

# Health Promotion Practice

<http://hpp.sagepub.com>

---

## **Helmets for Skiers and Snowboarders: An Injury Prevention Program**

A. Stewart Levy, Allison P. Hawkes and George V. Rossie  
*Health Promot Pract* 2007; 8; 257 originally published online May 10, 2007;  
DOI: 10.1177/1524839906292178

The online version of this article can be found at:  
<http://hpp.sagepub.com/cgi/content/abstract/8/3/257>

---

Published by:



<http://www.sagepublications.com>

On behalf of:



[Society for Public Health Education](#)

**Additional services and information for *Health Promotion Practice* can be found at:**

**Email Alerts:** <http://hpp.sagepub.com/cgi/alerts>

**Subscriptions:** <http://hpp.sagepub.com/subscriptions>

**Reprints:** <http://www.sagepub.com/journalsReprints.nav>

**Permissions:** <http://www.sagepub.com/journalsPermissions.nav>

**Citations** <http://hpp.sagepub.com/cgi/content/refs/8/3/257>

---

# *Helmets for Skiers and Snowboarders: An Injury Prevention Program*

A. Stewart Levy, MD  
Allison P. Hawkes, MD, MS  
George V. Rossie, PhD

*The authors' Level I trauma center has advocated the use of ski helmets for several years and in 1998, undertook a social-marketing campaign and a helmet loaner program to increase helmet use among skiers and snowboarders. The loaner program's effect on helmet acceptance was measured by comparing helmet acceptance in participating rental stores with acceptance in nonparticipating stores during 3 years. For the 1998-1999 season, 13.8% of renters in the participating stores accepted a helmet compared to 1.38% in the nonparticipating stores ( $p < .01$ ); for 2000-2001, 33.5% to 3.93% ( $p < .01$ ); and for 2001-2002, 30.3% to 4.48% ( $p < .01$ ). The authors believe that efforts to increase helmet use—by increasing education and public awareness and decreasing barriers, such as through helmet loaner programs or routinely including helmets in rental packages—have significant potential to decrease the incidence and severity of brain injuries from skiing and/or snowboarding accidents in Colorado.*

**Keywords:** head injury; brain injury; skiing; snowboarding; helmet; injury prevention

**T**raumatic brain injury (TBI) is the leading cause of death and disability from ski and snowboard accidents in Colorado and across the United States (U.S. Consumer Product Safety Commission, 1999). As a Level 1 Trauma Center located on the west side of Denver, our institution sees about one third of

all patients in Colorado who sustain a TBI from skiing or snowboarding and are either hospitalized at or seen in the emergency department of a Level 1, Level 2, or Level 3 Trauma Center (Levy, Hawkes, Hemminger, & Knight, 2002). Since 1983, more than 800 patients with a TBI from skiing or snowboarding have been admitted to our hospital, with a recent average of 50 admissions per year.

Because most TBIs treated at our facility have historically resulted from a direct-impact mechanism such as a skier hitting a tree (Levy et al., 2002), we have advocated the use of helmets for several years. In 1998, we undertook a promotional program to increase helmet use among skiers and snowboarders. To our knowledge, our program is the first community-based program to advocate the use of ski helmets and loan them at no cost to recreational skiers and snowboarders. The purpose of this article is to describe our program, the methods we used to evaluate it, and the results.

**Authors' Note:** Portions of this article were presented at the 38th Annual Meeting of the Rocky Mountain Neurosurgical Society, Big Sky, MT, June 16-19, 2003; and the 30th Annual Rocky Mountain Trauma and Emergency Medicine Conference, Beaver Run, CO, August 2-6, 2003. The authors gratefully acknowledge Jim Peterson, Winter Park area manager for Christy Sports, for making this project possible and everyone else at Christy Sports who dedicated countless hours to the implementation and administration of this program. The authors also thank Leslie Strate of the St. Anthony Health Foundation; Kathy Shaver, RN, CFNP; Kelly Fulton, RN, BSN; Mary Bonville, RN, MSN; and the many other volunteers. Helmets for the pilot program were purchased by the first author's practice, InterMountain Neurosurgery. In the subsequent 3 years, the program was funded primarily by grants from the St. Anthony Health Foundation but also by donations from InterMountain Neurosurgery, Centura Trauma Services at St. Anthony Central Hospital, and private individuals.

## **Health Promotion Practice**

July 2007 Vol. 8, No. 3, 257-265

DOI: 10.1177/1524839906292178

©2007 Society for Public Health Education

### **The Authors**

**A. Stewart Levy, MD**, is a neurosurgeon with Intermountain Neurosurgery and Neuroscience in Denver, Colorado.

**Allison P. Hawkes, MD, MS**, is the director of clinical research for the trauma service at St. Anthony Central Hospital in Denver, Colorado.

