ORIGINAL ARTICLE

Helmet rental practices at United States ski areas: a national survey

J M Clingenpeel, S W Marshall

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See end of article for authors' affiliations

Correspondence to:
Dr Joel M Clingenpeel,
Vanderbilt University
Medical Center,
Department of Emergency
Medicine, 703 Oxford
House, Nashville, TN
37232-4700, USA;
joel.clingenpeel@
vanderbilt.edu

Objectives: Studies have shown that head injuries are the leading cause of death on ski slopes. Statistics on helmet rental practices at ski areas across the United States have never been reported. This study sought to determine the prevalence of United States ski areas offering helmet rental during the 2002–03 ski season. Secondly it sought to analyze the relationships of geographic region and size of ski area with helmet rental availability and to gather information on ski helmet rental cost to the consumer.

Methods and setting: A stratified cross sectional telephone survey of a sample of 331 United States ski area onsite rental shops during February 2003.

Results: Altogether 50% of ski areas offered helmet rental with significant variation in the prevalence of helmet rental among ski areas of differing regions and sizes ($p < 0.01$). A majority of Northeastern (57%), Western (63%), and Rocky Mountain (71%) ski areas rented helmets, whereas a minority of Southern (37%) and Midwestern (23%) ski areas rented helmets. Twenty five percent of the smallest ski areas (≤ 50 acres) rented helmets compared with 74% of the largest ski areas (≥ 501 acres).

Conclusions: United States ski area helmet rental practices vary by region of the country and ski area size. Winter sports participants interested in wearing protective headgear should be aware of the helmet rental practices at the ski area in which they plan to visit and consider helmet purchase if they visit mainly smaller ski areas or areas within the South or Midwest.

Sports and recreational injuries constitute a significant public health problem.¹ Alpine winter recreational activities are popular in the United States with an estimated 54 million skier/snowboarder days annually.² Although winter sports participation continues to involve inherent physical risks, there has been a decline in the overall injury rate among skiers over the last two decades.^{3–5} While the overall ski injury rate has declined, recent studies have shown a sobering increase in the rate of skiing and snowboarding related head and spine injuries among children, adolescents, and adults.^{3–8} These studies, along with the highly publicized skiing related deaths of Michael Kennedy and Sonny Bono, have recently focused attention on winter sports related traumatic brain injury and the use of ski helmets.

Traumatic brain injury is the leading cause of death in injury events occurring on ski slopes.^{3–9–11} Given the absence of effective treatments to reverse neuronal damage once it has occurred, prevention remains the most important means of reducing the morbidity and mortality associated with traumatic brain injuries.¹² Studies evaluating the effectiveness of ski helmets in reducing head injuries among winter sports participants have yielded differing conclusions. A recent epidemiologic study found that helmet use significantly decreased the incidence of head injury requiring investigation and treatment among skiers and snowboarders less than 13 years of age.¹³ In contrast, a biomechanical investigation concluded that helmets are likely to prevent only those head injuries sustained as a result of an indirect or low speed direct blow to the head.¹⁴

Given the limited prospective data on the effectiveness of ski helmets in preventing serious head injuries and the overall low rate of sustaining a potentially serious skiing related head injury,³ many regulatory health and safety agencies have restricted their endorsements of ski helmet use. The American Medical Association concluded in 1997 that there was insufficient evidence to recommend a policy of

mandatory helmet use, but supports “the voluntary use of helmets and protective headgear for children and adolescents during recreational skiing and snowboarding”.¹⁵ Similarly, the National Ski Areas Association, the National Ski Patrol, and the Professional Ski Instructors of America all recommend that parents, skiers, and snowboarders make an informed choice about wearing a helmet after considering the potential benefits and limitations of helmet wear.¹⁶

Since choosing to wear a helmet necessitates helmet availability to the consumer, we sought to determine the prevalence of United States ski areas offering helmet rental at an onsite rental shop during the 2002–03 ski season. We secondarily sought to determine if there was regional variation in the prevalence of helmet rental, to analyze the relationship of ski area size with helmet rental availability, and to gather information on ski helmet rental cost to the consumer.

