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An empirical investigation of avalanche bulletin effectiveness and the risk behaviour of Backcountry Skiers in Austria

Pschernig Verena, Mayer Michael

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Adviser University of Natural Resources and Life Sciences Vienna (BOKU)

Univ. Prof. Dipl.-Ing. Dr.nat.techn. Johannes Hübl

Ao.Univ.Prof.Dipl.-Ing. Dr.nat.techn. Peter Schwarzbauer

Mag. Dr. Thomas Wiesinger

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Ort, Datum Unterschrift .....

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Ort, Datum Unterschrift .....

Mayer Michael

CONTENT

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Abstract

The number of backcountry skiers rises every year, but the relative number of fatalities stays nearly the same. Information about avalanches and weather data is becoming more thorough and accurate, and it is getting easier to acquire such information in a multimedia world. Nevertheless the number of deaths caused by avalanches accounts to 26 on the annual average (Österreichisches Kuratorium für alpine Sicherheit, 2012), even though the number of people in avalanche terrain has gone up dramatically over the last decades. To reduce accidents in the alpine region it is important to identify whether people are lacking knowledge about avalanche formation, or if they take higher risk, because they are influenced by so-called "human factors". Both are important factors that influence human action.

The influence of the avalanche bulletin on the backcountry skier´s behaviour in the field is analysed in this thesis. To detect correlations, a survey was conducted directly in the backcountry with 387 people from all over Austria. They were asked general information, and about their habits and experiences. The focus of the survey was the effectiveness of the avalanche bulletin and the risk behaviour of backcountry skiers.

It is important to detect lack of information along the knowledge chain for questions such as "who is reading the avalanche bulletin", "do the readers understand the content", and "can they apply the received information". The results show that more men than women are reading the avalanche bulletin, and older people read it more often than younger people. Also, the more ski tour experience the skier has, the better they are at understanding the avalanche bulletin. The results show that skiers under 25 years old tend to have the most problems understanding the avalanche bulletin. Regarding the skier's use of the information, more than 40% of the respondents could make some observation related to the bulletin during their ski tour. Of those, 50% have made some simple observations (is not necessary to have special avalanche skills) and the other 50%

made more scientific, sophisticated observations (special avalanche knowledge is assumed). To make the avalanche bulletin more understandable and more attractive for everyone it should be more present in people's minds. Additional information in daily newspapers like special articles regarding right behaviour in case of emergency, necessary equipment for backcountry skiing or where further information can be found (internet page of avalanche bulletin) should be presented from the beginning of winter. Potential existing Smartphone applications can be extended by the improvement of access, which is free for everyone. A single comprehensive application including all avalanche bulletins all over the country should ease the usage of this tool. Further it should reach more and younger people and move with the times. Human resources might have to be supplied for the technical realisation of the forecasting to assure a good quality of the app. Online links directly in the avalanche bulletin can help people get background knowledge to words and processes they do not understand. Additionally pictures can help to improve the understanding.

Whether accidents happen or not is extremely dependent on the risk behaviour of backcountry skiers and the decisions they make. These decisions are sometimes not rational or well-conceived because so-called "human factors" and heuristics affect people's behaviour and thinking processes. This influence was also surveyed with regard to some human factors namely gender, habituation, group dynamics and self-responsibility, and incorrect assumptions and beliefs. The concept of "Sensation Seeking" was also examined.

More than half of the respondents actually have a low readiness to assume risk. How low depends on the amount of ski tours people do per year. Men and women generally take the same amount of risk. The big difference in gender lays in the willingness to take on the leadership role for group. Only 7% of the women questioned would assume the

leadership role, while about 60% of the men would. It is remarkable that the more familiar the skiers are with a region, the more risk they are willing to take. Evidence shows that more than 74% of skiers who often do the same tour state that they did already tours without appropriate equipment. Among this group nearly half of the athletes had already triggered an avalanche. From those athletes who do tours in different but familiar regions, 39,2% had already triggered an avalanche and 13,7% of them, had used the avalanche beacon in an emergency.

Concerning self-responsibility the study shows that nearly half of the respondents are not willing to take self-responsibility and will only participate in ski tours with skilled persons, and rely on the judgment of others. As mentioned above the concept of "Sensation Seeking" was also part of the investigation but it could not be confirmed. The respondents like, of course, untraveled and steep slopes, but they are not willing to take more risk to satisfy their wishes.

Zusammenfassung

Obwohl die Skitourengeher jedes Jahr mehr werden, bleibt die Anzahl der Lawinentoten pro Jahr in etwa gleich. Nicht nur die Informationen über die aktuelle Lawinensituation und das Wetter werden immer besser, auch deren Zugänglichkeit ist in unserem multimedialen Zeitalter leichter geworden. Nichts desto trotz liegt die Anzahl der Lawinenopfer durchschnittlich bei 26 Todesfällen pro Jahr, obwohl die Zahl der Alpinisten in den letzten Jahren stark angestiegen ist. Um die Anzahl der Lawinenunfälle zu senken ist es von größter Wichtigkeit herauszufinden, warum sie passieren. Wissen die Sportler zu wenig über die Schneemetamorphose und das Entstehen von Lawinen oder gehen sie ein höheres Risiko ein weil sie von sogenannten „Human Factors" beeinflusst werden? Beides hat Einfluss auf das Verhalten der Skitourengeher und kann zu Unfällen führen.

Welchen Einfluss das Lesen des Lawinenlageberichtes auf das Verhalten der Skitourengeher hat, ist Untersuchungsgegenstand dieser Arbeit. Um etwaige Zusammenhänge herauszufinden wurden Skitourengeher in ganz Österreich mittels eines Fragebogens interviewt. Sie wurden zu ihren Gewohnheiten und Erfahrung bezüglich des Skitourengehens befragt, wobei Hauptaugenmerk auf die Effektivität des Lawinenlageberichtes und das Risikoverhalten der Sportler gelegt wurde.

Wichtig ist es herauszufinden ob und wer den Lawinenlagebericht liest, ob die Leser ihn verstehen und als letzten Schritt ob sie die Informationen aus dem Lagebericht in der Natur umsetzen können. Die Ergebnisse zeigen, dass grundsätzlich mehr Männer als Frauen und mehr ältere als jüngere Sportler den Lagebericht lesen. Des Weiteren kann man sagen, dass je mehr Skitouren die Befragten pro Jahr unternehmen, desto verständlicher finden sie den Lagebericht wohingegen die Sportler die unter 25 sind Probleme damit haben den Lagebericht zu verstehen. Mehr als 40% der Befragten waren in der Lage eine Information, die sie im Lagebericht gelesen haben, auch im Gelände zu erkennen wobei davon

50% eher offensichtliche Beobachtungen waren (solche für die man kein spezielles Wissen über Lawinen und ihre Entstehung benötigt) und 50% waren komplexer (dafür wird ein gewissen Grundwissen über Lawinenentstehung und Schneemetamorphose notwendig).

Wenn sich die Sportler mehr mit dem Lawinenlagebericht auseinandersetzten, erhöht dies auch seine Verständlichkeit. Um das zu erreichen sollten in den Tageszeitungen, auf die Existenz des Lageberichtes und darauf wo dieser zu finden ist, hingewiesen werden. Weiterführende Informationen darüber, wie man sich im Gelände sicherer bewegen kann sollten ebenfalls ein Themenschwerpunkt Anfang des Winters für Zeitungen werden. Um auch das jüngere Publikum leichter zu erreichen, können vorhandene Smartphone Applikationen einfacher zugänglich gemacht werden. Zur Erweiterung von Smartphone Applikationen werden zusätzliche Personalkapazitäten notwendig sein, um eine gute Qualität sicherzustellen. Die Verständlichkeit kann außerdem mit direkten Links zu bestimmten Begriffen im Lagebericht selbst verbessert werden. Zusätzlich könnten zur Beschreibung von komplizierten Begriffen und gefährlichen Schneezusammensetzungen Bilder verwendet werden.

Ob Unfälle passieren oder nicht ist trotzdem noch abhängig vom Risikoverhalten des einzelnen Skitourengehers und den Entscheidungen die auf der Tour getroffen werden. „Human Factors" und „Wahrnehmungsfallen" beeinflussen den Sportler beim Treffen der Entscheidungen weshalb sie oftmals weder rational noch gut durchdacht sind. In wieweit dieser Einfluss reicht wurde ebenfalls mit dem Fragebogen untersucht wobei der Schwerpunkt auf folgenden Human Factors gelegt wurde: Unterschied zwischen Männern und Frauen, Gewohnheit, Gruppendynamik und Selbstverantwortung und der Einfluss vorgefasster Meinungen. Außerdem wurde noch das Konzept des „Sensation Seeking" untersucht.

Bei mehr als der Hälfte der Befragten ist die Risikobereitschaft als eher niedrig einzustufen. Wie niedrig, beziehungsweise, wie hoch sie wirklich

ist, ist abhängig davon, wie viele Skitouren der Befragte pro Winter unternimmt. Hinsichtlich der allgemeinen Risikobereitschaft konnte kein Unterschied zwischen Männern und Frauen festgestellt werden. Der große Unterschied in den Geschlechtern liegt in der Bereitschaft die Führung einer Gruppe zu übernehmen. Nur 7% der weiblichen Athleten ist bereit eine Gruppe zu führen während bei den Männern mehr als 60% die Führung übernehmen. Auffallend ist auch dass, je besser die Sportler die Region kennen, in der sie unterwegs sind, desto mehr Risiko gehen sie ein. 75% der Befragten, die angegeben haben oft dieselbe Tour zu gehen, haben ebenfalls gesagt, sie würden Skitouren ohne entsprechendes Equipment unternehmen. In dieser Gruppe gab auch fast die Hälfte an, dass sie schon einmal eine Lawine ausgelöst haben. Von den Athleten, die viele Skitouren in ihnen vertrauten Regionen unternehmen, haben 39,2% schon eine Lawine ausgelöst und 13,7% mussten ihr LVS Gerät schon einmal in einem Notfall verwenden.

Im punkto Eigenverantwortung ist zu sagen, dass die Hälfte der Sportler nicht gewillt ist, auf einer Skitour wirklich Eigenverantwortung für ihr Handeln zu übernehmen. Sie gehen stattdessen nur mit erfahrenen Athleten auf eine Skitour beziehungsweise verlassen sich darauf, dass andere Personen die richtigen Entscheidungen treffen.

Wie schon erwähnt, wurde auch das Konzept des „Sensation Seeking" untersucht, allerdings konnte es nicht bestätigt werden. Die Befragten gaben zwar an, unbefahrene und steile Hänge zu bevorzugen, doch sie würden kein höheres Risiko eingehen, um diese Wünsche zu erfüllen.

1.Introduction

Avalanche accidents appear repeatedly in recent media. Then people discuss why it happened and whether the athletes took too much risk. Most of the time the reasons for avalanche accidents are not easy to explain, especially when experienced persons are involved. At least since Werner Munter (1997) introduced the "human factors" in avalanche science in Europe it is obvious that the most striking point in avalanche accidents are human beings and their subjective and often irrational way of making decisions. Therefore it is important to find out more about how people are influenced by unconscious factors and what these factors are. (Pschernig, V.)

The first chapter evaluates the daily avalanche bulletin (AB) of Austria regarding its effectiveness for backcountry skiers. It includes some general information about the avalanche bulletin in Austria as well as from other alpine countries in order to compare the improvement. The avalanche bulletin will be explained in detail and how it is composed. A great success for the publisher of the avalanche bulletin was the standardisation of the Europe on 5 danger levels, which is indicated in chapter 1.2.3. General avalanche information about Austria and the numbers of fatalities is presented to give an overview about the danger of avalanches. (Mayer, M.)

Despite of the success of the avalanche bulletin, there is a controversy between experts in the topic. The avalanche bulletin can support decisions of backcountry skiers, but the statements have to be seen as a forecast, which also can turn out to be not exactly true. The discussion of upscaling of single samples to a regional statement as well as the downscaling of a regional situation to a single slope is of high importance and is explained in chapter 1.2.7. (Mayer, M.)