**George V. Rossie, PhD**, is a neuropsychologist in private practice in Denver, Colorado.

## ► METHODS

The target audience for this program is skiers and snowboarders of any age who ski or ride at Colorado ski resorts. There are three components to the program: social marketing campaign, helmet loaner program, and distribution of helmets to ski patrollers and instructors. Table 1 briefly summarizes the description, purpose, and evaluation of each component.

For the social marketing campaign, data from the authors' prior work regarding TBI from ski and snowboard accidents and results from the program itself have been presented in multiple medical and layperson formats, including newspapers, magazines, and television, reaching thousands of individuals, locally and nationally. The messages conveyed in these interviews and presentations are that (a) TBI can occur in skiing/snowboarding, (b) the most common cause of TBI in skiing/snowboarding is hitting a stationary object such as a tree, (c) TBI is the leading cause of death and serious injury among skiers/snowboarders, (d) many TBIs can be prevented by wearing a helmet, and (e) free loaner helmets are available at Christy Sports. A representative sample of interviews and articles featuring the program and the estimated numbers of individuals reached are listed in Table 2. The program was titled "It Ain't Brain Surgery,"<sup>®</sup> (trademark by Centura Health) and a logo was developed (see Figure 1). The logo was included on posters displayed in participating stores and on brochures distributed throughout the target communities and was made into stickers for ski helmets. The brochure included a personal message from a neurosurgeon.

The helmet loaner program was developed in cooperation with Christy Sports, a local ski outfitter under the ownership of a single corporation that has multiple retail outlets both within the Denver metro area and at ski areas across the state. Anyone renting ski or snowboard equipment from any of the participating stores was offered a free loaner helmet to use for the duration of the rental period. The helmet was then returned

along with the rest of the rental equipment. In contrast, nonparticipating ski rental shops charged \$3 to \$10 a day for helmet rental in addition to the base cost of a rental package (Hennessey, Morgan, Elliot, Offner, & Ferrari, 2002). The corporation was motivated to participate in the program because of the marketing advantage of offering loaner helmets.

The helmet loaner program was introduced in the 1998-1999 ski season as a pilot study involving three ski and snowboard rental shops (owned by Christy Sports) in a single ski area that serves as both a destination resort and a local ski resort for Colorado front-range skiers. During the next three seasons, the program was expanded statewide to include 24 Christy Sports locations (located primarily in the Denver metro area, Summit and Grand counties) and other rental programs including a resort-based, ski school rental facility in the Winter Park Children's Center, a rental facility at a YMCA camp, and a Young Life Christian Center. The program was also expanded to Christy Sports locations in Utah, and the first author assisted in the development of replica programs in other states.

As the program expanded, all of the store managers were required to participate. The consistency of the program and message was maintained because the area manager (who was involved with the program since its inception) educated the other managers who, in turn, educated the rental technicians and other store personnel. Rental technicians were instructed to "offer" the loaner helmets and educated customers at the time of equipment rental. Informational brochures were also available at the point of rental.

The program was funded through a variety of means. Helmets for the pilot program were purchased by the first author's neurosurgery practice (InterMountain Neurosurgery), used for 1 year in the pilot study stores, then donated to The National Sports Center for the Disabled ski program in Winter Park, Colorado. In the subsequent 3 years, the program was funded primarily by grants from the St. Anthony Health Foundation but also by donations from InterMountain Neurosurgery, Centura Trauma Services at St. Anthony Central Hospital, and private individuals. Marketing costs, including logo design and production of stickers, posters, and rack brochures, were covered by the authors' primary hospital. Christy Sports provided "gift in kind" support in the form of helmets at wholesale cost and man hours administering the program. Christy Sports also advertised the program and paid for a comprehensive public awareness campaign one season. Additional "gift in kind" support was provided by the helmet manufacturers Boeri, Leedom, and Giro in the form of further discounts of helmets below wholesale cost. The entire program was

**TABLE 1**  
**Summary Description, Purpose, and Evaluation of Each Component for the “It Ain’t Brain Surgery”® (trademark by Centura Health) Traumatic Brain Injury Prevention Program Targeting Skiers and Snowboarders in Colorado**

