMENTAL MEDICINE, 28, 23–42 (2017)

WILDERNESS MEDICAL SOCIETY PRACTICE GUIDELINES

Wilderness Medical Society Practice Guidelines for Prevention and Management of Avalanche and Nonavalanche Snow Burial Accidents



Christopher Van Tilburg, MD; Colin K. Grissom, MD; Ken Zafren, MD; Scott McIntosh, MD, MPH;
Martin I. Radwin, MD; Peter Paal, MD; Pascal Haegeli, PhD; William “Will” R. Smith, MD;
Albert R. Wheeler, MD; David Weber, FP-C; Bruce Tremper, MS; Hermann Brugger, MD

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Recommendation. Travelers entering avalanche ter-
rain should consider using an avalanche airbag. Familiarity
and regular practice with airbags is essential. Grade: 1B.

Emergency and
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eler); Iasis
VHS Trust,
University
BC

(Dr Haegeli); the Department of Emergency Medicine, St. Johns Medical Center, Jackson, WY (Drs Smith and Wheeler); the Clinical WWAMI
Faculty, University of Washington School of Medicine, Seattle, WA (Dr Smith); the Utah Avalanche Center, Salt Lake City, UT (Mr Tremper);

Do Airbags work?

Yes: Airbags prevent morbidity and mortality

- For burial prevention – yes
- For trauma prevention – probably
- For asphyxiation prevention once buried – maybe

Haegeli et al

- Reduced mortality from 22% to 11%, an absolute reduction of 11%
- Non-inflation rate 20%, reducing overall mortality from 11 to 9 percentage points. From human error and device failure.

Haegeli P, Falk M, Procter E, et al. The effectiveness of avalanche airbags. *Resuscitation*. 2014;85(9):1197-1203.

Proceedings, 2012 International Snow Science Workshop, Anchorage, Alaska

HOW EFFECTIVE ARE AVALANCHE AIRBAGS? FIELD TESTS OF AVALANCHE SAFETY EQUIPMENT

Lorenz Meier *, Stephan Harvey

WSL Swiss Federal Institute for Snow and Avalanche Research SLF, Davos, Switzerland

ABSTRACT: Avalanche transceiver – shovel – probe. This still is the standard equipment recommended for touring in the backcountry. More and more, off-piste and backcountry recreationists carry additional avalanche safety gear such as avalanche airbags. In a series of field tests with four artificially triggered avalanches, we compared the effect of additional safety equipment. We measured burial depth and visibility of dummies equipped with two different brands of avalanche airbags (ABS and Snowpulse), the avalanche ball and of dummies with no additional equipment. The burial depth of dummies equipped with an airbag was significantly lower compared to dummies which carried an avalanche ball or no additional equipment. Moreover, based on a qualitative validation the airbag systems were rated better than dummies without airbag. Both brands of airbags and the avalanche ball were visible in all cases on the surface of the avalanche deposits – partly due to the avalanche size and the path topography. Acceleration measurements at the head of the dummies suggest that the risk of injury may be reduced with an appropriate form of the airbag.

Meier and Harvey

Burial

- Without airbags, 42 cm burial (25-63 cm)
- With airbags, 15 cm burial (18-26)

Visibility

- Without airbags, 1/5 visible
- With airbags, 14/14 visible

Meier L, Harvey S. How effective are avalanche airbags? Field Tests of Avalanche Safety Equipment. ISSW Proceedings, 2012.

	Credit points	median
Nix (n=5)	0/0/3/0/0	0
LB (n=6)	2ab/1a/3/1a/1a/1a	1
ABS (n=7)	3/3/3/1a/2ab/3/3	3
SP (n=7)	3/3/2ab/1a/2ab/3/3	3

- a) 1 credit point if equipment or dummy was visible from far away.
- b) 1 credit point if the head was visible
- c) 1 credit point if the airways were buried less than 10 cm under the surface.