Chapter 1.3 identifies some of the human factors which are often contributors to these accidents. By explaining these factors from a psychological and social-scientific point of view an explanation is given for the reasons athletes act and decide the way they do. "The decision making process" is examined in chapter 1.4. (Pschernig, V.)

Most of the accidents happen because of either inaction or wrong decisions. Very often there is a string of different wrong decisions whereby each is influenced by subjective experiences and unconscious human factors. This leads the athlete to fall into a heuristic trap, resulting sometimes with the most undesired outcome of a fatal accident. The willingness of people to assume risk plays an important role in the decision making process. Therefore chapter 1.5 "Risk and risk behaviour" is concerned with the level of risk people are willing to take and the possible reasons. (Pschernig, V.)

There is a previous study, which deals also with the process of understanding information presented in the avalanche bulletin. This study was conducted by the German Alpine Association (Deutscher Alpenverein - DAV) in the winter of 2003/2004 and 2004/2005 with 122 respondents in Austria. This survey focused the understanding of the avalanche bulletin. The respondents were asked about the actual avalanche information, the value of the avalanche bulletin for the planning of their tour, the understandability of the avalanche bulletin and if they can estimate terrain factors. The outcome of the survey was that the avalanche bulletin is very important to backcountry skier´s planning. Also the structure and the design of the avalanche bulletin turned out to be essential for the understanding of the reader and needed to be changed (Schwiersch et al, 2004). (Mayer, M.)

Now, 7 years later, the authors of this paper decided to extend the focus from the understanding of those who read the avalanche bulletin also to the persons, who do not read it. The reasons for not reading are beside others of high interest. Further an actual survey is needed to image the

recent situation. To gather more detailed information a survey with a bigger population of respondents from different Austrian federal states was aimed. Therefore 387 backcountry skiers were asked questions, which go beyond the only understanding to personal reasons for not reading, understanding and implementing information of the avalanche bulletin. The overall goal of the survey is to detect potential of improvement for the publishers of the avalanche bulletin like making the AB more popular and easier to understand for backcountry skiers. (Mayer, M.)

The gained data was evaluated with a statistical program called SPSS. The exact procedure is explained in chapter 2 "Methodological Framework".

These previous chapters are the basis for the interpretation of the results of the questionnaire. First the results are presented in chapter 3 "Results of the empirical investigation" and afterwards the collected data is analysed. A conclusion is offered in chapter 4 "Interpretation and Conclusion". (Pschernig, V.)

1.1. Intention of the thesis

In the last ten years the number of recreationists was steadily rising but the number of victims of avalanche accidents remains nearly the same. In most cases the avalanche bulletin is the only resource of information for backcountry skiers when planning their tour. Therefore it is important to know, if the avalanche bulletin acts as a contributor to avoid accidents in the backcountry, or in other words, if the bulletin is effective. Effectiveness in this case means, the combination of reading the avalanche bulletin, understanding it and implementing the information of the bulletin in the field. The most effective case would be, if the recreationist fulfils these three criteria.

Even though people are able to act this way, avalanche accidents cannot be avoided. They happen because people´s decision-making is influenced by their humanity, which is represented in the so-called "human factors".

They influence their risk behaviour and get them to neglect the information of the avalanche bulletin. As a result, their decisions are somehow irrational and based on subjective sensations. To optimize the decision-making process it is indispensable to know, how recreationists are influenced and why they act like they do in case of an accident. Then it is possible to develop strategies which guide the athletes throw the decision making process.

This thesis is divided into two parts that are written from different authors. One part is concerned with the effectiveness of the avalanche bulletin and represents the main research question of Michael Mayer. Pschernig Verena writes the second part, which focuses on the risk behaviour of the backcountry skiers.

1.2. The avalanche bulletin (Mayer, M.)

For a precise tour planning specific details are required. As we move in free and unsecured terrain, we need to make responsible decisions to ensure our health and safety. No one can make these decisions for us. We are standing in front of a slope and we have to decide if the slope is stable and where we can start our ascent or rather ride down the slope (AVS, 2012). Today there are many different resources to check the conditions in the mountains before planning a ski tour. The following paragraphs give information about the history of the avalanche bulletin as well as the European avalanche forecast system with the focus on Austria.

1.2.1. History

During the First World War 60,000 soldiers perished in avalanches in the Alps. As a result, in order to protect the soldiers in the high alpine terrain, the political significance of avalanche research in the Swiss Alps was raised during the Second World War. The Commission for Snow and Avalanche Research was founded in 1931 in Switzerland. It was created in order to conduct research systematically on avalanches. From the winter

of 1936/37 the Swiss Ski Association first used the Commission's observations to publish information on the weekend snow conditions in the Swiss Alps by way of press and radio reports (SLF, 2012a).

An entire company of Swiss mountain troops was buried in 1939 by an avalanche. Because of this accident the interest of military leaders in the Commission's work increased. In 1940 the military of Switzerland and the Commission for Snow and Avalanches Research was stepped up and established an avalanche warning service with observation stations in various locations in Switzerland (SLF, 2012a).

After the end of the Second World War in 1945, the SLF (Schnee- und Lawinenforschung) Institute spawned by the Commission took over responsibility for avalanche warnings from the military and established the civil avalanche warning service. In the 1950s, the SLF began to publish an avalanche bulletin each week. This includes the information from the 20 observers in the field, and information about the weather, snow, and avalanche situation. The emerging winter sports resorts and the agencies responsible for public safety welcomed these versions of an approximation to the avalanche bulletin (SLF, 2012a).

In the winter of 1950/51 extreme avalanches occurred, so structural avalanche protection and the avalanche warning service was expanded. An additional 30 observers were hired to telex daily reports to Davos. During this winter, the number of avalanche bulletins doubled to around 40. The avalanche bulletins were published from the SLF and allocated by radio and print media. Additionally the bulletin has been accessible by phone since the early fifties (SLF, 2012a). Since November 2012 the telephone number 187 has been shut down.

After a huge avalanche disaster on the Arlberg road, Vorarlberg became the first federal state of Austria to create an avalanche warning service in autumn 1953. Carinthia constructs an avalanche warning service in 1956 and Tyrol in 1960, and in the year 1965 Salzburg and Bavaria, Germany

followed. During the subsequent years until 1975 more avalanche warning services were created in Slovenia, France, Upper Austria and Styria. Nowadays, an avalanche warning service exists in the most developed mountain regions of the world (Mayr & Schimpp, 2000).

Originally the avalanche warning service was created for disaster prevention. In succession of tourism and traffic growth the avalanche warning service found an additional purpose in the guidance and support of backcountry skiers. This also includes transport routes, ski slopes, cross country ski tracks, toboggan runs, and other areas where humans are present (Mayr & Schimpp, 2000).

To create the standard European five-level danger scale in its recent form was not trivial. It took much effort from the countries involved to create a standard European danger scale. In the beginning, every country had their own danger scale and it was nearly impossible to compare it among the different countries. Austria and Germany had six different levels for residential zones and four for backcountry touring. In Switzerland the danger scale included seven different levels and France and Italy even had eight different levels. This made international collaboration difficult for all alpine countries. Nevertheless, in 1993, those countries presented the standard European danger scale and will be described in paragraph 1.2.3 (Lawinen Kolloquium, 2012).

1.2.2. Creation of the avalanche bulletin

The avalanche bulletin is an aggregated description of the avalanche situation in diverse alpine countries. The different countries and regions have created their own avalanche bulletins. The written part includes a detailed description of the avalanche situation and the output of the danger scale. All alpine countries use the five-level avalanche danger scale, which describe the probability of triggering an avalanche (DSV, 2012a).

The avalanche warning service of each alpine country creates periodic avalanche bulletins. If there is no snow there will also be no avalanche bulletin. The avalanche bulletin provides information not only for backcountry skiers and off slope skiing, but also informs the avalanche commissions about the prevailing avalanche situation. The avalanche bulletin provides a good general description of the situation, however the local situation must be estimated on-site (DSV, 2012a).

Most of the alpine countries have different infrastructures which are responsible for providing and publishing the avalanche bulletin. In Austria the individual federal states are responsible for providing the avalanche bulletin and it is published between 7:30 am and 8:00 am every day. In Bavaria the Bavarian State Ministry for Environment and Health publishes the avalanche bulletin daily at 7:30 am. In Italy the regional weather service (ARPA) and Meteomont is responsible for providing the avalanche bulletin. The individual federal states will publish at different times, regarding point of time and day. All federal states except Venetia publish the avalanche bulletin not daily but only on Monday, Wednesday and Friday between 11:00 am and 5:00 pm. In Slovenia the national weather service publishes the avalanche bulletin three times a week at 9:00 am. Switzerland and France publish their avalanche bulletins twice a day, one by 8:00 am for the coming day and one at 05:00 pm for the following day. The WSL-Institute of Snow and Avalanche Research (SLF) is in charge of publishing the avalanche bulletin in Switzerland. In France the responsible weather service is MeteoFrance, which also publishes avalanche forecasts (Lawinen Kolloquium, 2012).

The avalanche warning service receives the information for the avalanche bulletin from the different weather stations in the surrounding region. The factors of precipitation, wind, temperature, and solar irradiation are supplemented by snow profiles and observation of avalanches. The data from experts and weather stations about the avalanche situation is then collected, analysed, and integrated in an avalanche bulletin (DSV, 2012a).

	Responsibility	Available Daily at:	Available Monday, Wednesday, Friday at:	Supporting medium	Languages
Austria	Offices of the provincial government	07:30		W; A; F; N; T, M; FB; B	German, scattered English
Switzerland	WSL Institute for Snow and Avalanche Research (SLF)	08:00 am and 05:00 pm		W; A; N; T; M; MMS-SMS;	German, English, French, Italian
Germany	Bavarian State Ministry for Environment and Health	07:30 am		W; A; N; T	German
Italy	regional weather service (ARPA) and the Meteomont	only Venetia at 04:30 pm	between 11:00 am and 05:00 pm	W; A; F; N; T	Italian (scattered: English, French, German, Slovenian)
France	MeteoFrance	08:00 am and 05:00 pm		W; A	French
Slovenia	national weather service		09:00 am	W	Slovenian

Table 1-1: avalanche bulletin summary, status winter 2011/12 (own illustration)

Supporting medium:

W: Web	T: Teletext	FB: Facebook
A: Audiotape	M: Mobile phone	B: Blog
F: Fax	MMS: Multimedia Message Service	
N: Newsletter	SMS: Short Message Service	

1.2.3. The different danger scales

The avalanche danger scale describes how high the avalanche danger is estimated for a certain region. Estimating the danger scale is an essential function of the avalanche bulletin. Since 1993 a standard European avalanche danger scale exists, which includes 5 different levels: Low (1), moderate (2), considerable (3), high (4), very high (5). The level of the avalanche danger depends on:

- snow pack stability
- avalanche triggering probability: natural, low additional load, high additional load
- areal distribution of the dangerous areas
- expected type and size of avalanches

If the snowpack stability decreases the avalanche triggering probability will increase and therefore also the danger level. At the same time, the spread of danger zones and the avalanche size will rise. The avalanche danger scale describes the probability of occurrence and the possible dimensions for a region. It will not be created for a certain slope. That is why the danger level can be different within a region for various slopes. In this way, the avalanche danger scale informs about the general avalanche situation for a certain region (Harvey S. et al, 2012).

The following gives a detailed explanation for the different danger levels.

Low danger (1): The snowpack as a whole is generally well bonded or loosely packed and low in stress. This is a typical situation in mid-winter with shallow snow cover. For artificial triggering a high additional load is required for extreme steep slopes. In this situation, human triggered avalanches are unlikely, but cannot be ruled out entirely. The danger zones are easy to localise and mostly limited to extreme, steep terrain. Automatic release, so called natural avalanches, will be rare apart from slides and very small avalanches (SLF, 2012b).

Moderate danger (2): The snowpack is only moderately bonded in some places. This will be generally indicated in detail in the avalanche bulletin by altitude, aspect, or type of terrain. The avalanche release should not be disregarded by the presence of a large additional load. Even by small additional load avalanches can be released on steep slopes with less favourable snowpack conditions (SLF, 2012b).

