DISSERTATION

GROUP DYNAMICS AND DECISION MAKING:

BACKCOUNTRY RECREATIONISTS IN AVALANCHE TERRAIN

Submitted by

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In partial fulfillment of the requirements

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY LESLIE SHAY BRIGHT ENTITLED GROUP DYNAMICS AND DECISION MAKING: BACKCOUNTRY RECREATIONISTS IN AVALANCHE TERRAIN BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

GROUP DYNAMICS AND DECISION MAKING:

BACKCOUNTRY RECREATIONISTS IN AVALANCHE TERRAIN

The purpose of this study was to describe and determine the prevalence of decision-making characteristics of recreational backcountry groups when making a decision of where to travel and ride in avalanche terrain from the perspective of individuals. Decision-making characteristics encompassed communication, decision-making processes, leadership, and group factors, including groupthink and bounded awareness. Additionally, the study sought information on decision outcomes and group attributes and explored relationships among the characteristics, outcomes, and attributes. As little empirical findings existed, this study sought to provide foundational knowledge regarding the dynamics and decision making of winter recreational backcountry groups traveling in avalanche terrain.

This study utilized quantitative, cross-sectional survey research and a newly developed instrument. Participants were asked to complete the instrument online and reflect on one 2009-2010 backcountry outing in which they traveled with at least one other person in avalanche terrain. The study included 524 respondents with approximately 70% reporting an outing that occurred in Colorado.

Scale scores were determined for communication, decision-making processes, groupthink, bounded awareness, and decision outcomes. The Cronbach's alphas ranged from .41 to .80. With Spearman's correlation coefficient, positive, significant relationships were found between each of the five decision-making characteristics and between the characteristics and decision outcomes. Associations between leadership and the other decision-making characteristics and decision outcomes ranged from .09 to .22. The associations between group decision outcomes and the decision-making characteristics ranged from .16 to .45, and the correlations between communication, decision-making processes, groupthink, and bounded awareness ranged from .59 to .78. Relationships were found between particular group attributes and the characteristics and outcomes. Notably, communication worsened and groupthink increased as groups got larger, and as respondents spent more days per season in avalanche terrain they reported their groups to have more thorough decision-making processes.

The findings provide support for a variety of the suggested group behaviors presented in the literature as well as new insights on group dynamics and decision making. This study contributes to the avalanche hazard evaluation literature and educational resources and could positively impact the safety of those traveling in avalanche terrain.

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CHAPTER ONE: INTRODUCTION

Forms of winter backcountry recreation include telemark skiing, alpine touring (AT) or randonee skiing, cross-country skiing, snowboarding, snowshoeing, and snowmobiling. While traveling through the backcountry and accessing steeper slopes, recreationists run the risk of being caught in an avalanche and being injured or dying from trauma and/or asphyxiation. The level of risk is not nearly as high for those recreating at a ski resort as patrollers monitor the area for signs of avalanche hazard and conduct avalanche mitigation. In the backcountry, the area is not monitored and hence recreationists are responsible for evaluating avalanche hazard and selecting a safe travel route.

In most western states, avalanches account for the majority of deaths among all natural hazards (Tremper, 2008). From 1990 to 2007, 423 people died in avalanches in the United States (Tremper). The majority of these deaths occurred while people were recreating in the backcountry, and this number has been increasing over the years as more people have turned to backcountry skiing, snowboarding, and snowmobiling in avalanche terrain (Tremper). The majority of backcountry recreationists do not travel alone. A 2004 study reported that 60% travel in a group, 37% travel alone or in a group, and 1% travel alone in the backcountry at all times (Tase, 2004). Communication and decision making regarding avalanche hazard evaluation and route selection are expected among members of a backcountry group due to the fact they are traveling together and taking on risk in

avalanche terrain. Winter backcountry travel literature acknowledges and emphasizes the importance of group communication and decision making, offers a variety of common communication pitfalls, and provides some suggestions as to how groups should communicate and interact when making decisions. The literature, however, is slim in terms of empirical evidence that supports propositions regarding group communication, interaction, and how these dynamics influence a group's decision making and decision outcomes. Given the level of risk involved in the decisions backcountry groups are making, group decision making in this specific context warranted further research. This study consisted of cross-sectional survey research to establish foundational knowledge regarding groups and their decision-making characteristics as perceived by individuals. With insight as to how groups actually function, evidence-based conclusions might be reached as to how best groups can communicate and make decisions to avoid being caught, injured, or killed in an avalanche.

Purpose of Study and Research Questions

The purpose of this study was to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making a decision of where to travel and ride in avalanche terrain from the perspective of individuals. Decision-making characteristics encompass communication, decision-making processes, leadership, and group factors. To gain insight on this phenomenon, the study sought information on decision outcomes as well as knowledge of attributes of individual group members and groups as a whole. Additionally, the study sought to determine what relationships exist among group attributes, decision-making characteristics, and decision outcomes. To achieve the aforementioned purposes, the

study developed an instrument to measure decision-making characteristics, decision outcomes, and attributes of recreational winter backcountry groups and assessed its validity and reliability. The questions that served as the basis for this research were:

1. What are the attributes of winter recreational backcountry groups and group members?

2. How is communication that occurs during the decision making of winter recreational backcountry groups characterized?

3. How are the decision-making processes of winter recreational backcountry groups characterized?

4. How is leadership during the decision making of winter recreational backcountry groups characterized?

5. How are the group factors that occur during the decision making of winter recreational backcountry groups characterized?

6. How are group decision outcomes characterized?

7. What relationships exist among the decision-making characteristics of winter recreational backcountry groups?

8. What relationships exist among group attributes and the decision-making characteristics of winter recreational backcountry groups?

9. What relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?

10. What relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?

Significance of Study

Little empirical research has been conducted that assesses group dynamics and decision making of winter backcountry recreationists when determining where to travel and ride. Two studies have been located. One study of avalanche hazard professionals found close calls and avalanche accidents were a result of poor communication, and

decision quality was linked to communication quality (Adams, 2005a). The two studies recommended recreationists' improve their group communication (Adams; Tase, 2004) and decision-making capabilities (Adams). Adams confirmed the paucity of research by stating "the characteristics and qualities of successful avalanche decision-making teams have not been identified, thus defining these qualities and using that information as a guide for training offers great promise" (p. 239). In addition, Adams referenced a 2004 Canadian government report in which social science research was identified as the key to decreasing risks in natural hazards.

The study reported here fills a gap in the literature on avalanche hazard evaluation for backcountry recreationists and utilizes social science research to illuminate the group aspect of communication and decision making in this context. This study's data provides insights as to certain decision-making characteristics, group attributes, and decision outcomes and their relationships among winter backcountry recreationists. From this, avalanche hazard evaluation literature and training curriculum can be informed and hence impact the safety of those traveling in avalanche terrain and ultimately the fatality trend.

Delimitations

The boundaries of this study included the following:

- The participant must have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season.
- The participant's form of travel included telemark skiing, alpine touring (AT) or randonee skiing, cross-country skiing, snowboarding, snowshoeing, or snowmobiling.

Assumptions

In this study, a variety of conditions were assumed. These were:

- Participants were interested in avalanche safety and participated to contribute to the knowledge of the field and ultimately the safety of winter backcountry recreationists, including themselves.
- Participants were truthful and provided responses to the best of their recollection.
- Participants remembered the interactions that they had with other group members while communicating and making decisions regarding travel in avalanche terrain during their last backcountry outing.
- Sample was representative of winter backcountry recreationists who travel in avalanche terrain.

Definition of Terms

A variety of terms used in this study warrant further explanation so as to dissuade multiple interpretations. Below are the terms with their operational definitions as used in this study:

- Attributes: Descriptive information about a group or group member, such as age, gender, years of experience, training level, and form of travel.
- Avalanche terrain: Snow-covered mountainous region where the incline of the slopes are steep enough to avalanche. These slopes are typically between 33 and 45 degrees (Tremper, 2008).
- Communication: Imparting and interchanging thoughts, opinions, or information with verbal and non-verbal interactions.
- Decision making: Act of identifying and evaluating options and choosing among them.
- Decision-making characteristics: Aspects of decision making, including communication, decision-making processes, leadership, and group factors.
- Decision-making processes: Actions taken to foster, formalize, or bring structure to decision making.

- Decision outcomes: Results of a decision, including what was decided, whether the decision met the needs of those making it, to what events the decision led, and how those involved in the decision making perceived the decision.

- Factors: Aspects that have an influence on a particular entity or process.

- Group: Two or more people traveling or recreating together.

- Group aspect: Interactions and dynamics that occur between and among individuals in a group and the resulting decision-making process and decision outcome.

- Group factors: Conditions that affect a group's ability to accurately evaluate avalanche hazard and make appropriate decisions.

- Interactions: Verbal and non-verbal exchanges among people.

- Ride: Verb used to describe the activity of a rider in avalanche terrain when descending slopes.

- Rider: A winter backcountry recreationist who is on foot, skis, snowboard, snowshoes, or snowmobile. With the rise of snowboarding and the inclusion of snowmobiling, this term is used frequently to encompass all types of winter recreationists.

- Winter backcountry recreationist: Individual traveling and recreating in snow-covered mountainous areas on foot, skis, snowboard, snowshoes, or snowmobile. This term is used interchangeably with winter backcountry traveler.

- Winter backcountry traveler: Individual traveling and recreating in snow-covered mountainous terrain on foot, skis, snowboard, snowshoes, or snowmobile. This term is used interchangeably with winter backcountry recreationist.

Researcher's Perspective

The author of this study has been a skier for 30 years, a backcountry skier in avalanche terrain for 12 years, and a member of a volunteer backcountry ski patrol for six years. She has completed Level One and Level Two Avalanche training and assists in presenting avalanche trainings. Although, the author has never been caught in avalanche,

the thought of it is always in the forefront of her mind when riding in terrain capable of avalanching. While traveling in the backcountry, she has paid attention to how groups communicate and make decisions and particularly how individuals function in the group. With a MS degree in Conflict Analysis and Resolution and career in that field, she is attuned to group dynamics and the nuances of personal interaction. With this, she is curious as to what is happening among backcountry groups and how their interactions may influence what information is shared, how information is processed, the decision of where to travel and ride, and ultimately the safety inherent in their decisions.

CHAPTER TWO: REVIEW OF LITERATURE

This chapter presents an overview of literature that informed this study. The first section consists of a review of avalanche hazard evaluation literature, including an overview of variables that should be taken into consideration when traveling in the backcountry, recommended group interaction and decision-making characteristics, and research conducted on groups traveling in avalanche terrain. The second section reviews literature concerned with groups functioning in high-risk environments, and the third provides a review of group interaction and decision-making literature from the organizational realm.

Avalanche Hazard Evaluation Literature

Avalanche hazard evaluation is a concern for people traveling in the backcountry as they could be injured or killed if caught in an avalanche. Although recreationists could be caught in naturally occurring avalanches, 90% of those caught were from avalanches they or someone in their group triggered (McCammon, 2000; Tremper, 2008). Prior to and throughout a backcountry outing, travelers should consider a variety of variables to determine the likelihood of avalanches.

Evaluation Variables

When traveling in avalanche terrain and determining whether a slope is safe to ski, backcountry recreationists should consider three variables—snowpack, terrain, and weather (see Figure 1) (Fredston & Fesler, 1999; Tremper, 2008). In terms of snowpack,

travelers can conduct a variety of tests to assess the layers in the snowpack and gain insight into their cohesiveness and bonding characteristics. These tests consist of small actions to take while traveling, such as a ski pole test or ski cut and snowpit tests where a large face of the snowpack is exposed and tests are conducted to determine stability (Fredston & Fesler; Tremper). These tests provide information for recreationists to consider when determining whether the slope they want to ski will maintain its structural integrity when the weight of a traveler is added.

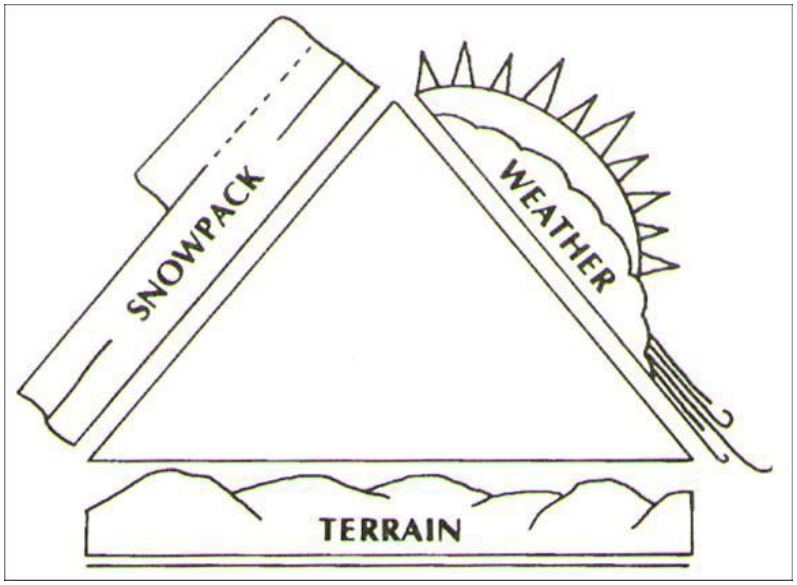

Figure 1. Three variables of avalanche hazard evaluation.[1]

When evaluating terrain, recreationists should consider a variety of aspects that could contribute to a slope's likelihood of avalanching. Slope angle is important as the majority of avalanches occur on slopes between 33 and 45 degrees (Tremper, 2008).

[1] From *Snow sense: A guide to evaluating snow avalanche hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1994 by J. Fredston and D. Fesler. Adapted with permission from authors (see Appendix A). Adaptation consists of deletion of "people" graphic that appears in the center of the triangle.

Slope aspect, the direction the slope is facing, impacts the amount of sun and wind a slope receives, which ultimately affects snow stability (Fredston & Fesler, 1999). Elevation, the shape of the slope (e.g., concave or convex), and exposed and hidden terrain features, such as trees, vegetation, stumps, and boulders, also affect the propensity of a particular slope to avalanche (Fredston & Fesler).

Weather, the third variable, consists of precipitation, wind, and temperature. Precipitation affects the snowpack in terms of the type, duration, amount, and intensity (Fredston & Fesler, 1999). Wind transports snow and windloads certain slopes making them more susceptible to avalanche activity. Wind also affects the surface of the snow and creates a distinct layer that may or may not bond well with adjacent layers (Fredston & Fesler). Air and ground temperatures affect the temperature of the snowpack, which in turn affects stability. A number of subtleties exist as to how changes in temperature affect the snowpack such as whether the snow warms gradually or quickly or if there is a sudden change in temperature (Fredston & Fesler).

For each particular backcountry area a person wants to travel through, these three variables—snowpack, terrain, and weather—should be considered. Each time an area is considered for recreation it should be evaluated as even a slight change in slope aspect, angle, or elevation could affect the snowpack as the terrain and weather in that particular area may be different. The three variables are inter-related and difficult to assess accurately given their subjectivity and complexity.

A fourth variable in the evaluation process are the people who are assessing the snowpack, terrain, and weather (see Figure 2) (Fredston & Fesler, 1999). Most avalanche literature discussed people as instrumental to the hazard evaluation equation as they are

responsible for assessing snowpack, terrain, and weather and making the decision of where to safely travel and ride. The literature provided guidance on this variable in terms of what an individual should consider and how to best conduct him/herself when evaluating the hazard.

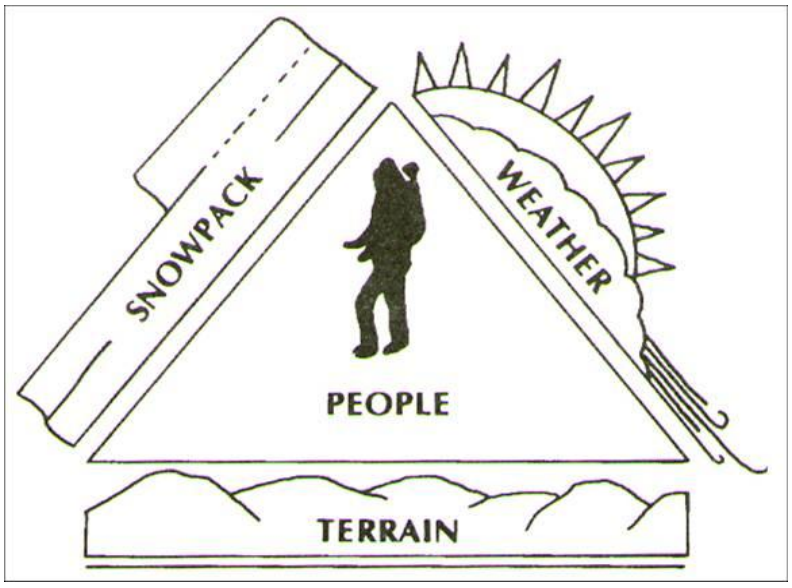

Figure 2. Four variables of avalanche hazard evaluation.[2]

Per a 2004 survey with over 1,400 participants, the majority of backcountry recreationists do not travel alone in avalanche terrain (Tase). Given the high rates of group activity in backcountry recreation and the complexity of the interrelationships of the variables to be considered when evaluating avalanche hazard, it is expected a group would communicate about the variables and engage in group decision making when determining where to travel and ride. Given this, some intricacies of group

[2] From *Snow sense: A guide to evaluating snow avalanche hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1994 by J. Fredston and D. Fesler. Reprinted with permission from authors (see Appendix A).

communication and group decision making are discussed as an aspect of the fourth variable of avalanche hazard evaluation (Freston & Fesler, 1999). However, this literature was thin and often presented without empirical support. As a result, the impact of group interactions and decision making on avalanche hazard evaluation are largely unknown and the crucial fourth variable of people is underdeveloped.

Group Communication and Interaction

When the literature discussed the fourth variable in terms of a group, communication was cited as a main aspect of decision making (Fredston & Fesler, 1999; Tremper, 2001) and was said to be the "common denominator" in mountaineering and avalanche accidents (Fredston, Fesler, & Tremper, 1994, p. 476; Tremper, 2008, p. 297). Poor communication consists of "weak" group members not wanting to speak up, members having different levels of risk and skills, and an informal leader failing to regularly consult all members (Tremper, 2001, p. 265). Other aspects of deficient communication include group members who may not speak up due to not wanting to be the "nerd," incomplete communication causing lack of shared data or wrong assumptions, lack of comprehension of the plan or hazards, and no communication at all (Fredston et al., p. 476).

In one study, 90% of respondents said they had traveled on terrain that made them uncomfortable (Tase, 2004). Fifty-four percent reported they were uncomfortable only once or twice a season, 26% were uncomfortable once or twice in their life, and 17% were frequently uncomfortable. As to reasons why respondents were uncomfortable, 24% said it was intentional and 22% said they were following others (see Table 1). These responses seem to be demonstrative of poor communication as either the group did not

communicate well about where they were traveling or some group members did not participate in the decision and simply followed others in the group.

Table 1

Reasons Respondents Were in Uncomfortable Positions (N=1,313)

Reason	Number	Percent
Necessary	725	55
To challenge yourself	327	25
Unintentional	312	24
Following others	295	22
Other	---	7

Note: Response percentages add to more than 100% because participants could choose multiple reasons.

Thirty-seven professionals working in the avalanche industry in Canada provided further insight on group interaction of decision making. Adams found "the capacity of teams to make effective decisions was a direct function of the quality of interactions amongst team members" (2005b, p.11). Effective communication improved judgment and actions and decreased the influence of individual biases. Increased communication improved the decision-making process with information exchange, suggestions, acknowledgements, and even disagreements (Adams, 2005b). In fact, poor communication was a prime attribute to close calls and avalanche accidents in her study (Adams, 2005a). Adams concluded "exceptional avalanche decision-makers were exceptional communicators" (2006, p. 17) as they fostered open communication, encouraged diverse opinions, were attentive listeners, and utilized critical thinking

techniques such as raising questions and analyzing assumptions and reasoning processes. Participants in Adams' study recommended communication and leadership skills as a main focus of training for those participating in group decision-making environments (Adams, 2006).

In Adams' study, communication was found to be instrumental in creation of a team's shared mental model or team mind (2005a). Participants in her study were experts in the field of avalanche hazard evaluation in Canada where they often worked with the same people each time and were able to develop trust, had shared experiences, and created collective knowledge over time. Teams were able to develop "collective metacognition," which in turn contributed to effective communication, critical thinking, and sound judgment when making decisions (Adams, 2005a, p. 155).

Tase assessed a variety of other aspects such as the relationship between avalanche education and involvement in avalanches (2004). Avalanche education was categorized in three levels: aware—no formal training but a basic awareness, basic—one-to-two day avalanche training, and advanced—multiple trainings and several years or more of backcountry experience. Involvement was categorized in four ways: witnessed an accident, witnessed and been caught in an avalanche, been caught in one avalanche, or been caught in two or more avalanches (Tase). It was statistically significant that those with advanced levels of avalanche education had a higher rate of involvement in avalanches as well as a higher level of involvement in those avalanches. Given the relationship of avalanche education with involvement in avalanches, the author concluded current avalanche education courses should be revised and proposed ways to improve communication and include group behavior.

Group Decision Making

In terms of group decision making, the avalanche literature recommended information and suggestions should be shared (Fredston & Fesler, 1999) and a collective decision is better than one made by one person (McClung, 2002a). The importance of group interaction seemed to be gaining more recognition as recent avalanche literature contained more information on this topic. A new edition of a classic avalanche book recommended democratic decision making based on the premise of James Surowiecki's book *The Wisdom of Crowds,* in which it is argued groups make better decisions than individuals (Tremper, 2008). This group decision-making process consists of some expertise among the individuals, differing opinions, open exchange of ideas, and a way to choose among options (Tremper). In addition, the process benefits by having a leader who seeks opinions from all members of the group (Tremper).

Another notable avalanche book warned decision makers to only accept arguments based on facts and not tainted by biases (McClung & Schaerer, 2006). In terms of the process, this book recommended groups "vote early and vote often" to be in continuous communication and agreement regarding signs of instability (McClung & Schaerer, p. 228). In addition, the group should appoint a leader who follows a formalized decision process with various checkpoints. The authors suggested the group re-evaluate and make decisions at each of the following points: before the trip begins, when determining the route at the trailhead, as the travel commences, and constantly during travel (McClung & Schaerer).

In her study of Canadian avalanche experts, Adams found collaborative decision making improved group judgment and decision choices (2005a). This decision making

consisted of shared mental models, communication that encouraged exchange of ideas and observations, and vigorous discussion. The experts' decisions were based typically on the most cautious perspective within the group (Adams).

Although avalanche literature promoted group communication and collective group decisions, a 2004 survey found 49% of recreationists who travel in groups did not have any formal methods for making group decisions (Tase). Twenty-four percent reported they are typically a member of a group that makes decisions together, while 14% reported the majority dictates their group decisions, 7% appointed a group leader, and less than 1% had the most experienced person make the decision for the group.

That study, which surveyed over 1,400 backcountry recreationists, hypothesized "groups with unclear decision-making processes are most at risk" (Tase, 2004, p. 20) for being involved in an avalanche. This hypothesis was addressed by questions that assessed how decisions were made in groups and how groups crossed slopes. These questions were evaluated individually by assigning the answers of each a rating of "poor group dynamics," "fair group dynamics," or "good group dynamics." The answers of the questions were then grouped according to their ratings. Eleven percent of participants had poor group dynamics, 46% had fair group dynamics, and 39% had good group dynamics.

The group dynamic construct was evaluated in conjunction with participants' avalanche involvement. If a participant had witnessed an avalanche, they were considered to be "somewhat involved," and participants who had witnessed as well as been caught by an avalanche were considered "very involved." A significant association ($p < .001$) was found between participants' avalanche involvement and their group dynamics rating. Of those surveyed, 32% had been involved in an avalanche to some

extent. Those with fair group dynamics had the highest rate of avalanche involvement, while those with poor group dynamics had the lowest involvement (see Table 2).

Table 2

Group Dynamics in Relation to Avalanche Involvement (N = 1,381)

Involved in Avalanche	Group Dynamics Rating		
	Poor	Fair	Good
	Percent		
Yes	19	38	31
No	81	62	69

No significant association was found when taking into account only those participants who had been involved in an avalanche accident and their group dynamics' score. Additionally, the findings did not support the hypothesis. In explanation, the author surmised recreationists with poor group dynamics may not travel in avalanche terrain very often and hence have a low rate of exposure as well as not have needed to develop group dynamics (Tase, 2004). Those with fair group dynamics may find themselves in avalanche prone areas yet lack the experience and skills to make effective decisions. Those with good group dynamics may go into the backcountry often and develop good skills that benefit them in making travel decisions (Tase).

Human Factors

Human factors are conditions that affect people's ability to accurately assess avalanche hazard. These factors are thinking errors that allow a person to overlook or disregard hazard clues in the snowpack, the weather, or the terrain (Fredston & Fesler,

1999; Tremper, 2008). Table 3 provides an overview of 21 human factors discussed in the literature.