<i>Component</i>	<i>Description</i>	<i>Purpose</i>	<i>Evaluation</i>
Marketing campaign	Interviews with and presentations by the first author. Logo developed, along with stickers (to place on helmets), posters, and informational brochures, which were then distributed in target communities and in participating stores. Message was as follows: (a) TBI can occur in skiing/snowboarding, (b) most common cause of TBI in skiing/snowboarding is hitting a stationary object such as a tree, (c) TBI is the leading cause of death and serious injury among skiers/snowboarders, (d) many TBI can be prevented by wearing a helmet.	Increase public awareness and knowledge about (1) ski- and snowboard-related TBI and (2) the helmet loaner program. Influence skiing public’s beliefs about helmets.	Observation of public’s helmet use on the slopes.
Helmet loaner program	Developed in cooperation with Christy Sports; anyone renting ski or snowboard equipment from any of the participating stores was offered a free loaner helmet to use for the duration of the rental period.	(1) Reduce barriers to wearing a helmet by making loaner helmets available at no cost, and (2) influence skiing public’s beliefs about helmets.	(1) Comparison of helmet acceptance among renters at study stores to helmet acceptance among renters at nonparticipating stores. (2) To determine acceptability of helmets, a survey was administered to a convenience sample of customers returning rental equipment to one of the study stores during the pilot season.
Instructors and patrollers	(a) Ski patrollers and ski instructors were given helmets and encouraged to wear a helmet while working on the slopes and (b) were educated about TBI and the effectiveness of helmets at their annual fall “refresher courses” and after caring for patients with a significant TBI.	(1) Have ski industry professionals set an example for the skiing public and (2) influence skiing public’s beliefs about helmets.	Observation of patrollers’ and instructors’ helmet use on the slopes.

administered by volunteers and “gift in kind” labor; every dollar raised was used to purchase helmets.

In an attempt to have ski industry professionals set an example for the skiing public, program funds were used to buy helmets for ski patrollers and ski instructors at multiple resorts, and they were encouraged to wear a helmet while working on the slopes. An outreach program was initiated to educate ski patrollers

about the significance of head injuries on the slopes and the effectiveness of helmets in preventing them. The ski patrollers were educated at their annual fall “refresher courses” and in “debriefing” follow-up sessions after caring for patients suffering a significant TBI. Program funds were also used to purchase helmets for the ski patrol and racecourse personnel at the 2002 Winter Olympics in Salt Lake City.

**TABLE 2**  
**Sample of Articles and Interviews Featuring the “It Ain’t Brain Surgery”®**  
**(trademark by Centura Health) Injury Prevention Program**

<i>Type of Publication</i>	<i>Approximate Circulation/Viewers</i>
National newspaper	
“Helmets cut risk for skiers, boarders,” <i>USA Today</i> (Ruibal, 2001)	5 million <sup>a</sup>
Los Angeles and Denver newspapers	
“Taking the kids: Even the hardheaded need ski helmets,” <i>Los Angeles Times</i> (Ogintz, 2002)	1 million <sup>b</sup>
“Doctor says making helmet decision isn’t, well, brain surgery,” <i>Rocky Mountain News (Denver)</i> (Melani, 2002)	300,000 <sup>c</sup>
“Ski safety’s a matter of brains: Denver neurosurgeon maintains helmets offer vital protection to those on the slopes,” <i>Rocky Mountain News (Denver)</i> (Frazier, 2001)	300,000 <sup>c</sup>
“It’s a no-brainer: Doctor crusades for helmet use on slopes,” <i>Rocky Mountain News (Denver)</i> (Stedman, 2000)	300,000 <sup>c</sup>
“Doctors push ski helmets,” <i>The Denver Post</i> (Schrader, 1999)	300,000 <sup>d</sup>
Denver television	
Channel 9 News. Interview with A. Stewart Levy, February 2002.	110,000 <sup>e</sup>
Channel 7 News. Interview with A. Stewart Levy, January 2001.	78,000 <sup>e</sup>
Channel 9 News. Interview with A. Stewart Levy, January 2001.	110,000 <sup>e</sup>
Channel 2 News. Interview with A. Stewart Levy, May 2000.	25,000 <sup>e</sup>
Local newspapers in ski resort areas	
“Helmets on slopes—A healthy trend,” <i>Sky-Hi News/Daily Tribune</i> (Bonville, 2003)	3,650 <sup>f</sup>
“Brain buckets: The great helmet debate,” <i>Vail Trail</i> (Boyd, 2002)	16,500 <sup>f</sup>
“Free ski helmet program is larger,” <i>Winter Park Manifest/Daily Tribune</i> (Williamson, 2000)	NA
“A heady debate,” <i>The Daily Camera</i> (Kauder, 2000)	34,000 <sup>g</sup>
“Doctors expanding ski helmet promotion,” <i>Summit Daily News</i> (1999)	NA
“Local shops, doctors, and hospital provide helmets,” <i>Winter Park</i> <i>Manifest/Daily Tribune</i> (Williamson, 1998)	NA
Ski magazines	
“A heady debate,” <i>Ski magazine</i> (Katagi, 2000)	450,000 <sup>h</sup>
“Neurosurgeons buy 1,250 helmets for free rentals,” <i>Wintersport Business</i> <i>Magazine</i> (Mazzante, 2002)	NA
Press release	
“Skiers and snowboarders need to exercise caution on the slopes” (Congress of Neurological Surgeons, 1999)	NA

NOTE: NA = not available.

a. USA Today Media Kit, 2003.

b. *Los Angeles Times*, 2003.

c. “Profile of our businesses,” 2003.

d. “100 Largest U.S. Newspapers,” 2001.

e. “Top 50 Market Profiles: No. 18—Denver,” 2003.

f. American Newspaper Representatives, Inc. Colorado, 2003.

g. “Top 50 Boulder and Broomfield County Employers,” 2003.

h. K. Katagi, personal communication, October 13, 2003.