Considerable danger (3): The snowpack is only weakly to moderately bonded in many places, therefore triggering is possible even with low additional loads. Mainly in the avalanche bulletin indicated aspects and altitude zones. Even from outside the starting zone, isolated slab avalanches can be released (SLF, 2012b).

High danger (4): The snowpack is weakly bonded in most places, therefore triggering is probable with even small additional loads. In this situation, remote triggering is often possible. Many medium natural avalanches and an increasing number of large avalanches can be expected when the amount of new snow is high and the snowpack is unstable (SLF, 2012b).

Very high danger (5): The snowpack is generally weakly bonded. High amounts of fresh snow could have a weak layer within the fresh snowpack, but also deep in the snowpack. Therefore snowpack's in this danger level are largely unstable. Numerous large and increasingly very

large natural avalanches are to be expected. Backcountry touring is usually impossible in this case (SLF, 2012b).

Figure 1-1 shows the occurrence of the individual danger levels of Austria in the winter 2010/11. In this year there was little snow which explains the low danger level over the season. Figure 1-2 illustrates the long time average of individual danger levels over the seasons in the Swiss Alps.

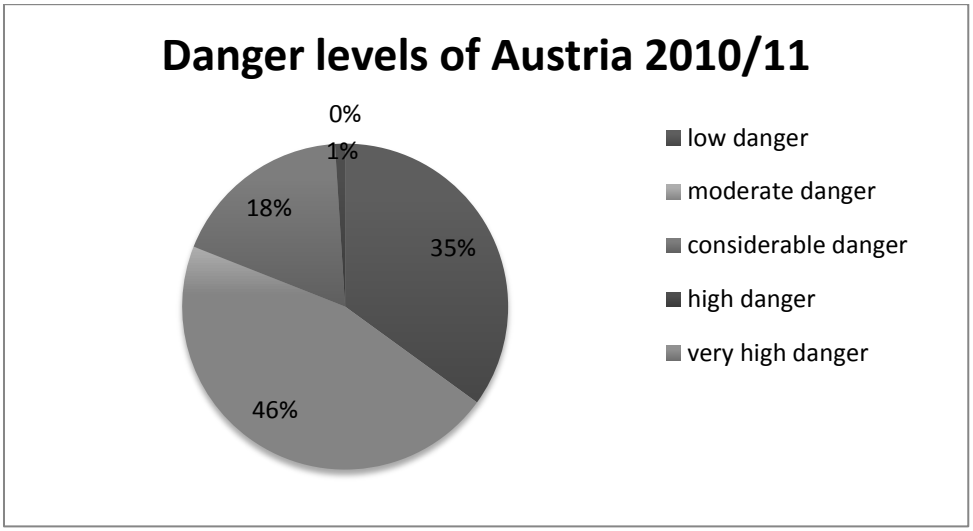


Figure 1-1: Danger levels of Austria in the winter 2010/11 (RIEGLER et al, 2011)

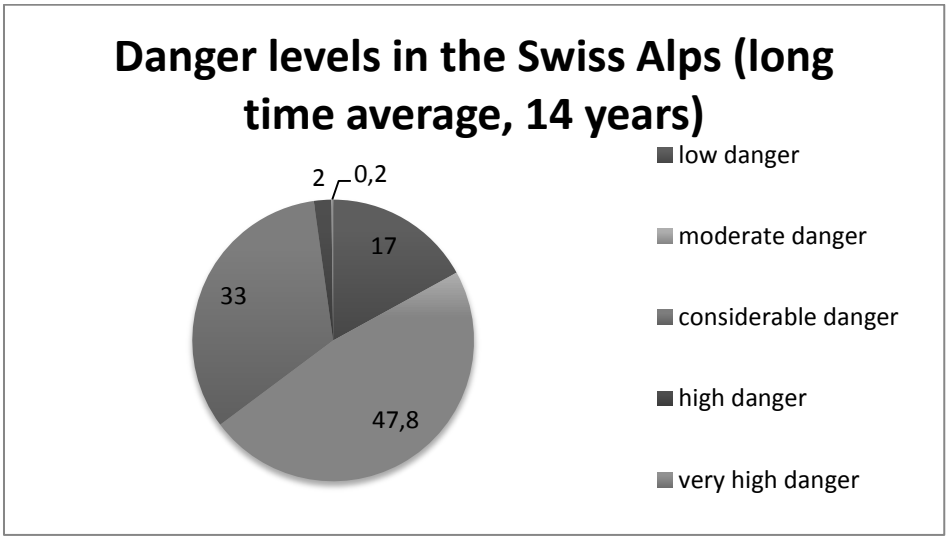


Figure 1-2: Long time average of individual danger levels based on seasons (1996/97 - 2010/11) in the Swiss Alps (SLF, 2011)

The avalanche risk in the nature rises continuously and disproportional in contrast to the steps of the danger level. Therefore the avalanche danger within a level can have different characteristics, which is common by the

level (3), considerable danger. In the upper part, close to high danger (4), prevalent avalanches can be triggered or happen naturally. In the lower part, close to moderate danger (2), fresh snow and new snowdrifts can be warning indicators for avalanches. Therefore in the considerable danger (3) level a relatively big scope exists. The following graph explains that different avalanche situations can happen within one danger level (Harvey S. et al, 2012).

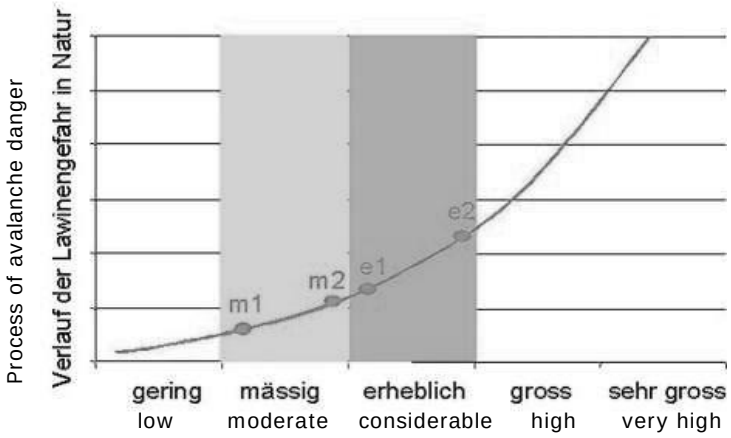


Figure 1-3: Different avalanche probabilities within the same danger level (SLF, 2012c)

The line in Figure 1-3 shows the natural process of the avalanche danger. The situation e2 shows a high considerable danger, natural avalanches and remote triggering are often possible. In the situation e1, there will be less or no natural avalanches and hardly any warning signs. For backcountry touring the situation e1 will implicate less risk than the situation e2, even though both situations are in the same level (Harvey S. et al, 2012). Not only is the avalanche level important to know, but the general part and description of the avalanche bulletin are also important to planning a safe tour.

1.2.4. Structure of the avalanche bulletin

In addition to the avalanche levels, the avalanche bulletin includes much more important information. The content of the avalanche bulletin is separated in different chapters. In the first section, there is general information about the weather and its effect on the current avalanche

bulletin. Therefore, data about the amount of fresh snow, wind conditions, zero degree level, and snow line will get a close look. The next chapter will describe the snowpack and a detailed statement about the development of the snowpack and the weak layers is given. This part has a relevant influence on the danger level of the avalanche bulletin. The next part in the avalanche bulletin estimates the danger level for time of day, type of terrain, altitude and aspect, particularly considering the snowpack stability and avalanche triggering probability. Finally, the avalanche bulletin informs about special advice and trends and gives recommendations of behaviour and a forecast about the development of avalanche situations (DSV, 2012a).

The avalanche bulletin has its limits. It describes the nationwide avalanche situation and might not give information for individual slopes. Therefore, certain slopes can be only estimated with personal judgement. The avalanche bulletin offers some important supporting information, which has to be supplemented with one's own knowledge about weather, snowpack, and avalanches. Especially information about the danger spots and triggering probability is helpful for an individual's assessment (DSV, 2012a).

1.2.5. Tyrolean avalanche bulletin

The Tyrolean avalanche bulletin is the showpiece of all Austrian avalanche bulletins. It is rich in details and very well compiled. This was also one of the findings of our survey. Most of the people would appreciate the avalanche bulletin to be modelled after the Tyrolean one. The Tyrolean avalanche bulletin includes all standard information such as danger level, weather, snow pack stability, and trends. Furthermore, it includes a detailed map with different danger levels during the day as well as pictographs (see Figure 1-4). This illustrates the danger aspect and the danger scale depending on altitude. The pictograph from another avalanche situation, shown in Figure 1-5, illustrates that, it can be expected that, slopes from north over east till southeast aspects are at

risk. The general danger level of the past few days and an outlook of the following day are provided. Additional information such as daily maps and forecast maps about the snow height, wind and temperature are available. Furthermore, snow profiles and avalanche events are also shown. Another advantage is that the data of over 80 weather stations is available to everyone. This additional information is of high interest for backcountry skiing (Lawinenwarndienst Tirol, 2012).

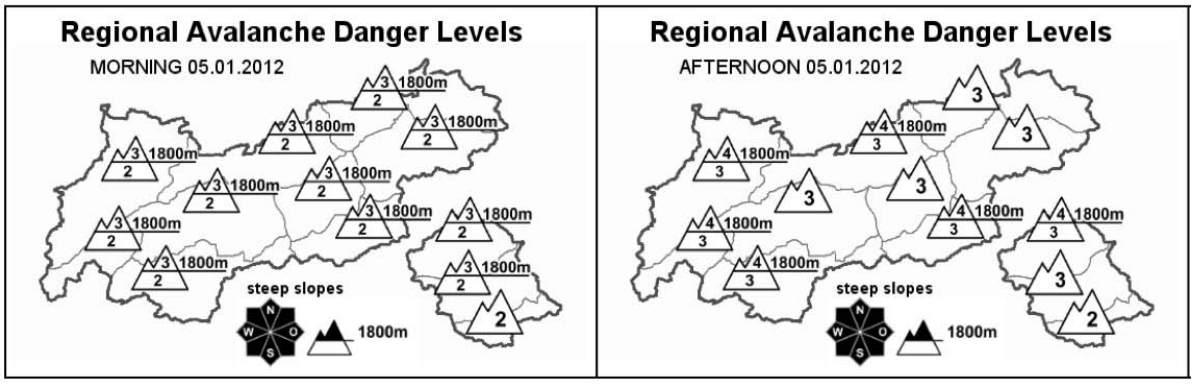


Figure 1-4: Danger map for Tyrol (Lawinenwarndienst Tirol, 2012)

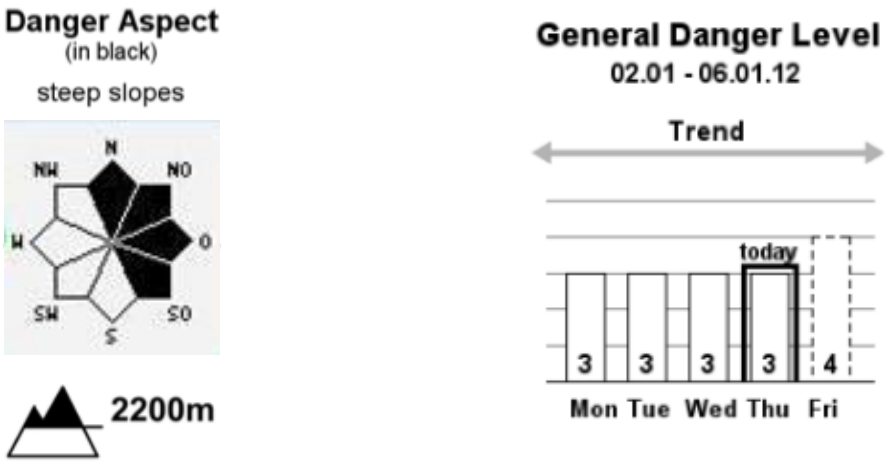


Figure 1-5: Pictographs of the Tyrolean avalanche bulletin (Lawinenwarndienst Tirol, 2012)

1.2.6. General avalanche situation in Austria

The descent of an avalanche is associated with hazard especially when people are involved. Every year people die in the Alps from avalanches. Immediate help in such situations is very important. Therefore carrying along right equipment is essential to perform the rescue operation on

one's own (DSV, 2012b). The chance of survival in an avalanche decreases with every minute. Already after 15 minutes the survival of a completely buried person drops significantly. The most common cause of death is suffocation and inhalation of CO_2, because the buried person only has a small air pocket. Immediate help is essential. The following Figure 1-6 shows the chance of survival for a completely buried person (SFL, 2012d).