Table 3

Human Factors in the Literature

Human Factors	Adams, 2005a	McClung, 2002a	Atkins, 2000	Fredston & Fesler, 1999	Fredston, Fesler, & Tremper, 1994
Ego and attitude			x	x	x
Poor communication	x		x		x
Believing what one wants to believe	x				x
Indecision and complacency			x	x	
Peer pressure	x			x	
Thinking if have good skiing ability, then have good avalanche safety skills				x	x
Thinking there is safety in numbers				x	x
Fatigue				x	
Group management			x		
Haste				x	
Incorrect assumptions				x	
Laziness				x	
Letting one's guard down on a sunny day					x
Miscalculating consequences				x	
Not respecting power of mountains and nature					x
Overconfidence			x		
Perception vs. reality		x			
Poor planning				x	
Risk-taking propensity		x			
Summit fever				x	
Testosterone influencing behavior					x

Many of the human factors influence thinking and decision making at the individual level, such as fatigue causing a person to miss important clues of instability or summit fever compelling someone to continue even in severe weather. However, all of the human factors have implications for a group as one individual falling victim to a thinking error could influence the rest of the group.

In a study of 41 fatal avalanche accidents involving people with some avalanche education, 82% of the accidents were attributed to human factors (Atkins, 2000). Of 41 accidents, the frequencies of the human factors were over confidence (15), attitude (12), group management (8), complacency (6), and poor communication (6). Some accidents had multiple human factors at play.

In her study of 37 avalanche industry professionals, Adams found three team human factors negatively influenced individual team members and the group's decision-making process (Adams, 2005a). These were inadequate communication, being influenced by others, and being resistant to different opinions. Resistance to opinions is somewhat similar to the human factor of believing what one wants to believe in that a group member may want to discount another's perspective if it is counter to what she/he wants to do.

Heuristics

In recent years some human factors have been characterized as heuristics. These act as mental shortcuts (Tremper, 2008) or rules of thumb people unconsciously use to guide their decisions (McCammon, 2004). Table 4 provides an overview of the heuristics identified as possible influences on backcountry recreationists' decisions.

Table 4

Heuristics with Descriptions and Sources

Heuristic	Description	Literature
Familiarity	• Being familiar with a slope and assuming it is safe because it has been skied in the past and not avalanched.	McCammon, 2004; Tremper, 2008.
Consistency/ commitment	• Believing a behavior is correct because it is consistent with a prior commitment. • Not changing a plan to ski a particular slope regardless of clues indicating danger. • Being committed to an identity, such as risk-taker, that influences behavior.	McCammon, 2004; McCammon, 2002; Tremper, 2008.
Acceptance	• Participating in a behavior (such as skiing a risky slope) that will possibly gain attention and acceptance from others. • Going along with the group and not speaking up even when concerned so as maintain acceptance of the group.	McCammon, 2004; Tremper, 2008.
Expert halo	• Relying on an informal leader as an expert when she/he does not have adequate knowledge and skills.	McCammon, 2004; Tremper, 2008.
Social facilitation	• Taking more risks after having met another group.	McCammon, 2004.
Scarcity/ competition	• Being motivated to reach a particular slope so as to be the first to ski scarce, untracked powder.	McCammon, 2004; Tremper, 2008.
Social proof/ herding instinct	• Looking to others for behavior cues. • Taking more risks in a group.	Tremper, 2008.

Just like human factors, each of the heuristics has implications for group interaction and decision making. Ultimately one person applying any of these rules of thumb could impact what is discussed in a group, how the group communicates and interacts, who

shares what information, and the decisions a group makes. However, the heuristics of acceptance, expert halo, and herding instinct have direct application to the group aspect of avalanche hazard evaluation.

Acceptance. To gain and maintain acceptance from peers, people have a tendency to go along with the crowd (Tremper, 2008). This can be dangerous when a group is engaging in risky or dangerous activities and people do not voice their concerns. Ultimately, this heuristic can influence people to engage in behaviors they think will gain notice and acceptance from others (McCammon, 2004). The avalanche literature referenced this heuristic occurring in terms of gender interactions, in that men often engage in risky behaviors to impress and gain acceptance of women (McCammon; Tremper).

To investigate the influence of acceptance and other heuristics on avalanche accidents, 715 recreational accidents that occurred in the United States between 1972 and 2003 were reviewed (McCammon, 2004). All accidents were assigned an exposure score that signified the existence of seven easily recognized indicators or signs of avalanche hazard. For example, an accident with an exposure score of seven meant seven indicators existed that the people in the group could have identified prior to the avalanche. To analyze the gender acceptance heuristic, accidents involving mixed-gender groups were compared to all-male groups. Of the groups involved in avalanche accidents, those that included women had a significantly higher exposure score. It does not appear women were taking more risk as they were caught less often in avalanches than men and avoided groups that were the most likely to experience an accident (McCammon). Given the mixed-gender groups had higher exposure scores but women were less likely to take risks

or be caught in an avalanche, the author surmised men were more apt to engage in risky behavior in those groups to gain acceptance from the women

Expert halo. In many avalanche accidents, one person had taken on an informal leadership role and as a result had made important travel decisions for the group (McCammon, 2004). The expert halo heuristic occurs when "an overall positive impression of the leader within the party leads them to ascribe avalanche skills to that person that they may not have" (McCammon, p. 45). This person's leadership could be based on knowledge and experience or simply that he or she was older, a better skier, or more assertive than others (McCammon).

The previously mentioned heuristic research reported groups that had an identified leader (133 cases) had significantly higher exposure scores than those without an identified leader (465 cases) (McCammon, 2004). This suggests groups involved in accidents that had a leader overlooked or ignored a higher number of hazard clues than groups without a formal leader. Perhaps group members were simply following the leader and not being individually vigilant in observing and acknowledging hazard clues. In addition, groups with an identified leader and higher exposure scores reported the leader had minimal or no avalanche training (McCammon). In contrast, groups with little avalanche training and no identified leader exposed themselves to fewer hazards than they would if they had an untrained leader. Given the findings, the author surmised "groups were often better off utilizing a consensus decision process rather than relying on the decisions of a perceived 'expert,' particularly when that leader had poor avalanche skills" (McCammon, 2004, p. 46).

Herding instinct. This heuristic causes people to make riskier decisions when they are in groups and to increase the risk as the groups get larger (Tremper, 2008). It is believed as group size increases, people's ability to perceive hazards decreases (Tremper). One avalanche author recommended traveling in groups of four or less as he believes communication and logistical problems increase and the heuristics of acceptance and competition are more likely with larger groups (Tremper).

In a review of 146 fatal accidents from 1990 to 2000, the influence of group size on avalanche accidents appeared somewhat inconclusive (see Table 5) (Atkins, 2000). The highest number of fatal accidents occurred in groups of two or three; however it could not be determined these group sizes took the most risk due to the fact groups of two or three are most common. Groups of four and seven followed with the next highest numbers of fatal accidents.

In McCammon's heuristic research, he assessed risk level and group size in 631 avalanche accidents. People traveling alone and those traveling in groups of six to ten exposed themselves to more hazards, per the groups' exposure scores (McCammon, 2004). Additionally, McCammon analyzed group size with the prevalence of six heuristics and found susceptibility to heuristics increased with group size. While these heuristics are not a direct sign of risk, they do indicate thinking errors could lead to higher risk exposure.

Table 5

Occurrence of Fatal Accidents with Varying Size Groups, 1990-2000

Group Size	Number of Accidents With Fatalities
1	21
2	43
3	30
4	16
5	8
6	9
7+	19

Decision-Making Aids

Even if a group has a member with significant knowledge or experience, the group should not depend solely on that person to make decisions as knowledge and experience do not necessarily make someone an expert (McClung, 2002a). To overcome the influence of the expert halo heuristic and other human factors and heuristics, it is recommended the decision-making process should be formalized and all possible information objectively considered and utilized when making a decision (McClung, 2002a; 2002b). One way to formalize decision making and increase the breadth of data considered is to use a decision-making framework or aid. In a survey of 79 avalanche professionals in Canada, 83% responded at a moderate or greater extent that the "design and implementation of a recreational decision support framework for Canadian

recreational travelers will improve decision making in snow covered terrain and result in fewer avalanche accidents and fatalities" (Adams, 2004, p. 446). In reference to various group dynamics, one respondent said, "A decision support tool may take some of the guesswork out of recreational decisions and make it easier to arrive at a decision without being influenced by other group or internal pressures" (2004, p. 446). Some respondents, however, had concerns that a decision framework might oversimplify the decision-making process for those with more experience and such an aid should only be used in lieu of experience.

In a 2007 study, five decision aids were assessed as to whether their use would have prevented avalanche accidents (McCammon & Hageli). The performance of the aids was determined by the researchers retrospectively applying them to 751 avalanche accidents in the United States. Although prevention of accidents varied among the different aids, the authors found if the decision aids would have been used and their cautions followed, 60% to 92% of accidents would have been prevented. In addition, a simple decision aid, consisting of a checklist of hazard clues, was the best performer in terms of accident prevention, ease of use, and applicability to various slope angles (McCammon & Hageli, 2007).

Groups in High-Risk Environments Literature

In terms of group decision making, communication, and interaction, the literature and research available on avalanche hazard evaluation were limited. The literature provided cursory warnings to winter backcountry recreationists to improve and increase their communication and decision making when deciding where to travel and ride. The majority of research that pertained to people recreating in avalanche terrain is within the

realm of human factors and heuristics and was largely focused on individual thinking errors. Some of the heuristic categories contained aspects of how thinking and behavior of a collective of individuals might contribute to deficient communication and decision making. However, little research explored the intricacies of group functioning and decision making and how they impact decision outcomes.

Groups functioning in risky environments other than avalanche terrain have garnered little research as well. One five-year study assessed group interaction in the high risk fields of medicine, aviation, and nuclear power and resulted in a handbook of recommendations (Sexton, 2004). Although these three fields are quite different than the activities of winter backcountry recreation, the importance of the group aspect was common. According to Rudolf Kellenberger, the deputy chief executive officer of the Swiss Re Centre for Global Dialogue, "In high risk situations the quality of human interaction is critical to the minimizing of human error" (Sexton, p. 5). Of the study's ten recommendations to improve communication, five were relevant to backcountry travelers. They were:

- Maintain an environment of open communication and stay calm during high workload situations.
- Encourage the new person—use positive feedback when an inexperienced team member has to carry out a task.
- Give a verbal nod—while listening, it is important to provide verbal indication of comprehension and reaction.
- Speak simply—use small words, articulate simple thoughts, and ask simple questions.
- Get better results by taking group interaction aspects of risk assessment into consideration (Sexton, p. 7).

A survey study of climbers of Mt. Rainer, Washington, assessed various aspects of group performance (Rutland, 1983). Group performance was positively related to intra-group conflict. This finding provided field evidence that if group members disagree and/or have conflicting perspectives, performance increases. The study did not, however, indicate whether group performance improved as a result of discussion surrounding the disagreement or whether perhaps the tension due to conflict increased performance. A second finding was group performance being negatively related to "a member's perception of the group's openness to his ideas" (Rutland, p. 81) and new groups are just as susceptible to this as long-standing groups. The author related this finding to the concept of groupthink where a member chooses not to share his/her ideas to maintain cohesiveness of a group. A third finding was group performance related positively to heterogeneity of group members, in terms of age, sex, experience, dominance, formal training, and skill. A fourth finding, which was consistent with the avalanche hazard evaluation literature, was group size was negatively related to performance on cooperative tasks. A final finding of this study was that weather was the biggest determinant of group performance, with better weather being related to better performance.

Organizational Literature

Although little research was available on group interaction and decision making specific to avalanche hazard evaluation and other risky environments, the organizational literature was brimming with research on a variety of group decision-making topics. Given the specificity of winter backcountry travel in avalanche terrain, this review of organizational literature was guided by aspects of group interaction and decision making

referenced in the avalanche hazard evaluation literature. While the avalanche literature is sparse, that which existed was authored by experts in the field. Hence the aspects of group interaction and decision making mentioned were those observed by professionals with decades of experience as recreationists themselves and as either trainers, guides, or forecasters in the field of avalanche hazard evaluation. The majority of the aspects mentioned by these experts were covered briefly, not explained in depth, or not empirically based. An examination of these aspects within the organizational literature provided further insight as to the possible influence of certain group member interactions and group decision-making characteristics on the safety and decision outcomes of backcountry recreationists.

Group Communication

Communication, given it aids groups in processing information, exchanging opinions, examining ideas, and reaching consensus, is "*the* organizing element" and is the "crux of the task and social dimensions of all groups" (Fisher, 1980, p. xi). Communication and its effectiveness can be broken into intrapersonal and interpersonal factors (Ellis & Fisher, 1994; Fisher). Intrapersonal attributes are those within one's self and consist of a person's attitude toward the group, attitude toward interaction, creativity, criticism, and honesty (Fisher). Interpersonal factors are an individual's interactions with other members of the group. These interactions include active verbal participation, communicative skill, supportive communication, and responding to others (Fisher).

In terms of communication, listening and questioning are two of the most important skills as catalysts for engaging group members, figuring out what they are thinking, establishing a productive environment, and fostering dialogue (Ellis & Fisher,

1994). In group decision making, critical listening is vital as it engages the listener intellectually. The listener analyzes, interprets, and questions what the speaker is saying while also questioning oneself as a listener (Ellis & Fisher). Four strategies for listening critically are to eliminate distractions, listen for concepts and ideas, organize what is heard, and evaluate what is heard (Ellis & Fisher). Critical questioning is equally important and consists of asking a group member to clarify, add to, or justify what she or he said. Questioning is not meant to be critical of people or their opinions but to allow deeper understanding and to expand the quality of discussion among all group members. Critical questioning strategies are requesting clarification, asking analytical and tough questions, and asking group members to expand their thoughts (Ellis & Fisher).

In two studies Hirokawa and his colleagues identified four communication characteristics that differentiated effective and ineffective groups (as cited in Ellis & Fisher, 1994, p. 277). The characteristics of effective groups were:

- Group members strongly evaluate each other's opinions and assumptions for legitimacy.
- Group assesses all possible decision alternatives.
- Group uses accurate and intelligent premises in discussion.
- Group members who are most influential are facilitative and encourage open communication (Ellis & Fisher).

Group Decision Making

The avalanche hazard literature recommended collective decision making for a variety of reasons, but in particular because a group decision is thought to be better than one made by one person (McClung, 2002a). In a similar vein, the accuracy and confidence of groups performing judgment tasks were assessed (Sniezek & Henry, 1989).

Although decision making was not necessarily referenced in this study, group judgment tasks are similar to decision making. According to Steiner, a group task is "(a) unitary in that division of labor according to subtasks is not feasible, (b) discretionary because the task does not constrain the group to a particular set of procedures for combining individual contributions, and (c) optimizing because accurate judgment is the desired output" (as cited in Sniezek & Henry, p. 1). In addition, the authors added the characteristic of uncertainty to group judgment tasks as all group members cannot be certain of their answers. To determine the quality of a judgment, it is judged with a confidence assessment (Sniezek & Henry).

The judgment task consisted of participants rank ordering 15 causes of death in terms of frequency in the United States as well as estimating the frequency of deaths (Sniezek & Henry, 1998). In addition, participants indicated a confidence interval for each cause they ranked. This task was completed by each participant individually and then in groups of three. All participants completed a post-task form that obtained ratings on group factors of cooperation, accuracy of responses, disagreement about responses, confidence in responses, and conflict. In terms of accuracy of judgment of the causes of death, groups were significantly more accurate than individuals. For accuracy of rankings of the causes of death, groups were superior to individuals. For confidence of judgment, groups declared smaller confidence intervals than individuals but the differences were not significant. The groups' small confidence intervals, however, more often contained the true frequency for the cause of death than individuals' confidence intervals and had a higher confidence assessment. In addition, group members' ratings of accuracy and confidence were significantly related. Finally, higher accuracy was significantly

correlated with the group's own accuracy rating, level of disagreement during discussion, and level of confidence in their responses.

Group Decision-Making Process

Team or group decision making has been described by many as an "information-processing process" (Duffy, 1993, p. 346). According to Hinsz, the major points in the process where information is filtered are attention/perception, acquisition, encoding, storage/retention, retrieval, and judgment/response (as cited in Duffy, p. 348). These steps can aid in understanding how group decision-making errors and biases occur. To begin the group must identify the processing objective or the decision that needs to be made as this helps define the context in which the group must obtain information as well as the information needed (Duffy). Following this, the first step in the information-processing process is attention or perception. This refers to the lenses through which an individual attends and perceives information. These lenses are referred to as schemas or mental models (Duffy). Group members can have similar or divergent schemas and if their schemas are different misunderstandings can occur (Duffy).

The second step is acquisition. This step, the most complex, consists of group members acquiring information for processing (Duffy, 1993). Not all team members have to acquire the information for the group to have acquired it; however, the likelihood to process and discuss information is higher if more members acquire it (Duffy). Encoding is the third step (Duffy). According to Hinsz, "Encoding is important because it reflects the question of how the separate individual representations of the information by each group member are combined in a meaningful representation by the group" (as cited in Duffy, p. 350). The group encoding process may result in a shared schema and

understanding of the aspects of the decision to be made (Duffy). The fourth step, storage, consists of what is captured in group memory. Not everyone in the group has to know and store the same knowledge. Information can be disseminated and the group needs to know and remember which members have what information. Process losses can occur at this point as groups inevitably lose information due to the quality of collaboration required for group memory. Groups may overcome information loss through extensive experience together or by having highly defined roles (Duffy).

Retrieval of information is the fifth step. Retrieving information in a group is more enhanced than that by an individual as groups are better able to identify correct or faulty retrieval of information (Duffy, 1993). Errors can occur; however, as individuals retrieve information based on his/her schema and that schema may or may not match the group's. The last step is judgment or decision. This refers to the decision the group makes as result of information processing.

Decision-Making Techniques

A group can make a decision in a variety of ways. One person can make the decision for the group, majority opinion can determine the decision, or the group can attempt to reach consensus. In the majority rules situation, not everyone in the group has to agree. In consensus, everyone agrees and is committed to the decision (Ellis & Fisher, 1994). Consensus is more likely to occur in groups where members share common objectives, have equal status, foster balanced participation, and are not steadfast in their opinions (Ellis & Fisher).

Cognitive consensus is the "similarity among group members regarding how key issues are defined and conceptualized" (Mohammed & Ringseis, 2001, p. 311). Rather

than focusing on outcomes of decision making, the researchers were interested in individual processing in group decision making and what conditions impact the ability to achieve group consensus on issues. This interest stemmed from research that demonstrated cognitive consensus impacted group unity and performance (Mohammed & Ringseis). The two conditions under scrutiny were unanimity decision rule—requires all group members agree before a decision can occur—and majority rule—a decision can be made once a majority of members agree (Mohammed & Ringseis).

As predicted, groups using the unanimity rule had higher cognitive consensus than the majority-rule groups (Mohammed & Ringseis, 2001). In addition, groups using the skills of "inquiring concerning the reasons underlying others' decision preferences, accepting others' viewpoints as legitimate, and incorporating others' perspectives into one's own interpretations of issues" (Mohammed & Ringseis, p. 325) had more cognitive consensus. By using the unanimity rule and employing communication skills, groups were able to achieve shared assumptions to a greater extent than majority-rule groups. This achievement would assist groups in step three of the aforementioned decision-making process, creating a shared group schema (Duffy, 1993).

Two techniques, dialectical inquiry (DI) and devil's advocacy (DA), have been studied to determine their influence in decision making (Schwenk, 1990). A meta-analysis of studies was conducted to determine relative strengths and whether one technique proved superior. According to Mason, DI consists of the following steps: a recommended or prevailing plan or decision and supporting data are identified, assumptions underlying the choice of plan are identified, a feasible counter plan that rests on opposite assumptions is raised, and finally those responsible for making the decision

hear a structured debate on the two plans (as cited in Schwenk, p. 162). With the DA technique, as described by Mason, the devil's advocate critiques the prevailing plan but does not present a counter plan (as cited in Schwenk, p. 162). Both of these techniques, per Mason, can be compared to the expert (E) approach in which certain individuals provide expert advice and recommendations regarding the plan or decision, but do not share the assumptions behind their recommendations (as cited in Schwenk, p. 162). The meta-analysis of research showed the DA improved decision making more than the expert-based approach. Findings concerning DI and E were inconclusive as were findings for the DA in comparison to the DI.

Group Decision-Making Errors

Although group decision making is promoted in the avalanche literature, groups can make faulty decisions. The avalanche literature discussed that groups exposed themselves to more hazards when the heuristics of acceptance, expert halo (McCammon, 2004), and herding instinct (Tremper, 2008) were at play. For backcountry recreationists, increased exposure to hazards could be seen as a decision-making error. Overall, however, the group dynamic contributes to a variety of decision-making errors (Orasanu & Salas, 1993). One type of decision-making error is concerned with assumptions. Groups may ultimately make bad decisions when members fail to challenge each other's perspectives, assume they know each other's beliefs, one member believes others share his/her opinions, and one member thinks she/he is the only one who has a certain belief (Orasanu & Salas).

Groupthink. Established by Janis in the early 1970s, groupthink is one well-known error in which a group's ability for rational judgment is compromised to preserve

group cohesion (as cited in Orasanu & Salas, 1993, p. 341). Janis presented groupthink as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action" (as cited in Moorhead, Neck, & West, 1998, p. 327).

In analyzing many historic government decision-making fiascos, Janis identified antecedent conditions and symptoms of groupthink and symptoms of defective decision making (see Figure 3) (Janis & Mann, 1977).

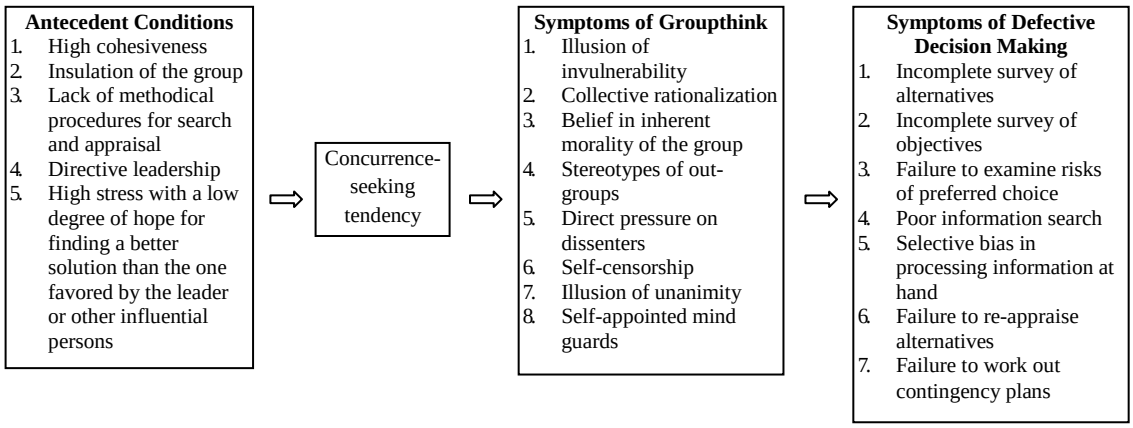

Figure 3. Analysis of groupthink. [3]

Given backcountry recreationists' susceptibility to the heuristics of acceptance, expert halo (McCammon, 2004), and herding instinct (Tremper, 2008), groups traveling in avalanche terrain could fall victim to groupthink and defective decision making as many of the antecedent conditions are potentially present.

[3] From *Decision making: A psychological analysis of conflict, choice, and commitment* (p. 132), by I.L. Janis and L. Mann, 1977, New York: The Free Press. Copyright 1977 by The Free Press.

One study analyzed a particular type of group, whose characteristics were similar to those of backcountry travelers. Self-managed teams function as decision-making groups and could be susceptible to groupthink (Moorhead et al., 1998). The characteristics of self-managed teams (SMTs) are task assignment, decision-making responsibility, skill requirements, reward systems, and internal leadership (Moorhead et al.). Given these traits, it is believed self-managed teams possess the conditions conducive for groupthink. Many self-managed teams, however, are successful and not plagued by groupthink. To understand why some self-managed teams do not fall prey to groupthink, Moorhead and colleagues utilized an empirically tested model of self-managed team effectiveness to discern characteristics of successful teams. Identified characteristics were larger teams composed of both genders having norms that promote methodical decision making, effective technical and self-leadership training, and higher levels of task-based cohesion and lower levels of interpersonal cohesion. Moorhead also found successful teams were led by leaders with an impartial style.

Bounded awareness. The information a group uses to make a decision is bounded by information that ultimately becomes part of the discussion. This is referred to as bounded awareness (Bazerman, 2006). Collectively groups possess more information than an individual so it is critical individuals share information (Bazerman). Group discussion during decision making can provide additional information, which can act as a corrective function of individual members' incomplete and biased information. Pooling information can create a more complete and unbiased picture of the situation and decision alternatives (Stasser & Titus, 1985).