### **Evaluation Methods**

The effect of free loaner helmets on helmet rental rates was measured by comparing helmet acceptance among renters at study stores to helmet acceptance

among renters at nonparticipating stores. During the 1998-1999 season, rental data from the study stores were compared with rental data from four nonparticipating stores in the same resort area. No data were available to serve as a control for the 1999-2000 season

of the study. During the 2000-2001 and 2001-2002 seasons, the control group consisted of 30 nonparticipating ski rental stores across the state in locations corresponding to the study stores. Helmet acceptance was expressed as a percentage of the total number of rental days and calculated as follows: (Total Number of Helmet Days for the Season/Total Number of Rental Days for the Season)  $\times$  100, where one "helmet day" equaled one helmet loaned out for 1 day and one "rental day" equaled one rental package rented out for 1 day.

To determine whether helmets were actually worn during skiing/boarding and to get a sense of how well the skiers and snowboarders liked wearing the helmets, a survey was administered to a convenience sample of approximately 100 customers returning rental equipment to one of the study stores during the pilot season.

The social marketing campaign was evaluated by conducting helmet observation studies of the general skiing population each year. These studies took place at multiple ski resorts at different times during the season, and the majority of these observations were performed at front-range ski resorts located in Summit and Grand counties. Observers counted and assessed helmet use in skiers and snowboarders as they loaded into chairlifts leaving the lift area. Observations were conducted at a representative sample of chairlifts serving a variety of terrain in the ski resorts. Observers counted for periods of 15 to 45 minutes per chairlift, depending on the length of the lift line and the terrain served, to reduce the chance of counting skiers or boarders multiple times.

Statistical significance was calculated for the differences in proportions by using a chi-square test and comparing 95% confidence intervals (CI) around point estimates. Yate's correction to the chi-square test was used when one expected cell was fewer than 5. Statistical analyses were performed with Statview (SAS Institute, Inc., 1998) and Epi-Info (Dean et al., 1994). Statistical significance was considered for a  $p$  value  $\leq$  .05.

## ► RESULTS

Table 3 shows helmet acceptance rates at the participating rental shops for the 4 seasons of the program and in nonparticipating stores for the seasons available. During the pilot season, 1998-1999, 1.38% (248 Helmet Days/18,000 Rental Days) of customers renting ski and snowboard equipment in the nonparticipating stores paid the extra cost to rent a helmet. In contrast, helmet acceptance in the participating stores, in the same ski area during the same season, was 10 times higher (13.8%; 2,150 Helmet Days/15,567 Rental Days). During

the pilot season, participating stores also sold 5 times more helmets than control stores. The program grew from 3 stores in the pilot season to 24 stores by the 2001-2002 ski season (17 in ski resort areas and 7 in metro areas). Helmet acceptance was significantly greater at participating stores for every season for which data were available ( $\chi^2$  values by season are as follows: 1998-1999, 1709.2 (1 *df*),  $p < .01$ ; 2000-2001, 67312.7 (1 *df*),  $p < .01$ ; 2001-2002, 48323.3 (1 *df*),  $p < .01$ ).

The results from the exit surveys of customers returning rental equipment are included in Table 4. Out of 117 customers surveyed, 83% reported accepting a loaner helmet. The highest percentage of helmet acceptance was found in children aged 10 and younger (93%, 25/27) and the lowest in adults aged 31 and older (65.7%, 23/35). Snowboarders reported a significantly higher acceptance rate than skiers ( $\chi^2 = 12.27$  (1 *df*),  $p < .05$ ); however, a greater proportion of skiers who accepted the helmet indicated that they actually wore it, but this difference was not statistically significant. Of the 97 people who accepted a helmet, 84 (86.6%) said that they would buy a helmet in the future. Even more interesting was the response from those who did not accept a free loaner helmet: About half (8/20) of them reported that they would likely buy a helmet in the future. Some even came back to the rental shop to pick up a free loaner helmet for the remainder of their rental period.

Figure 1 illustrates helmet use rates on the ski slopes. Helmet use increased significantly for both skiers and snowboarders during the 4 years of the study (chi-square for trend: skiers,  $\chi^2 = 1189.60$ ,  $p < .001$ ; snowboarders,  $\chi^2 = 286.41$ ,  $p < .001$ ), and was significantly higher among snowboarders than skiers for every year studied.