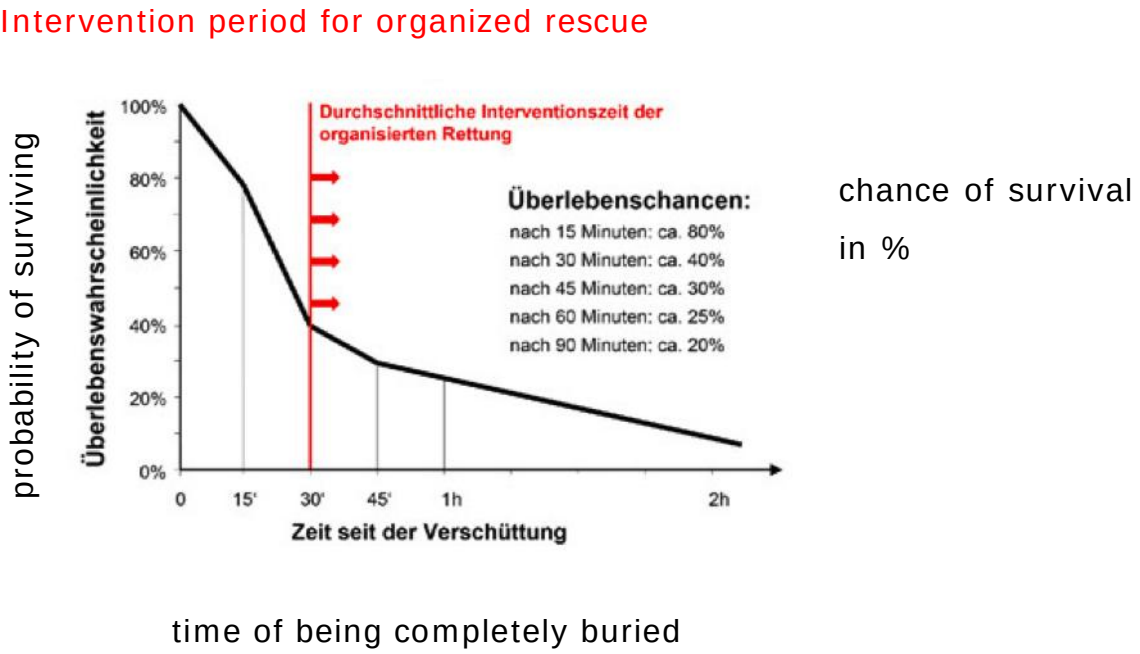


Figure 1-6: Chance of survival for a complete buried person (SFL, 2012d)

According to the accident statistics in alpine regions the annual average number of events of death due to avalanches is about 26. This number of fatalities is based on an average of 20 years (1985/1986 - 2005/2006) in the Austrian Alps. In this last winter season, 2011/2012 between late September 2011 until the 28th of March 2012, 16 people died in avalanches (Österreichisches Kuratorium für alpine Sicherheit, 2012). In the following Table 1-2 numbers of avalanche fatalities over the last few years are shown.

Winter	Avalanche fatalities in Austria
average of 20 years (1985/86 - 2005/06)	26
2006/07	17
2007/08	29
2008/09	32
2009/10	36
2010/11	3
2011/12 (until March 28th)	16

Table 1-2: Avalanche fatalities in the Austrian Alps over the last 26 years (Österreichisches Kuratorium für alpine Sicherheit, 2012)

As mentioned earlier in this section, the chance of survival in an avalanche decreases with every minute. It takes some time until the rescue team will be at the accident scene, therefore the companion rescue is very important. In this case rescue can be done within a short timeframe, where the probability of surviving is high. This requires that every person who is in the Alpine region during the winter carries an avalanche beacon and is capable to operate it. Unfortunately the 'Alpinunfallstatistik' states that about 50% of the avalanche fatalities in the season 2008/09 were caused due to the absence of an avalanche beacon. In the year 2009/10, 12 avalanche fatalities out of 36 had no avalanche safety equipment with them (Österreichisches Kuratorium für alpine Sicherheit, 2012).

1.2.7. The limits of the avalanche bulletin - controversial aspects

Beside all positive aspects of the avalanche bulletin, There is a controversy between experts in the topic. The avalanche bulletin can support decisions of backcountry skiers, but the statements have to be considered as a forecast, which also can turn out to be not exactly. The discussion of upscaling of single samples to a regional statement as well as the downscaling of a regional situation to a single slope is of high importance.

The avalanche bulletin is just one building block to assess danger in alpine regions. It is not legally binding. Experience and the understanding of snow pack metamorphism and avalanche formation on special slopes are also essential to estimate risk. The general danger level should therefore not be overestimated for a single slope (Zenke, 2012).

Danger level of single slopes

The avalanche bulletin can give an overview of the general avalanche situation in a region. Danger levels are clearly defined (see chapter 1.2.3) and are valid in regions, which are bigger than 100 km^2. Some of the experts say, that the avalanche danger level does not apply for certain slopes. To judge a single slope upon a regional danger level would be theoretically not right. The wording of the avalanche bulletin is helpful for the support of the avalanche committees (Lawinenkommissionen). The grade of the danger level is considered to be not relevant for the avalanche committees. The backcountry skier or the mountain guide cannot adapt the danger level because he or she can overview only 0,5 to 5 km^2. Therefore single snow profiles cannot be extrapolated up to a region. (Zenke, 2012)

Other experts share the opinion that in an area of 5 km^2 there are a lot of evidences, who can tell about the snow pack stability in a region. Mountain guides, who are able to organise themselves can create a good

imagination of the regional avalanche situation. In Davos e.g. some mountain guides do estimate danger levels on regional level because of their collaboration.

The question of the sufficiency of up and downscaling in the classification of the danger level is a methodical one. In general an upscaling is an efficient way to give a general statement. The downscaling to a single slope might differ by one danger class up or down. That means it can disagree with the danger level in the avalanche bulletin. This can be because of the insecurity factor of the forecast as well as because of the different situation in single slopes. This leads to a fundamental problem of any kind of forecast, which is related to methodical issues.

Limits of the avalanche bulletin

The avalanche bulletin is very popular and has a good image in Austria. It has a good potential to supply the reader with overview information. In many cases its relevance and its possibility to inform is supervalued. Even experts are sometime hesitating to decide against the avalanche bulletin, although they state reasons.

The avalanche bulletin is made by forecasters, which use snow profiles, observations and their experience to estimate the danger level. As described in chapter 1.2.3 different avalanche probabilities can occur in one danger level. (see Figure 1-3) Not only is the avalanche level important to know, but the general part and description of the avalanche bulletin are also crucial to plan a safe tour.

To judge an avalanche situation with a certain danger level is connected to some methodical problems. First it is to clear if the forecast is right, means that the forecasted situation will occur in the future. Because of upscaling it can be the case that the regional estimation can disagree with the situation of a single slope. Further an often skied slope can have a different danger level because the danger level is true for less used alpine terrain (Wiesinger, 2012b).

The danger level 3 is broadly classified: The snowpack is only weakly to moderately bonded in many steep slopes, therefore triggering is possible even with low additional loads (SLF, 2012b). Further there are cultural differences in the countries. For example France and South Tyrol rate danger levels differently than other alpine countries for years. This leads to problems in comparing danger levels from different countries (Wiesinger, 2012b).

The quality of the forecast is correlated to the quality of the information available. In Switzerland the network of automated weather stations is dens, but there are high mountain regions with almost no information available to the forecaster. Lack of information causes a bias in the forecasts (Wiesinger, 2012b).

Forecast verification

The verification of the avalanche danger level is very difficult and is not done in Austria and either in Switzerland operationally. The result of the avalanche bulletin is a forecast or an assessment meaning a best guess. It can be true but it might not. The security of the avalanche bulletin was estimated with 70 -90%. This varies of course from country to country and from winter season to winter season. (Föhn, 1995) Therefore it is to recommend that other forecasters check prognoses before they are published.

1.3. Human Factors (Pschernig, V.)

Figure 1-7: Backcountry skiers can be overwhelmed by wonderful conditions and the feeling that an accident can happen fade from the spotlight. (Kölnbreinsperre, Maltatal, Verena P.)

People sometimes plan their tours in the backcountry arbitrarily and most of the time they trigger avalanches on their own. For this reason, the human factor must be considered in avalanche research (Munter, 1997).

In avalanche prone terrain human actions become very important. When evaluating avalanche risk we perceive process, estimate, weigh, interlink, repeatedly make decisions, and act subsequently. Various inner and outside influences affect our risk behaviour and have an impact on our decisions. A picture develops in our minds of the actual avalanche risk, which is affected by our own wishes and perceptions. This picture has little to do with reality, which leads to failures in the decision making process (Harvey, Rhyner, & Schweizer, 2012). This applies not only to laymen, but experts are also not invulnerable to making wrong decisions. André Roche, an Alpinist and avalanche researcher said: "Expert, take care, the avalanche does not know that you are an expert" (Harvey, Rhyner, &

Schweizer, 2012). Experts as well as laymen are influenced by this so-called human factor. McCammon found that in recreational accidents involving people with prior avalanche training, about 89% had evidence the danger level was high (Atkins ed, 2000). This poses the question "Is good avalanche education not enough to prevent people from having an avalanche accident"? Obviously it is not. Dale Atkins holds that "human factors are not just a contributor to accidents but are the primary factor in fatal accidents" (Atkins ed., 2000). He is not the only one with this opinion. Many other surveys prove that the way people make their decisions, is greatly influenced by their subjective experience and that they often get into heuristic traps[1]. Most groups of backcountry skiers make appropriate decisions but still get involved in accidents.

Tversky and Kahneman found that people base their decisions often on some rules, or heuristics (Tversky & Kahneman, 1974). Especially in critical and unknown situations people try to lean on systematic biases and rules of thumb which were the focus of much researchs (Cohen, 1993). They concluded that humans are hardly good decision makers, but in everyday life heuristic strategies work very well. For a backcountry skier an example of such a heuristic could be "avoid slopes steeper than 30° when avalanche warning level is high" (McCammon, 2004). But an avalanche represents a unique hazard and therefore some heuristics are inapplicable, and in some cases, deceptive. Here a rule of thumb can lead to a completely wrong perception of the risk and we step into a so-called heuristic trap. McCammon recognized six heuristics which people use in decision making every day: familiarity, consistency, acceptance, the expert halo, social facilitation, and scarcity.

[1] Heuristic refers to experience-based techniques for problem solving, learning, and discovery. Where the exhaustive search is impractical, heuristic methods are used to speed up the process of finding a satisfactory solution. Examples of this method include using a rule of thumb, an educated guess or an intuitive judgment. If these heuristics lead to wrong assumptions, then people tend to fall into a heuristic trap.

Familiarity

"Our experiences in the past let us believe that our behaviour is also appropriate in the current situation" (Adams, 2005). "We do not figure out what is appropriate for every time, we just behave like we did it the last time" (McCammon, 2004). According to McCammon about 69% of avalanche accidents occur on slopes, which are well known by the victim (Adams, 2005).

Consistency

When we decide about something then subsequent decisions are easier to make when we maintain consistency with the decision made before. We do not go through all the relevant information when circumstances change, instead we hold on to our original assumption.

Acceptance

If we want to be accepted by people we respect we tend to take actions which we think will lead to the desired acceptance. This heuristic is more on the spot in gender acceptance.

The expert halo

In many groups there is a leader who is making the decisions for the others. Their leadership is based on different reasons such as knowledge, or simply being older, a better skier, or more decisive. The positive impression of the leader within the group leads them to attribute avalanche skills to people who may not have these skills.

Social facilitation

This means simply that people who are self-confident with their skills are willing to take more risk when other people are around than when others are absent. And in contrast people who are not self-confident with their skills tend to take less risk when others are around. An example would be the moguls under a ski lift. A good skier will ski better knowing that others

are watching but a bad skier will not even try to ski down the moguls when thinking that others are watching.