Stasser and colleagues, however, have found groups do not pool all information and have a tendency to focus on information known to all members (shared information) rather than information known to only one member (unshared information) (Bazerman). In one study Stasser and Titus proposed the biased sampling model of group discussion, which identifies two sources of bias in face-to-face, unstructured group discussion when consensus is to be reached (1985). The first source of bias is information is more likely to be discussed if it is shared (known by more than one person) rather than unshared (known by only one person or some in the group). Second, information is more likely to be discussed if it favors the current decision preference of the group rather than opposes it. The bias sampling model is concerned with decision tasks in which no "commonly accepted system of logic that would lead to an unambiguously correct decision" exists (Stasser & Titus, p. 1470). With this type of decision, the model states group members rarely share all information. Individuals share a sampling of their information and this information usually supports a member's current preference. In terms of the group as a whole, the sampling of information could be affected by the number of members who possess certain information. With that, "the more members there are who have been exposed to an item of information, the more likely it is that at least one of them will recall and mention it" (Stasser & Titus, p. 1470).

Stasser and Titus' study sought to analyze two specific implications of the bias sampling model (1985). The first was "when pregroup distributions of information are severely biased against one alternative, group discussion tends to enhance rather than erode this initial bias" (Stasser & Titus, p. 1471). The second implication was "discussion is more likely to counter an initial bias when there is disagreement that is due to

conflicting patterns of information across group members than when pregroup information is consistently biased in favor of one alternative" (Stasser & Titus, p. 1471). The study consisted of four-person groups provided with descriptions of three hypothetical student body president candidates. The groups were to engage in discussion and decide which candidate was the best for the position. Given all the information, candidate A was the best candidate, but the information given on the candidates and when the information was given varied among groups and individual group members. Although not all members had all the information, the study was designed so a group collectively had all the information and if all information was shared the group could recreate each candidate's profile in its entirety and determine candidate A was best suited for the position.

The study confirmed unshared information is omitted from discussion and has little effect on the group's final preference, even when the collective unshared information would have favored another preference. Discussion did not increase the amount of unshared information shared, but rather focused on information that supported the initial preference of group members and had previously been shared. The findings are particularly interesting when considering groups composed of members with differing areas of expertise. In this circumstance, sharing of unshared information is critical to the discussion. Given the findings, the authors proposed unstructured discussion with a consensus requirement is not a successful method for combining unique information and for overcoming initial group preferences even when they are incorrect (Stasser & Titus, 1985).

In a follow-up study of the bias sampling model, Stasser and Titus sought to determine whether the amount of overall available information and the amount of information given to all members (shared information) before discussion influenced sharing of unshared information (1987). Minus a few changes, this study's design was similar to that reported in 1985. The groups were designated as either low-load or high-load depending on how much information was in each of the candidate's profiles they received. Low-load groups received 12 items of information for each candidate, and high-load groups received 24 items of information for each candidate. Before discussion, some information was disseminated to all members of the group and other information was given only to one member. Some of the groups were given one third (33%) of the information (two-thirds not shared) in a candidate's profile, and other groups were given two-thirds (66%) of the information (one-third not shared) in a candidate's profile. The unshared information was then distributed equally among each of the group's four members before discussion.

Findings supported the authors' prediction that most recall of unshared information would occur with the low-load groups and groups with the most unshared information (the 33%-shared groups). In addition, the low-load group retained large amounts of information received during discussion. This was the not the case for groups of other conditions. In contemplating the findings, the authors contended decision-making tasks typically lack an absolute correct decision. So even though this research focused on the amount of recall and sharing of information during group discussion, the authors suggested further evaluation of whether "available information is fairly represented in discussion and reflected in the group's final choice" and if the "decision

tends to use information in an evenhanded manner" (Stasser & Titus, 1987, p. 91). To this end, the authors suggested assessing the merits of various group decision making prescribed techniques such as structuring discussion and promoting devil's advocacy.

In a third study, Stasser, Taylor, and Hanna used a similar design to the 1987 study and added components that assessed the influence of group size and structured discussion (1989). The groups consisted of either three or six people. In terms of structured discussion, some groups were instructed to focus on recalling information and steering clear of expressing preferences during the early phase of discussion. The unstructured discussion groups were not given any instructions other than to discuss the candidates and reach a decision. The authors predicted more shared than unshared information would be discussed and this occurrence would be greater for six-person than three-person groups. The authors also predicted the structured discussion would increase the amount of shared information discussed compared to unshared information.

As with the two previous Stasser studies, groups in this study were more likely to discuss shared information than unshared information (Stasser et al., 1989). Six-person groups discussed more information than three-person groups but the information consisted largely of shared information rather than unshared information. Similarly, the groups participating in structured discussion mentioned more information, with the bulk being shared information.

Situations in which group discussion focuses mainly on shared information and groups choose an alternative not supported by their collective information is referred to as a hidden profile by Stasser (as cited in Stasser et al., 1989). The hidden profile refers to a more superior alternative that remains hidden because supporting information was

unshared. The hidden profile remained buried in three of Stasser's studies regardless of how the information was disseminated, group size, or discussion structure.

In a modification of the biased sampling model, two studies explored the influence of group norms, group cohesion, and group history on the sharing of information and the quality of group decisions (Postmes, Spears, & Cihangir, 2001). A group norm "is defined as a standard or rule that is accepted by members of the group as applying to themselves and other group members, prescribing appropriate thought and behavior within the group" (Postmes et al., p. 919). This study evaluated difference between the group norms of consensus and critical thought on decision making. In two pilot studies, different groups were given a pilot task in which the groups were manipulated into using either a consensus or critical thought norm while group cohesion was maintained and group history was being created. Following the pilot task, the groups participated in an experiment, similar to those used by Stasser and colleagues, in which the groups were given shared and unshared information about three candidates and had to choose the best candidate through discussion.

The authors concluded group history does have an influence on group norms, and group norms influence the quality of the group decision (Postmes et al., 2001). In particular, the critical thought group norm developed in the first task improved the quality of decision for those groups, but not reliably for the consensus norm groups. The critical thought groups utilized unshared information where consensus groups chose a candidate using only shared information. In terms of cohesion, groups of both norms were equally cohesive and hence cohesion did not have influence on group norms. A highlight of this study was the more groups considered unshared information, the better the quality of

their decisions, and groups with a critical thought norm were more likely to consider unshared information. This study demonstrated the value of information is based in some part on group norms, but further research could explore what influences groups to value shared or unshared information (Postmes et al.).

None of the referenced studies on bounded awareness discussed why individuals did not share information in the groups. Perhaps this could be linked to groupthink in that people are worried they will decrease group cohesiveness if they share information different from what the group already knows. If so, this could be tied with the heuristic of acceptance identified in the avalanche hazard evaluation literature in which a group member may go along with others to gain and/or maintain acceptance (Tremper, 2008).

Leadership

The avalanche hazard evaluation literature suggested backcountry groups should appoint a leader who follows a particular decision-making process with various checkpoints (McClung & Schaerer, 2006). However, research found 7% of backcountry travelers appointed a group leader (Tase, 2004). A member of the group, however, may "take the lead" in an informal manner. Van Knippenberg and Van Knippenberg have operationalized "taking the lead" as "being the first to explicitly state (i.e., in the early phase of group discussion) what decision the group should make" (2000, p. 215). They state taking the lead is different than being the leader or leadership, but someone who takes the lead could be seen as the group's leader. "In general group members that hold relatively risk seeking positions will be more likely to take the lead than group members with less risk seeking positions, because risk seeking is, at least in Western society, valued positively" (Van Knippenberg & Van Knippenberg, p. 215). In two experiments

to test their proposition, the researchers found the most risk-seeking member was most likely to take the lead in discussion during risky decision making. This matched the avalanche literature as groups with an informal leader exposed themselves to more hazards than groups without a leader, whether intentionally or inadvertently (McCammon, 2004).

Selection of leaders. Studies have been conducted that assess group performance in regards to how leaders are selected. In one study two experiments demonstrated randomly selected leaders produced superior group performance over groups with non-randomly selected leaders and groups with no appointed leader (Haslam et al., 1998). The second experiment found an association between random leader selection and greater commitment to the group and its decision. The authors cautioned the use of randomly selected leaders may not always be appropriate. They suggested use of a randomly selected leader would be beneficial when the group:

> (a) has a clearly defined shared goal, (b) is disposed or able to behave in a relatively democratic manner (e.g., involving shared decision making and division of labor and responsibility), and therefore (c) in the absence of a leader being appointed might tend to have a reasonably strong sense of shared social identity anyway (p. 182).

The influence of how leaders are selected as well as the quality of a leader's information sharing was assessed in a 2004 study (Henningsen, Henningsen, Jakobsen, & Borton). The design of this study consisted of distributing information among group decision-making participants. Some of the information was shared with all members (shared), and some of the information was given to one member in each group (unshared). Some of the groups had leaders who were systematically selected while others had leaders who were randomly selected. Given the distribution of information,

leaders of each group could have varied allocations of shared and unshared information. Findings of the study were when the leader:

- Possessed full information compared to partial information, groups made better decisions (p. 69).
- Held full information, groups did better with randomly selected leaders than with systematically selected leaders (p. 69).
- Held full information, groups appear to be more cohesive (p. 71).
- Held partial information, groups made better decisions with systematically rather than randomly selected leaders (p.69).
- Held partial information groups uncovered more of the unshared information with systematically selected leaders than with randomly selected leaders (p.70).
- Had information that favored the best decision alternative, groups pooled more of the unshared information than when the leader's information favored a suboptimal alternative (p.70).
- Favored the suboptimal alternative, groups discussed more shared information with randomly as opposed to systematically selected leaders (p.71).
- Was randomly as opposed to systematically selected, groups reported higher levels of cohesiveness (p. 71).

It is unlikely a leader, whether formal or informal, of a recreational backcountry group would have full information to make a decision where it would be entirely safe for a group to travel and ride in avalanche terrain. Hence, according to this study, a systematically selected leader would help a group make better decisions. The downfall, however, could be lower levels of group cohesion.

CHAPTER THREE: METHODOLOGY

This chapter presents the methodology of this study. Conceptual framework is discussed, followed by the research design, including the method, theoretical frame, and grounding of the methodology. Sampling and population are then presented, followed by instrumentation. Data collection, data analysis, and study limitations are discussed.

Conceptual Framework

This study was guided by a postpositivism worldview. If a backcountry recreationist group was caught in an avalanche and one or more members were injured or killed, a variety of factors ultimately played into that outcome. The variables of weather, terrain, and snowpack contributed to the avalanche as did the recreationists' evaluation of the variables and their resulting decision. The majority of avalanche literature was dedicated to the analysis of these variables and how recreationists can accurately evaluate them to make decisions that do not result in anyone being caught in an avalanche. The recreationists' evaluation of the first three variables and their decision making, a fourth variable, are considered in the equation of avalanche hazard evaluation (see Figure 2). In terms of postpositivism, the variables, the evaluation of the variables, and decisions based on the evaluation are "antecedents" (Creswell, 2009, p.10) of travelers ultimately being injured or killed in an avalanche. These can also be considered antecedents of a positive outcome, such as when the variables, recreationists' evaluation of the variables, and the decision results in a safe and accident-free day in the backcountry.

The avalanche literature discussed the fourth variable of people in terms of individual thinking and decision-making errors that contribute to incorrect evaluations of weather, snowpack, or terrain, and hence inaccurate decisions. The literature often mentioned how interactions between and among individuals in a group traveling in the backcountry may impact the decision-making process and outcome of avalanche hazard evaluation. Although the understanding of group aspect is not widely developed and little empirical research has been conducted, the literature acknowledged the impact group communication and interaction can have on decision making and the outcome of a group's backcountry outing. Therefore, this study proposed a conceptual framework in which the group aspect is a fifth variable of avalanche hazard evaluation, and in light of postpositivism, the group aspect is considered an antecedent of a backcountry group's decision outcome.

From a review of the avalanche literature, this study categorized the group aspect into four characteristics: decision-making process, communication, leadership, and group factors. A review of group decision-making literature in the organizational field as well as literature regarding group decision making in other high-risk environments confirmed these four characteristics as appropriate for elucidating the phenomenon of group decision making among backcountry recreationists traveling in avalanche terrain. In a review of approximately 187 avalanche accident reports in the United States from January 1, 2004 to May 31, 2009 obtained from the Colorado Avalanche Information Center, 41 contained information about group communication and decision making. An analysis of these reports confirmed the four characteristics as appropriate. With the group aspect as a fifth variable, the avalanche hazard evaluation model can be adapted to

include this variable and its characteristics as an extension of the people variable (see Figure 4). This figure is an adaptation of an existing model widely used in the avalanche hazard evaluation literature and training curricula.

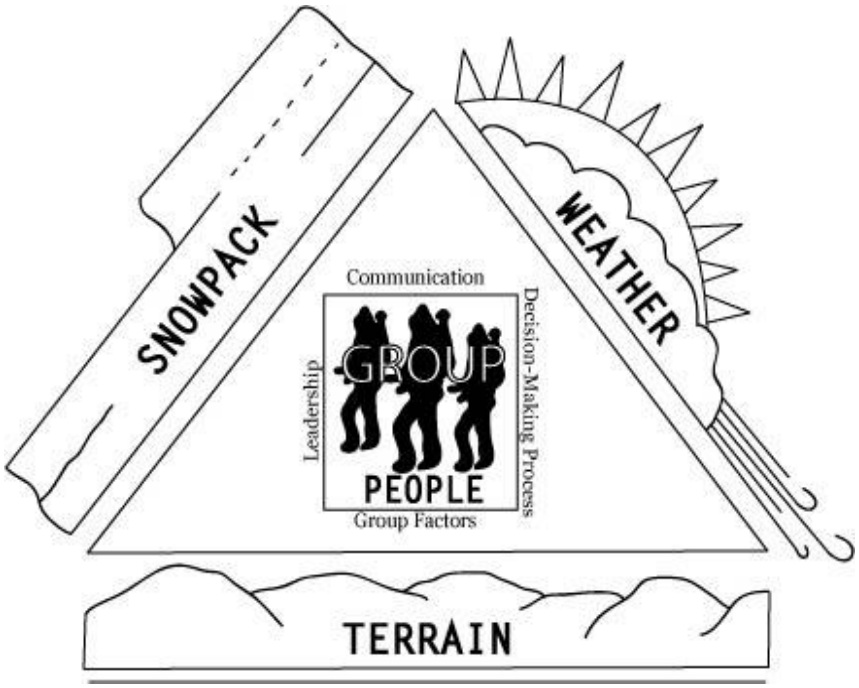

Figure 4. Five variables of avalanche hazard evaluation.[4]

Per the review of literature and analysis of the accident reports, the four characteristics can best be described with behavioral errors that occur when people interact in groups and with suggested group behaviors. The errors could contribute to groups not accurately assessing the variables of weather, terrain, and snowpack, making incorrect decisions, and hence one or more members of the group being caught in an

[4] Adapted from *Snow sense: A guide to evaluating snow avalanche hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1994 by J. Fredston and D. Fesler. Adapted with permission from authors (see Appendix A). Adaptation consists of the addition of "group," "communication," "decision-making characteristics," "group factors," and "leadership."

avalanche. Suggested group behaviors could decrease a group's likelihood of being caught in an avalanche. Table 6 details the four characteristics with behavioral errors and suggestions.

Table 6

Group Characteristics with Errors and Suggestions and Sources

Characteristic	Errors	Literature [a]
Communication	• Group members not speaking up	Tremper, 2001.
	• Group members not participating in the discussion	Tremper, 2008.
	• Incomplete communication causing lack of shared data or wrong assumptions	Fredston, Fesler, & Tremper, 1994.
	• Lack of comprehension of the plan or hazards	
	• Poor or no communication	Adams, 2005a.
	• Influenced by others	
	• Resistant to differing opinions	
	• Group members getting spread out and not waiting to communicate and discuss together	Accident report.
Decision-Making Process	• Depending on one person to make the decision	McClung, 2002a.
Leadership	• Listening to and following someone who may not have adequate skills	McCammon, 2004.
	Informal leader failing to regularly consult all members	Tremper, 2001.
Group Factors	• Members having different levels of risk and skill	Tremper, 2001.
	• Making riskier decisions in a group	Tremper, 2008.
	• Following others without discussion	Tase, 2004.
	• Going along with the group to gain acceptance	McCammon, 2004.
	• Falling victim to groupthink	Orasanu & Salas, 1993.
	• Operating with bounded awareness—a group's decision being bounded by only the information each member shares with the group	Bazerman, 2006.

Table 6, Continued

Characteristic	Suggestions	Literature [a]
Communication	• Foster open communication	Adams, 2005a.
	• Encourage diverse opinions	
	• Exchange information and ideas	
	• Give suggestions	Adams, 2006.
	• Disagree with others	
	• Have vigorous discussion	
	• Be an attentive listener	
	• Raise questions	
	• Analyze assumptions and reasoning processes	McClung & Schaerer, 2006.
	• Have shared mental models	
	• Only accept arguments based on fact and not tainted by biases	Sexton, 2004.
	• Encourage a new person with positive feedback	
	• While listening, provide verbal indication of comprehension and reaction	
	• Listen critically	
	• Use critical questioning	
	• Strongly evaluate other's opinions and assumptions	Ellis & Fisher, 1994.
	• Use accurate and intelligent premises	
Decision-Making Process	• Make a collective decision	McClung, 2002a.
	• Formalize the decision-making process	
	• "Vote early and vote often" to be in continuous communication and agreement	
	• Appoint a leader who follows a formalized decision process with various checkpoints	McClung & Schaerer, 2006.
	• Re-evaluate and make decisions before trip begins, when determining route at trailhead, as travel commences, and constantly during travel	
	• Base decision on the most cautious in the group	Adams, 2005a.
	• Use a decision-making framework or aid	
	• Have a way to choose among the option	Tremper, 2008.
	• Assess all possible decision alternatives	Ellis & Fisher, 1994.

Table 6, Continued

Characteristic	Suggestions	Literature [a]
Decision-Making Process	• Follow a process that consists of attention, acquisition, encoding, retention, retrieval, and judgment	Duffy, 1993.
	• Strive for cognitive consensus among group members	Mohammed & Ringseis, 2001.
Leadership	• Possess leadership skills	Adams, 2006.
	• Have a leader who seeks opinions from everyone in the group	Tremper, 2001.
	• Influential group members are facilitative and encourage open communication	Ellis & Fisher, 1994.
	• Randomly selected leaders may produce superior group performance	Haslam et al., 1998.
	• Randomly selected leaders may create more group cohesion	Henningsen et al., 2004.
	• Appoint a leader who follows a formalized decision process with various checkpoints	McClung & Schaerer, 2006.
Group Factors	• Ward off groupthink with larger groups composed of both genders, and have norms that promote methodical decision making, effective technical and self-leadership training, high levels of task-based cohesion, lower levels of interpersonal cohesion, led by leaders with an impartial style	Moorhead et al., 1998.
	• Pool all information to create a more complete and unbiased picture of the situation and decision alternatives	Stasser & Titus, 1985.

[a] While some of the descriptions were found in multiple sources, only the primary source is listed.

Research Design

This study's intent was to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making the decision of where to travel in avalanche terrain from the perspective of the individual. Decision-making characteristics encompass communication, decision-making processes,

leadership, and group factors. To gain insight on this phenomenon, the study sought information on decision outcomes as well as knowledge of the attributes of individual group members and groups as a whole. Additionally, relationships among group attributes, decision-making characteristics, and decision outcomes were explored. To achieve the aforementioned purposes, the study sought to develop a reliable and valid instrument to describe and measure the decision-making characteristics, decision outcomes, and attributes of recreational winter backcountry groups.

The questions that served as the basis for this research were:

1. What are the attributes of winter recreational backcountry groups and group members?
2. How is communication that occurs during the decision making of winter recreational backcountry groups characterized?
3. How are the decision-making processes of winter recreational backcountry groups characterized?
4. How is leadership during the decision making of winter recreational backcountry groups characterized?
5. How are the group factors that occur during the decision making of winter recreational backcountry groups characterized?
6. How are group decision outcomes characterized?
7. What relationships exist among the decision-making characteristics of winter recreational backcountry groups?
8. What relationships exist among group attributes and the decision-making characteristics of winter recreational backcountry groups?
9. What relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?
10. What relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?

As this study was based on a conceptual framework that proposed an adaptation of a model of five variables of avalanche hazard evaluation (see Figure 3), study findings allowed for the explanation and substantiation of the proposed model.

Method, Theoretical Frame, and Grounding of Methodology

The research method for this study consisted of quantitative survey research with instrument-based questions. This method and the study's design were informed by multiple worldview paradigms and a variety of inquiry strategies.

Worldview

While avalanches occur naturally, they can be triggered by a force acting on the snow, such as a person traveling across a slope. Due to the danger of being caught in an avalanche, winter backcountry travelers typically take precautions to avoid traveling on or below slopes that have the potential to avalanche. Nevertheless, in the majority of western states, avalanches have caused the most deaths among all natural hazards (Tremper, 2008). The three variables of snowpack, weather, and terrain should be evaluated to determine the likelihood of avalanches. People are the fourth variable in this equation of avalanche hazard evaluation as it is their interpretation of snowpack, weather, and terrain, which aids making a decision about where to travel and ride. While a person's knowledge and understanding of the first three variables can impact his/her decision making, a person's decision and hence the outcome of his/her decision is influenced by others in groups.

The majority of backcountry recreationists travel in groups (Tase, 2004) and are in some manner making decisions of where to travel and ride together. Hence a group's decision and the resulting outcome are the product of the group. Avalanche literature

purported a variety of interactions occur among group members, which influence group decisions and outcomes. This study sought empirical evidence of this group aspect, or phenomenon, of avalanche hazard evaluation. The epistemological position of postpositivism was the cornerstone of this study as this research could provide data that would identify knowledge on this topic (Bryman, 2008; Creswell, 2009). Additionally, knowledge could be gained as to whether relationships exist among group attributes, group decision-making characteristics, and decision outcomes.

This study was also influenced by the pragmatic and advocacy and participatory worldviews (see Figure 5). Pragmatism influenced this study in that foundational empirical knowledge was needed on this topic. While other research methods could have been appropriate for this study, the design of this study was a practical approach for identifying needed empirical knowledge that will serve as the basis for additional research (Creswell, 2009). This study was also guided by an advocacy and participatory worldview. Although this study did not have a policy agenda, it could result in an "action agenda for reform that may change the lives of participants" (Creswell, p. 9). In the avalanche literature, the group aspect is believed to have a strong influence on how groups communicate, make decisions, and the decisions made. As a group's decision could result in an outcome of one or more group members being caught, injured, or killed in an avalanche, this study dealt with a topic that affects people's lives.

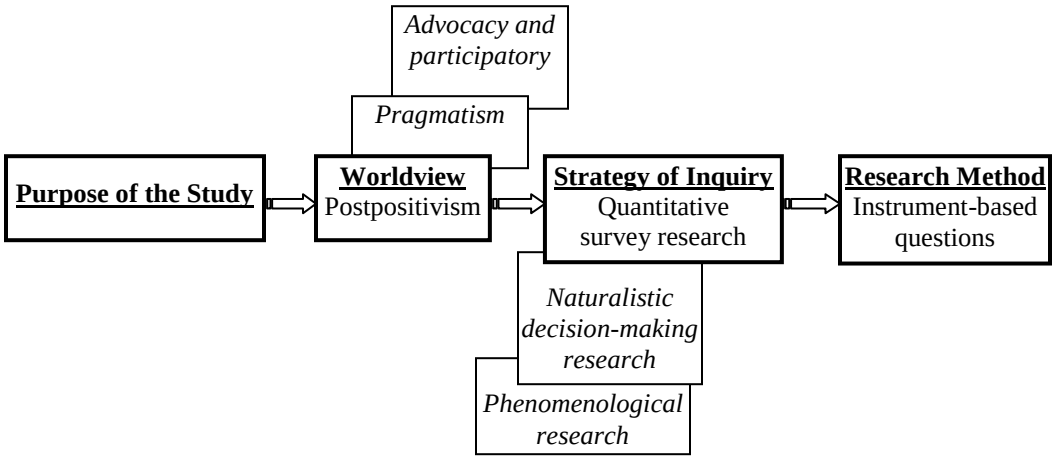

Figure 5. Research design including worldview, strategy, and method.

Strategy of Inquiry

This study sought to obtain an abundance of information about the phenomenon of group decision making among backcountry travelers from the perspective of individuals. Quantitative survey research was used (Blaikie, 2003; Creswell, 2009). This study was based on phenomenological research, which strives to describe what is common among participants when experiencing a particular concept or event and to develop "a composite description of the essence of the experience for all the individuals" (Creswell, 2007, p. 58). Decision making of backcountry recreationists in avalanche terrain was the particular phenomenon or event. A descriptive research approach was used to provide insight on the phenomenon. Additionally, comparative and associational approaches were used in the analysis to determine relationships of various group attributes, decision-making characteristics, and decision outcomes.