METHODS

A stratified cross sectional telephone survey was performed to determine the prevalence of ski areas in the United States offering helmet rental at an onsite rental shop during February 2003. We enumerated the total population of United States ski areas through SkiTown.com and by writing to the departments of tourism of all 50 states. All of the identified ski areas ($n = 424$) were initially contacted by telephone during the last week of January 2003. Using inclusion criteria which consisted of active operation for at least two consecutive days during the preceding three weeks of January, alpine skiing availability on at least one trail, onsite equipment rental availability, and at least one surface or above ground ski lift, a study population of 395 ski areas was identified. Ski areas were classified as independent of one another, even if owned by the same parent company, so long as they had different equipment rental shops and were physically separate from each other in such a way that

Figure 1 Geographic regions with study population number (N) and sample number (n).

prevented skiing from one to the other while staying within ski area boundaries.

The study population was subclassified into five strata based on ski area geographic location, and ski areas within each stratum were randomly sampled (fig 1). We used a disproportionate stratified survey design. Strata specific survey sampling sizes were calculated to ensure that the survey would have sufficient precision to estimate the proportion of ski areas renting helmets within each stratum to within five percentage points with 95% confidence. We assumed a 95% response ratio would be achieved. In the case of one strata, the South, we chose to sample with certainty because of the small size of the strata.

All sampled rental shops were contacted during the first three weeks of February 2003 by calling the ski area's front desk or operator and asking for connection to the ski area's rental shop. Within ski areas that had more than one affiliated onsite rental shop, an attempt was made to survey the shop that was the most centrally located. Verbal informed consent was obtained from the rental shop employee who served as a survey participant before data collection. The telephone survey consisted of 5–8 questions pertaining to ski helmet rental availability using a scripted interview administered by a single investigator (JC). Initial questions served to confirm that the ski area shop was located at the ski area and that the surveyed participant was an employee of the rental shop. Employees were asked if the rental shop in which they were working was currently offering helmet rental to skiers and/or snowboarders. For ski areas offering helmet rental, we

asked additional questions about the availability of adult and child sizes, the cost of helmet rental, and whether it was included in the standard rental package. Demographic data were collected for all sampled ski areas using ski area marketing information (table 1).

We conducted two sided tests, $\alpha=0.05$, to compare differences in the prevalence of ski areas offering helmet rental by ski area location and ski area size. Weighted regional stratum specific prevalence proportions were calculated by adjusting for the variation in the proportion of ski areas sampled in each stratum, and differences were assessed for statistical significance using a survey based χ^2 analysis.¹⁷ Regional variations in skiable acres, number of trails, number of lifts, vertical drop, and longest trail were investigated using a survey based one way analysis of variance. In order to better understand the relationship between geographic area and ski area size as they relate to helmet rental, we performed a survey based multivariate logistic regression analysis with helmet rental as the dependent variable and geographic region and ski area size as the categorical predictor variables. Adjusted helmet rental prevalence estimates were calculated rather than exponentiated coefficients as the prevalence odds ratio is a poor estimator of the prevalence ratio when prevalence is around 50%. Geographic region and ski area size were coded as indicator variables using the categories shown in table 2. All statistical analyses correctly accounted for the disproportionate stratified sampling design. All proportions reported here are national estimates of the prevalence of ski helmet rental at United States ski areas;

Table 1 Ski area demographics, by geographic location*; results are row % (95% confidence interval) for area size and mean (95% confidence interval) for other values