Scarcity

Scarcity is the tendency to value opportunities in proportion to the possibility of losing them, for instance to a competitor. An example would be that athletes often take high risks to be the first on an untracked powder slope (McCammon, 2004).

Name	Trigger feature	Heuristic
Familiarity	familiar setting or situation	If I've done it before then it's what I should do now.
Authority	credible expert opinion	If an expert believes it then it's what I should believe.
Social proof	behavior of people similar to myself	If people like me are doing it then it's what I should do.
Commitment/ consistency	opportunity to validate prior actions or words	I should remain consistent with my prior opinions and actions
Liking/ conformity	actions by a person or group that I like	If someone I like is doing it then it's what I should do to be accepted.
Scarcity	competition for a limited resource	If something is scarce then I should desire it.

Table 1-3: Summary of heuristic traps (McCammon, 2000)

We use these heuristics unconsciously, even when we make critical decisions, and this is the best precondition for falling into heuristic traps. Surveys show that victims of an avalanche accident often step into one or more of these heuristic traps, but it is important to say that this is not the only reason why an accident occurs. It shows only a correlation between the behaviour of the people involved and the existence of heuristic traps. (McCammon, 2004)

Barry LePatner said "good judgement comes from experience, and experience comes from bad judgement" (Tremper, 2005). Of course this is

true, but the problem is that there are some domains where bad judgements can have devastating consequences. For instance, when we decide a slope is safe and cross it. Then it appears that we trigger an avalanche, get buried, and die. We will not have the chance to learn from this mistake. So the most important thing is to avoid bad decisions in backcountry skiing as much as possible. We should keep this in mind when planning a ski tour.

During the decision-making process humans are the struggling factor and the reason for wrong decisions. Either they have a lack of knowledge of avalanches or they make mistakes because of their humanity. Avalanche skills can be approved relatively easy but our humanity is something constant which affects our entire life.

But what are human factors? There is no specific definition but authors catalogue different attitudes they believe that often influence the decision making of backcountry recreationists. For instance, Tremper (2005) names 11 human factors, Fredston and Fesler (1999) list 14 human factors, while Volken, Schell and Wheeler (2007) list as many as 25 human factors. From an educational perspective these lists are very important because most of the named factors can be demonstrated in accident case studies (McCammon, 2009). All of the human factors are strongly correlated with heuristics. The one would not exist without the other. How important human factors are is shown in the following graphs.

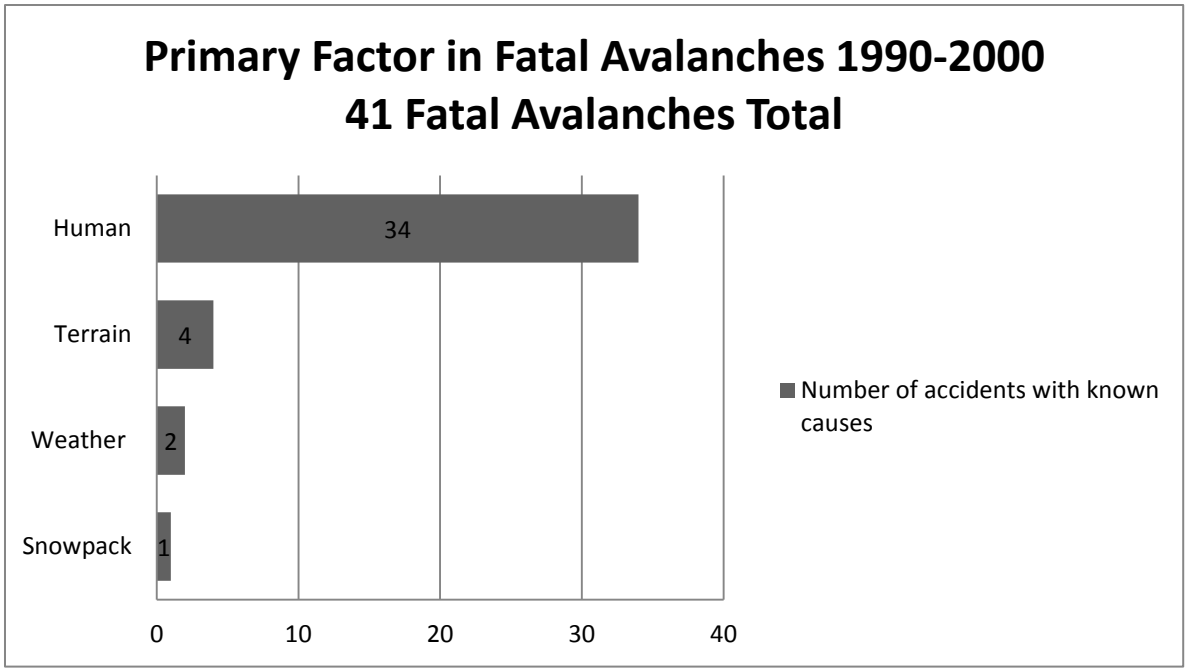


Figure 1-8: Primary factors in avalanche accidents (adapted from Tremper, 2005)

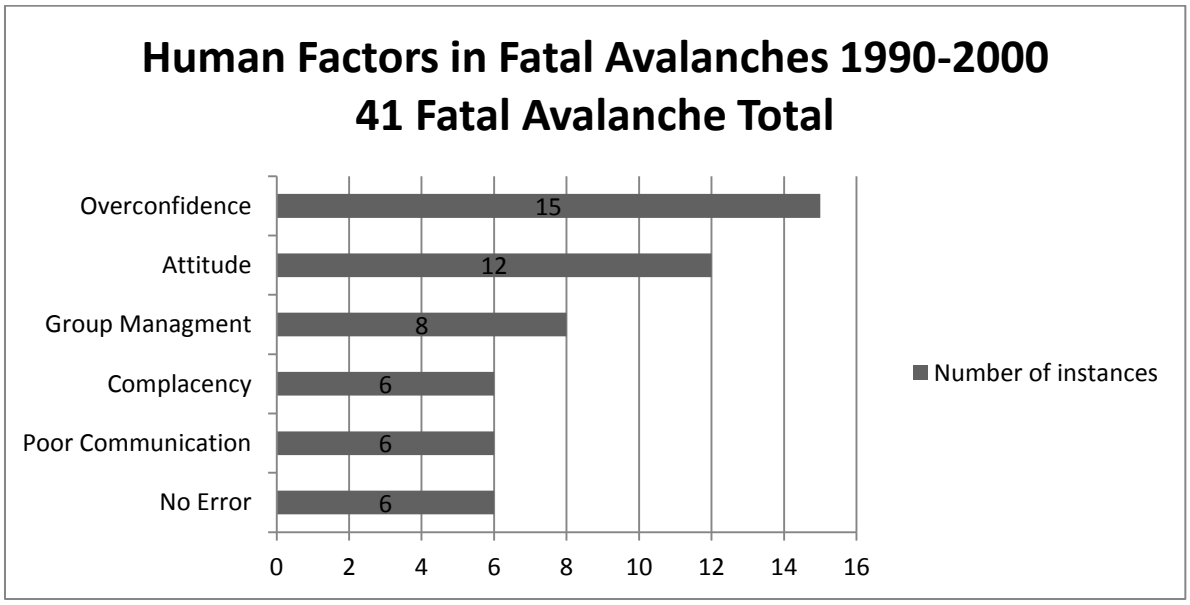


Figure 1-9: Human factors in avalanche accidents (adapted from Tremper, 2005)

The following sections provide a description of human factors or perception traps which are relevant for our survey.

1.3.1. Incorrect assumptions/beliefs

"I believe what I see." This is a common statement everyone knows. But people tend to see what they want to see and then they believe what they see is real. For instance, if we believe the snowpack is stable, then we will

not see signs of instability (Tremper, 2005). When going in avalanche terrain this could be crucial. Albert Einstein said:"It is harder to smash a preconception than to smash an atom". We all know how much truth this sentence contains. If we go in the field with the assumption that it will be safe then it is likely that we are blind to see contraindications (Fredston & Fesler, 1999). We try to downplay critical changes and try to dismiss negative factors (Harvey, Rhyner, & Schweizer, 2012). Therefore it is important to be as objective as possible in the field. Even when we read the avalanche bulletin we should keep in mind that this is often very regional and can also be subjective. Forecasters are also human, and the avalanche bulletin cannot replace the individual's assessment of the specific slope.

1.3.2. The Herding Instinct

Due to the fact that humans are extremely social creatures, we tend to feel safer in a bigger group. When going in avalanche terrain this is an illusion. While we think that the hazard is decreasing because we are in a group, the hazard remains the same. The possibility that an avalanche will be triggered actually increases with a larger group (Fredston & Fesler, 1999). The bigger the group the more people are exposed to risk (Harvey, Rhyner, & Schweizer, 2012) and the more people on the slope the higher the possibility that one triggers an avalanche if the snowpack is not stable. Furthermore a bigger group is sluggish and not able to react on unforeseen circumstances. Tremper (2005) suggests that the optimal group size is two persons. Two persons can trigger an avalanche, but communication is easier and if an accident happens where one is buried then there is another person to dig the other out (Tremper, 2005). In contrary Atkins states that in groups of two or three people, when one is buried there are too few people to make an efficient rescue (Figure 1-10) (Atkins, 2000).

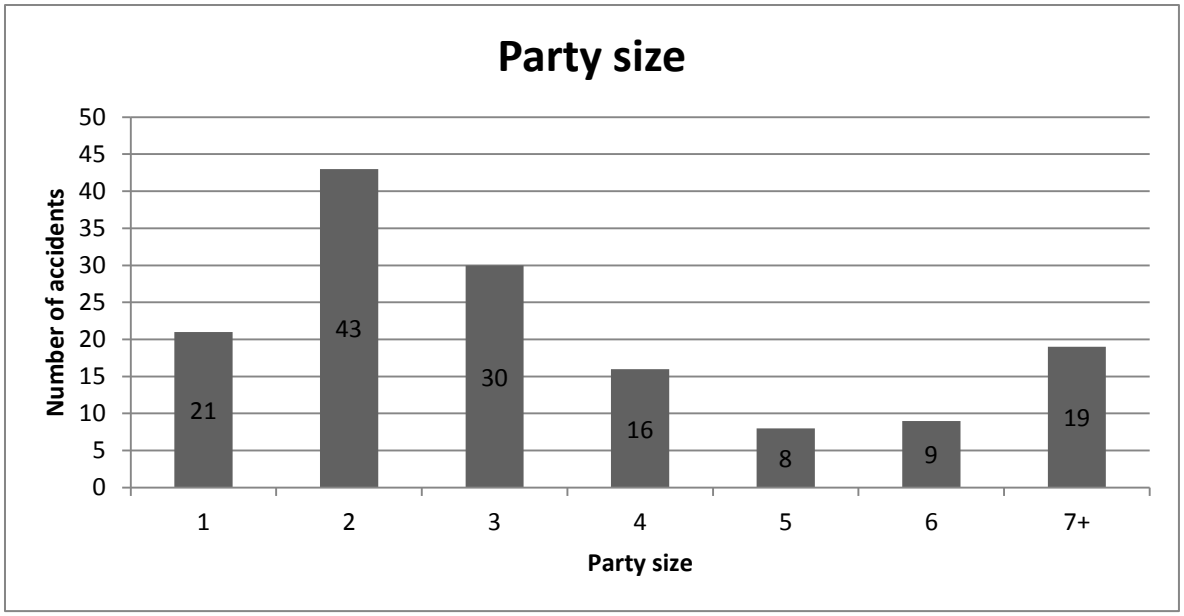


Figure 1-10: Frequency of fatal accidents compared to party size from 1990/91-1999/00 (adapted from Atkins, 2000)

Moreover scientists found out that the bigger the group, the higher the willingness to make riskier decisions. In literature this is called the "Risky-shift-effect" (Munter, 1997).

In every group there is something we call group dynamics. This is the development of behaviours, values, and attitudes which develops solely from the interaction of multiple persons and does not appear at one individual (SDI-Research, 2009). Decisions made in a group under the influence of group dynamics tend to be more risky than decisions made by one person, and this leads to accidents repeatedly (Gebetsberger, 2011).