The study design was guided by naturalistic decision-making (NDM) research which strives "to understand how people make decisions in real-world contexts that are

meaningful and familiar to them" (Lipshitz et al., 2001, p. 332). NDM research focuses on situations that involve the following characteristics: ill-structured problems; incomplete or ambiguous information; shifting or competing goals; multiple feedback loops; time constraints; high stakes decisions; and multiple decision participants (Orasanu & Connolly, 1993). The decision-making phenomenon involved in this study included all of the characteristics of NDM. In terms of team or group decision making, NDM focuses on "the process by which decisions are made and how information between team members is communicated and coordinated" (Lipshitz, p. 343). NDM research is concerned with studying real groups making real decisions in real environments. (Lipshitz). The research design and method of this study allowed for the decision making of backcountry groups in avalanche terrain to be explored.

Research Method

Given the limited empirical research about group dynamics and decision making of winter backcountry recreationists, this study used cross-sectional survey research to establish foundational knowledge regarding groups and their decision-making characteristics. Information gathered from a sample of backcountry recreationists allowed for inferences to be made about this population's behavior when making decisions about where to travel and ride (Babbie, 1990).

Sampling and Population

The target population consisted of recreationists who travel in groups in the backcountry during the winter with the intent of accessing and descending angled slopes. Although backcountry recreationists are found throughout the United States and the world, this study focused primarily on those in Colorado. Although a sample from this

state was convenient given the researcher's location, Colorado was a prime location for the target population given it was the state with the highest number of avalanche fatalities from 1997 to 2007. A breakdown of fatalities is as follows: Colorado (21%), Alaska (18%), Montana (17%), Utah (14%), Wyoming (9%), Idaho (8%), Washington (8%), California (3%), and New Hampshire (1%) (Tremper, 2008).

However, given the data collection methods, backcountry travelers from other states and outside the United States also participated. As knowledge of this population in terms of size and attributes is limited, and no list of such a population exists, nonprobability sampling was used. Therefore, a general population had to be identified (Rea & Parker, 2005). The criteria that defined the sample members included:

- The participant must have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season.
- The participant's form of travel included telemark skiing, alpine touring (AT) or randonee skiing, cross-country skiing, snowboarding, snowshoeing, or snowmobiling.

Targeted data collection methods were used to locate individuals who met these criteria and they were invited to voluntarily participate. Prospective participants were informed they must meet the criteria to proceed with completing the questionnaire. Representativeness of the sample was established in part by participants proceeding to respond to the questionnaire after being informed they must meet the criteria. This study utilized voluntary response sampling as it included those who matched selection criteria and elected to complete the questionnaire.

External Validity

In terms of external validity and whether the participants and the questionnaire results were representative of the population of interest, this study rated medium on population external validity and medium on ecological external validity. Due to the nonprobability sampling used in this study, the sample could not be used to generalize about the target population (Morgan et al., 2006). A large number of responses, however, helped to achieve population external validity in the medium range. Given this study consisted of self reporting on a questionnaire, it rated medium on an ecological scale of external validity and hence the findings can be moderately generalized to real outcomes (Morgan et al., 2006).

Instrumentation

The instrument was developed using a variety of resources. A review of the avalanche literature provided insight into aspects of group decision making researchers and authorities in the field were discussing. As mentioned in the Conceptual Framework section, this study characterized the group aspect into four areas—decision-making process, communication, leadership, and group factors—based on the review of literature. A review of literature regarding group decision making in other high-risk environments, group decision making in the organizational field, an analysis of avalanche accident reports, and the researcher's personal experience substantiated these characteristics and the intricacies of each. The instrument's development was informed by these characteristics as the questionnaire's items sought to assess the extent to which the errors and suggestions, as described in Table 6, occurred when winter backcountry recreational groups wee evaluating avalanche hazard and making decisions. Four subject matter

experts who work in the avalanche hazard evaluation field reviewed drafts and provided feedback on the instrument during its creation.

Instrument Description

Those who met the participant criteria and elected to complete the questionnaire were asked to use their most recent recreational group backcountry outing during the winter season of 2009-2010 as a frame of reference when responding to the questionnaire. The questionnaire consisted of 25 items (see Appendix B). Items 1 and 2 assessed group composition, and items 3 through 19 assessed the decision-making characteristics and decision outcomes. Items 20 through 23 were demographically oriented, item 24 asked how participants heard about the questionnaire, and item 25 asked for personal information to prevent duplicate responses. A majority of the items provided multiple responses from which to choose; a fewer number asked the participants to select an option on a Likert-based agreement scale.

The questionnaire items aligned with the study's research questions and hence all variables were addressed in the questionnaire. Table 7 displays this alignment.

Table 7

Alignment of Research Questions and Questionnaire Items

Research Question	Questionnaire Item
1. What are the attributes of winter recreational backcountry groups and group members?	1-2, 20-23
2. How is the communication that occurs during the decision making of winter recreational backcountry groups characterized?	5, 9, 17e
3. How are the decision-making processes of winter recreational backcountry groups characterized?	3-4, 6-8, 17c
4. How is leadership during the decision making of winter recreational backcountry groups characterized?	6e, 6i, 6j, 6p, 6q, 13-14
5. How are the group factors that occur during the decision making of winter recreational backcountry groups characterized?	5a, 5b, 5e, 5g, 5h, 5i, 6f, 6j, 6m, 6n, 6o, 6r, 9-10, 12
6. How are group decision outcomes characterized?	11, 15, 16 , 17a, 17b, 17d, 18-19
7. What relationships exist among the decision-making characteristics of winter recreational backcountry groups?	3-10, 12-14, 17c, 17e
8. What relationships exist among group attributes and the decision-making characteristics of winter recreational backcountry groups?	1-10, 12-14, 17c, 17e, 20-23
9. What relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?	1-2, 11, 15-16, 17a, 17b, 17d, 18-23
10. What relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?	3-19

Pilot Test

Ski patrol members from Diamond Peaks Ski Patrol (DPSP), the organization of which the researcher is a member, participated in the pilot testing phase. DPSP is affiliated with National Ski Patrol and its members, all volunteers, provide emergency medical care and engage in search and rescue operations in the Cameron Pass region of Colorado as well as provide educational classes on avalanche hazard evaluation. In the first phase of the pilot test, nine ski patrol participants were in one room with each completing a paper version of the questionnaire. The researcher stayed in the room to observe the participants. This allowed the researcher to gather information about the questionnaire based on how the participants behaved while taking it (Fowler, 2002). When the participants were finished, the researcher debriefed the participants exploring if any of the observed behaviors were indicative of problems with the questionnaire. Additionally, the researcher engaged the participants in discussion based on the following questions:

- What, if any, aspects of the instructions did not make sense? (Fowler, 2002)
- What items did you have difficulty understanding? Why? (Fowler, 2002)
- Is there any aspect of this topic that you do not think was covered with the questionnaire?
- What answers did you have difficulty understanding? Why?
- Were there any items for which the answers provided were not appropriate? If so, which?
- Were there any items for which the answer you wanted to provide was not available? If so, which?
- How was the length of the questionnaire?

A variety of changes were made to the questionnaire following the first pilot test. These included shortening the questionnaire, reworking the instructions, changing some of the Likert scales to ones participants were more familiar with, and rewording a number of the items and response choices. After making changes to the questionnaire, a second pilot test was conducted. Ten ski patrol members participated in this test. Five were from the previous pilot, and five were new participants. All the participants were in the same room on individual laptops taking the electronic version of the questionnaire, with the researcher observing. When they were finished, the researcher led a discussion using the same questions previously stated. By having five returning and five new participants, the researcher had two different perspectives on the questionnaire. The returning participants helped the researcher determine whether earlier problems were corrected, and the new participants provided a fresh perspective on the questionnaire.

Measurement Validity

In terms of the four types of validity assessed when evaluating a survey instrument, face and content validity were the most appropriate and achievable with this instrument (Litwin, 1995). During its development, the purpose of the study and the questionnaire was shared with a variety of backcountry recreationists to get their quick impressions in terms of face validity, and all responded the instrument appeared to be measuring what was intended. The questionnaire was reviewed by four subject matter experts to attain content validity. One reviewer was the director of the Colorado Avalanche Information Center (CAIC), the second developed avalanche hazard training curriculum and conducts trainings for the American Institute for Avalanche Research and Education (AIARE), the third conducted research in avalanche hazard evaluation field,

and the fourth reviewer was the founding director of CAIC and has been instrumental in a variety of avalanche hazard evaluation projects. The reviewers assessed the questionnaire and provided feedback and suggestions on content, pertinence, and wording.

Given that this was a foundational study on group decision-making characteristics of backcountry recreationists, this instrument had not been used before and no other instrument or alternative measure existed for assessing this specific phenomenon (Litwin, 1995). This limited assessment of criterion and construct validity of the instrument.

Measurement Reliability

The survey instrument was assessed with internal consistency reliability. Questionnaire items that measured aspects of the same concept were grouped, and their internal consistency was measured by calculating Cronbach's coefficient alpha (Litwin, 1995). The results of this are in chapter 4.

Data Collection

The researcher created a website, www.brightresearch.net, to serve as a portal for the questionnaire, which was hosted on www.SurveyMonkey.com. The website provided the topic of the study, information about the research including participation criteria, and an invitation to complete the questionnaire (see Appendix C). The website and the questionnaire were promoted in a variety of ways. The primary promotion consisted of posting two announcements about the research project on the homepage of the Colorado Avalanche Information Center (CAIC) website (http://avalanche.state.co.us/index.php) (see Appendix D). CAIC is a Colorado Geologic Survey program whose purpose is "to minimize the economic and human impact of snow avalanches on recreation, tourism, commerce, industry and the citizens of Colorado" (Colorado Avalanche Information

Center, n.d.a). CAIC's purpose is achieved through avalanche forecasting and education. During the winter months, CAIC provides twice daily avalanche forecasts for ten regions in Colorado. Crucial to backcountry recreationists, these forecasts provide information as to avalanche likelihood at various elevations and aspects as well as tips and danger clues.

Information about the research and a link to the research website was posted on CAIC's website from January 3, 2010, to January 31, 2010. The directions told participants to use their most recent group backcountry outing during the winter season of 2009-2010 as a frame of reference when responding to the questionnaire. The January time frame was chosen as throughout the period 1950 to 2007, January had the most avalanche fatalities of any other month (Colorado Avalanche Information Center, n.d.b).

The research project was also promoted on Powderbuzz, http://www.powderbuzz.com/, which is a Colorado-based web forum oriented toward winter backcountry recreationists. Information was posted on January 4, 2010, and reminders were posted on January 17 and January 28 (see Appendix E). Information about the research was also posted on two additional web forums geared toward backcountry recreationists. The first posting on Telemarktips, http://www.telemarktips.com, occurred on January 19, and reminders were posted on January 25 and January 29 (see Appendix F). Information was posted on the Teton Gravity Research forum, http://www.tetongravity.com, on January 17, and reminders were posted on January 24 and January 28 (see Appendix G). Lastly, the Colorado Avalanche Information Center and the American Institute for Avalanche Research and Education both sent information about the research project to their membership via email.

CAIC sent an email on January 24 (see Appendix H), and AIARE sent one on approximately January 20 (See Appendix I).

Duplicate responses were prevented through various methods. The website that served as a portal for the study asked participants to complete the questionnaire only once. Through the use of cookies, SurveyMonkey allowed only one response per computer. Lastly, participants responded to a required questionnaire item (I25) asking for the first two letters of their last name and the four digits of their birth month and day. Responses to this item were assessed before data analysis began.

Data Analysis and Form of Results

Due to this study's research design and research questions, the data were analyzed using a variety of methods and statistics (see Table 8). As a main objective of this study was to gather information about group decision-making characteristics from individuals traveling in groups in avalanche terrain, the instrument items associated with research questions one through six were analyzed in a descriptive manner and assessed using measures of frequency, central tendency, and spread (Fink, 1995a).

Data reduction and the associated statistics were used to explore research questions two through six and to analyze the respective instrument items for research questions two through ten. Data reduction combined responses to a number of questionnaire items into a single score (Blaikie, 2003). For research questions two through six, each decision-making characteristic and the decision outcomes were represented as a single score and used as a single variable in additional analysis, as required for research questions seven through ten. As an example of data reduction, the decision-making characteristic of communication was assessed by instrument items 5, 9,

and 17e. Once reduced, a single variable existed for the decision-making characteristic of communication and was used in further analysis.

Table 8

Alignment of Research Questions, Instrument Items, Analysis Methods, and Statistics

Research Question	Instrument Item	Method of Analysis	Statistic
1. What are the attributes of winter recreational backcountry groups and group members?	1-2, 20-23	Frequency, central tendency, and spread	Mean, standard deviation, percentage
2. How is the communication that occurs during the decision making of winter recreational backcountry groups characterized?	5, 9, 17e	Frequency, central tendency, and spread; data reduction	Mean, standard deviation, percentage; item-to-total correlations, Cronbach's alpha
3. How are the decision-making processes of winter recreational backcountry groups characterized?	3-4, 6-8, 17c	Frequency, central tendency, and spread; data reduction	Mean, standard deviation, percentage; item-to-total correlations, Cronbach's alpha
4. How is leadership during the decision making of winter recreational backcountry groups characterized?	6e, 6i, 6j, 6p, 6q, 13-14	Frequency, central tendency, and spread; data reduction	Mean, standard deviation, percentage; item-to-total correlations, Cronbach's alpha
5. How are the group factors that occur during the decision making of winter recreational backcountry groups characterized?	5a, 5b, 5e, 5g, 5h, 5i, 6f, 6j, 6m, 6n, 6o, 6r, 9-10, 12	Frequency, central tendency, and spread; data reduction	Mean, standard deviation, percentage; item-to-total correlations, Cronbach's alpha
6. How are group decision outcomes characterized?	11, 15, 16 , 17a, 17b, 17d, 18-19	Frequency, central tendency, and spread; data reduction	Mean, standard deviation, percentage; item-to-total correlations, Cronbach's alpha

Table 8, Continued

Research Question	Instrument Item	Method of Analysis	Statistic
7. What relationships exist among the decision-making characteristics of winter recreational backcountry groups?	3-10, 12-14, 17c, 17e	Data reduction, correlation, ANOVA	Cronbach's alpha, Spearman's rho, LSD pairwise comparison
8. What relationships exist among group attributes and the decision-making characteristics of winter recreational backcountry groups?	1-10, 12-14, 17c, 17e, 20-23	Data reduction, correlation, ANOVA	Cronbach's alpha, Spearman's rho, LSD pairwise comparison
9. What relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?	1-2, 11, 15-16, 17a, 17b, 17d, 18-23	Data reduction; correlation; ANOVA	Cronbach's alpha, Spearman's rho, LSD pairwise comparison
10. What relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?	3-19	Data reduction; correlation; ANOVA	Cronbach's alpha, Spearman's rho, LSD pairwise comparison

Research questions seven through 10 utilized correlation analysis methods to determine relationships among the four decision-making characteristics, among the characteristics and decision outcomes and group attributes, and among decision outcomes and group attributes. Significance of the relationships was also analyzed. A comparison data analysis technique was used for research questions seven through ten to determine differences between various decision-making characteristics, decision outcomes, and attributes. The methods of internal consistency, data reduction, and measurement

reliability were used to assess the reliability of the instrument. The data are reported in chapter 4 in formats appropriate for the results including tables and figures.

CHAPTER FOUR: FINDINGS

The purpose of this study was to gather information about the communication, decision-making processes, leadership, and group factors of recreational winter backcountry groups when deciding where to travel and ride in avalanche terrain from the perspective of individuals. Additionally, the study sought information on decision outcomes and group attributes and explored relationships among the characteristics, outcomes, and attributes. To achieve the aforementioned purposes, the study sought to develop a reliable and valid instrument to measure decision-making characteristics, decision outcomes, and attributes of recreational winter backcountry groups.

This chapter presents the findings of this study based on the research questions. The questions that served as the basis for this research were:

1. What are the attributes of winter recreational backcountry groups and group members?

2. How is communication that occurs during the decision making of winter recreational backcountry groups characterized?

3. How are the decision-making processes of winter recreational backcountry groups characterized?

4. How is leadership during the decision making of winter recreational backcountry groups characterized?

5. How are the group factors that occur during the decision making of winter recreational backcountry groups characterized?

6. How are group decision outcomes characterized?

7. What relationships exist among the decision-making characteristics of winter recreational backcountry groups?

8. What relationships exist among group attributes and the decision-making characteristics of winter recreational backcountry groups?

9. What relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?

10. What relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?

Participants

The total number of participants in the study was 523, with the number of responses for each questionnaire item varying from 523 to 485. The time required to complete the questionnaire may have influenced the response number as the items that received fewer responses were toward the end of the questionnaire. An invitation to participate in the research was communicated using a variety of methods. Of the 459 participants who selected a response to the item that asked how one heard about the questionnaire (I24), the largest number (n = 170, 37%) cited the CAIC website announcement. Table 9 displays the questionnaire promotion methods and the numbers and percentages of those who selected each method.

Table 9

Questionnaire Promotion Methods (N = 459)

Questionnaire Promotion Method	Number	Percent
CAIC website announcement	170	37.0
Email from CAIC	90	19.6
Word of mouth	72	15.7
Telmarktips.com forum posting	55	12.0
Powerbuzz forum posting	40	8.7
Teton Gravity Research forum posting	16	3.5
Email from AIARE	16	3.5

Participants were asked to type in a response if they heard about the questionnaire through a promotion method other than the seven listed on the questionnaire. Other methods included snowmobile clubs and online forums, the Crested Butte Avalanche Center, Summitpost.com, San Juan County Search and Rescue, Friends of Berthoud Pass, the Northwest Weather and Avalanche Center, emails from friends, and postings on Facebook. The number of participants informed of the questionnaire through each of these methods ranged from one to ten.

Group Attributes: Research Question One

Research question one asked "what are the attributes of winter recreational backcountry groups and group members?" and was assessed with questionnaire items 1 – 2 and 20 – 23. Group size was one of the attributes examined (I1), and the results are presented in Table 10. Approximately a third of the groups consisted of two members and

one-quarter consisted of three members. The results demonstrated a fairly consistent decline in number of group members.

Table 10

Sizes of Recreational Winter Backcountry Groups (N = 523)

Group Size	Number	Percent
2	191	36.5
3	133	25.4
4	90	17.2
5	44	8.4
6	31	5.9
7	8	1.5
8	8	1.5
9	5	1.0
10	5	1.0
11+	8	1.5

Group attributes for up to 10 members of a group were assessed (I2). The attributes were gender, age, form of travel, completion of Level One Avalanche training, years traveling in avalanche terrain, and whether the person completing the questionnaire had traveled in avalanche terrain with the other members of the group. For age, the choices available on the questionnaire were <16, 16 – 20, 21 – 25, 26 – 30, 31 – 35, 36 – 40, 41 – 45, 46+. For analysis purposes, these responses were coded to 14, 18, 23, 28, 33, 38, 43, and 48, respectively. For years traveling in avalanche terrain, the choices

available on the questionnaire were <1, 1 – 2, 3 – 4, 5 – 9, 10 – 19, 20+. For analysis purposes, these responses were coded to .5, 1.5, 3.5, 7, 15, and 20, respectively.

Table 11 provides results. Given the group size findings, group attributes were provided on 1,850 group members. A typical group consisted of two men, age 35, who had taken Level One Avalanche training, had spent 9.5 years traveling in avalanche terrain, had traveled together before, and were using AT/randonee gear.

Table 11

Group Members' Attributes

Attribute of Group Members	Groups	Percent of Group Members	Average for Group Members
Gender	523	---	---
Female	---	19.2	---
Male	---	80.8	---
Age (years)	523	---	35
Level One Avalanche training (yes)	522	76.3	---
Traveled in avalanche terrain (years)	521	---	9.5
Traveled in avalanche terrain with person(s) before (yes)	521	81.4	---
Form of travel	522	---	---
Telemark	---	33.7	---
AT/Randonee	---	44.2	---
Snowboard or splitboard	---	9.9	---
Snowshoes or cross-country skis	---	6.6	---
Snowmobile	---	5.6	---

Respondents were asked how they compared their risk level to others in the group (I20). Of the 485 who responded, 8.4% cited they were "the riskiest in the group" (n = 44), 14.5% chose "tend toward the riskiest, but not the riskiest" (n = 76), 41.6% were "in the middle" (n = 218), 23.3% chose "tend toward the least risky, but not the least risky" (n = 122), and 4.8% were "the least risky in the group" (n = 25).

How many days respondents typically traveled/rode in avalanche terrain during a winter season was another attribute (I21). Of the 485 who responded, 3.2% chose 1 – 5 days (n = 17), 11.5% chose 6 – 10 (n = 60), 27.9% chose 11 – 20 (n = 146), 20.6% chose 21 – 30 (n = 108), and 29.4% selected 31+ days (n = 154).

Participants were asked where they lived (I22) and where their outing occurred (I23). The most frequent states for each item are detailed in Table 12. Colorado was the most cited in terms of where peopled lived and where their outing occurred.

Table 12

States Where Participants Live and Backcountry Outings Occurred (N = 524)

	Where Live		Where Outing Occurred	
State	Number	Percent	Number	Percent
Colorado	360	68.7	359	68.5
Washington	28	5.3	24	4.6
Utah	15	2.9	21	4.0
Wyoming	12	2.3	15	2.9
California	10	1.9	12	2.3

Less frequently mentioned states of outings included Alaska, Montana, Oregon, Idaho, Nevada, and New Hampshire. Outside of the United States, approximately 20 people lived and participated in backcountry outings in Canada. Other countries for backcountry outings, which were selected by one participant each, were France and New Zealand.

Communication: Research Question Two

Research question two was "how is the communication that occurs during the decision making of winter recreational backcountry groups characterized?" This question was assessed with questionnaire items 5, 9, and 17e. Various aspects of the participants' communication were gauged with nine statements and a Likert agreement scale (I5). Table 13 provides these results with the most frequent response highlighted in bold type. While lower mean values indicate higher levels of agreement, a "strongly agree" or "strongly disagree" response could indicate good communication depending on the phrasing of the statement. Overall, respondents reported their group communicated openly and thoroughly.

Table 13

Communication Characteristics When a Group Was Discussing Where to Travel/Ride

				Strongly Agree	Agree	Disagree	Strongly Disagree
Statement	N	Mean	SD	Percent			
I shared all of the aspects that I thought were important to consider (5a)	523	1.43	.55	**59.5**	38.0	2.3	.2
I felt the group was open to my perspective (5b)	523	1.45	.57	**58.5**	39.0	1.9	.6

Table 13, Continued

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
Everyone in the group had an opportunity to share their perspective (5d)	520	1.51	.58	**52.5**	43.8	3.4	.2
I was influenced by someone's nonverbal cues (5c)	520	2.63	.88	11.5	29.2	**43.8**	15.4
The group had inadequate communication (5e)	519	3.22	.87	6.4	9.8	38.9	**44.9**
Some members of the group were resistant to differing perspectives (5g)	521	3.33	.70	1.2	10.2	43.0	**45.7**
Not everyone in the group was involved in the discussion because the group got spread out while traveling (5f)	520	3.44	.73	2.3	7.5	34.0	**56.2**
The group dismissed information that went against the preferred course of action (5i)	519	3.50	.63	1.2	3.7	39.7	**55.5**
Some group member's perspectives were criticized (5h)	520	3.52	.66	1.3	4.2	35.4	**59.0**

Participants were asked whether they had information that could have contributed to the discussion and decision but they did not share it (I9). Of the 518 who responded to this questionnaire item, 7.5% responded "yes" (n = 39), and 92.5% responded "no" (n = 479). For those who responded "yes," they were given eight reasons why they may not have shared (they could select all that applied) (see Table 14).

Table 14

Reasons Why Group Members Did Not Share Information They Had

Reason for Not Sharing Information	Number
Didn't think it would really contribute to the discussion	9
Someone else brought up what I was thinking	8
The group had gotten spread out and I could not communicate with those ahead of/behind me	6
Felt uncomfortable expressing my opinion because I didn't know the group very well	4
Didn't want to share it and be responsible for making the discussion last longer	4
Didn't want to influence the preferred course of action	3
Wanted to be accepted by the group	3
Figured if the information was really important someone else in the group would bring it up	2

Participants were asked to select their level of agreement with the statement "your group's communication was very good" (I17e). The results consisted of strongly agree, 42.2% (n = 215); agree, 52.3% (n = 266); disagree, 4.3% (n = 22); and strongly agree, 1.2% (n = 6).

A scale score for communication was assessed using questionnaire items 5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 9, and 17e. Coding for items 5a, 5b, 5d and 17e was reversed. A reliability analysis was conducted using Cronbach's alpha, and the communication scale yielded a coefficient alpha of .80 (N = 496). A Cronbach's alpha ranges between 0 and 1 (Blaikie, 2003), with .70 indicating an acceptable value (Field, 2009). This value as well as others are discussed in the reliability section of this chapter.