Geographic area	≤50 acres (≤20.2 hectares)	51–150 acres (20.6–60.7 hectares)	151–500 acres (61.1–202.3 hectares)	≥501 acres (≥202.7 hectares)	Skiable acres	No of trails	No of lifts†	Vertical drop (m)	Longest trail (m)
South‡ (N§=19, n =19)	47.4	47.3	5.3	0	65.7	17.3	5.3	221.2	1482.3
Midwest (N=106, n=84)	38.1 (33.4 to 42.9)	42.9 (38.1 to 47.8)	16.6 (13.3 to 20.7)	2.4 (1.3 to 4.4)	112.2 (98.5 to 126.0)	19.0 (17.7 to 20.3)	7.0 (6.6 to 7.4)	110.8 (105.3 to 116.3)	972.4 (903.9 to 1040.8)
Northeast (N=136, n=101)	23.8 (19.8 to 28.2)	44.5 (39.7 to 49.6)	24.8 (20.7 to 29.3)	6.9 (4.8 to 9.9)	174.5 (151.4 to 197.5)	31.7 (28.7 to 34.8)	6.8 (6.3 to 7.2)	291.6 (269.7 to 313.5)	2362.8 (2159.0 to 2566.7)
Rocky Mountains (N=80, n=68)	1.5 (0.7 to 3.1)	7.3 (5.3 to 10.2)	23.5 (19.8 to 27.7)	67.7 (63.1 to 71.8)	1388.9 (1269.9 to 1507.9)	66.9 (62.2 to 71.7)	9.4 (8.6 to 10.0)	640.9 (615.1 to 666.7)	3858.8 (3682.4 to 4035.1)
West (N=54, n=48)	4.2 (2.6 to 6.6)	10.4 (7.8 to 13.7)	22.9 (19.1 to 27.2)	62.5 (57.8 to 67.0)	1115.0 (1005.5 to 1224.6)	45.8 (42.5 to 49.2)	9.4 (8.7 to 10.0)	527.9 (502.7 to 553.1)	3028.7 (2866.1 to 3191.3)

*Significant ($p<0.01$) differences between strata for all demographic variables, using one way survey based analysis of variance.
†Includes surface lifts.
‡Sampled with certainty.
§N, Number in study population.
||n, Number sampled.

Table 2 Multivariate survey based logistic regression with helmet rental as outcome

Predictor variable	Coefficient (log prevalence odds ratio)	Standard error of coefficient	Adjusted prevalence estimate* (95% confidence interval)
Region			
West (referent)	1.0000	–	24.3 (16.6 to 34.1)
South	0.2238	0.1690	28.7 (18.6 to 41.3)
Northeast	0.6957	0.1798	39.2 (23.0 to 58.1)
Midwest	–0.7299	0.1947	13.4 (10.6 to 16.8)
Rocky Mountains	0.2829	0.1505	29.9 (19.2 to 43.4)
Ski area size			
≤50 acres (referent) (≤20.2 hectares)	1.0000	–	24.3 (16.6 to 34.1)
51–150 acres (20.6–60.7 hectares)	0.5854	0.1724	36.6 (22.0 to 54.2)
151–500 acres (61.1–202.3 hectares)	1.5220	0.1891	59.5 (23.7 to 68.6)
≥501 acres (≥202.7 hectares)	2.004	0.2151	70.4 (37.9 to 90.4)

*For region, this is the estimated prevalence of helmet rental availability (in any capacity) for ski areas of size ≤50 acres (referent category). For ski area size, this is the estimated prevalence of helmet rental availability (in any capacity) for resorts in the West (referent category).

95% confidence intervals were used to quantify precision. Stata Statistical Software (Stata Corporation, College Station, TX, v7.0) was used for all statistical analyses.

RESULTS

Three hundred ninety five ski areas met the inclusion criteria and were eligible for participation in the survey. Three hundred thirty one ski areas were randomly sampled after stratification by ski area geography. Response ratios for the South (100%), Midwest (97.7%), Northeast (96.2%), Rocky Mountains (98.5%), and West (94.1%) were all high for an

overall response ratio of 97.0%. The final study sample of 320 ski areas comprised 19 (5.9%) Southern, 84 (26.2%) Midwestern, 101 (31.6%) Northeastern, 68 (21.2%) Rocky Mountain, and 48 (15%) Western ski areas. Ski area demographics were significantly different ($p<0.01$) among geographic regions (table 1).