In contrast, helmet use among ski patrollers and instructors remained low despite buying hundreds of helmets for these ski professionals. During the 2001-2002 season, only 9.5% of ski patrollers and 12% of ski instructors were noted to be wearing helmets in areas where helmets had been donated to the ski professionals in previous seasons. Ski professionals gave many reasons as to why they did not wear a helmet while working on the slopes, and some said that they did wear a helmet while recreationally skiing. The most disconcerting reason given, particularly by ski patrollers, was that they did not believe that helmets could reduce the risk of brain injuries among skiers and snowboarders and that in fact they believed that helmets would cause a false sense of security, resulting in increased risk-taking behavior and would thus increase overall injury rates.

**TABLE 3**  
**Ski Helmet Acceptance Rate Among Renters, Participating Ski Rental Stores Versus Control Stores,**  
**Colorado, 1998-1999 Through 2001-2002 Ski Seasons**

	<i>Ski Season</i>			
	<i>1998-1999</i>	<i>1999-2000</i>	<i>2000-2001</i>	<i>2001-2002</i>
<i>Participating Stores</i>				
<i>Percentage of Rental Packages That Included a Loaner Helmet</i>				
Front-range ski resort locations				
Store 84	14.0	36.2	37.0	39.0
Store 81	13.8	38.1	40.0	42.0
Store 83	13.7	32.0	42.0	38.0
Store 23	—	8.0	12.0	25.0
Store 26	—	36.1	29.0	27.0
Store 21	—	30.0	32.0	38.0
Store 22	—	35.0	35.0	28.0
Store 24	—	28.0	39.0	42.0
Store 20	—	28.0	36.0	33.0
Store 32	—	—	27.0	25.0
Store 31	—	—	22.0	32.0
Mean	13.8	30.1	31.9	30.3
Other ski resort locations				
Store 51	—	24.2	31.0	31.0
Store 54	—	28.0	37.0	35.0
Store 56	—	—	36.0	36.0
Store 55	—	—	41.0	27.0
Store 42	—	—	36.0	33.0
Store 63	—	—	28.0	33.0
Mean	—	26.1	30.9	32.5
Metro area locations <sup>a</sup>				
Store 16	—	34.3	38.0	35.0
Store 15	—	38.1	40.0	38.0
Store 14	—	32.1	28.0	33.0
Store 19	—	31.0	33.0	36.0
Store 12	—	29.1	35.0	36.0
Store 17	—	47.0	49.0	39.0
Store 18	—	58.1	53.0	42.0
Mean	—	38.5	39.4	35.0
Mean (all stores)	13.8*	30.9	33.5*	33.5*
Helmet days/rental days	2,150/15,567	55,581/179,705	44,351/132,219	75,037/224,008
Control stores				
Mean (all stores)	1.38	NA	3.93	4.48
Helmet days/rental days	248/18,000		12,389/278,319	9,754/247,917

NOTE: Em-dashes indicate not participating in program for season. NA = no data available.  $\chi^2$  values by season are as follows: 1998-1999, 1709.2 (1 *df*); 2000-2001, 67312.7 (1 *df*); 2001-2002, 48328.3 (1 *df*).

a. Locations include Denver, Colorado Springs, and Boulder.

\**p* < .001.

## ► DISCUSSION

The results of our cross-sectional evaluation suggest that this injury prevention program achieved its desired effect by increasing helmet acceptance and use. The

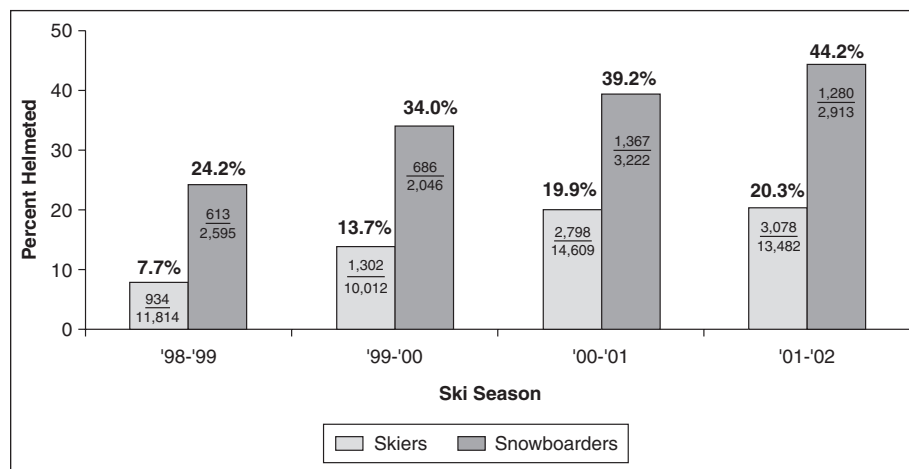
reason the program was successful is likely multifactorial. The program was designed by a local practicing neurosurgeon, local businessman, and personnel from the hospital's marketing department who did not knowingly base it on any formal behavioral theory. In retrospect,