Different persons can have different influences on the group. For instance, a loud open minded person will have more impact on the group than a cautious person.

To avoid misunderstandings it is important to define the role of every group member and to define who is responsible. It is good to discuss the goals and expectations of each member and to make communication as transparent as possible. This will reduce pressure on the responsible leader. Values of the group and objectives of the day should be defined before starting the tour (Harvey, Rhyner, & Schweizer, 2012).

1.3.3. Habituation

"I have never seen an avalanche in this region". Going backcountry skiing in familiar terrain provides us with a feeling of security. We are prone to be manipulated by the circumstances and behaviour of the past. Every ski tour without descent of an avalanche is basically positive (Harvey, Rhyner, & Schweizer, 2012). But if the slope is prone to avalanches then sooner or later it will happen, no matter if it was safe most of the time (Tremper, 2005). We cannot conclude that no enhanced risk exists just because nothing had happened before. When we have stored a positive experience in our mind, then it is likely that we take more risk the next time (Harvey, Rhyner, & Schweizer, 2012). This applies not only to the individual but also to the group. If a group is in familiar terrain, they tend to make riskier decisions independently of their level of avalanche skills (McCammon, 2004).

Experts are also not invulnerable against habituation. When they do avalanche warning frequently in the same region and on the same slope (Tremper, 2005) they are also at risk to making bad decisions because they believe that the slope is safe because "it was always like this".

1.3.4. Gender

McCammon (2004) as well as Fredston and Fesler (1999) claim testosterone as co-respondent factor for avalanche accidents. Testosterone has a big influence on the ego and young men feel very strong because of it. In the United States, most avalanche victims are male and between 16 and 35. This can be correlated with testosterone level. Only 7 percent of the avalanche victims in the U.S. are female. A survey from Utah for example showed that from 66 fatalities involved in avalanche accidents only four were females, although in Utah only about one third of the backcountry recreationists are female (McCammon, 2004, Fredston & Fesler, 1999). This human factor is strongly connected with the acceptance heuristic as described before. McCammon (2004) found

out that men tend to take more risky actions and behave more competitively and aggressively in the presence of females. In his study concerning heuristics as a contributor to accidents he discovered that mixed-gender groups, with no special training on avalanche skills, take more risk than those who only consist of males. This is due to the acceptance heuristic, where men think that they can gain the respect of women by exposing themselves to a higher risk, and not because women are willing to take more risk.

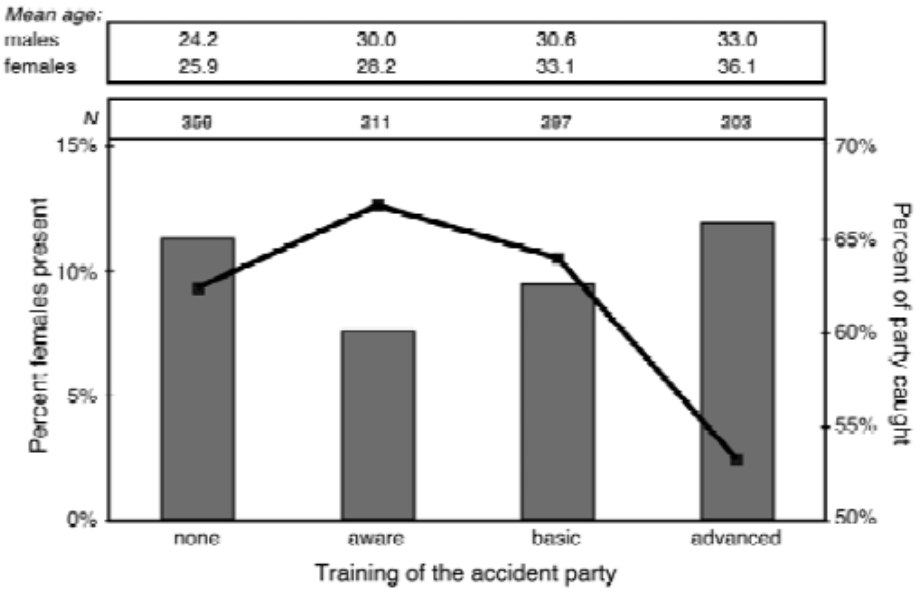


Figure 1-11: Percentage of females present in accident parties (columns) and the average percent of each party caught (line graph). Women appeared to avoid those groups where they had the highest chances of being caught (McCammon, 2004)

Actually it is the other way around. According to McCammon's study females had a lower chance of being involved in an avalanche accident than males most likely because they try to avoid those groups where the chance of being caught is higher (Figure 1-11) (McCammon, 2004).

Unfortunately there was no comparable study found for Austria.

1.3.5. Weather and perception

Figure 1-12: Weather can have a crucial influence on backcountry skiers. (Photo by Hans P.)

The sky is blue, the temperatures are moderate, snow conditions are extremely fine, and there is no wind. It sounds like a wonderful day to go out backcountry skiing or climb a mountain. Under these conditions many people do not care about what occurred the night or the day before. They do not think about the storm which brought a lot of new snow during windy conditions or produced wind slab. People think that avalanches occur during storms, and they are right. But most avalanche accidents occur exactly at conditions described above, the day after the storm (Tremper, 2005). Athletes feel good and want to reach the summit. And this can make them blind to signs of instability. Good weather is influencing our perception of the hazard, most of the times in a negative way.

On the other hand going backcountry skiing during bad weather conditions can also be dangerous (Tremper, 2005). If it is cold, the wind is blowing, and visibility is very bad, then we look forward to sitting on the couch drinking a hot cacao. Fredston and Fesler name this the "horse syndrome". Athletes want to get back to the "barn" as fast as possible and this can lead to hasty and often wrong decisions ending up in an accident (Fredston & Fesler, 1999). When visibility is bad it is hard to assess the terrain and to decide where we groom or ski down. Furthermore if it is windy then we are likely not to hear the "whoom" noise associated with an avalanche (Harvey, Rhyner, & Schweizer, 2012).

1.3.6. Avalanche skills versus travel skills

The investigation of various avalanche accidents pointed out that most of the people involved are very well trained in their sports (Tremper, 2005). They know how to ski and how to use their equipment. They did many ski

tours over several years and became confident because of this. But this makes it likely that they overestimate themselves. Athletes overestimate their avalanche skills. They enjoy the illusion that they are very experienced because of the large number of ski tours they made. Knowing many mountains in different regions and spending a lot of time skiing are not the same as learning how to stay alive in avalanche terrain. Therefore special training, to gain knowledge about avalanche formation, is needed which should be done by every backcountry skier (Tremper, 2005, Fredston & Fesler, 1999).

1.3.7. Communication

Figure 1-13: Communication is very important in a group (Verena P. Region Bonner Hütte)

In my opinion communication is a crucial factor for a successful ski tour, but the bigger the group the more complicated it gets. Groups basically tend to avoid tensions and are anxious for sustaining their friendship. Conflicting opinions are not expressed because nobody wants to propagate negativity (Gebetsberger, 2011). This can have bad consequences because the group can only be as good as the weakest member. Often these people are calm and do not speak up and tell the others their opinion or physical state (Fredston & Fesler, 1999). It is important to be familiar with the skills of the others because with this information the group can adjust the route. All members of the group should be informed about the route for the ascent and the plan of skiing down. Everyone should understand the plan and should be informed about the prevalent avalanche situation and potential hazard (Tremper, 2005). There should be a discussion about

what to do in critical situations. All members should voice their opinion to make an appropriate decision.

1.3.8. Pride

Unfortunately pride is a part of being human. Some people are prouder than others but nobody can completely silence it. When being a recreationist pride can be a terrible companion and influence our decisions in a negative way. Very often it is very hard to admit a mistake or to say that we do not know the answer. This can lead to decisions which may have bad consequences. For instance, crossing a slope when we are uncertain can lead to an accident. Of course, it is not possible to be 100 percent sure that nothing will happen, but taking risks despite doubts and failing to recognize that we made a big mistake can endanger us and other people (Tremper, 2005).

1.3.9. Summit fever

We all know the feeling of reaching a goal at all event. This way of thinking is anchored in present society. It is sad to say that thereby we often forget that desires like this can involve crucial consequences (Gebetsberger, 2011). Particularly on sunny days with good snow conditions people tend to become euphoric and this leads to making wrong decisions and unconsciously taking high risk (Tremper, 2005). In this case it would be helpful to think about alternative objectives when planning a tour (Gebetsberger, 2011).

1.3.10. Pressure

When people are under pressure their perception is influenced in a negative way. When people become stressed many of them are not able to think rationally anymore, and this affects their risk behaviour.

Pressure can arise for different reasons. Either we are under pressure because of expectations or precautions from exterior organisations, or it is

the pressure we impose ourselves. The latter is in most cases bigger than the pressure from others (Harvey, Rhyner, & Schweizer, 2012). We set objectives which we want to reach and cannot acknowledge to ourselves that our expectations were too high.

With thoughts like: "I can make this. I want to provide a good day for my guests. Everything will be alright", we change our risk behaviour. Often the leading person believes that the group members want to reach the summit or that they absolutely want to ski steep slopes. The group gives the leader reinforcement with phrases like: "You are super. You always find a good downhill." The leader wants to live up to this picture mostly unconsciously and thereby changes the risk behaviour. Assumptions and interpretations can pressure us, change our risk behaviour, and prevent us from making the right decisions in respect to the prevalent conditions (Harvey, Rhyner, & Schweizer, 2012).

Knowing about the human factors as contributors to accidents seems to not be enough. Why do people act like they do in dangerous situations? How can we reconstruct their decision making process and behaviour? Dekker (2006) points out two different views on human mistakes and on human beings as a contributor to accidents (Dekker, 2002). The so called "old view" sees the human error as the cause of accidents while the "new view" sees it as "the symptom of deeper trouble" (Dekker, 2000).

The "old view" is based on the "Bad Apple Model". This model states, the system, in which people are working and living is infallible. If an accident happens, then it is just because some people behaved wrongly and caused the failure of the system (Dekker, 2000). These people are often willing to take more risk than others, or in the words of McCammon, they have a "personal disregard for safety" which is seen as a common trait of people (McCammon, 2009). The solution in this case would be to simply eliminate the failing factors, "to throw away the bad apples" (Dekker, 2000) and the system will work well again. But it is not that easy. This model is very intuitive and is built on a sort of folk wisdom, "bad things happen to bad

people" (McCammon, 2009). McCammon points out quite well the difficulties of the model:

- Not only people who are willing to take more risk are involved in accidents, others are also involved.
- The very important link to outer factors influencing these events is missing.
- It offers nearly no possibility for accident reduction because things like avalanche classes or awareness could not change the personality trait (McCammon, 2009).

In contrary the "new view" on human errors connects the behaviour of the person with the surrounding circumstances at that moment when the accident occurs. It does not expect that the system itself is safe, but that the people are responsible for safety (Dekker, 2002). The aim is to find out how people made their evaluation and chose their actions and how it made sense in light of prevalent circumstances (Dekker, 2000).

In the case of backcountry skiing we must ask the questions: Why did people ski down this slope even though it was dangerous? What led them to decide as they had? What were the conditions? And in this case, what could have been done to avoid the accident? The crucial thing in this model is that "human error is not the explanation for failure but instead demands an explanation" (Dekker, 2002). An action to avoid accidents in this case is not to purge an individual person but discover the processes leading to the wrong decision (Dekker, 2000).

These two approaches are not the only possibilities to cope with human factors. Other scientists also try to learn why people act wrongly and how these human factors influence our decisions.

One theory is the "The introspection model". It encourages people to look at their actions from an introspective view and to discover their own shortcomings that led to the accident (McCammon, 2009). For instance it could be helpful to imagine how we would explain our actions to an

experienced person, and how we would justify our decisions in the case of an accident (Harvey, Rhyner, & Schweizer, 2012).