Overall, 50.5% (95% CI 48.2%, 52.7%) of ski areas were offering helmet rental at an onsite rental shop during February 2003. There was significant variation ($p<0.01$) in the prevalence of helmet rental among ski areas from different regions. Only 36.8% (sampled with certainty) of

Table 3 Estimated percentages of ski helmet rental practices, by ski area location and ski area size; results are row % (95% confidence interval)

	Rent helmets in any capacity*	Rent helmets to both children and adults* (extra fee)	Rent helmets to children only† (extra fee)	Rent helmets as standard equipment to children‡ (no extra fee)	Rent helmets as standard equipment to adults (no extra fee)	Rent helmets in some other capacity*
Geographic region						
South§	36.8	36.8	0	0	0	0
Midwest	22.6 (18.8 to 27.0)	17.9 (14.4 to 21.9)	4.8 (3.1 to 7.4)	0	0	0
Northeast	57.4 (52.4 to 62.3)	49.5 (44.5 to 54.5)	5.0 (3.2 to 7.6)	0	0	3.0 (1.7 to 5.2)
Rocky Mountains	70.6 (66.2 to 74.7)	60.3 (55.7 to 64.7)	10.3 (7.8 to 13.5)	0	0	0
West	62.5 (57.8 to 67.0)	50.0 (45.2 to 54.8)	2.1 (1.1 to 4.0)	4.2 (2.6 to 6.6)	0	6.2 (4.3 to 9.0)
Ski area size						
≤50 acres (≤20.2 hectares)	25.3 (20.8 to 30.4)	20.8 (16.6 to 25.6)	4.5 (2.7 to 7.6)	0	0	0
51–150 acres (20.6–60.7 hectares)	40.1 (35.7 to 44.7)	31.1 (27.0 to 35.5)	5.1 (3.4 to 7.7)	1.1 (0.6 to 2.2)	0	3.0 (1.8 to 5.1)
151–500 acres (61.1–202.3 hectares)	63.4 (58.3 to 68.2)	58.8 (53.6 to 63.9)	4.5 (2.7 to 7.5)	0	0	0
≥501 acres (≥202.7 hectares)	74.2 (70.4 to 77.6)	62.4 (58.3 to 66.4)	7.0 (5.2 to 9.4)	1.1 (0.6 to 2.2)	0	3.6 (2.3 to 5.7)
Total	50.5 (48.2 to 52.7)	42.6 (40.4 to 45.0)	5.3 (4.3 to 6.6)	0.6 (0.4 to 0.9)	0	1.9 (1.3 to 2.7)

*Significant differences ($p<0.01$) between the five geographic strata and between the four size strata.

†Significant differences ($p<0.01$) between the five geographic strata.

‡Significant differences ($p<0.05$) between the five geographic strata and between the four size strata.

§Sampled with certainty.

ski areas in the South and 22.6% (95% confidence interval (CI) 18.8% to 27.0%) of ski areas in the Midwest were offering helmet rental. By contrast, 57.4% (95% CI 52.4% to 62.3%) of Northeastern, 70.6% (95% CI 66.2% to 74.7%) of Rocky Mountain, and 62.5% (95% CI 57.8% to 67.0%) of Western ski areas were offering ski helmet rental (table 3).

There was significant variation ($p < 0.01$) in the prevalence of helmet rental among ski areas of different sizes, as measured by skiable acres. Only 25.3% (95% CI 20.8% to 30.4%) of ski areas 50 acres or less and 40.1% (95% CI 35.7% to 44.7%) of ski areas 51–150 acres were offering ski helmet rental. In comparison, 63.4% (95% CI 58.3% to 68.2%) of ski areas 151–500 acres and 74.2% (95% CI 70.4% to 77.6%) of ski areas greater than 501 acres were offering ski helmet rental (table 3).