**TABLE 4**  
**Self-Reported Use of Free/Loaner Helmets Among Skiers and Snowboarders Returning Rental Equipment to a Store Participating in the Free/Loaner Helmet Program, 1998-1999 Ski Season (N = 117)**

No. (%) of Individuals Who:	Skier (n = 50)	Snowboarder (n = 60)	Both Sports (n = 7)
Accepted free/loaner helmet	35 (70.0)	55 (90.2)	7 (100.0)
Wore helmet <sup>a</sup>	34 (97.1)	49 (89.1)	7 (100.0)
Wore every day <sup>b</sup>	29 (85.3)	43 (87.8)	4 (57.1)
Wore all day <sup>b</sup>	31 (91.1)	42 (85.7)	6 (85.7)
Will buy helmet in future <sup>a</sup>	31 (88.6)	45 (81.8)	7 (100.0)

a. Denominator is number of individuals who reported accepting free/loaner helmet.

b. Denominator is number of individuals who reported wearing helmet.



**FIGURE 1** Mean Percentage of Skiers and Snowboarders Observed to Be Wearing Helmets, by Season, Front-Range Ski Areas, Colorado.

however, the program's success may be because of the fact that it followed "The four Ps" of social marketing (product, price, place, and promotion; Glanz & Rimer, 2005) and was built on the health belief model (HBM; Glanz & Rimer, 2005). The interviews, articles, and educational brochure all addressed the risk and severity of TBI from skiing and snowboarding (perceived susceptibility and perceived severity from the HBM), informed the public that wearing a helmet could reduce the risk of a TBI (perceived benefits), and stated that loaner helmets were available through Christy Sports (perceived barriers). Educational brochures were available at the ski stores, and the rental technicians and store managers were also available to assist customers with helmet rental (cues to action and self-efficacy from the HBM). The personalized note from

the neurosurgeon on the brochure and the idea of modeling helmet use by patrollers and instructors could also be viewed as strategies to increase self-efficacy.

According to the HBM, people are ready to act if they believe that the costs of taking action are outweighed by the benefits. Therefore, one potential reason that the helmet loaner program succeeded is that it addressed the issue of ski helmet cost. By decreasing the financial cost of wearing a helmet to zero, the cost of wearing a helmet was outweighed by the benefit of preventing a TBI. Skiing is an expensive sport, however, and compared to the cost of renting equipment, buying a lift

ticket, and possibly even flying to a destination ski resort, the additional cost of \$3.00 to \$10.00 for helmet rental (which is what other ski stores charge) seems minimal. It is possible that not including helmets in an equipment package encourages the perception that helmets are not a necessary piece of equipment for participation in the activity (Hennessey et al., 2002). Thus, perhaps routinely offering a helmet with an equipment package conveys the opposite message. If that is the case, then another potential reason the helmet loaner program succeeded is that it decreased the psychological cost of wearing a helmet (by eliminating the decision whether to wear) so that it was outweighed by the benefit of preventing a TBI.

Admittedly, one of the limitations to our analysis is that it is a cross-sectional comparison, not a randomized

controlled trial. Our finding of increased helmet acceptance at stores, however, was corroborated by an independent survey of ski resort rental shops, which were not included in either of our samples, revealing that only 3.2% of equipment renters, on average, rented helmets (range 1.0% to 8.6%) during the 1998-1999 season (Hennessey et al., 2002).

Another limitation is that self-selection may have increased helmet acceptance in the participating stores because skiers and snowboarders who wanted to wear a helmet specifically sought out the stores that were offering the free loaner helmets. However, advertising the availability of loaner helmets was part of the social marketing campaign.

The loaner program was also successful in getting people to wear helmets, as evidenced by the replies on the exit surveys. Admittedly, the exit surveys indicated a much greater acceptance rate of helmets (70% to 90%) than the actual rate calculated as helmet days per rental days, and therefore it was biased toward interested customers willing to complete a survey. Of those who did complete a survey, however, the vast majority who accepted a loaner helmet indicated that they actually wore it, and many, in fact, said that they were likely to buy a helmet in the near future. Interestingly, even some of those who did not accept a loaner helmet initially seemed to be influenced by the program.