Decision-Making Processes: Research Question Three

Research question three, "how are the decision-making processes of winter recreational backcountry groups characterized?" was assessed with questionnaire items 3, 4, 6, 7, 8, and 17c. Participants indicated when their group discussed the safety/risk of where they were planning to travel and ride (I3) from among nine options (they could choose all that applied). Responses are detailed in Table 15. Respondents reported discussion more frequently once they had arrived at the slope they were considering riding (83.8%), before leaving town (73.3%), and once the travel had begun (72.3%).

Table 15

When Group Discussed Safety/Risk of Where They Were Planning to Travel/Ride (N = 524)

When Discussed Safety/Risk	Percent
Upon arriving at a slope that your group was considering riding	83.8
Before leaving home/town	73.3
Once the backcountry travel had began	72.3
Upon arrival in the area of where the group planned to begin the outing	67.6
On the drive to	57.8
After conducting stability tests	46.0
After traveling/riding through an area that caused concern	42.0
After traveling/riding through an area that seemed stable	36.8
My group never discussed it	0.6

A variety of factors can come up during group discussion of where to travel and ride (I4). For each factor presented, participants selected "yes" or "no." Table 16 presents the results. Of the four variables of avalanche hazard evaluation, respondents discussed factors related to terrain more frequently than weather, snowpack, and people.

Table 16

Factors That Came Up During Group Discussion of Where to Travel/Ride

Factor	Number	Percent
Terrain	518	99.4
Slope angle	513	95.1
Slope aspect	516	92.4
Avalanche forecast bulletin	519	90.4
Avalanche activity (recent slides or absence of activity)	512	90.4
Amount of new snow	516	87.8
Wind	510	87.3
Your group's goal for the day	493	67.7
Temperature	481	62.6
Elevation of slope	478	59.0
Snowpack stability test results	472	55.1
Human factors/heuristics (e.g., powder fever, summit fever, seeking acceptance, etc.)	465	38.9

Respondents assessed 22 aspects of their group's decision-making process based on a Likert agreement scale (I6). See Table 17 for the results with the most frequent responses highlighted in bold type. Group decision making was reported to be thorough and conducted based on a majority or consensus opinion. Groups, however, were mixed as to whether they used a decision-making process and deferred to the member with the most experience or most training.

Table 17

Characteristics of a Group's Decision-Making Process When Deciding Where to Travel/Ride

				Strongly Agree	Agree	Disagree	Strongly Disagree
Statement	N	Mean	SD	Percent			
The group was realistic about the risk particular areas posed (6k)	521	1.60	.59	44.5	**52.0**	2.5	1.0
The group considered the full range of options (6o)	520	1.88	.60	23.7	**66.2**	9.2	1.0
The group attempted to reach consensus so that everyone agreed (6t)	513	1.99	.65	19.5	**64.7**	13.5	2.3
The group went with a decision that the majority of the group members supported (6r)	517	2.00	.73	22.1	**60.5**	13.0	4.4
I played an active role in trying to get every group member to voice their opinion (6e)	516	2.06	.74	20.2	**57.4**	18.6	3.9
A group member (including you) really influenced the group's decision of where to travel/ride (6j)	517	2.20	.84	19.0	**50.5**	22.2	8.3
The group's decision was based on the most cautious perspective in the group (6s)	516	2.30	.75	12.8	**49.2**	33.5	4.5

Table 17, Continued

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
The group followed a specific decision-making process (6m)	513	2.37	.78	13.1	**42.1**	39.2	5.7
The group deferred to the member (s) with the most experience to make the decision (6p)	518	2.41	.79	12.0	**41.9**	39.2	6.9
The group deferred to the member(s) with the most training to make the decision (6q)	514	2.44	.78	11.5	39.5	**42.8**	6.2
I shared my opinion but didn't push for it (6c)	517	2.54	.76	3.3	**52.6**	30.8	13.3
The group used a specific decision-making aid (e.g., ALPTRUTh/Obvious Cues Method, AIARE Decision-Making Framework, Avulator, etc.) (6n)	516	2.89	.84	6.2	22.1	**47.9**	23.8
A group member (including you) played devil's advocate (6i)	513	2.93	.88	3.7	31.0	**34.1**	31.2
I kept voicing my opinion until the group agreed with me (6a)	517	2.93	.73	3.1	20.7	**56.1**	20.1
Group members often disagreed with each other (6g)	518	3.32	.62	.6	6.6	**53.5**	39.4
I kept voicing my opinion but the group never agreed with me (6b)	517	3.37	.58	.8	2.7	**55.5**	41.0

Table 17, Continued

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
I stayed out of it and let the others make the decision (6d)	517	3.43	.60	.6	3.7	**48.0**	47.8
The group didn't really talk through the decision (6v)	518	3.46	.66	1.4	5.4	38.8	**54.4**
I didn't share my preference but hoped someone else would say what I was thinking (6f)	519	3.48	.57	.4	2.7	45.9	**51.1**
Not everyone in the group was involved in the decision because the group got spread out while traveling (6u)	517	3.50	.63	1.0	4.4	38.3	**56.3**
The group was careless (6l)	516	3.56	.58	.6	2.9	36.0	**60.5**
Group members had heated exchanges with each other (6h)	514	3.68	.53	.4	1.8	27.8	**70.0**

Respondents were asked if at least one group member disagreed with the decision the rest of the group made in terms of where to travel/ride (I7). Of 521 respondents, 10% selected "yes" (n = 52), and 90% selected "no" (n = 469). Of those who selected "yes," they were asked whether or not four courses of action occurred (I8). Of the 51 who responded, 56.9% indicated the group continued to discuss with the member until consensus was reached on traveling/riding another area (n = 29), 49% continued to

discuss with the member until s/he agreed to travel/ride where the majority wanted to go (n = 25), 15.7% pressured the member to give in and go with the group (n = 8), and 23.5% indicated the group member who dissented did not travel/ride with the group and the group split up (n = 12).

Participants were asked to indicate their level of agreement with the statement "your group's decision-making process was thorough" (I17c). Of the 510 respondents, 27.8% strongly agreed (n = 142), 63.3% agreed (n = 323), 7.8% disagreed (n = 40), and 1% strongly disagreed (n = 5).

A scale score for decision-making processes was assessed using questionnaire items 6k, 6l, 6m, 6n, 6o, 6t, 6u, 6v, and 17c. Coding for items 6k, 6m, 6n, 6o, 6t, and 17c was reversed. A reliability analysis was conducted using Cronbach's alpha, and the decision-making processes scale yielded an alpha of .76 (N = 480), which was considered acceptable (Field, 2009). The scale scores for this study are discussed further in the reliability section of this chapter.

Leadership: Research Question Four

Research question four, which asked "how is leadership during the decision making of winter recreational backcountry groups characterized?" was assessed with questionnaire items 6e, 6i, 6j, 6p, 6q, 13, and 14. See Table 18 for the results of items 6e, 6i, 6j, 6p, 6q. The most frequent response is highlighted in bold type. These statements evaluated subtle aspects of leadership, such as when a member of the group takes a role that in some way facilitated making decisions.

Table 18

Characteristics of Leadership During Decision Making of Where to Travel/Ride

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
I played an active role in trying to get every group member to voice their opinion (6e)	516	2.06	.74	20.2	**57.4**	18.6	3.9
A group member (including you) really influenced the group's decision of where to travel/ride (6j)	517	2.20	.84	19.0	**50.5**	22.2	8.3
The group deferred to the member (s) with the most experience to make the decision (6p)	518	2.41	.79	12.0	**41.9**	39.2	6.9
The group deferred to the member(s) with the most training to make the decision (6q)	514	2.44	.78	11.5	39.5	**42.8**	6.2
A group member (including you) played devil's advocate (6i)	513	2.93	.88	3.7	31.0	**34.1**	31.2

Items 13 and 14 assessed more overt actions of leadership within the group. Item 13 asked whether a group member acted in a formal or informal leadership capacity and how he/she impacted decision making. See Table 19 for results.

Table 19

Frequency of Occurrence of Leadership Actions

Leadership Action	Number	Percent
No one stood out as the formal/informal leader; group made decision as a whole	213	41.5
Someone stood out as the informal leader who helped facilitate the group decision making	161	31.4
Someone stood out as the informal leader who influenced the decision of the group	64	12.5
The group appointed a formal leader who didn't make a decision but helped facilitate group decision making	24	4.7
Someone stood out as the informal leader who made the decision for the group	23	4.5
The group appointed a formal leader who made the decision for the group	18	3.5
No one stood out as a formal/informal leader; group didn't really make a decision; we just traveled/rode where we wanted to go	10	1.9

Questionnaire item 14 consisted of multiple forced pairs, which asked respondents to choose one of two aspects on nine leadership traits that would best describe the person who took a formal or informal leadership role in their group. See Table 20 for results. A typical leader was male, a high risk taker, took time and included group members in the decision-making process, was diplomatic, valued others' opinions, and had more backcountry experience, ability, and training.

Table 20

Traits of Person Who Assumed Leadership Role in Group

	Trait Aspects			
Leader Trait	Number	Percent	Number	Percent
Risk	High		Low	
	227	79.1	60	20.9
BC Experience	More		Less	
	282	97.2	8	2.8
Training	Less		More	
	26	9.1	259	90.9
Process	Made for Group		Included Group	
	31	10.8	257	89.2
Style	Diplomatic		Outspoken	
	237	82.3	51	9.7
Opinions	Valued Others		Pushed Own	
	267	93.7	18	6.3
Decision Making	Quick		Took Time	
	48	9.2	215	81.7
Ability	Strong		Less	
	206	95.8	9	4.2
Gender	Male		Female	
	191	93.6	13	6.4

Given the nature of the questionnaire items that assessed leadership characteristics, one item, 13, directly measured how leadership occurred in the group in terms of whether someone was appointed as leader or someone took the lead and in what way this person impacted the decision-making process. With only one item, a scale score was not created for leadership. The responses to this questionnaire item were used to answer research questions seven, eight, and ten. These are discussed in the corresponding sections of this chapter.

Group Factors: Research Question Five

Research question five asked "how are the group factors that occur during the decision making of winter recreational backcountry groups characterized?" Per this study's literature review and conceptual framework, group factors consisted of two specific group decision-making errors—groupthink and bounded awareness—and a variety of group influences and dynamics that can cause decision-making errors. Groupthink was evaluated by questionnaire items 5a, 5b, 5e, 5g, 5h, 5i, 6f, 6j, 6m, 6n, 6o, and 6r. These items assessed individual and group behaviors that are antecedent conditions and symptoms of groupthink. These item results are detailed in Table 21 with the most frequent response highlighted in bold type.

Table 21

Antecedent Conditions and Symptoms of Groupthink

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
I shared all of the aspects that I thought were important to consider (5a) [a]	523	1.43	.55	**59.5**	38.0	2.3	.2
I felt the group was open to my perspective (5b) [a]	523	1.45	.57	**58.5**	39.0	1.9	.6
The group considered the full range of options (6o) [a]	520	1.88	.59	23.7	**66.2**	9.2	1.0
The group went with a decision that the majority of the group members supported (6r)	517	2.00	.73	22.1	**60.5**	13.0	4.4
A group member (including you) really influenced the group's decision of where to travel/ride (6j) [a]	517	2.20	.84	19.0	**50.5**	22.2	8.3
The group followed a specific decision-making process (6m) [a]	513	2.37	.78	13.1	**42.1**	39.2	5.7

Table 21, Continued

Statement	N	Mean	SD	Strongly Agree	Agree	Disagree	Strongly Disagree
				Percent			
The group used a specific decision-making aid (e.g., ALPTRUTh/Obvious Cues Method, AIARE Decision-Making Framework, Avulator, etc.) (6n) [a]	516	2.89	.84	6.2	22.1	**47.9**	23.8
The group had inadequate communication (5e)	519	3.22	.87	6.4	9.8	38.9	**44.9**
Some members of the group were resistant to differing perspectives (5g)	521	3.33	.70	1.2	10.2	43	**45.7**
I didn't share my preference but hoped someone else would say what I was thinking (6f)	519	3.48	.57	.4	2.7	45.9	**51.1**
The group dismissed information that went against the preferred course of action (5i)	519	3.50	.63	1.2	3.7	39.7	**55.5**
Some group member's perspectives were criticized (5h)	520	3.52	.66	1.3	4.2	35.4	**59.0**

[a] These statements regarding individual and group behaviors are indicative of a group that is not experiencing groupthink. Hence, answers of "disagree" and "strongly disagree" would be demonstrative of groupthink.

A scale score for the group factor of groupthink was initially assessed using questionnaire items 5a, 5b, 5e, 5g, 5h, 5i, 6f, 6j, 6m, 6n, 6o, and 6r. Coding for items 5a, 5b, 6j, 6m, 6n, and 6o was reversed so that the groupthink scale represents the absence of groupthink. A reliability analysis was conducted using Cronbach's alpha, and the groupthink scale yielded a coefficient alpha of .66 (N = 495). Upon review of the item-to-total correlations, the coefficient alpha could be improved by dropping questionnaire 6r. With this adjustment, the groupthink scale resulted in a coefficient alpha of .71 (N = 497), which was considered acceptable (Field, 2009). This scale score and others are discussed further in the reliability section of this chapter.

Bounded awareness was assessed with questionnaire items 5a, 5i, and 9. Participants were asked if they shared all of the aspects they thought important to consider (I5a). Of the 523 who responded, 59.5% strongly agreed, 38% agreed, 2.3% disagreed, and 0.2% strongly disagreed. For bounded awareness to occur, a group member(s) would not share all the aspects of which he/she was aware and considered to be important. Hence, "disagree" and "strongly disagree" responses would have been indicative of bounded awareness. In another item, participants were asked if their group dismissed information that went against the preferred course of action (I5i). Of the 519 who responded, 55.5% strongly disagreed (n = 288), 39.7% disagreed (n = 206), 3.7% agreed (n = 19), and 1.2% strongly agreed (n = 6). A group experiencing bounded awareness might disregard information that did not support an initial preference, even if that preference was not the best choice; hence, "strongly agree" and "agree" responses would be indicators of bounded awareness. In a third questionnaire item regarding bounded awareness, participants were asked if they had information that could have

contributed to the discussion and decision and did not share it (Q9). Of the 518 that answered this item, 7.5% responded "yes" (n = 39), and 92.5% responded "no" (n = 479).

A scale score for the group factor of bounded awareness was assessed using questionnaire items 5a, 5i, and 9. Coding for item 5a was reversed so that the bounded awareness scale would represent the absence of bounded awareness. Item 9 was coded to give additional weight to the each of the two possible responses as items 5a and 5i consisted of four responses. A reliability analysis was conducted using Cronbach's alpha, and the bounded awareness scale yielded a coefficient alpha of .40 (N = 513). While the value of this alpha was not considered necessarily acceptable (Field, 2009), it should be noted that the number of items in a scale can affect the value of alpha (Blaikie, 2003), and this scale consisted of three items. This scale score is discussed further in the reliability section of this chapter.

Questionnaire items 10 and 12 assessed the participant's reasons for not sharing information and for traveling/riding in an area he/she did not think was completely safe. Many of the reasons could be considered group factors as they are dynamics and influences that occur as a result of being a group and could contribute to decision-making errors. For those who did not share information and responded "yes" (n = 39) to questionnaire item 9, they were given eight reasons to select from as to why they may not have shared (I10) (they could select all that applied). See Table 14 for results. Those who responded "moderately," "slightly," or "not at all" to questionnaire item 11, which asked "how secure were you with your group's decision where all of you would be traveling/riding would be safe in terms of avalanche potential?" were directed to item 12. This item asked "why did you travel/ride in an area that you didn't think was completely

safe in terms of avalanche potential?" The 157 participants directed to item 12 were provided eight reasons from which to choose (they could choose all that applied). See Table 22 for the findings. Overwhelmingly, respondents reported that one has to be willing to take risks when traveling/riding in avalanche terrain.

Table 22

Reasons Why Group Members Travel/Rode in Areas They Did Not Think Were Completely Safe

Reasons For Traveling/Riding in "Not Completely Safe" Areas	Number
Have to be willing to take on some risk	112
No one else seemed concerned	18
Time was an issue and we needed to get down	11
Felt pressured by the group	8
The group had gotten spread out and I could not communicate with those ahead of/behind me	8
Weather was an issue and we needed to get down	7
New to the sport so went along with the group	6
Didn't want to go against the majority decision	3

Group Decision Outcomes: Research Question Six

Research question six asked "how are group decision outcomes characterized?" Questionnaire items 11, 15, 16, 17a, 17b, 17d, 18, and 19 were used to assess this research question. Participants were asked how secure they were with their group's decision where they would be traveling/riding would be safe in terms of avalanche potential (I11). Of the 513 who responded, 69.4% were very secure (n = 356), 27.3%

were moderately secure (n = 140), 2.1% were slightly secure (n = 11), and 1.2% were not at all secure (n = 6).

When asked “did you or anyone in your group trigger an avalanche during this outing?” (I15), 59 respondents (11.5%) said “yes,” and 88.5% said “no” (n = 454). Those who said “yes” on item 15 were directed to “were you or anyone in your group caught in an avalanche that was triggered by your group during this outing?” (I16). Of those, 32.2% said “yes” (n = 19), and 67.8% said “no” (n = 40).

Questionnaire items 17a, 17b, and 17d consisted of statements regarding outcomes of the group’s decision making, and participants selected a response for each from a Likert agreement scale. See Table 23 for the statements and findings. The most frequent response is highlighted in bold type. The results indicate respondents felt their group made a safe and informed decision.

Table 23

Opinions Regarding Group Decision Outcomes

				Strongly Agree	Agree	Disagree	Strongly Disagree
Statement	N	Mean	SD	Percent			
Your group made an informed decision(s) of where to travel and ride (17d)	510	1.65	.59	39.8	**56.7**	2.4	1.2
In terms of avalanche potential, your group's decision of where to ride was risky (17a)	511	3.07	.72	2.9	13.7	**56.9**	26.4
Your group was just lucky no one triggered an avalanche (17b)	507	3.48	.67	2.2	3.2	39.3	**55.4**

Questionnaire items 18 and 19 inquired as to the angle of slope the group wanted to ride before the outing and the angle of slope the group rode. Table 24 provides the results of these items. Slope angle is important as the majority of avalanches occur on slopes between 33 and 45 degrees (Tremper, 2008). Approximately 49% of respondents indicated their group wanted to ride a slope between 30 and 44 degrees. Interestingly, a higher percent of groups, 61.3%, did ride a slope within that range. This finding could indicate that upon conducting avalanche hazard evaluation for a particular 30 to 44-degree slope, groups determined the slope was not prone to avalanche during their outing and was safe to ride.

Table 24

Angle of Slope Group Wanted to Ride Before the Outing and Angle Group Rode

	Before	Actual
Slope Angle	Percent	
< 30 degrees	19.2	33.7
30 – 34 degrees	25.0	33.7
35 – 39 degrees	18.4	21.3
40 – 44 degrees	5.9	6.3
45+ degrees	2.2	2.9
Didn't have a specific slope in mind	28.2	---
Don't know	1.2	2.2

A scale score for decision outcomes was assessed using questionnaire items 11, 15, 17a, 17b, and 17d. Coding for items 11 and 17d was reversed, while item 15 was coded to give additional weight to each of the two possible responses as the other items consisted of four responses. A reliability analysis was conducted using Cronbach's alpha, and the decision outcomes scale yielded a coefficient alpha of .66 (N = 505). This score was just below an acceptable value (Field, 2009), but as mentioned previously, the number of items in a scale can influence the value of alpha (Blaikie, 2003). This scale is discussed in the reliability section of this chapter.

Reliability

Scale scores assessed in terms of Cronbach's alphas were discussed for the decision-making characteristics referenced in research questions two, three, and five.

These characteristics are communication, decision-making processes, and group factors, consisting of groupthink and bounded awareness. Additionally, a Cronbach's alpha was determined for group decision outcomes (research question six). Each scale and its Cronbach's alpha are listed in Table 25. Three of the Cronbach's alpha values were considered acceptable as they were above .70 (Field, 2009), and the alpha for group decision outcomes was just below the .70 threshold. The alpha for bounded awareness was lower at .41. These scale scores were used in the analysis of research questions seven, eight, nine, and ten. While the bounded awareness scale score was not necessarily considered acceptable, it was used in associational analysis to provide preliminary insight on the relationship of this group factor with the other decision-making characteristics and decision outcomes.

Table 25

Scale Reliabilities for Decision-Making Characteristics and Group Decision Outcomes

Scale	Number of Items	Number	Cronbach's Alpha
Communication	11	496	.80
Decision-making processes	9	480	.77
Groupthink	11	497	.71
Bounded awareness	3	513	.41
Group decision outcomes	5	505	.66

Relationships among Characteristics and Outcomes: Research Questions Seven and Ten

Research question seven asked "what relationships exist among the decision-making characteristics of winter recreational backcountry groups?", and research question ten asked "what relationships exist among the decision-making characteristics and the decision outcomes of winter recreational backcountry groups?" Using the scale scores for group decision outcomes, communication, decision-making processes, groupthink, bounded awareness, and one leadership questionnaire item (I13), associational analysis was conducted using Spearman's rho. The results of item 13 are reported in Table 19. Based on the review of literature on leadership, the choices for questionnaire item 13 were coded to reflect preferred leadership actions within a group as recommended in the literature (see Table 26). The choice coded with 4 is the most recommended action in the literature. Those coded 3 and 2 are not recommended as often as that coded 4, yet they are preferred actions over those coded 1.

Table 26

Coding of Leadership Actions Based on Literature Review

Leadership Action	Code
The group appointed a formal leader who didn't make a decision but helped facilitate group decision making	4
Someone stood out as the informal leader who helped facilitate the group decision making	3
No one stood out as the formal/informal leader; group made decision as a whole	2
Someone stood out as the informal leader who influenced the decision of the group	1
Someone stood out as the informal leader who made the decision for the group	1
The group appointed a formal leader who made the decision for the group	1
No one stood out as a formal/informal leader; group didn't really make a decision; we just traveled/rode where we wanted to go	1

Using this coding for questionnaire item 13, which represented leadership, the four decision-making characteristics scale scores (as reported in the reliability section), and the group decision outcomes scale score (as reported in the reliability section), correlation analyses was conducted using Spearman's correlation coefficient. The findings are reported in Table 27.

Table 27

Correlations Between Decision-Making Characteristics and Group Decision Outcomes

Decision Characteristics and Outcome	Communication			Decision-Making Processes			Groupthink			Bounded Awareness			Leadership			Decision Outcomes		
	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n
Communication	1																	
Decision-Making Processes	.59	.00	523	1														
Groupthink	.75	.00	524	.68	.00	523	1											
Bounded Awareness	.78	.00	524	.57	.00	523	.71	.00	524	1								
Leadership	.09	.04	513	.22	.00	513	.12	.01	513	.13	.01	513	1					
Decision Outcomes	.37	.00	514	.45	.00	514	.27	.00	514	.37	.00	514	.16	.00	513	1		

The associations between all of the decision-making characteristics as well as between the decision-making characteristics and group decision outcomes were positive and significantly related. The correlations between communication and decision-making processes (.59), groupthink (.75), and bounded awareness (.78) were larger than typically found in studies in applied behavioral sciences (Morgan et al., 2006), as were those between decision-making processes and groupthink (.68) and bounded awareness (.58). In terms of effect size, these correlation coefficients represent strong relationships between the variables (Morgan et al.). The associations between leadership and the other decision-making characteristics (.09, .12, .13, .22) and decision outcomes (.16) were smaller than typically found and indicative of weak relationships (Morgan et al.). The associations between the group decision outcomes and the decision-making characteristics (.16, .27, .37, .37, .45) ranged from smaller than typical to typical and indicated weak to medium relationships.

To further investigate the association of leadership with the other decision-making characteristics and group decision outcomes, questionnaire item 13 was re-coded to reflect the actual responses of questionnaire respondents versus that recommended in the literature (see Table 28). Approximately 40% of respondents reported that no one stood out as the leader and the group made a decision as a whole, approximately 30% reported someone stood out as an informal leader who helped facilitate decision making, and 12% reported that someone stood out as the informal leader who influenced the decision of the group. The other four leadership actions garnered less than 5% each of the responses. Codes were assigned to each leadership action based on the frequency with which it was reported by the respondents. The combined percentages of responses for the leadership

actions within each code are 41.5% for code 4, 31.4% for code 3, 12.5% for code 2, and 14.6% for code 1.

Table 28

Coding of Leadership Actions Based on Questionnaire Responses

Leadership Actions	Code
No one stood out as the formal/informal leader; group made decision as a whole	4
Someone stood out as the informal leader who helped facilitate the group decision making	3
The group appointed a formal leader who didn't make a decision but helped facilitate group decision making	2
Someone stood out as the informal leader who influenced the decision of the group	1
Someone stood out as the informal leader who made the decision for the group	1
The group appointed a formal leader who made the decision for the group	1
No one stood out as a formal/informal leader; group didn't really make a decision; we just traveled/rode where we wanted to go	1

Using this alternative coding for leadership, the four decision-making characteristics scale scores, and the decision outcomes scale score, associational analysis was again conducted using Spearman's correlation coefficient. The findings are reported in Table 29.