Offering ski helmet rental to both adults and children for an extra fee was the most common rental practice, available in 42.6% (95% CI 40.4% to 45.0%) of all ski areas. The mean (SD) cost per day of helmet rental was \$7.0 (0.3) for adults and \$6.7 (0.2) for children. Rental of helmets for an extra fee to children only was the next most common rental practice, but this was available at only 5.3% (95% CI 4.3% to 6.6%) of ski areas. Only two sampled ski areas, 0.6% (95% CI 0.4% to 0.9%), included helmets within the standard child equipment rental package, and no sampled ski area offered helmets as part of the standard adult rental package. There were six sampled ski areas, 1.9% (95% CI 1.3% to 2.7%), which either restricted helmet rental to individuals taking lessons or offered only adult helmet rental for an extra fee (table 3). All sampled ski areas offering helmet rental offered them to both snowboarders and skiers without preference or variation in cost.

The logistic regression model suggested that location in the Northeast was an independent positive predictor for prevalence of helmet rental, relative to the West whereas location in the Midwest was an independent negative predictor for helmet rental, relative to the West. Thus, the prevalence of ski areas offering helmet rental was higher than predicted, based on ski area size alone, in the Northeast (57% observed *v* 44% predicted) and lower than predicted, based on ski area size alone, in the Midwest (23% observed *v* 39% predicted). Ski area size was a strong predictor for helmet rental, even when controlling for geographic location (table 2).

DISCUSSION

A previously published study reported that 79% of Colorado ski areas rented helmets at an onsite rental shop during the 1998–99 ski season.¹⁸ Although helmet rental has become increasingly more prevalent at United States ski areas in recent years, many ski areas are still not offering this service. Specifically, approximately 50% of all ski areas in the United States were not offering helmet rental during the 2002–03 ski season, and there is significant variation in helmet rental practices by geographic region. Within the Northeast, West, and Rocky Mountain areas, the majority of ski areas were renting helmets, whereas within the South and Midwest, the majority of ski areas were not offering helmet rental. We also found significant variation in helmet rental practices among ski areas of different sizes, with only 25% of the smallest areas (≤ 50 skiable acres) renting helmets whereas 74% of the largest areas (≥ 501 skiable acres) were renting helmets.

For many skiers and snowboarders, and in particular those individuals who frequently visit areas in the South and Midwest, choosing to wear a helmet on the slopes may necessitate ski helmet purchase. Our results therefore have important implications for those skiers and snowboarders not interested in purchasing any ski equipment (that is, infrequent winter sports participants or those new to winter

sports) in that their ability to choose whether or not to use a ski helmet depends in large part on their choice as to which ski area to visit. Our survey shows that smaller ski areas, which often market themselves to high injury rate groups such as young and inexperienced skiers and snowboarders,^{3 19 20} infrequently provide the choice of protective headgear rental.

The logistic regression model suggests that ski helmet rental is closely associated with both ski area size and location. The differences in rental prevalence between the Rocky Mountains (71%), West (63%), and South (37%), however, seem to be mainly an artifact of the variation in ski area size between these three regions (95% of ski areas in the South are less than or equal to 150 acres while 91% and 85% of ski areas in the Rocky Mountains and West, respectively, are more than 150 acres), coupled with the fact that the larger the ski area, the more likely it is to rent helmets (74% of ski areas over 500 acres rent helmets compared with 25% of those under 50 acres or less). Understanding the precise reasons for the limited helmet rental availability among smaller ski areas cannot be determined from this survey, as no attempt was made to quantify why different ski areas had chosen whether or not to provide helmet rental. The data suggest, however, that the choice of whether or not to provide helmet rental currently is not so much a variation in regional acceptance of this practice as it may be related to economic feasibility for the ski area. Since ski helmets are relatively expensive to purchase (approximate price range \$50–\$150 at the time of this writing), smaller ski areas may not be able to provide this service if the rental volume is not high enough to offset the initial overhead costs. Future strategies which focus on how to reduce the overhead costs of helmet rental for smaller ski areas may help to increase the overall prevalence of helmet rental availability.