It was more difficult to measure the effects of our social marketing campaign because we could not determine whether helmeted skiers and snowboarders on the slope had actually been exposed to the campaign, clearly a limitation to our analysis. Although helmet use among skiers and snowboarders at Colorado front-range resorts did increase significantly during the 4 years, the increase was likely the result of many factors, and it is difficult to attribute any specific portion of this increase in helmet use directly to the campaign. A widespread rise in public awareness regarding head injuries on the slopes and the potential usefulness of helmets was initiated by several high-profile fatalities and then fueled by the media. The program was designed, in part, to further stimulate this surge in public interest and to clarify information for the public about the significance of head injuries and the effectiveness of helmets. It does appear, however, that the combination of these factors may have had some effect based on comparative studies by other investigators. Buller et al. (2003) found that during the 2000-2001 season, a statistically significantly greater proportion of guests at Colorado resorts were observed to be wearing ski helmets when compared to guests at resorts located in Utah, California, and the Southwest region of the United States. Similar findings were noted in a follow-up analysis by Andersen et al. (2004), who

found that Colorado ski resorts had a statistically significantly higher prevalence of helmet use compared with ski resorts in California and the Southwest.

There were, however, barriers to the implementation of the program. The results of our efforts to stimulate helmet use among ski professionals working on the slopes were disappointing. Helmet use among ski patrollers remained less than 10% even in the most recent season assessed (2001-2002) despite our donation of hundreds of helmets to patrollers over several seasons.

In addition, a significant proportion of renters did not accept a loaner helmet, so further work needs to be done to determine the obstacles in reaching this population.

One of the biggest disappointments to the implementation of the program is that the program has not become self-sustaining. We must continue to raise money to buy helmets for the loaner program, but Christy Sports is now paying for 50% of the cost of the helmets.

## ► CONCLUSION

We believe that efforts to increase helmet use on the slopes through increasing education and public awareness and decreasing barriers to helmet use, such as helmet loaner programs or routine inclusion of helmets in rental packages, have significant potential to decrease the incidence and severity of brain injuries from skiing and snowboarding accidents in Colorado. Ski patrollers need to be informed of recent studies that show that ski helmets are effective in preventing traumatic brain injury (Hagel, Pless, Goulet, Platt, & Robitaille, 2005a; Macnab, Smith, Gagnon, & Macnab, 2002; Sulheim, Holme, Ekeland, & Bahr, 2006) and do not promote increased risk taking in skiers and snowboarders (Hagel, Pless, Goulet, Platt, & Robitaille, 2005b).

## REFERENCES

- 100 largest U.S. newspapers. (2001). Retrieved October 20, 2003, from [http://www.freep.com/jobspage/links/top100\\_99.htm](http://www.freep.com/jobspage/links/top100_99.htm)
- American Newspaper Representatives, Inc. (2003). Colorado. Retrieved October 10, 2003, from <http://www.anrinc.net/Newspaper%20Database/CO.htm>
- Andersen, P. A., Buller, D. B., Scott, M. D., Walkosz, B. J., Voeks, J. H., Cutter, G. R., et al. (2004). Prevalence and diffusion of helmet use at ski areas in Western North America in 2001-02. *Injury Prevention, 10*, 358-362.
- Bonville, M. (2003 March 20). Helmets on slopes—A healthy trend. *Sky-Hi News/Daily Tribune*, p. 13.
- Boyd, T. (2002, March 8-14). Brain buckets: The great helmet debate. *Vail Trail*, pp. 8-9.
- Buller, D. B., Andersen, P. A., Walkosz, B. J., Scott, M. D., Cutter, G. R., Dignan, M. B., et al. (2003). The prevalence and predictors of helmet use by skiers and snowboarders at ski areas in western North America in 2001. *Journal of Trauma, 55*, 939-945.