Beacon-Shovel-Probe are quaternary tools

- Primary: avoid (safe travel)
- Secondary: avoid burial (manual techniques/airbag)
- Tertiary: survive burial (airpocket/airway/undersnow air diverter)
- Quaternary: rescue burial (beacon-shovel-probe)

Hohlrieder et al

- Burial time decreased from 102 minutes to 20 minutes with beacon.
- Mortality of completely buried victims reduced from 68% to about 54% (14%)

Hohlrieder M, Mair P, Wuertl W, Brugger H. The impact of avalanche transceivers on mortality from avalanche accidents. *High altitude medicine & biology*. 2005;6(1):72-77.

Does type of airbag matter?

Electronic Fan	Compressed Gas Canister	Standard pack
Multi-use easier	Multi-use more difficult	NA
Airline transport easy	Airline transport difficult	NA
Heavy	<Heavy (+extra canisters)	Light/Compact
Needs power	Canisters difficult to fill	NA
Costly	<Costly	Inexpensive

Other questions

What is the optimal size of balloon for flotation?



Other questions

Does the shape of balloon prevent trauma?



Other questions

Does balloon create an air pocket/protect airway, for asphyxia prevention once buried?



Other questions

Should canisters be standardized with contents and connections?



Other questions

Should we all be using air diverters with airbags?

Grissom et al

Breathing with an AD sustained adequate oxygenation for up to 60 minutes.

Without AD and with 500 mL air pocket, hypoxemia within 5 to 14 minutes.

Grissom CK, Radwin MI, Harmston CH, Hirshberg EL, Crowley TJ. Respiration during snow burial using an artificial air pocket. *Jama*. 2000;283(17):2266-2271.





Barriers for universal use of airbags

1. Size/weight
2. Cost
3. Training burden
4. Insurance?
5. Lack of authority recommendation

1. Airbag weight

Weight	Weight (kg)	Notes
Person	70	
Skis/skins/binders/poles/boots	4-6	
Airbag	2.0-3.0	0.7-1.0 standard pack
Beacon/shovel/probe	1.2	
Snowmobile	215	Early adopters in NA

2. Airbag financial cost

Cost	USD	Notes
Person	\$9,000,000	
Skis/skins/binders/poles/boots	\$2000	
Airbag	\$800-1,200	\$150 standard pack
Beacon/shovel/probe	\$400	
Snowmobile	\$3,000-5,000	+ trailer and maintenance

Cost: Avalanche workers at risk in North America

From 1950-2014, 86 avalanche workers/1564 total fatalities (5.5%)

- 59 avalanches (3.8%)

- 27 non-avalanche (1.7%)

- ~1 fatality/year avalanche workers in avalanches

<https://avalanche.state.co.us/accidents/statistics-and-reporting/> Accessed 7/26/19.

Cost of Airbag Pack for Avalanche Workers

3400 workers/year in NA for 231,575 days/year exposed

Airbag:

$\$800/3 \text{ years} \times 3400 \text{ airbags} = \$906,000/\text{year}$

~1 fatality/year, 11% mortality reduction overall

Beacon/shovel/probe

$\$400/3 \text{ years} \times 3400 = \$453,000/\text{year}$

~1 fatality/year, 14% mortality reduction only for completely buried

Green EM, Jamieson B, Logan S. Proceedings ISSW, Banff, Canada; 2014.

Cost of one life

Some countries use US\$ 9million as value of life.

Some countries use US\$ 50,000/per
medical threshold for adding new tr
that prolongs one life for one year.

New Piston Bully Snowcat
US\$500,000



3. Training

General recreational user: additional tool to practice

Professional: adds complexity to an already complex system

Schools: adds cost and complexity

4. Insurance?

If a professional society deems mandatory, then insurance carriers exclude coverage if mandatory requirement not followed?

5. Lack of Recommendations

Likely will not be universally accepted until professional recommendations or guidelines change.

In other words: some people may not using airbags because of a lack of definitive guideline or recommendations of mandatory use.

Question?

Does ICAR have a duty to make a stronger position on airbag use?





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