Table 29

Correlations Between Decision-Making Characteristics and Group Decision Outcomes with Alternative Leadership Coding

Decision Characteristics and Outcome	Communication			Decision-Making Processes			Groupthink			Bounded Awareness			Leadership			Decision Outcomes		
	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n	r_s	p	n
Communication	1																	
Decision-Making Processes	.59	.00	523	1														
Groupthink	.75	.00	524	.68	.00	523	1											
Bounded Awareness	.78	.00	524	.57	.00	523	.71	.00	524	1								
Leadership	.25	.00	513	.15	.00	513	.08	.08	513	.16	.00	513	1					
Decision Outcomes	.37	.00	514	.48	.00	514	.27	.00	514	.37	.00	514	.08	.07	513	1		

In this analysis, the correlations between leadership and groupthink (.08), decision outcomes (.08), decision-making processes (.15), bounded awareness (.16) were smaller than typically found and indicated weak relationships (Morgan et al., 2006). Significance was not found with groupthink and decision outcomes. The correlation between leadership and communication (.25) was higher than the others but was still considered smaller than typically found in applied behavioral sciences (Morgan et al., 2006).

Leadership's relationship with the decision-making characteristics and group decision outcomes was assessed by conducting a one-way ANOVA. For this analysis, leadership questionnaire item 13 was coded into four categories that represented four types of decision making—leader facilitating group decision making, no leader and group making decision as whole, leader making or influencing the decision, and no leader and no real decision. Table 30 details the categories.

Table 30

Coding of Categories of Leadership for ANOVA

Leadership Category	Code
The group appointed a formal **leader** who didn't make a decision but helped a **facilitate** group decision making	4
Someone stood out as the informal **leader** who helped **facilitate** the group decision making	4
No one stood out as the formal/informal leader; **group made decision as a whole**	3
Someone stood out as the informal **leader** who **influenced** the decision of the group	2
Someone stood out as the informal **leader** who **made** the decision for the group	2
The group appointed a formal **leader** who **made** the decision for the group	2
No one stood out as a formal/informal **leader**; **group didn't really make a decision**; we just traveled/rode where we wanted to go	1

The ANOVA indicated a significant difference of leadership with all of the decision-making characteristics and decision outcomes, and effect sizes ranged from weak to medium. See Table 31.

Table 31

ANOVA Results of Leadership Categories With Decision Characteristics and Outcomes

Decision Characteristics/Decision Outcomes	df	F	*p*	ω
Communication	3, 509	16.50	.000	.29
Decision Processes	3, 509	25.27	.000	.35
Groupthink	3, 509	7.58	.000	.19
Bounded Awareness	3, 509	12.44	.000	.25
Group Decision Outcomes	3, 509	15.01	.000	.28

A significant linear trend existed for each relationship as well. See Figure 6 for these results.

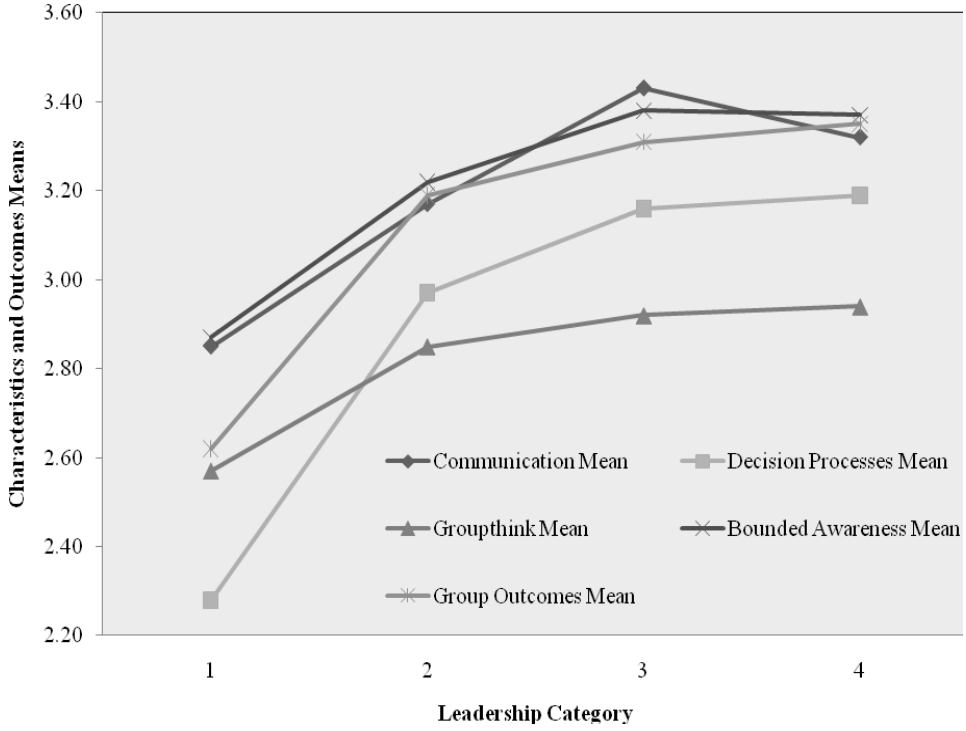

Figure 6. Linear relationship of decision-making characteristics and decision outcomes with leadership.

A post hoc procedure, the least-significant difference (LSD) pairwise comparison, was conducted to determine which leadership categories differed in respect to the decision-making characteristics and group decision outcomes scores. Table 32 details these results. For communication, groupthink, and decision outcomes, each leadership category was significantly different than the others. For decision processes and bounded awareness, each category differed significantly from the others except for the two categories of a leader facilitating decision making and a group with no leader making a decision as a whole.

Table 32

Mean Difference Between Leadership Categories in Respect to Decision-Making Characteristics and Group Decision Outcomes

	Leadership Category	Leader Making/ Influencing Decision	No Leader, Group Making Decision	Leader Facilitating Decision Making
Communication	No leader, no decision made	-.320 (.008)	-.568 (.000)	-.470 (.000)
	Leader making/ influencing decision	---	-.248 (.000)	-.150 (.001)
	No leader, group making decision	---	---	.097 (.008)
	Leader facilitating decision making	---	---	---
Decision Processes	No leader, no decision made	-.692 (.000)	-.880 (.000)	-.908 (.000)
	Leader making/ influencing decision	---	-.188 (.000)	-.216 (.000)
	No leader, group making decision	---	---	-.028 (.456)
	Leader facilitating decision making	---	---	---

Table 32, Continued

	Leadership Category	Leader Making/ Influencing Decision	No Leader, Group Making Decision	Leader Facilitating Decision Making
Groupthink	No leader, no decision made	-.284 (.002)	-.360 (.000)	-.376 (.000)
	Leader making/ influencing decision	---	-.075 (.026)	-.092 (.008)
	No leader, group making decision	---	---	-.017 (.556)
	Leader facilitating decision making	---	---	---
Bounded Awareness	No leader, no decision made	-.357 (.001)	-.511 (.000)	-.498 (.000)
	Leader making/ influencing decision	---	-.154 (.000)	-.141 (.000)
	No leader, group making decision	---	---	.013 (.693)
	Leader facilitating decision making	---	---	---
Decision Outcomes	No leader, no decision made	-.566 (.000)	-.686 (.000)	-.730 (.000)
	Leader making/ influencing decision	---	-.120 (.008)	-.164 (.000)
	No leader, group making decision	---	---	-.044 (.239)
	Leader facilitating decision making	---	---	---

Relationships among Attributes, Characteristics, and Outcomes: Research Questions Eight and Nine

Research question eight asked "what relationships exist among the group attributes and the decision-making characteristics of winter recreational backcountry groups?", and research question nine asked "what relationships exist among group attributes and the decision outcomes of winter recreational backcountry groups?" The attributes assessed included group size, gender, age, whether participants had taken Level One Avalanche training, years participants had been traveling in avalanche terrain, whether participants had traveled together, form of travel, risk level, and average days spent traveling in the backcountry per winter season. The relationship of these attributes with the decision-making characteristics and decision outcomes scale scores are presented below.

Group Size

Group size, which was assessed in questionnaire item 1, was the basis for groups of two, three, four, five, six, and seven and more persons. One-way ANOVAs were used to examine group differences of the five decision-making characteristics and group decision outcomes. There was a significant difference on communication, $F(5, 517) = 3.62$, $p = .003$, $\omega = .16$, and on groupthink, $F(5, 517) = 3.90$, $p = .002$, $\omega = .16$, by group size. Effects sizes for both were low indicating the strength of the relationship between the variables was weak. The mean and standard error of communication and groupthink in relation to group size are detailed in Table 33. A significant linear trend existed among the means for both communication and groupthink with larger groups having lower means. Hence as groups got larger, communication decreased and groupthink increased.

Table 33

Mean and Standard Error of Communication and Groupthink in Relation to Group Size

		Communication		Groupthink	
Group Size	N	Mean	Standard Error	Mean	Standard Error
2	191	3.39	.028	2.96	.021
3	133	3.31	.030	2.87	.022
4	90	3.31	.036	2.94	.031
5	44	3.21	.057	2.80	.036
6	31	3.26	.073	2.93	.057
7+	34	3.16	.084	2.82	.058

A post hoc procedure, the least-significant difference (LSD) pairwise comparison, was conducted to determine which groups differed in respect to communication and groupthink. For communication, differences were found between groups of two and five (mean difference = .182, p = .004) and seven (mean difference = .237, p = .001). Groups of three differed significantly from groups of seven (mean difference = .158, p = .029), and groups of four differed significantly from groups of seven (mean difference = .155, p = .042). For groupthink, groups of two differed significantly from groups of three (mean difference = .089, p = .005), groups of five (mean difference = .156, p = .001), and groups of seven (mean difference = .139, p = .008). Groups of four differed significantly from groups of five (mean difference = .138, p = .008) and groups of seven (mean difference = .121, p = .034).

Gender

Each questionnaire respondent was asked his/her gender as well the gender of each person in their group. Based on the 523 respondents who responded to the gender item for him/herself and the others in their group, 19.5% of the total group members were female. Using this percentage for gender and the scale scores for the decision-making characteristics and group outcomes, relationships among these variables were explored using Spearman's correlation coefficient. Group decision outcomes was the score to be significantly correlated with gender—females, $r_s = .11$, $p = .015$; males, $r_s = -.11$, $p = .015$. This coefficient was considered smaller than typically found in applied behavioral sciences studies and represented a weak relationship in terms of effect size (Morgan et al., 2006). Another analysis explored the relationship between the characteristics and group outcomes scores and the gender of the questionnaire respondent through Spearman's correlation coefficient. No significant relationships were found.

Age

Relationships between age and the decision-making characteristics and group decision outcomes scale scores were assessed three ways. First, Spearman's correlation coefficients were found using the age of the questionnaire respondent as well as the age of all of those in his/her backcountry group, as reported in questionnaire item 2. The overall age within groups was 35.4 years. While no relationships were significant in this analysis, all relationships were positive except that between age and bounded awareness. Second, Spearman's correlation coefficient was performed with the age of only the questionnaire respondent, which was 36.4. Although no relationships were significant in this analysis, all relationships were positive except for that between age and leadership.

Lastly, an ANOVA was conducted with age and the decision-making characteristics and decision outcomes. Age was categorized into six age spans, 16 – 25, 26 – 30, 31 – 35, 36 – 40, 41 – 45, and 46+. No differences were found to be significant.

Avalanche Training

Of 522 participants, 76.2% had Level One Avalanche training. Spearman's correlation coefficient was conducted to assess the relationship between those who had Level One and the decision-making characteristics and group decision outcomes scale scores. Positive significant relationships and small effect sizes were found with the characteristics of decision processes (r_s = .09, p = .032) and groupthink (r_s = .09, p = .035). A negative significant relationship and small effect size existed with decision outcomes (r_s = -.11, p = .016). Although, this coefficient represented a small effect size, this finding suggests those with Level One training had less positive decision outcomes.

Years Traveling in Avalanche Terrain

Of 521 respondents and the people traveling in their groups, the average number of years people had been traveling in avalanche terrain was 9.5. Spearman's rho found only decision processes to be significantly related with years traveling in avalanche terrain, r_s = .10, p = .018. This correlation coefficient was smaller than typically found and was indicative of a weak relationship.

An ANOVA was conducted to assess differences between the characteristics and decision outcomes by five categories of years traveling in the backcountry. No differences were found.

Travel with Before

Of 521 participants who answered the questionnaire item about whether they had traveled in the backcountry with each of their group members before, they answered "yes" for 81.3% of their group members. Having traveled with group members before was correlated with each of the decision-making characteristics and decision outcomes scale scores to see if any relationships existed. The characteristic of communication was found to be significantly related to whether people had traveled together before, $r_s = .09$, $p = .037$. The coefficient, however, was smaller than typical and reflected a weak relationship.

Form of Travel

To determine whether relationships existed between the five forms of travel (AT/randonee, telemark, snowboard or splitboard, snowshoes or cross-country skis, or snowmobile) and the characteristics and decision outcomes, Spearman's rho was performed. No relationships were determined to be significant.

Risk Level

ANOVA was conducted to assess whether differences existed among the five categories of risk—the riskiest in the group; tend toward the riskiest, but not the riskiest; in the middle; tend toward the least risky, but not the least risky; and the least risky in the group—and the characteristics and decision outcomes. No differences were found.

Days in Avalanche Terrain per Winter Season

Using ANOVA, whether differences existed by the number of days that participants traveled/rode in avalanche terrain and the decision-making characteristics and decision outcomes were assessed. Among the day categories of 1 – 5, 6 – 10, 11 – 20,

21 – 30, and 31+, there was a significant difference for decision processes, F (4, 480) = 4.72, p = .001, ω = .17. The effect size was small, however, indicating the strength of the relationship between the variables was weak. The mean and standard error for the day categories in relation to decision processes are detailed in Table 34.

Table 34

Mean and Standard Error of Days in Avalanche Terrain in Relation to Decision Processes

	Decision Processes		
Days in the Backcountry	N	Mean	Standard Error
1 – 5	17	2.89	.130
6 – 10	60	3.01	.051
11 – 20	146	3.11	.032
21 – 30	108	3.07	.036
31+	154	3.20	.032

A significant linear trend existed among the means for decision processes with those with more days having higher means. See the mean plot in Figure 7.

A post hoc procedure, the least-significant difference (LSD) pairwise comparison, was conducted to determine which decision processes scores differed by category of days in avalanche terrain. One to 5 days differed significantly from 11 – 20 days (mean difference = -.219, p = .030). Thirty-one days and more differed significantly from 1 – 5 days (mean difference = .310, p = .002), 6 – 10 days (mean difference = .193, p = .001),

11 – 20 days (mean difference = .091, p = .046), and 21 – 30 days (mean difference = .135, p = .007).

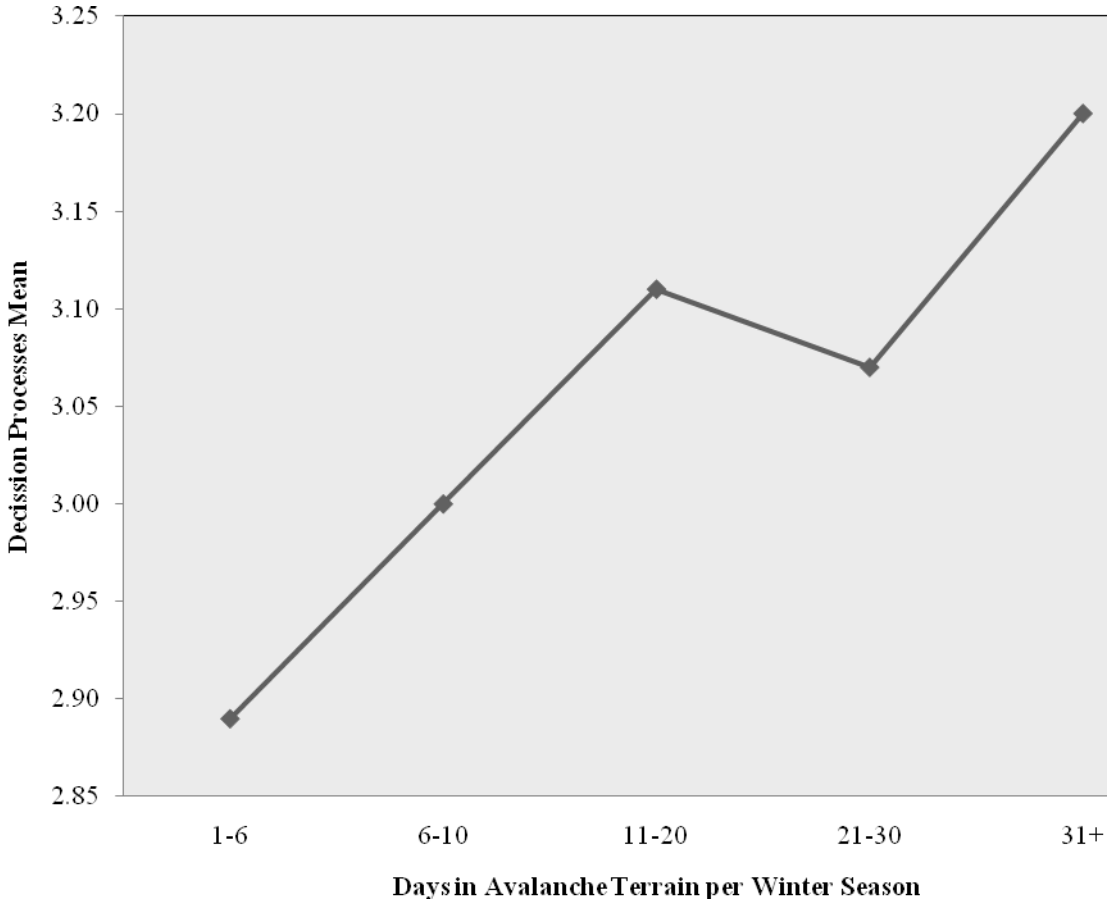

Figure 7. Linear relationship of decision processes with days in avalanche terrain.

CHAPTER FIVE: DISCUSSION

This study's purpose was to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making a decision of where to travel and ride in avalanche terrain. To gain insight on this decision-making phenomenon, the study sought information on decision outcomes and group attributes and explored what relationships existed among the characteristics, outcomes, and attributes. As little empirical findings exist, this study sought to provide foundational knowledge regarding the dynamics and decision making of winter recreational backcountry groups traveling in avalanche terrain. This chapter provides the research findings as well as discusses implications of the findings and needed research. Limitations of the study and conclusions are included.

This study's purpose was grounded in a postpositivism worldview in that the four avalanche hazard variables of weather, terrain, snowpack, and people were viewed as antecedents of a recreationist being caught and possibly injured or killed in an avalanche. The fourth variable, people, consisted of recreationists evaluating the first three avalanche hazard variables and making a decision of where to travel and ride based on that evaluation. As the majority of backcountry recreationists travel in groups (Tase, 2004), the interactions between and among individuals may impact the group dynamics, decision making, and outcome of the avalanche hazard evaluation. Although the group aspect was not widely developed and little empirical research had been conducted in this

area, the literature readily acknowledged the impact group communication and interaction have on decision making and ultimately the outcome of a group's backcountry outing. With that, this study proposed a conceptual framework in which the group is a fifth variable of avalanche hazard evaluation, and in light of postpositivism, the group aspect is considered an antecedent of a backcountry group's decision. See Figure 8. The conceptual framework is discussed later in this chapter.

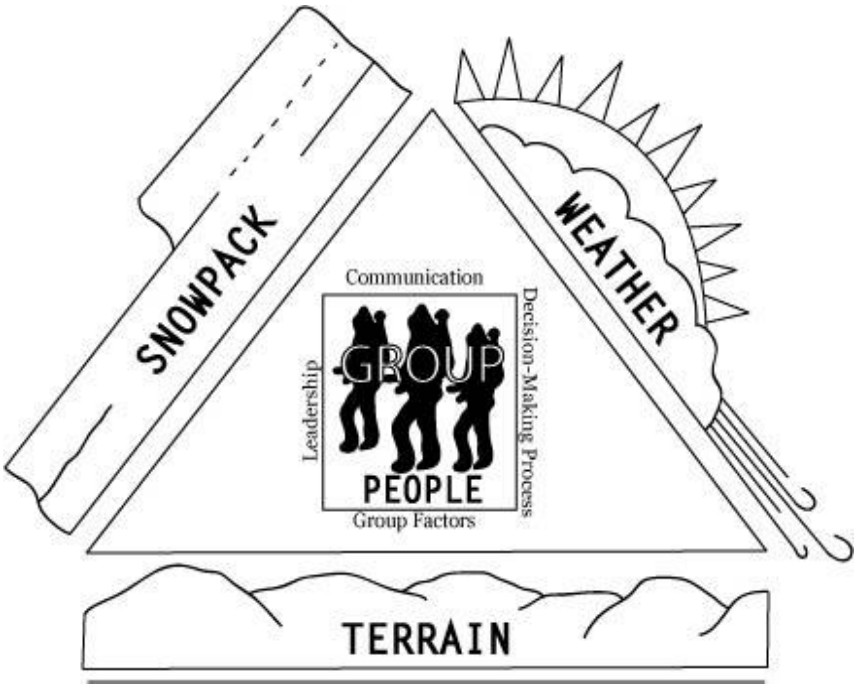

Figure 8. Five variables of avalanche hazard evaluation.[5]

[5] Adapted from *Snow sense: A guide to evaluating snow avalanche hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1994 by J. Fredston and D. Fesler. Adapted with permission from authors (see Appendix A). Adaptation consists of the addition of "group," "communication," "decision-making characteristics," "group factors," and "leadership."

To explore the proposed fifth variable of avalanche hazard evaluation, this study sought to obtain an abundance of information about the phenomenon of group decision making among backcountry travelers. Quantitative survey research was used. This study was also based on phenomenological research, which strives to describe what is common among participants when experiencing a particular concept or event and to develop "a composite description of the essence of the experience for all the individuals" (Creswell, 2007, p. 58). The group aspect of backcountry recreationists in avalanche terrain, including dynamics and decision making, was the particular phenomenon or event this study sought to describe and explore.

Additionally, the design of this study was guided by naturalistic decision-making (NDM) research, which strives "to understand how people make decisions in real-world contexts that are meaningful and familiar to them" (Lipshitz et al., 2001, p. 332). In terms of team or group decision making, NDM focuses on "the process by which decisions are made and how information between team members is communicated and coordinated" (Lipshitz, p. 343). The research design and method of this study allowed the dynamics and decision making of backcountry groups in avalanche terrain to be explored as a fifth variable in avalanche hazard evaluation.

Summary and Interpretation of Research Findings

Ten questions and the conceptual framework served as the basis of this research. Six questions focused on ascertaining a description of winter recreational backcountry groups, including their attributes, decision-making characteristics, and decision outcomes, so as to contribute to foundational knowledge. Four questions explored

relationships among group attributes, decision-making characteristics, and decision outcomes. The findings of these questions are discussed.

Attributes: Research Question One

From the 523 respondents, it was determined that approximately a third of groups were composed of two people with men primarily comprising these groups. The average age of respondents was 35, and 76% of group members had taken Level One Avalanche training. On average, these recreationists have traveled in avalanche terrain for 9.5 years and 81% had traveled with their group partners before. AT/randonee was the most frequently selected form of travel, and snowmobiles were the least frequently selected. Although this study did not particularly seek snowmobiler users, their low representation was noteworthy as the majority of avalanche deaths have occurred among snowmobilers since 1998 (Colorado Avalanche Information Center, n.d.c).

Approximately 42% of questionnaire respondents identified themselves in the middle in terms of risk-taking with 23% saying they tended toward the least risky. The majority of recreationists lived in and reported on an outing that occurred in Colorado and spent 31 or more days during a winter season traveling avalanche terrain.

Communication: Research Question Two

Overall, participants in this study reported their group communication to be free of likely errors and to include suggested behaviors, such as those detailed in Table 6 from the literature. When responding to Likert scale statements regarding their group's communication, the responses with the highest percentage were typically that of strong agreement or disagreement, depending on the statement. The two statements for which the most frequently selected response was not that of strongly disagree/agree were "I was

influenced by someone's nonverbal cues" and "your group's communication was very good." For the non-verbal cue statement, the highest percentage (43.8%) responded disagree, and 52.3% agreed their group's communication was very good. Although overall group communication was good, these two statements and their responses suggest groups have room for improvement, and given the possible outcome of dying in an avalanche, groups should be open and thorough when communicating about avalanche hazards (Adams, 2005a; Fredston et al., 1994).