The model and adjusted prevalence estimates also suggest, however, that in the Northeast helmet rental is more common than would be expected, predicted on the basis of ski area size alone, while in the Midwest it is less common than expected, predicted on ski area size alone. Additional factors specifically related to ski area geography, such as differences in consumer demand and variation in opinion among consumers and organizational leaders about the benefits of helmet wear, may be contributing to the higher and lower than expected prevalences in these regions.²¹ Further studies which seek to delineate region specific variables, which are either contributing to or detracting from helmet rental availability, will be important for future investigators interested in making helmet rental more universal.

The survey showed that few ski areas were providing financial motivation for skiers and snowboarders to rent a helmet. None of the ski areas surveyed offered helmets as part of the standard adult rental package. Skiers and snowboarders wishing to rent a helmet currently must pay extra for helmet rental with an average adult price of \$7 per day. For many winter sports participants the extra monetary burden of helmet rental is likely to influence the choice of helmet wear. It is conceivable that many individuals who contemplate wearing a helmet will choose otherwise so long as an extra fee is required. Skiers and snowboarders would have an increased opportunity to consider helmet use based upon the perceived protective benefits and limitations of wear should helmets become incorporated into the standard rental package. It must be acknowledged, however, that the average fee for helmet rental is modest relative to the overall cost of access to most ski areas.

Our data indicate that a limited number of ski areas are preferentially making helmet rental available for children (age < 13 in our sample). The mean daily price of a child's

rental helmet was slightly cheaper than for an adult. For ski areas that wish to offer helmet rental but are constrained financially as to how extensively they can offer this service, having ski helmets available for children may be the best choice given that young skiers are at increased risk for injury.^{3, 22–24} Since the use of a ski helmet at a young age may be a way to establish familiarity and thus increase the use later in life, it is possible that preferential rental of helmets to children will result in an increase in consumer demand in the future.

We studied availability of helmet rental under the assumption that it was a reasonable surrogate for helmet use at ski areas in the United States. As ski areas not offering helmet rental may have many skiers and snowboarders who have either purchased helmets or rented a helmet at an off-site rental shop at their facility, direct observational studies are needed in order to more precisely quantify individual usage among winter sports participants. It is clear from our results, however, that helmet owners and those skiers renting helmets at an offsite rental shop are currently the only users of protective headgear at approximately one half of all United States ski facilities.

The validity of any cross sectional study depends in part on minimizing the possibility of response bias.²⁵ The high response rates attained for each geographic stratum in our survey make response bias an improbable source of error in this study. Cross sectional studies are also prone to error as they depend on the accuracy of self reported information.²⁶ Only current employees of rental shops were surveyed in this study in an attempt to maximize the accuracy of information attained. Given the large number of ski area rental shops sampled, our results probably represent a reasonable estimation of the prevalence of United States ski areas offering helmet rental.

CONCLUSIONS

Ski helmet rental practices at ski areas in the United States vary by geographic region and ski area size. Our data indicate that for current winter sports participants the choice to wear a helmet is made more difficult by the lack of helmet rental availability at many ski areas and the extra cost of helmet

rental. Skiers and snowboarders desiring to use protective headgear should be aware of the helmet rental practices at the ski area in which they plan to visit and consider helmet purchase if they visit mainly smaller ski areas or areas within the South or Midwest.

Authors' affiliations

J M Clingenpeel, Department of Emergency Medicine, Vanderbilt University Medical Center, Nashville, Tennessee

S W Marshall, Departments of Epidemiology and Orthopedics, University of North Carolina School of Public Health, Chapel Hill, North Carolina

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Key points

- Helmet rental practices at United States ski areas vary by region of the country and size of ski area.
- 50% of all ski areas were not offering helmet rental during the 2002–03 ski season.
- Within the Northeast, West, and Rocky Mountain areas, the majority of ski areas were renting helmets, whereas within the South and Midwest, the majority of ski areas were not offering helmet rental.
- Only 25% of the smallest areas (≤ 50 skiable acres) were renting helmets whereas 74% of the largest areas (≥ 501 skiable acres) were renting helmets.
- Few ski areas were providing financial motivation for skiers and snowboarders to rent a helmet and no sampled ski area included helmet rental in the price of a standard adult rental package.