Another theory is "The informed deliberator model" which states that accidents occur because people make conscious decisions although they are missing the sufficient knowledge about the hazard and that there is a lack of information (McCammon, 2009). Especially in avalanche terrain basic knowledge and avalanche skills are of big importance but they do not guarantee that people make the right decisions (Tremper, 2005). We can repeatedly observe that well educated people and even experts can also behave wrongly. Nevertheless this model is used in educational purposes very often (McCammon, 2009).

In contrast, the "bounded deliberator model" points out that human beings are limited in gathering and processing information, and these limitations can cause failures in the decision making process. To minimize errors we need procedures by which we can eliminate subjective factors (Gilovich, Griffin, & Kahneman, 2002). This model has two different approaches. The first one is process orientated and works with the available information. Examples are Munter's 3x3 Method or the Avalanche Triangle. The second approach emphasises the cognitive skills of the group members. An example would be the crew resource method (McCammon, 2009) or the six-colour-thinking (Harvey, Rhyner, & Schweizer, 2012). These decision making aids must be designed carefully and as reliably as possible to avoid introductory errors (McCammon, 2009). Despite these aids, the decision making process remains a very complex, and unfortunately often very subjective task which is crucial for the prevention of avalanche accidents.

1.4. The decision making process (Pschernig, V.)

Making decisions is part of our everyday life. Sometimes we make them very easy sometimes it is harder to come to a solution. We don´t like to make unpleasant decisions and delay them but glad ones we make

incidentally. Sometimes we are aware of the reasons for making the decisions but more often we make decisions unconsciously. When we are backcountry skiing then it is the same but the consequences of our decisions are more concrete and a lot of important decisions cannot be remitted till later. Most of the time accidents happen because people do not make decisions or it is a string of wrong decisions which leads to the accident. It is not the problem that this happens deliberately but it is not perceived that a decision should be made and that people are facing a problem. Therefore it is important to

- realize that we have to make a decision,
- make the decision at the right time that we do not get stucked at a blind end, and at least
- come to a structured and conscious decision (Wassermann & Wicky, 2004).

From the point on when we start to plan a ski tour right up to the downhill, we pass different phases where it is necessary to reassess weather conditions, the terrain and the human factors. When we succeed in making profound decisions and adapt our actions then it is possible to reduce the risk that an avalanche accident happens to a minimum (Harvey, Rhyner, & Schweizer, 2012). But how is it possible to make an accurate decision and what affects the decision-making process?

Most of the time a decision making process is seen as an analytical process. Find out your goal, collect information, compare alternatives and then make your decision. When moving through this framework we will maybe get the best possible solution given the present information. This analytical decision-making process is a good approach for difficult decisions because it breaks it down into more smaller duties and it seems like that it can be used for nearly every problem (McCammon, 2001). Unfortunately it is not that easy. Decision making in avalanche terrain is influences by different factors. It is not enough to know the physical parameters needed that an avalanche can occur. Beside them we also

have to consider the environmental factor and not to forget the human factor. It is important to be aware of all of these three factors and to understand the inter-relationship between them (Adams, 2005). Then it should be possible to make a logical decision. But as Bruce Tremper points out "Human being do not naturally make logical decisions". Very often we are conducted by our emotions (Tremper, 2005) or intuition.

Intuitive decision making is dependent on our knowledge and experience. It means that due to our experiences over years we define patterns and then in the future we unconsciously use them and base our decisions on it (Adams, 2005). That is also the big difference between experts an novice. McCammon and Atkins say that different studies found out that, "experts and novice may have about the same base level of knowledge, but it is the vast accumulation experience that allows experts to use their knowledge faster and in more diverse and beneficial ways" (Atkins & McCammon, 2004). But what do we do, if we are not experienced in avalanche terrain? We have no patterns we can fall back on but nevertheless we will not get out of making a decision. Therefore it is important, that we use both, an analytical and intuitive process for making good decisions. For recognizing the situation at the beginning the use of intuitions is preferred and afterwards we should use an analytical thinking to verify our intuition and make sure that we have not been fallen in a heuristic trap (Adams, 2005). Especially when we have few avalanche skills then we assess the hazard mainly because of the avalanche level written in the avalanche bulletin. The more avalanche skills we have the better we can evaluate the processes which are responsible for the release of an avalanche.

An example therefore is an accident which happened at the Silvretta in Austria near the Heidelbergerhütte. Till Christmas time there was little snow and cold temperatures which enforce the constructive snow metamorphosis. After Christmas the wind was blowing and it was snowing at the same time which extremely increases the avalanche danger. Three

groups left the hut to reach the summit. The first group consists of five young men and the other two groups where led by an alpine guide. They followed the young men for a short period of time but soon decided to reverse because they think that is was too dangerous. The five men proceeded. When they started the downhill, the first one skied down in a gully and triggered a small avalanche on the opposite side of the slope which buried him to the half. The other laughed about him because they thought that this was a very funny picture. Several second later the whole opposite slope break away and buried him completely. In addition a second avalanche was released in the gully next to them which they cannot see and this avalanche buried another 2 persons from one of the guided groups. All three victims died.

The group of the five men were inexperienced but when asking them afterwards one of them state that he is really experiences because he is a backcountry skier since two years and every year he did a short and a longer ski tour. When asking them how they evaluated the actual avalanche situation they told that they listened to the weather forecast two days ago and there was no evidence for a high avalanche danger level. One of the alpine guides explains that the situation was extremely dangerous. They heard "Whoom" noises permanently and observed crack formations (personal correspondence, T.Wiesinger, 2012).

This accident is a good example therefore, what can happen if we make a bad decision in alpine sports and that education plays in important role in making a good decision. The young men have not been able to assess the avalanche situation in the right way due to their lack of avalanche skills. Further they extremely overestimated their own skills which can be ascribed to their default of experience.

1.5. Risk and risk behaviour (Pschernig, V.)

When speaking about risk, it is important to know, what we are speaking about. But this is not easy. Several different definitions exist about the

term "risk". The simplest one is: "Risk is the probability that an event will occur" (Burt, 2001). Often this is used to express the probability, that a chosen action or activity, or as described the chapter before, a made decision, will lead to a loss. With making the right decisions and act in an appropriate way in the backcountry it is possible to reduce the risk that an avalanche will occur. The ability doing it, is dependent on different parameters, like for example educational skills, which will be explained later.

Assuming that we have the ability to act and decide the right way in the backcountry, there is still something we cannot get rid of: the residual risk. The term residual risk is often used in literature but in this context it is better to use the term "acceptable risk", because mountainous and high alpine sports are basically characterized by uncertainty and risk (Munter, 1997). Mostly backcountry skiing is seen as a high-risk sports and this means that decisions and errors of the athlete can lead to fatal consequences like severe injury or even death (Gunn, 1997). Also Munter poses that off-piste skiing is a high-risk sport because the safety standards of our daily routine cannot be applied to the open ski terrain. The backcountry skiers are deliberately accepting the higher risk otherwise they cannot do their sport (Munter, 1997).

However every sporting activity which requires physical effort is associated with a certain injury risk. Gebauer & Alkemeyer think that risk is in fact part of our new culture of sports and of our everyday lives (Gebauer & Alkemeyer, 2004).

People are susceptible to risk every day. If we are in road traffic, doing sports, or simply going downstairs, we run into the danger of injuring ourselves. Living without any risks is impossible.

Fortunately we have some psychological mechanisms for self-protection. An important one is cognitive dissonance[2] which helps us to avoid inner contradictions. To endure our life with all its risks it is necessary to underestimate them, otherwise we will be constantly paranoid. Another point is that people tend to be very optimistic when it comes to evaluating their personal capabilities. They are likely to overestimate themselves because then it seems that we can control and therefore alter life for the better. When investigating avalanche accidents this pattern can be found repeatedly.

An example would be an accident that happened in the Unterengardin at the Piz Foraz in Switzerland. Three men went up a slope steeper than 30° in late April. At the col two of them decided to turn back while the leader of the group proceeded. When traversing a slope of about 38° he recognized shooting cracks in front of his skis and a few steps further he triggered a dry slab avalanche which caught but did not bury him. When the police asked him he said: "I saw these shooting cracks and interpreted them as a sign for stabilisation of the snowpack." This accident is a combination of different factors. The leader, who proceeded on the one hand underestimate the risk of an avalanche, and on the other hand overestimate his own skills, which led to misinterpret the shooting cracks (personal correspondence, T.Wiesinger, 2012).

The theory of psychological stress is also part of the concept of cognitive dissonance. It implies that an individual can try to reduce their fear by not appreciating the risk, or rejecting it (Keller-Lengen, Keller, & Ledergerber, 1998). Along with this comes the question of which risks do people accept or seek, and which they do not. The border between acceptable and unacceptable risk is often called the "stupid line" (see Figure 1-14). Where we draw our individual stupid line is according to Tremper dependent on

[2] Cognitive dissonance (Kognitive Dissonanz) is the term used in modern psychology to describe the state of holding two or more conflicting cognitions (e.g., ideas, beliefs, values, emotional reactions) simultaneously. The theory of cognitive dissonance in social psychology proposes that people have a motivational drive to reduce dissonance by altering existing cognitions, adding new ones to create a consistent belief system, or alternatively by reducing the importance of any one of the dissonant elements.

"our penchant of risk, our knowledge of the hazard, and our perceptions of the hazard."

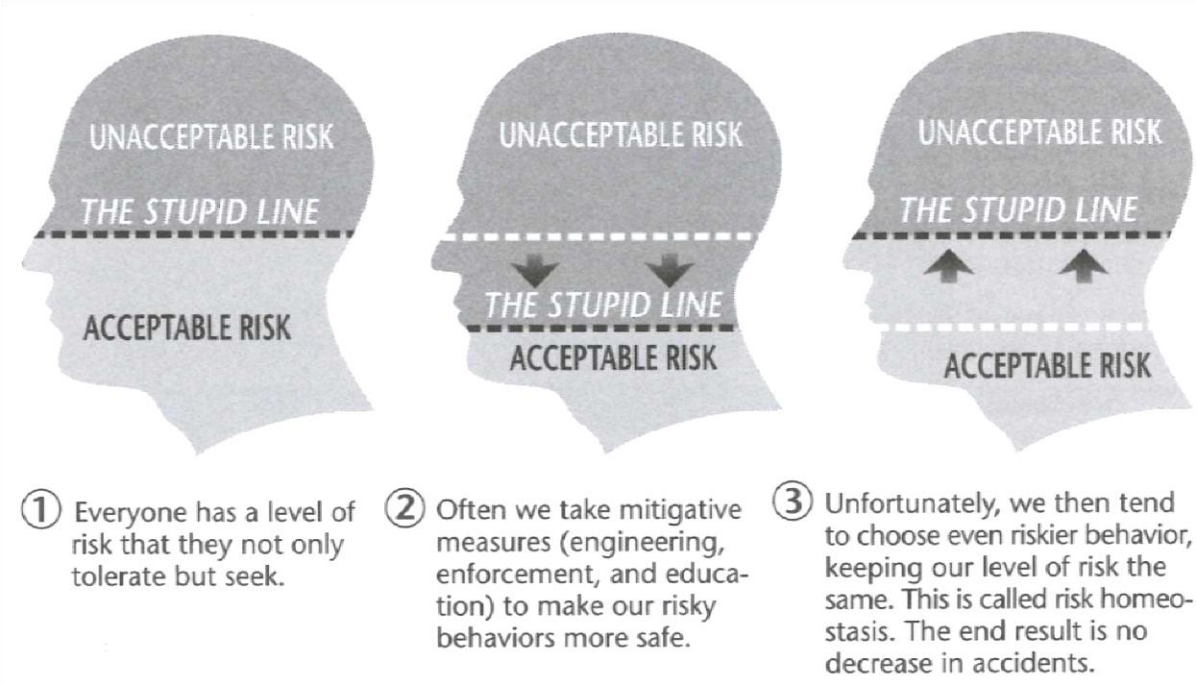


Figure 1-14: Stupid line (Tremper, 2005)

During our lifetime the position of the stupid line is shifting very often. We act differently as children or teenager then as adults. Moreover, outer circumstances change frequently and influence our risk behaviour. Traffic studies have shown, that since industry installed airbag systems and seatbelts to make car driving safer, people began to drive even faster than before. They think that now the car is safer and in case of an accident less will happen. This can be deceptive because by driving faster the probability that an accident occurs is higher. This behaviour can be observed in many other life situations like in sports, or finances. This affinity is called "risk homeostasis". This theory states that in any action, people accept a specific level of subjectively estimated risk to their safety, health, and other things they value, in substitution to the benefit they will get from their action (Bruns, 1996).