Decision-Making Processes: Research Question Three

A suggested group decision-making process is "vote early and vote often" so as to be in continuous communication and agreement (McClung, 2002a). Almost three quarters of questionnaire respondents discussed the safety and risk of where they were planning to travel and ride before leaving town, more than half discussed it on the drive to the outing, and two-thirds discussed it upon arrival in the area where they planned to begin the outing. This is an indication of groups discussing and making decisions early in their travels. Almost three quarters discussed it once the travel had begun, and over 80% discussed the safety and risk after they had arrived at a slope they were considering riding. This could be viewed as an indication of groups continuing to discuss and make decisions. Less than half discussed the safety/risk after conducting stability tests and after traveling/riding through an area that caused concern or seemed stable. It is not known why discussion did not occur as often in these later instances. It could be groups felt previous discussion and decision making were sufficient or groups neglected to discuss safety/risk at later times during their outing.

In terms of factors groups discussed when they were making a decision of where to travel/ride, five—terrain, slope angle, slope aspect, avalanche forecast bulletin, and avalanche activity—were cited by over 90% of the participants. Amount of new snow and wind were cited by over 80%, and temperature and their group's goal for the day were cited by over 60%. Elevation of slope and results of snowpack stability tests were cited by 59% and 55%, respectively. The factor cited the least was human factors at 40%. Human factors are individual thinking errors that influence decisions and can affect outcomes (Tremper, 2008). Although research and focus on human factors have been occurring in the last ten years, this finding may be a sign human factors have yet to become a significant item in discussions among backcountry recreationists. A focus on human factors would require recreationists to be aware of the just-below-consciousness thoughts, to be critical of their own thinking, and to identify their own and other's thinking errors. These behaviors are difficult to do and hence could be a reason for the low occurrence of human factors being discussed. Additionally, individuals could think about human factors on their own but not contribute those thoughts to the group discussion.

For the many group decision-making process behaviors addressed in questionnaire item 6, most responses tended toward the middle with agree and disagree rather than strongly agree or disagree. This would be an indication groups and group members are tending toward behaviors suggested in the literature (see Table 6). Given that the responses were not strongly agree or strongly disagree, groups could still hone their decision-making processes by more readily engaging in certain behaviors suggested in the literature.

Although the avalanche literature recommended recreationists use a specific decision-making process (McClung, 2002a) or aid (Adams, 2005a; McClung & Schaerer, 2006) to determine whether a slope is safe to ride, 55% reported use of a process and 28% reported using an aid. A process would formalize group interactions by encouraging communication and decision making at various checkpoints and throughout the outing (Adams; McClung & Schaerer). By using a decision-making aid, groups would follow a specific checklist that encourages consideration of or answering certain questions about the factors of weather, terrain, and snowpack before making a decision to travel or ride in a specific area. A 2007 study retrospectively applied the use of five decision aids to 751 avalanche accidents (McCammon & Hageli). The study found if the aids would have been used and their cautions followed, 60% to 92% of accidents would have been prevented. With that finding, it is curious only 28% reported using an aid in this study. It could be, however, that recreationists are not aware of the compelling findings from this 2007 study or the aids.

Use of less formalized methods of decision making garnered higher response frequencies from respondents. Going with a decision the majority of the group members supported was reported by 83%. Adams (2005a) recommended groups base their decision on the most cautious perspective of the group, and 62% reported they did this. McClung (2002) advised groups to make a collective decision, and while perhaps not exactly comparable, 84% reported attempting to reach consensus so everyone agreed. While smaller percentages of recreationists report using a more formal method of decision making, more recreationists are making collective decisions than reported in 2004 when a study found 24% of groups were making decisions together (Tase, 2004).

Research Question Four: Leadership

Tremper (2001) recommended a leader seeks opinions from everyone in the group. While it may not have been a formal group leader doing this, over three-quarters of participants reported they played an active role in trying to get every group member to voice their opinions. Seventy percent of participants reported a group member really influenced the group's decision of where to travel/ride. While this influential person's intent is not known, it could be viewed that behavior of this sort is not conducive to group members sharing their opinions and reaching true consensus. Participants' responses were approximately equal as to their perception of groups deferring to the member with the most experience to make the decision and to the member with the most training to make the decision. Groups deferring to members with more training and experience should be cautious so as to avoid the expert halo heuristic, which occurs when "an overall positive impression of the leader within the party leads them to ascribe avalanche skills to that person that they may not have" (McCammon, 2004, p. 45).

The literature advised groups to have a leader who seeks opinions from everyone (Tremper, 2001), facilitates open communication (Ellis & Fisher, 1994), and follows a formalized decision process with various checkpoints (McClung & Schaerer, 2006). Less than 5% of participants, however, reported their group appointed a formal leader who facilitated group decision making. Rather, just over 30% reported that someone stood out as the informal leader who helped facilitate group decision making, and approximately 40% said no one stood out as a leader and the group made the decision as a whole. Additionally, in contrast to a previous questionnaire item in which 70% reported a group member really influenced the group's decision, few participants reported instances where

informal or formal leaders influenced or made the decision for the group. This appears to indicate a group member who is not in a leadership role influenced the group's decision.

For those who did take on an informal or formal leadership role, a composite of this person, as perceived by respondents, consisted of someone who is male, a high risk taker, had more backcountry experience, had more training, included the group in the decision-making process, was diplomatic, valued others' opinions, took time for decision making, and had strong traveling/riding ability.

Group Factors: Research Question Five

Of the 12 questionnaire statements that assessed behaviors of groupthink, participants answered ten items indicating groupthink did not appear to be occurring in their group. The two items in which participants' answers tended toward groupthink were about whether a group used a specific decision-making aid and went with a decision the majority supported. One antecedent condition of groupthink is "lack of methodical procedures for search and appraisal" (Janis & Mann, 1977, p. 132), and this could be more likely to occur in groups not using a specific decision-making aid. For groups that went with a decision the majority supported, some antecedent conditions and symptoms of groupthink are "high cohesiveness," "insulation of the group," "collective rationalization," and "illusion of unanimity" (Janis & Mann, 1977). Going with a majority decision could be viewed positively in that a group is attempting to make a collective decision. Interestingly, the statement regarding the group making a decision the majority supported was dropped from the scale score for groupthink as the Cronbach's alpha increased from .66 to .71 with its deletion. This could be an indication this behavior in this specific group decision-making circumstance is not an indication of groupthink.

The second specific group factor explored in this study is bounded awareness, which refers to the circumstance in which a group is bounded by the information that ultimately becomes part of the discussion (Bazerman, 2006). Collectively groups possess more information than an individual does so it would be beneficial if every member of a group shared all the pertinent information they had (Bazerman). Research, however, has shown people do not pool all information and instead focus on information known to all members rather than information known to only one (Bazerman; Stasser & Titus, 1985). Three questionnaire items in this study assessed whether group members shared all of the information they had. For each item, participants responded in such a way that indicated they were sharing all information and hence were not bounding the group's awareness. However, in terms of information shared, "all" could have been interpreted by respondents in a variety of ways. Additionally, it is not known whether respondents truly shared "all" the information they had.

Group Decision Outcomes: Research Question Six

Overall participants' responses indicated they felt comfortable with the decision their group made. They reported feeling very secure with the decision, not feeling like the decision was risky, believing the outcome was not due to just luck, and believing their group made an informed decision. For two of the statements—whether their decision was risky and their group made informed decision—however, the most frequent response among participants was agree, not strongly agree. This is an indication at least one group member, the questionnaire respondent, had some doubt as to the group's decision outcomes. Little if any research has been conducted on perceptions of decision outcomes in the context of recreational backcountry skiing. For avalanche accidents that cause

injury or death an investigation is conducted. Surviving victims and witnesses are often interviewed and occasionally the accident report includes information about individual perceptions about the group's communication and/or decision making. Beyond this, however, no research appears to have been conducted.

Additionally in terms of decision outcomes, of 454 participants, 59 (11.5%) reported their group triggered an avalanche, and of those, 19 reported someone in their group was caught in the avalanche. The Colorado Avalanche Information Center (CAIC) website collects reports of avalanche accidents that occur in the United States. For the 2009-2010 winter season, CAIC has reports of 29 avalanche accidents in which people were caught and injured or killed (Colorado Avalanche Information Center, n.d.d). It is not known whether the avalanches in which the 19 respondents reported someone in their group being caught were reported to CAIC and included on the organization's website.

Relationships among Characteristics and Outcomes: Research Questions Seven and Ten

Relationships between each of the decision-making characteristics and between the characteristics and group decision outcomes were positive and significantly related. The correlations between the communication, decision-making processes, groupthink, and bounded awareness scores ranged from .56 to .78 indicating strong relationships. The correlations between decision outcomes and the characteristics were lower. Decision outcomes and decision-making processes had a correlation coefficient of .45, which was a medium effect size. Decision outcomes and bounded awareness as well as decision outcomes and communication had a correlation coefficient of .37 indicating a medium effect size, and the lowest correlations for decision outcomes were with groupthink (.27), and leadership (.16). Additionally, the correlations between leadership and each of the

characteristics (.22 and below) indicated small effect sizes and the strength of the relationships were low.

Leadership type, however, proved to have a significant relationship with all the characteristics and decision outcomes through ANOVAs. In this circumstance, leadership was coded into four categories of decision making. The leadership category with a formal or informal leader who helped facilitate group decision making had the highest scores in decision-making processes, lack of groupthink, and group outcomes. This finding provides support for the leadership recommendation in the literature that groups have a leader who encourages communication and helps facilitate decision making (Mclung & Shaerer, 2006; Tremper 2001). The literature also recommended groups make collective decisions (McClung, 2002a). In this study, groups who made a decision as a whole without a leader had the highest communication scores and lack of bounded awareness. This is interesting as it could be that groups with a leader who deliberately facilitates communication and decision making would score higher on communication and bounded awareness. The specific behaviors of the leader in these groups and the functioning of the groups without a leader, however, were not explicitly known and hence limited further interpretation. Nevertheless, these two types of leadership scored high with all the characteristics, whereas groups who had a leader who really influenced or made the decision for the group and those groups who did not really make a decision scored much lower with all the characteristics.

Relationships among Attributes, Characteristics, and Outcomes: Research Questions Eight and Nine

In exploring relationships among group attributes and the characteristics and decision outcomes, no significant relationships were found for respondents' age, form of travel, and level of risk taker. Being female was found to have a positive and significant correlation with group decision outcomes, while men had a negative significant correlation. Although the effect size was small for both, this does suggest that females have decision outcomes that may be less risky and less likely to result in an avalanche. This finding provides partial support for McCammon's 2004 study that found mixed-gender groups to have higher exposure scores, but the women of those groups were caught less often in avalanches than men.

Level One Avalanche training had small, positive correlations with decision processes and groupthink scores. Interestingly, Level One Avalanche training, which consists of a minimum of 24 hours of instruction (American Institute for Avalanche Research and Education, n.d.; National Ski Patrol, n.d.), had a negative correlation with decision outcomes albeit it was small effect size. This result supports the findings of a 2004 study in which those with advanced level of avalanche education had a higher rate of involvement in avalanches (Tase). Neither this study nor the 2004 study assessed why those with advanced avalanche education had less positive decision outcomes. One possibility, however, is those with more education are willing to take more risks, and this could increase the likelihood of negative decision outcomes.

Years traveled in avalanche terrain had a positive, significant relationship with decision processes but with a small effect size. The attribute of group members who had

traveled together before had a significant and positive relationship with communication but again with a small effect size.

In terms of group size, a significant linear trend existed among the means for both communication and groupthink with larger groups having lower means. Therefore, communication was not as thorough and groupthink was more likely present as groups were larger. However, some fluctuations occurred within these linear trends. The communication means were less as the groups got larger except for groups of six, which had a slightly higher mean than groups of five. For groupthink, the scores were more varied with groups of two, four, and six having higher groupthink mean scores than groups of three, five, and seven and more persons. Given the fluctuations within the linear trend, findings should be taken with some caution and additional analysis and research in this area are warranted.

The overall linear trend for communication and groupthink with group size complements that found in the literature on avalanche group size. The herding instinct heuristic was said to cause people to make riskier decisions when they are in groups and to have increased risk as the groups get larger (Tremper, 2008). In a study of 631 avalanche accidents, it was determined people traveling alone and those traveling in groups of six to ten exposed themselves to more avalanche hazards (McCammon, 2004). It is not known why these groups made riskier decisions or exposed themselves to more hazards, but perhaps it was because they communicated less and were more susceptible to groupthink.

Another notable relationship with a significant linear trend was between days in avalanche terrain per season and decision processes. Group decision processes scores

were higher the more days group members spent in avalanche terrain, with those who have spent 31+ days in avalanche terrain in a winter season having significantly better decision processes scores.

Implications of Research Findings

Guided by phenomenological and naturalistic decision-making research, this study provided a composite description of the attributes, group dynamics, and decision making of winter backcountry recreationists. As little research has been conducted on this topic, this study's findings contribute to the literature and provide foundational knowledge on the attributes of winter backcountry recreationists as well as the group aspect of avalanche hazard evaluation among recreationists.

In addition to postpositivism, this study was guided by the advocacy and participatory worldview. Although this research did not have a policy agenda, it could contribute to an "action agenda for reform that may change the lives of participants" (Creswell, p. 9). As a group's decision could result in an outcome of one or more group members being caught, injured, or killed in an avalanche, this research does deal with a topic that affects people's lives. Some of the findings could reinforce what many in the field of winter backcountry recreational travel feel or know to be true. Other findings may cause recreationists to reconsider and alter certain beliefs and behaviors to decrease their likelihood of triggering and possibly being caught and/or killed in an avalanche.

Findings from this study may be of interest to professionals who conduct educational trainings on avalanche hazard evaluation for recreationists and could be used to alter or supplement training curriculum. The findings show clear relationships between specific attributes, decision-making characteristics, and decision outcomes and could

provide empirical evidence for particular concepts already addressed or that could be addressed in avalanche training. Many of the multi-day avalanche courses cover basic information on group dynamics, such as the pitfalls of some heuristics and the importance of good communication. Findings could be used in trainings to emphasize the correlations between communication, decision processes, leadership, group factors, and decision outcomes; provide educators with additional material; and draw students' attention to the phenomenon of group dynamics and decision making. Additionally, findings may further draw the attention of researchers in the avalanche field to the group aspect of avalanche hazard evaluation.

Conceptual Framework

This study proposed the group aspect as a fifth variable of avalanche hazard evaluation. The majority of backcountry recreationists do not travel alone (Tase, 2004), and given the findings, it appears a considerable amount of interaction occurred among group members when discussing and making a decision about where to travel and ride. Additionally, this study found group members discussed the avalanche hazard variables of snowpack, weather, and terrain. Given these findings, the avalanche variable of people could be complemented by adding the group aspect as it clearly plays a role in the process of avalanche hazard evaluation. Hence, the existing avalanche hazard evaluation model could be adapted to include the group aspect as a fifth variable (see Figure 8).

In light of a postpositivism worldview, this study proposed the group aspect as an antecedent of a group's decision outcome. The scale scores for each group decision-making characteristic were found to be positively and significantly related to the group decision outcomes score. This is notable as it attests the group aspect's relationship with

group decision outcomes is not due to chance. Additionally, the strength of the relationships between three of the group decision-making characteristics and decision outcomes was moderate.

Implications for Further Research

The design of this study was influenced by the pragmatic worldview as foundational empirical knowledge could make a considerable contribution to this topic. While other research methods could have been appropriate for this study, the design was a practical approach for gathering empirical knowledge to serve as the basis for continued research (Creswell, 2009).

Attributes

Significant findings occurred between group size and communication and groupthink, with lower communication means and higher groupthink means as group size increased. Research into specific aspects of communication and group factors in light of group size could be helpful to large groups in terms of monitoring their behaviors.

The participant attribute of 31+ days in the backcountry per season had a positive and significant relationship with the characteristic of decision-making processes. Just as Adams' (2005a) research sought to gain knowledge from avalanche professionals to inform recreationists, research could be conducted with this particular group of recreationists to learn more about their decision- making processes and impart that to recreationists who do not spend as many days in the backcountry. Additionally, research could be conducted with recreationists who travel less often so as to determine possible drawbacks of their decision-making processes.

Other attributes, including gender, avalanche training, years in the backcountry, and previous travel with group members, had significant relationships with some of the characteristics and/or decision outcomes. Research into any of these relationships could be noteworthy to explore the impact of members' attributes on group dynamics and decision making. The attribute of previous travel with group members would be particularly interesting to study in terms of whether people interact differently or are influenced in unique ways depending on whether they have traveled with people before or not. Almost 70% of respondents indicated they lived and reported on an outing in Colorado. Given that Colorado had the highest number of avalanche fatalities from 1997 to 2007 (Tremper, 2008), additional analysis with this sub-group is warranted. Findings on this particular sub-group could provide insights specific to Colorado recreationists and positively impact group dynamics and decision making so as to contribute to a decrease in fatalities in Colorado.

Form of travel, particularly snowmobiles, would be another attribute whose relationship with the characteristics and decision outcomes would be worth pursuing. This study found no significant relationships between snowmobile travel and the decision-making characteristics and decision outcomes; however, a small number of respondents indicated their travel to be snowmobiles. Nonetheless, given riders of snowmobiles are most often victims in avalanches (Colorado Avalanche Information Center, n.d.d), research could provide insight into this group of recreationists and impact the safety of this population.

Decision-Making Characteristics

Although research into each decision-making characteristic can be valuable, investigation into the role of snowpack stability tests and human factors/heuristics in a group's decision-making process would be worthwhile. Snowpack stability tests and human factors/heuristics were the least frequently cited group discussion factors identified by participants. Given their importance among the variables of avalanche hazard evaluation, investigation into their occurrence and role in group discussion would be valuable.

Slightly more than half of the groups used a specific decision-making process and considerably fewer used a specific decision-making aid. Since the avalanche literature (Adams, 2005a; McCammon & Hageli, 2007; McClung, 2002a; Tremper, 2008) recommended use of a process or aid, research as to why groups are not using a process/aid would be useful as it could inform educational professionals and impact how this recommendation is presented in avalanche hazard evaluation training.

A variety of leadership aspects warrant research. Even though the literature recommended appointing a leader to facilitate discussion and decision making (McClung & Schaerer, 2006), a very small number of participants reported their groups did. Although this could be because over a third of respondents reported being members of two-person groups, research into the efficacy of this leadership recommendation would be worthwhile. Groups who did not have a leader and made decisions as a whole had good communication and a lack of bounded awareness. While this could be due to a large number of two-person groups, additional research on how leadership types relate to the decision-making characteristics and decision outcomes would be worthwhile. Conducting

further analysis with this study's data on groups larger than two could provide further insight in the role of leadership.

In a variety of experiments, group members did not share information they had that was unknown to the rest of the group (Stasser & Titus, 1985, 1987, 1989). Withholding information is called bounded awareness and influences a group's ability to make the best decision (Bazerman, 2006). Although this group factor of bounded awareness has consistently been found in research, it was not perceived among recreationists in this study. Although it cannot be unequivocally known whether respondents truly shared all information, investigation of this group factor for this population could be a contribution to the field of study of bounded awareness.

Group Decision Outcomes

Albeit the effect size was quite small, a significant, negative relationship was found between decision outcomes and the attribute of those that had taken Level One Avalanche training. Tase's study also found a correlation between advanced level of avalanche training and avalanche involvement (2004). This is opposite of what would be expected as the purpose of avalanche training is to provide recreationists with knowledge and skills to assess avalanche hazard and avoid making decisions that would put them at risk of triggering and being caught in an avalanche. Hence, the relationship between decision outcomes and avalanche training warrants further study. Another aspect to consider in light of avalanche training and decision outcomes would be when the respondents received their training and from which organization as this could temper results that link training to outcomes.

Research on the relationship between decision outcomes and the group aspect is also warranted and necessary. Although positive and significant relationships were found between the characteristics and decision outcomes, the small to moderate strength of the relationships is interesting. Since backcountry recreationists are most likely communicating and making decisions regarding avalanche hazard evaluation, it could be thought the various decision-making characteristics would have stronger relationships with the outcomes of their decisions. Further exploration of those relationships could contribute to improved understanding of how the group aspect impacts the decisions of recreational groups and ultimately their safety while traveling in the backcountry.

Additional research and analyses could be conducted with the data from this study. The relationship of decision outcomes with a number of individual questionnaire items could be explored. The decision outcomes scale score and/or individual decision outcome items could be used in these analyses. For instance, the relationship between whether groups discussed the factor of snow stability tests and decision outcomes could be explored. Other aspects that could be examined with decision outcomes are use of a specific decision-making process or aid, whether one member disagreed with the decision of the majority of the group, leadership traits, risk levels, whether the respondent shared all the information he/she was considering, and whether the group deferred to the member with the most experience or the most training to made the decision.

Conceptual Framework

This study garnered considerable findings to support the proposition of the group aspect being considered an antecedent of a group's decision outcome and hence the group aspect being a fifth variable of avalanche hazard evaluation. The scale score for each

group decision-making characteristic was positive and significantly related to the decision outcomes score, and the strength of the relationships for three of the characteristics was moderate. Additionally, findings indicated groups discussed the avalanche hazard variables of snowpack, weather, and terrain. While these finding provide support, additional research into the role of the group aspect in avalanche hazard evaluation is necessary to further determine whether the group aspect should be considered a fifth variable.

Gathering information regarding group dynamics and decision making specifically from avalanche victims and individuals whose groups have triggered avalanches would provide additional insight. Survey research could be utilized, including this study's instrument, as well as qualitative interview methods. Survey research in conjunction with participant observation research could also further explore the role of the group aspect in avalanche hazard evaluation. Researchers could accompany groups in avalanche terrain and directly observe the decision-making characteristics of communication, leadership, decision processes, and group factors. Researcher observations could be compared with findings from questionnaires completed by group members. Discrepancies and similarities between what group members believed occurred and what actually occurred could be assessed.

Limitations of the Study

Although many of the study's findings were significant, some were not indicative of strong relationships. Cohen considered values of +.50/-.50 to be strong, +.30/-.30 as medium strength, and values around +.10/-.10 to indicate weak relationships (as cited in Morgan et al., 2006). Some of the coefficients representing the relationships between

certain decision-making characteristics and decision outcomes were .30 and below and hence are considered medium or weak relationships.

The questionnaire's scale reliabilities for four of the decision-making characteristics and decision outcomes ranged from .41 to .80. Cronbach's alphas range between 0 and 1, and the higher the value the higher the consistency among the items in the scale (Blaikie, 2003). Alphas above .70 indicate a scale has reasonable internal consistency (Morgan et al., 2006). Three of the instrument's scales were above .70, one was just below .70, and another was .41. While the items used in the three scales with alphas over .70 definitely warrant further use, the items and therefore the two scales (below. 70) could be refined to achieve higher reliabilities. Additionally, while the associational analysis conducted with the bounded awareness scale (.41) provided insight as to the relationship of that group factor with the other characteristics and decision outcomes, these findings cannot necessarily be considered robust.

Nonprobability sampling was used since identification of this population in terms of size and attributes was limited and no sampling frame existed. Given this, the level of knowledge and skills of backcountry recreationists was largely unknown. This study has contributed to knowledge of this population. Nevertheless, ambiguity exists as to whether the respondents are representative of the target population of winter backcountry recreationists. Given the data collection methods, the majority of respondents were from Colorado. Additionally, the CAIC website announcement and email may have drawn participants who were more knowledgeable and aware of avalanche hazard evaluation than the general population of backcountry recreationists. In addition, this study may not have been stratified as to the forms of travel that recreationists use in the backcountry. No

quantifiable information on the number of backcountry recreationists and their forms of travel is known so gaining a representative sample by form of travel would have been difficult.

This study's strategy of inquiry consisted of quantitative survey research. To gather adequate information on group attributes, the decision-making characteristics, and group decision outcomes, the instrument required approximately 10 – 15 minutes to complete. The length of the questionnaire and the intricacy of thought that some of the items required may have influenced some recreationists' decision to participate and/or the diligence with which they responded to some of the items. In addition, since the questionnaire consisted of close-ended, multiple-choice items, it did not allow for exploration of participants' unique group experiences.

Although the instrument was created based on a review of literature, an analysis of five and half years of recent avalanche accident reports, twelve years of the researcher's personal backcountry experience, and the insight and feedback of four subject matter experts, it may not have captured the appropriate group aspects of avalanche hazard evaluation. Additionally, the questionnaire assessed the group aspect from the perspective of an individual and it is not known whether responses were received from members of the same group.

Conclusions

The purpose of this study was to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making a decision of where to travel and ride in avalanche terrain from the perspective of individuals. To gain insight on this phenomenon, the study sought information on

decision outcomes and group attributes and explored relationships among the decision-making characteristics, group attributes, and decision outcomes. The information gained from this study contributes to the foundational knowledge of the dynamics and decision making of recreational backcountry groups.

Significant relationships were found between certain attributes, decision-making characteristics, and decision outcomes. Many of the study's findings provide support for how groups can best communicate and make decisions so as to lessen the risk of being caught and injured or killed in an avalanche. As stated at the outset of this research in chapter 1, it is hoped this study makes a contribution to the avalanche hazard evaluation literature and training curriculum and impacts the safety of those traveling in avalanche terrain and ultimately the number of injuries and deaths. The freedom and joy of winter backcountry travel will continue to draw people to the mountains. Although no amount of research will erase the danger of traveling in avalanche terrain, this study will help groups manage the risks and contribute to their continued return to the mountains.