- Congress of Neurological Surgeons. (1999, October 20). *Skiers and snowboarders need to exercise caution on the slopes*. Retrieved October 17, 2003, from <http://www.neurosurgery.org/health/news/detail.asp?PressID=38>
- Dean, A., Dean, J., Coulombier, D., Brendel, K. A., Smith, D. C., Burton, A. H., et al. (1994). *Epi Info, Version 6: A word processing database and statistics program for epidemiology on microcomputers* [Computer program]. Atlanta, GA: Centers for Disease Control and Prevention.
- Doctors expanding ski helmet promotion. (1999, November 28). *Summit Daily News*, p. 14.
- Frazier, D. (2001, March 12). Ski safety's a matter of brains: Denver neurosurgeon maintains helmets offer vital protection to those on the slopes. *Rocky Mountain News (Denver)*, pp. 7A, 12A.
- Glanz, K., & Rimer, B. K. (2005). *Theory at a glance. A guide for health promotion practice* (2nd ed., NIH Pub. No. 97-3896). Washington, DC: National Cancer Institute, National Institutes of Health, U.S. Department of Health and Human Services.
- Hagel, B. E., Pless, I. B., Goulet, C., Platt, R. W., & Robitaille, Y. (2005a, January 4). Effectiveness of helmets in skiers and snowboarders: Case-control and case crossover study. *British Medical Journal*. Retrieved February 25, 2005, from [http://bmj.bmjournals.com/onlinefirst\\_date.shtml](http://bmj.bmjournals.com/onlinefirst_date.shtml)
- Hagel, B. E., Pless, I. B., Goulet, C., Platt, R. W., & Robitaille, Y. (2005b). The effect of helmet use on injury severity and crash circumstances in skiers and snowboarders. *Accident Analysis and Prevention*, 37, 103-108.
- Hennessey, T., Morgan, S. J., Elliot, P., Offner, P. J., & Ferrari, J. D. (2002). Helmet availability at skiing and snowboarding rental shops: A survey of Colorado ski resort rental practices. *American Journal of Preventive Medicine*, 22, 110-112.
- Katagi, K. (2000, October). A heady debate. *Ski magazine*.
- Kauder, C. (2000, March 13). A heady debate. *The Daily Camera*, pp. 1B, 8B.
- Levy, A. S., Hawkes, A. P., Hemminger, L. M., & Knight, S. (2002). An analysis of head injuries among skiers and snowboarders. *Journal of Trauma*, 53, 695-704.
- Los Angeles Times* reports March circulation. (2003, May 5). *Los Angeles Times*. Retrieved October 20, 2003, from <http://www.latimes.com/services/newspaper/mediacenter/la-mediacenter-2w003-0505abc.html>.
- Macnab, A. J., Smith, T., Gagnon, F. A., & Macnab, M. (2002). Effect of helmet wear on the incidence of head/face and cervical spine injuries in young skiers and snowboarders. *Injury Prevention*, 8, 324-327.
- Mazzante, L. (2002, January). Neurosurgeons buy 1,250 helmets for free rentals. *Wintersport Business Magazine*. Retrieved October 17, 2003, from [http://www.skihelmets.com/News\\_article\\_template.ASP?ID=22](http://www.skihelmets.com/News_article_template.ASP?ID=22)
- Melani, D. (2002, March 5). Doctor says making helmet decision isn't, well, brain surgery. *Rocky Mountain News (Denver)*, p. 5D.
- Ogintz, E. (2002, October 20). Taking the kids: Even the hard-headed need ski helmets. *Los Angeles Times*, p. 17.
- Profile of our businesses: Newspaper. (2003). *Rocky Mountain News (Denver)*. Retrieved October 10, 2003, from <http://www.scripps.com/corporateoverview/businesses/newspaper/denverhtml>
- Ruibal, S. (2001, February 23). Helmets cut risk for skiers, boarders. *USA Today*, p. 11C.
- SAS Institute Inc. (1998). *Statview* [Computer program]. Cary, NC: Author.
- Schrader, A. (1999, November 27). Doctors push ski helmets. *The Denver Post*, pp. 1B, 6B.
- Stedman, T. A. (2000, December 6). It's a no-brainer: Doctor crusades for helmet use on slopes. *Rocky Mountain News (Denver)*, p. 20C.
- Sulheim, S., Holme, I., Ekeland, A., & Bahr, R. (2006). Helmet use and risk of head injuries in alpine skiers and snowboarders. *Journal of the American Medical Association*, 295, 919-924.
- Top 50 Boulder and Broomfield County employers: No. 43*. (2003). Boulder, CO: Boulder Publishing LLC. Retrieved October 10, 2003, from [http://www.dailycamera.com/bdc/business/article/0,1713,BDC\\_2400\\_1950749,00.html](http://www.dailycamera.com/bdc/business/article/0,1713,BDC_2400_1950749,00.html)
- Top 50 Market Profiles: No. 18—Denver*. (2003). *Mediaweek*. Retrieved October 10, 2003, from <http://www.mediaweek.com/mediaweek/top50/denver.jsp>
- U.S. Consumer Product Safety Commission. (1999). *Skiing helmets: An evaluation of the potential to reduce head injury*. Retrieved April 5, 2004, from <http://www.cpsc.gov/library/ski-helm.pdf>
- USA Today Media Kit. (2003). *USA Today*. Retrieved October 10, 2003, from [http://www.usatoday.com/media\\_kit/pressroom/pr\\_justfacts\\_usatoday.htm](http://www.usatoday.com/media_kit/pressroom/pr_justfacts_usatoday.htm)
- Williamson, H. (1998, November 11). Local shops, doctors, and hospital provide helmets. *Winter Park Manifest/Daily Tribune*, p. 11.
- Williamson, H. (2000, August 16). Free ski helmet program is larger. *Winter Park Manifest/Daily Tribune*, p. 11.