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APPENDIX A

Permission from Authors

From: Jill Fredston [jillfredston@yahoo.com]
Sent: Friday, April 09, 2010 6:35 PM
To: Bright,Shay
Subject: Permission

Hi Shay: Sorry for the slow response but we are living on our boat traveling south toward Chile and only have very intermittent internet access. You are welcome to use the figure as long with full credit (our names, complete book citation, etc) , of course. If you make adaptations, please make it clear what changes you have made. This is one time permission for your thesis. If you end up publishing your dissertation, please just get hold of us again. If you have any questions, the address that will get you the fastest response right now is WDB7028@sailmail.com. In any case, please confirm that you received this as I've had it bounce back a few times. Thanks, J

APPENDIX B

Winter Backcountry Traveler Questionnaire

This questionnaire assesses the interactions and decision making of groups traveling and riding in avalanche terrain.

When answering the questions please use ONE recent winter backcountry outing within the 2009-2010 season that fits the following criteria: 1) you were traveling/riding in terrain that was CAPABLE of avalanching and 2) you were part of a group (at least one person in addition to you).

First, let's explore the composition of the group you traveled with on this outing.

1. How many people were in your group (including you)? *Choose the one answer that fits best.*
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. 6
    g. 7+

2. *For each group member, including you, provide a response for each question along the top row. Choose your responses from the drop-down menus. If you aren't sure, please provide your best estimate.*

Group Member	**Gender?**	**Age?**	**Form of travel?**	**Have at least Level One Avalanche training?**	**How many years had this person been travelling in avalanche terrain?**	**Traveled in avalanche terrain with this person before?**
You						n/a
Member #2						
Member #3						
Member #4						
Member #5						

Member #6						
Member #7						
Member #8						
Member #9						

Let's think about your group's interaction and decision making when you were determining where to travel and ride on this outing.

3. Throughout your outing, when did the group discuss the safety/risk of where you were planning to travel and ride? *Choose all that apply.*
    a. Before leaving home/town
    b. On the drive to
    c. Upon arrival of in the area of where the group planned to begin the outing
    d. Once the backcountry travel had began
    e. Upon arriving at a slope that your group was considering riding
    f. After conducting snowpack stability tests
    g. After traveling/riding through an area that caused concern
    h. After traveling/riding through an area that seemed stable
    i. My group never discussed it

4. When discussing where to travel/ride, which of the following factors came up in your group? *Choose the answer that best fits for each factor.*		
a. Avalanche forecast bulletin	*Yes*	*No*
b. Amount of new snow	*Yes*	*No*
c. Wind	*Yes*	*No*
d. Temperature	*Yes*	*No*
e. Terrain	*Yes*	*No*
f. Slope aspect	*Yes*	*No*
g. Slope angle	*Yes*	*No*
h. Elevation of slope	*Yes*	*No*
i. Snowpack stability test results	*Yes*	*No*
j. Avalanche activity (recent slides or absence of activity)	*Yes*	*No*
k. Human factors/heuristics (e.g., powder fever, summit fever, seeking acceptance, etc.)	*Yes*	*No*
l. Your group's goal for the day	*Yes*	*No*

5. *Indicate to what extent you agree that the following occurred during your backcountry outing.* When your group was <u>discussing</u> where to travel/ride… *Choose the answer that best fits.*				
a. I shared all of the aspects I thought were important to consider	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
b. I felt the group was open to my perspective	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
c. I was influenced by someone's nonverbal cues (tone of voice, facial expressions, body language)	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
d. Everyone in the group had an opportunity to share their perspective	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
e. The group had inadequate communication	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
f. Not everyone in the group was involved in the discussion because the group got spread out while traveling	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
g. Some members of the group were resistant to differing perspectives	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
h. Some group member's perspectives were criticized	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
i. The group dismissed information that went against the preferred course of action	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*

6. *Indicate to what extent you agree the following occurred during your outing.* When your group was <u>making a decision</u> about whether to travel/ride in a particular area… *Choose the answer that best fits.*				
a. I kept voicing my opinion until the group agreed with me	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
b. I kept voicing my opinion but the group never agreed with me	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
c. I shared my opinion but didn't push for it	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
d. I stayed out of it and let the others make the decision	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
e. I played an active role in trying to get every group member to voice their opinion	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
f. I didn't share my preference but hoped someone else would say what I was thinking	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
g. Group members often disagreed with each other	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
h. Group members had heated exchanges with each other	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*

i. A group member (including you) played devil's advocate	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
j. A group member (including you) really influenced the group's decision of where to travel/ride	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
k. The group was realistic about the risk particular areas posed	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
l. The group was careless	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
m. The group followed a specific decision-making process	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
n. The group used a specific decision-making aid (e.g., ALPTRUTh/Obvious Cues Method, AIARE Decision-Making Framework, Avulator, etc.)	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
o. The group considered the full range of options	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
p. The group deferred to the member (s) with the most experience to make the decision	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
q. The group deferred to the member(s) with the most training to make the decision	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
r. The group went with a decision that the majority of the group members supported	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
s. The group's decision was based on the most cautious perspective in the group	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
t. The group attempted to reach consensus so that everyone agreed	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
u. Not everyone in the group was involved in the decision because the group got spread out while traveling	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
v. The group didn't really talk through the decision	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*

7. Did at least one group member(s) disagree with the decision that the rest of the group made in terms of where to travel/ride? *Choose the one answer that fits best.*
    a. Yes
    b. No (skip #8)

8. *Indicate whether each the following occurred.* If a group member disagreed with the decision of where to travel/ride… *Choose the answer that best fits.*		
a. The group continued to discuss with that member until consensus was reached on traveling/riding another area	*Yes*	*No*
b. The group continued to discuss with that member until s/he agreed to travel/ride where the majority wanted to go	*Yes*	*No*

c. The group pressured the member until s/he gave in and went with the group	*Yes*	*No*
d. The group member who dissented did not travel/ride with the group and the rest of the group went ahead, resulting in the group splitting up	*Yes*	*No*

9. Did you have any information/knowledge/thoughts that could have contributed to the discussion and decision of where to travel/ride and you did NOT share it? *Choose the one answer that fits best.*
    a. Yes
    b. No (skip #10)

10. For what reasons did you not share information/knowledge/thoughts you had? *Choose all that apply.*
    a. Didn't think it would really contribute to the discussion
    b. Figured if the information was really important that someone else in the group would bring it up
    c. Someone else brought up what I was thinking
    d. Didn't want to influence the preferred course of action
    e. Wanted to be accepted by the group so didn't want to rock the boat
    f. Felt uncomfortable expressing my opinion because I didn't know the group very well
    g. Didn't want to share it and be responsible for making the discussion last longer
    h. The group had gotten spread out and I could not communicate with those ahead of me
    i. Other _____

11. How secure were you with your group's decision that where you all would be traveling/riding would be safe in terms of avalanche potential? *Choose the one answer that fits best.*
    a. Very (skip #12)
    b. Moderately
    c. Slightly
    d. Not at all

12. Why did you travel/ride in an area that you didn't think was completely safe in terms of avalanche potential? *Choose all that apply.*
    a. Have to be willing to take on some risk
    b. New to the sport so went along with the group
    c. Did not want to go against the majority decision
    d. Felt pressured by the group
    e. No one else seemed concerned
    f. Time was an issue and we needed to get down
    g. Weather was an issue and we needed to get down

h. The group had gotten spread out and I could not communicate with those ahead of me
i. Other _____

13. Which of the following occurred in your group? *Choose the one answer that fits best.*
    a. The group appointed a formal leader who made the decision for the group
    b. The group appointed a formal leader who didn't make a decision but helped facilitate group decision making
    c. Someone stood out as the informal leader who helped facilitate the group decision making
    d. Someone stood out as the informal leader who influenced the decision of the group
    e. Someone stood out as the informal leader who made the decision for the group
    f. No one stood out as a formal/informal leader; group made a decision as whole (skip #14)
    g. No one stood out as a formal/informal leader; group didn't really make a decision; we just traveled/rode where we wanted to (skip #14)

14. What traits best describe the person who took on a leadership role in your group? *From each drop-down menu, choose the trait that provides the best description from your perspective.*

Risk	**BC Experience**	**Training**	**Process**	**Style**	**Opinions**	**Decision Making**	**Ability**	**Gender**
Low	More	Less	Made for group	Diplo-matic	Valued others	Quick	Strong	Male
High	Less	More	Included group	Out-spoken	Pushed own	Took time	Less	Female

15. Did you or anyone in your group trigger an avalanche during this outing? *Choose the one answer that fits best.*
    a. Yes
    b. No (skip #16)

16. Were you or anyone in your group caught in an avalanche that was triggered by your group during this outing? *Choose the one answer that fits best.*
    a. Yes
    b. No

17. *Indicate to what extent you agree with the following statements.* *Choose the answer that best fits.*				
a. In terms of avalanche potential, your group's decision of where to ride was risky	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
b. Your group was just lucky that no one triggered an avalanche	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
c. Your group's decision-making process was thorough	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
d. Your group made an informed decision(s) of where to travel and ride	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*
e. The quality of your group's communication was very good	*Strongly Agree*	*Agree*	*Disagree*	*Strongly Disagree*

18. What angle of slope did your group want to ride before beginning your outing? *Choose the one answer that fits best.*
    a. < 30 degrees
    b. 30 – 34 degrees
    c. 35 – 39 degrees
    d. 40 – 44 degrees
    e. 45+ degrees
    f. We didn't have a specific slope in mind
    g. Don't know
19. What angle of slope did your group end up riding? *Choose the one answer that fits best.*
    a. < 30 degrees
    b. 30 – 34 degrees
    c. 35 – 39 degrees
    d. 40 – 44 degrees
    e. 45+ degrees
    f. Don't know

<u>Let's get some information about you.</u>

20. How would you typically compare your risk level to the others in your group? *Choose the one answer that fits best.*
    a. The riskiest in my group
    b. Tend toward the riskiest, but not the riskiest
    c. In the middle
    d. Tend toward the least risky, but not the least risky
    e. The least risky in the group

21. During a winter season about how many days do you typically travel/ride in avalanche terrain? *Choose the one answer that fits best.*
    a. 1 – 5
    b. 6 – 10
    c. 11 – 20
    d. 21 – 30
    e. 31+

22. In which state do you currently live? *Choose from the drop-down box. If outside the U.S., list country.*

23. In which state did this backcountry outing occur? *Choose from the drop-down box. If outside the U.S., list country.*

24. How did you hear about this survey?
    a. CAIC website.
    b. Post on Powderbuzz
    c. Teton Gravity Research forum
    d. Telemarktips.com forum
    e. Email from CAIC
    f. Email from AIARE
    g. Word of mouth
    h. Other _____

25. To ensure only one response per person, please provide the first two letters of your last name and the four digits of your birth month and day below (e.g., John Smith who was born on April 28 would enter "Sm0428").

Thank you for participating!

APPENDIX C

Website Content

Decision Making of Winter Backcountry Recreationists in Avalanche Terrain

If you have traveled in a group in avalanche terrain during the 2009-2010 winter season, please take the survey below.

The survey should take approximately 10-15 minutes to complete.

This survey is part of study being conducted by a PhD student at Colorado State University.

By clicking on the survey link below you acknowledge that you have read the consent information and willingly agree to participate.

When answering the survey questions, you will be asked to use ONE recent winter backcountry outing within the 2009-2010 season as your frame of reference. The outing should fit the following criteria:

1) you were traveling/riding in terrain that was CAPABLE of avalanching and,

2) you were part of a group (at least one person in addition to you).

Click here to go to the survey.

If you are interested in reading more about this study, see more information.

If you have any questions, please contact me at shay@brightresearch.net

Thanks for taking the survey!!
Check back around April to get a look at some of the results.

Many happy turns to you,
Shay Bright

Consent for Survey

INFORMED CONSENT INFORMATION

TITLE OF STUDY: Group Dynamics and Decision-Making Processes: Backcountry Recreationists in Avalanche Terrain

PRINCIPAL INVESTIGATOR: Jerry Gilley, Department of Organizational Performance and Change, 246 School of Education, Colorado State University, Fort Collins, CO, 80523; 970-491-2918; jerry.gilley@colostate.edu

CO-PRINCIPAL INVESTIGATOR: Shay Bright, Department of Organizational Performance and Change, School of Education, Colorado State University, Fort Collins, CO, 80523; 970-491-7165; shay@brightresearch.net

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH?
This study is assessing the group dynamics and decision-making processes of winter backcountry recreationists traveling in avalanche terrain. If you have traveled in the avalanche terrain with at least one other person during the 2009-2010 winter, you are invited to take part in this research.

WHO IS DOING THE STUDY?
A PhD student in the Organizational Performance and Change department of the School of Education at Colorado State University in Fort Collins is conducting this research. She is supported by her committee, which is led by Dr. Jerry Gilley.

WHAT IS THE PURPOSE OF THIS STUDY?
The purpose of this study is to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making a decision of where to travel and ride in avalanche terrain. For this study, decision-making characteristics encompass communication, decision-making processes, leadership, and group factors. To gain insight on this phenomenon, the study sought information on decision outcomes as well as knowledge of attributes of individual group members and groups as a whole.

WHAT WILL I BE ASKED TO DO?
If you choose to participate, you will be asked to click on the survey link below, which will take you to the questionnaire. You will answer the questions by clicking or selecting the response that best fits. Taking the questionnaire will take 15-20 minutes.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY?
You should not participate in this study if you have not traveled in avalanche terrain in the backcountry during the 2009-2010 winter season with at least one person in addition to you.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?
It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY?
Your participation in this study could benefit all backcountry recreationists that are traveling and riding in avalanche terrain. It is hoped that this study's data will provide additional information on group dynamics and decision making in this context. With this, contributions could possibly be made to the avalanche hazard evaluation literature and training curriculum and hence impact the safety of those traveling in avalanche terrain and ultimately the fatality trend.

DO I HAVE TO TAKE PART IN THE STUDY?
Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time without penalty or loss of benefits to which you are otherwise entitled.

WHO WILL SEE THE INFORMATION THAT I GIVE?
Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. Additionally, this study is anonymous. That means that no one, not even members of the research team, will know that the information you give comes from you.

WHAT HAPPENS IF I AM INJURED BECAUSE OF THE RESEARCH?
The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

WHAT IF I HAVE QUESTIONS?
If you have questions about the study, you can contact the investigators: Shay Bright at shay@brightresearch.net, 970-491-7165, or Jerry Gilley at jerry.gilley@colostate.edu, 970-491-2918. If you have any questions about your rights as a volunteer in this research, contact Janell Barker, Human Research Administrator at 970-491-1655.

This consent form was approved by the CSU Institutional Review Board for the protection of human subjects in research on December 15, 2009.

By clicking on the survey link below you acknowledge that you have read the consent information stated above and willingly agree to participate.

Click here to access the survey.

Thank you!

More Information

I am a PhD student at Colorado State University, and for my dissertation I am exploring the group dynamics and group decision making of winter backcountry recreationists traveling in avalanche terrain.

Although a lot is surmised about how these groups interact and make decisions, a small amount of empirical evidence is available.

Given the level of risk involved in the decisions these backcountry groups are making, group decision making in this specific context warrants further research.

With insight as to how these groups actually function, evidence-based conclusions might be reached as to how best groups can communicate and make decisions to avoid being caught and injured or killed in an avalanche.

Little empirical research has been conducted that directly assesses group dynamics and decision making of winter backcountry recreationists when determining where to travel and ride. Two studies were found. One study of avalanche hazard professionals found close calls and avalanche accidents were a result of poor communication, and decision quality was linked to communication quality (Adams, 2005). The two studies recommended recreationists' improve their group communication (Adams; Tase, 2004) and decision-making capabilities (Adams). Adams confirmed the paucity of research in this area by stating "the characteristics and qualities of successful avalanche decision-making teams have not been identified, thus defining these qualities and using that information as a guide for training offers great promise (p. 239).

Adams, L. (2005). *A systems approach to human factors and expert decision making within Canadian avalanche phenomena*. Unpublished masters thesis, Royal Roads University, Victoria, BC, Canada.

Tase, J.E. (2004). *Influences on backcountry recreationists' risk of exposure to snow avalanche hazards*. Unpublished masters thesis, University of Montana, Missoula.

APPENDIX D

CAIC Website Announcement

1st CAIC Announcement

Please participate in a survey on the group dynamics of winter backcountry travelers. Click here to get more information and to access the survey.

2nd CAIC Announcement

Traveled in a group in the backcountry this season? Complete a survey about that experience to contribute to knowledge of group dynamics and decision making. Click here to get more information and to access the survey.

APPENDIX E

Postings on Powderbuzz

Posted: January 4, 2010
Subject: Please participate in a backcountry traveler survey

The survey is assessing the communication and decision making of backcountry groups traveling in avalanche terrain.

If you have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season, please consider completing the survey.

Or fill out the survey after your next backcountry outing!

This survey is anonymous and is part of a study being conducted by a PhD student at Colorado State University. It will take approximately 10-15 minutes to complete.

Visit www.brightresearch.net to get more information and to access the survey.

The results will hopefully contribute to a greater understanding of how groups are functioning and making decisions and have a positive impact on the safety of backcountry travelers.

Thanks much!
Shay Bright

Posted: January 17, 2010
Subject: Thanks for taking the survey!

Hi all!

Thanks for taking the survey! This study is for my PhD dissertation so getting high response numbers would be great on many fronts. I know it's a bit long but needed to ask all those questions to get a sense of how groups are functioning.

I'll for sure be posting results on www.brightresearch.net in the spring. I'll plan to do a post on powderbuzz to let folks know when to visit the site.

The way the study is set up you can only take the survey once, but please spread the word and encourage people you know and people you ski with to go take the survey. The more people taking it, the better the results.

The survey will be up throughout January.

Really appreciate the response so far!

Shay

Posted: January 28, 2010
Subject: Last weekend to take the survey on group aspect of bc travel

Hi all,

Thanks for all that have read about my research, provided feedback, and/or taken the survey! If you haven't participated yet, please take it by Tuesday (2/2) as that's when it will close.

If you're out traveling/recreating in a group in avalanche terrain this weekend, consider completing the survey when you get back.

The survey is assessing the communication and decision making of backcountry groups (2 or more) traveling in avalanche terrain and will ask you to reflect on an outing from this season.

The survey is anonymous and is part of my PhD research at Colorado State University. It will take approximately 10-15 minutes to complete. Sorry if it seems long, but I think all the questions are necessary to really get at the group aspect.

Visit www.brightresearch.net to get more information and to access the survey. Results will be posted on this site probably around April.

The results will hopefully contribute to a greater understanding of how groups are functioning and making decisions and have a positive impact on the safety of backcountry travelers.

Thanks much!
Shay Bright

APPENDIX F

Postings on Telemarktips

Posted: January 20, 2010
Subject: Participate in survey on group aspect of backcountry travel

The survey is assessing the communication and decision making of backcountry groups traveling in avalanche terrain.

If you have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season, please consider completing the survey. Or fill out the survey after your next backcountry outing!

The survey will be available through the month of January.

Visit www.brightresearch.net to get more information and to access the survey.

This survey is anonymous and is part of my dissertation research. I'm a PhD student at Colorado State University and a backcountry skier who is interested in how group interactions and communication (or lack thereof) affect the decisions that a group makes.

It will take approximately 10-15 minutes to complete the survey. Sorry it's a bit long but in order to get a sense of what is happening in the groups, I believe all the questions are necessary.

Please consider taking the survey! The more responses the better—as the results will hopefully contribute to a greater understanding of how groups interact and make decisions and have a positive impact on the safety of backcountry travelers.

Thanks much!
Shay Bright

Posted: January 29, 2010
Subject: Last weekend to take survey on group aspect of bc travel

Hi all,

Thanks for all that have read about my research, provided feedback, and/or taken the survey! If you haven't participated yet, please take it by Tuesday (2/2) as that's when it will close.

If you're out traveling/recreating in a group in avalanche terrain this weekend, consider completing the survey when you get back.

The survey is assessing the communication and decision making of backcountry groups (2 or more) traveling in avalanche terrain and will ask you to reflect on an outing from this season.

The survey is anonymous and is part of my PhD research at Colorado State University. It will take approximately 10-15 minutes to complete. Sorry if it seems long, but I think all the questions are necessary to really get at the group aspect.

Visit www.brightresearch.net to get more information and to access the survey. Results will be posted on this site probably around April.

The results will hopefully contribute to a greater understanding of how groups are functioning and making decisions and have a positive impact on the safety of backcountry travelers.

Thanks much!
Shay Bright

APPENDIX G

Postings on Teton Gravity Research

Posted: January 17, 2010
Subject: Participate in a backcountry travel survey

The survey is assessing the communication and decision making of backcountry groups traveling in avalanche terrain.

If you have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season, please consider completing the survey. Or fill out the survey after your next backcountry outing! The survey will be available through the month of January.

Visit www.brightresearch.net to get more information and to access the survey.

This survey is anonymous and is part of my dissertation research. I'm a PhD student at Colorado State University and a backcountry skier who is interested in how group interactions and communication (or lack thereof) affect the decisions that a group makes.

It will take approximately 10-15 minutes to complete the survey. Sorry it's a bit long but in order to get a sense of what is happening in the groups, I believe all the questions are necessary.

Please consider taking the survey! The more responses the better—as the results will hopefully contribute to a greater understanding of how groups interact and make decisions and have a positive impact on the safety of backcountry travelers.

Thanks so much!
Shay Bright

Posted: January 28, 2010
Subject: Last weekend to take survey on group aspect of bc travel

Hi all,

Thanks for all that have read about my research, provided feedback, and/or taken the survey! If you haven't participated yet, please take it by Tuesday (2/2) as that's when it will close.

If you're out traveling/recreating in a group in avalanche terrain this weekend, consider completing the survey when you get back.

The survey is assessing the communication and decision making of backcountry groups (2 or more) traveling in avalanche terrain and will ask you to reflect on an outing from this season.

The survey is anonymous and is part of my PhD research at Colorado State University. It will take approximately 10-15 minutes to complete. Sorry if it seems long, but I think all the questions are necessary to really get at the group aspect.

Visit www.brightresearch.net to get more information and to access the survey. Results will be posted on this site probably around April.

The results will hopefully contribute to a greater understanding of how groups are functioning and making decisions and have a positive impact on the safety of backcountry travelers.

Thanks much!
Shay Bright

APPENDIX H

CAIC Email

From: caic@avalanche.org [mailto:caic@avalanche.org]
Sent: Sunday, January 24, 2010 8:48 PM
To: caic@avalanche.org
Subject: Help us learn about decision making in avi terrain

Shay Bright is a Ph.D. candidate working on how groups of backcountry recreationalists make decisions in avalanche terrain. Please help her collect data for her dissertation by filling out a short survey. The survey will be online for one more week. Please check it out!

Your answers to the survey should come from one day when you were out in the backcountry and traveling in a group of 2 or more. The questions are short and easy to answer. You can fill out the whole thing in 10-15 min. Your answers will be used to help Shay address questions about how backcountry travelers make decisions in avalanche terrain and could help us all move safely through the snow dragon's den. Please take a few minutes to answer the survey questions.

Check out www.brightresearch.net and help us learn more about how we make decisions in avalanche terrain.

APPENDIX I

AIARE Email Communication

From: AIARE [brian@avtraining.org]
Sent: Monday, January 25, 2010 10:34 AM
To: Bright, Shay
Cc: info@avtraining.org
Subject: Re: American Institute for Avalanche Research and Education (AIARE): research on group aspect

Hi Shay-

Yes, we sent it out. I believe Murf sent it mid last week.

Cheers,
Brian
Brian Lazar
Executive Director
American Institute for Avalanche Research and Education
www.avtraining.org
303-618-8996
brian@avtraining.org

----- Original Message -----
From: "Bright, Shay" <Shay.Bright@ColoState.EDU>
To: "AIARE" <brian@avtraining.org>
Sent: Sunday, January 24, 2010 6:41 PM
Subject: RE: American Institute for Avalanche Research and Education (AIARE): research on group aspect

Hi Brian,

I just wanted to check in and see if you had been able to send out that email yet. If all goes well numbers-wise, this next week will be the last week that the survey is up, so wanted to check to check on this. If you've already sent it, could you let me know which day you sent it? And if you still have to send it, could you let me know when you do? I just have to keep track of all of this for methodology purposes.

I so much appreciate you doing this! Please let me know if you need anything from me for the email.

Thanks so much!

Shay

From: AIARE [brian@avtraining.org]
Sent: Tuesday, January 19, 2010 2:40 PM
To: Bright, Shay
Cc: info@avtraining.org
Subject: Re: American Institute for Avalanche Research and Education (AIARE): research on group aspect

Hi Shay-

Good to hear from you. We would be happy to send out your survey. We will do so shortly.

Cheers, and Happy New Year!

Brian
Brian Lazar
Executive Director
American Institute for Avalanche Research and Education
www.avtraining.org
303-618-8996
brian@avtraining.org