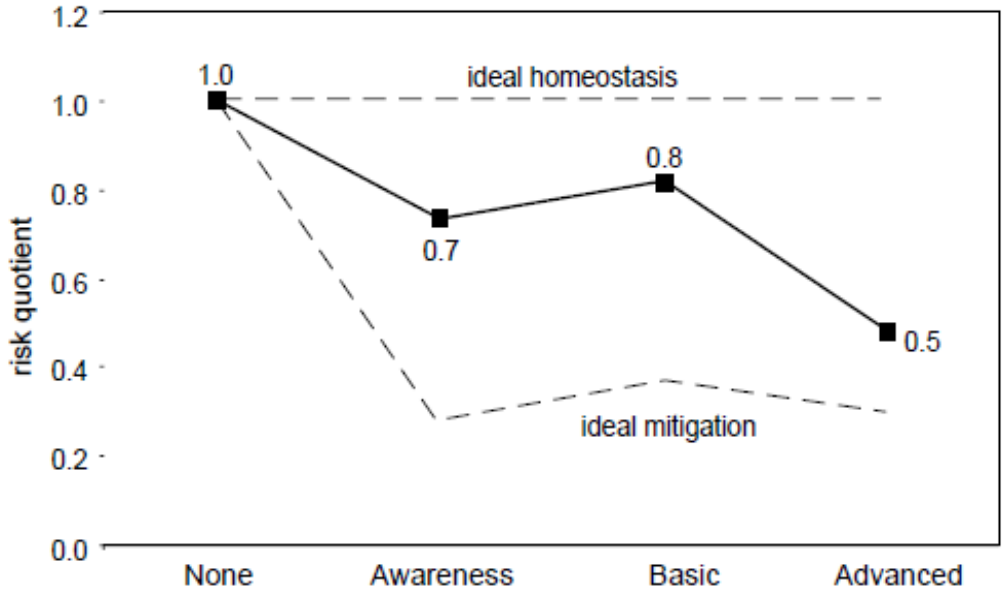


Figure 1-15: Risk quotients for avalanche victims by level of training (McCammon, 2000)

This concept explains exactly what was described above. Ian McCammon expresses it like this:"As people learn how to mitigate a hazard, they compensate by taking more risk while keeping their overall level of risk the same." He did a survey about the model of risk homeostasis in the field of backcountry skiing and found out that, if athletes have done an avalanche course, they are afterwards willing to choose riskier slopes because they think that this education decreases their chance to have an avalanche accident. When considering only this model, it seems that education has no influence on risk behaviour of athletes and that the so-called risk quotient[3] would follow a poorly homeostatic model (Figure 1-15). If education would be most effective then the risk quotient will follow an ideal mitigation model. The truth is somewhere in between. When we examine the line in the middle, we see that people with basic avalanche knowledge take more risk than people with awareness, but less risk than people with no education about avalanches. The importance of avalanche education is shown by the results for athletes with advanced avalanche skills. They take less risk than all the others (McCammon,

[3] risk quotient: By combining hazard and mitigation parameters with the definition of risk from Tobin and Montz (1997) McCammon come up with a relative measure (or risk quotient RQ) of the risk taken by each group at the time of the accident (McCammon, 2000).

2000). The graph below shows that people with no education tend to overlook obvious indicators of avalanche hazard. Furthermore they are not able or not willing to take mitigation measures except the point that they are not going out alone as shown in Figure 1-17(McCammon, 2001).

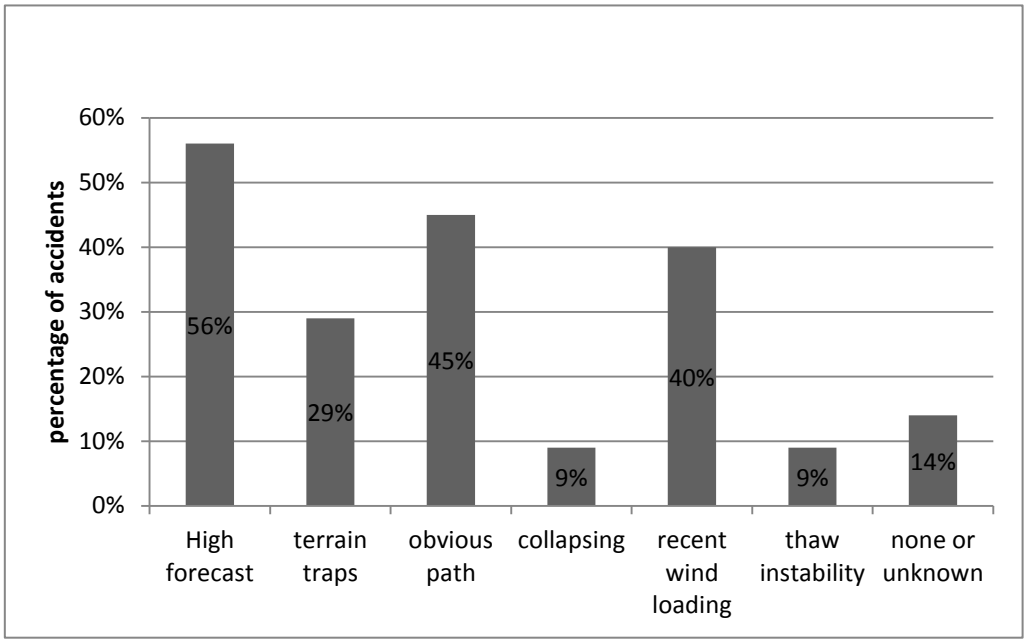


Figure 1-16: Reported frequency of hazard indicators for accidents involving recreationists with no avalanche training (adapted from McCammon, 2001)

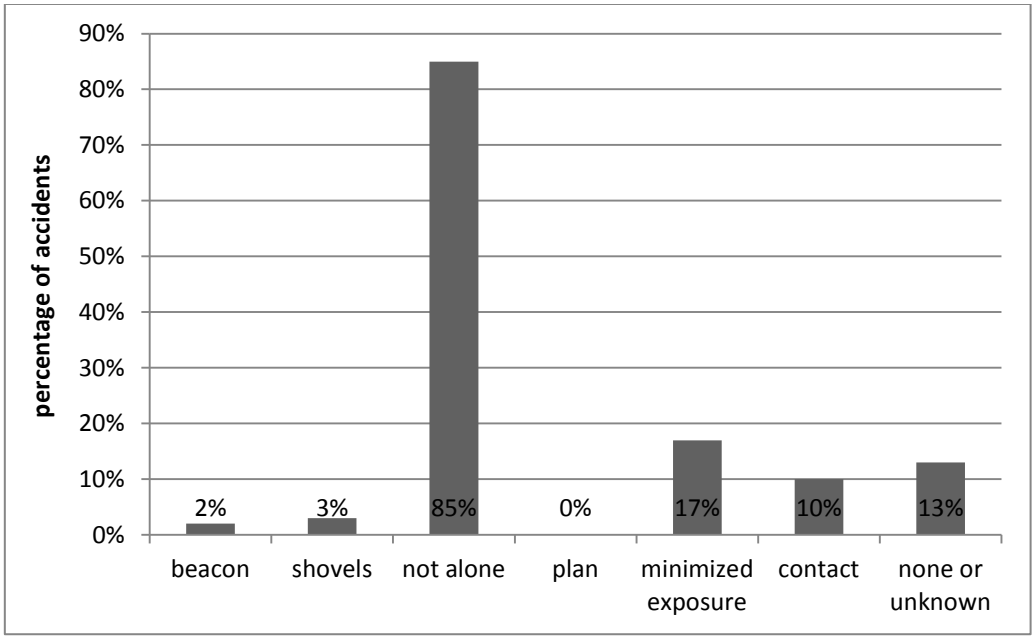


Figure 1-17: Reported frequency of mitigation measures for accidents involving recreationists with no avalanche training (adapted from McCammon, 2001)

Before people can act in a proper way in dangerous situations they must be able to realize the risk. But the individual perception of risk is intuitive. There are some facts which have an influence on how people value a dangerous situation. For example if the risk is mentally available, meaning someone has already experienced an avalanche, then it is more likely that the risk will be overestimated. On the other hand, if for the last ten years no avalanche had occurred then people tend to underestimate the risk that it can happen again. Also the type of risk is crucial for the assessment of the risk and its valuation. If the probability of occurrence is very small but the expectation of loss is high then people are likely to overestimate the risk. The other way around, if the probability of occurrence is very high and the expectation of loss is small then people tend to underestimate the risk (Keller-Lengen, Keller, & Ledergerber, 1998).

With the concept of "Sensation Seeking" it is possible to explain the willingness to take higher or lower risks. Sensation Seeking is the search for various, new, complex, and intense sensations and experiences and the willingness to take high physical, social, and financial risks to reach them. If the Sensation Seeking is high then high-risk sports are evaluated as less risky and the possibility to harm oneself is embraced as very low. So people with a high Sensation Seeking will take more risk than those with less. Scientists pose that it is a native personality trait to search for thrill or to avoid it. But this trait can be enhanced or muted by learning and making determining experiences (Onnen, 2008). This emphasizes the importance of avalanche education mentioned above. Steiger states that the amount of Sensation Seekers is above average among backcountry skiers but this is not yet proven by scientific studies (Onnen, 2008).

2. Methodological Framework (Pschernig, V.)

For answering the questions of this thesis we make use of 3 different practices. The main part is represented by the questionnaire which was elaborated together with the Market Research Institute of the University of Natural Resources and Life Sciences, and therewith the field survey was performed. Afterwards the collected data was analysed with SPSS, a statistical program. In preparation, it was necessary to approach the topic by doing extensive literature research and an investigation of the state of the art concerning studies about alpine skiing and the socio-economic factors often causing accidents.

2.1. Data collection and empirical analysis

As mentioned above, a questionnaire was used to collect the needed data by a field study. This kind of data collection is a good instrument if:

- it is possible to ask various people standardised questions to get the needed information.
- it is impossible to include the entire target group, in this case, all backcountry skiers. Therefore the aim is to reach a meaningful sample and to generalize the inquiry in the way to get perceptions for the sum of the ski tours.
- it is difficult or impossible to get and generalize the data with another method, for instance through observation or an experiment.

Two main characteristics of a well constructed survey are the application of a sample and the raising of standardized information. With a carefully selected sample it is possible to gain knowledge about the entirely investigated group and to assess the extent of mistakes in the data (Rodeghier, 1997).

2.1.1. Structure of the questionnaire and formulating questions

When creating a questionnaire it is important to deliberately define the information one wants to get from the respondent. Hence it is an advantage to divide the questions into different groups. For this study the questions correspond to the following groups:

- evaluation of the avalanche bulletin,
- risk behaviour of the interviewed person,
- manner and experience of the interviewed person, and
- demographic information.

By defining these different parts, the threat of collecting data arbitrary and without an exact vision of what is desired, is avoided.

When formulating the questions it is important to construct them as simple as possible, and moreover they should be as interesting as possible and packed in an appealing layout to arouse the interest and attention of the respondent. When going into detail about phrasing the questions some other points had to receive attention.

- If it was possible that an expression or a phrase is unknown to some respondent or they could misunderstand it, then a definition or explanation was given.
- Simple language was used, less common words and phrases, and spoken language was avoided as well.
- Double negations, long and complicated nested sets of formulations were avoided.
- It was ensured that each question is related to one topic to not confuse the respondents.

Furthermore the interviewed persons have the opportunity to tick "Other" and write down their answer. This is because not all the possible answers which can be selected contain the opinion of each respondent. Without

this, it would not be possible to divide between those who are not able to choose an answer and those who deny giving an answer.

The most important point to regard is not to provide suggestive questions. For instance, "Experts say that the avalanche bulletin is understandably formulated. Do you agree?" With this kind of question the answer of the respondents is urged into a particular direction which may not coincide with their real opinion. If this happens the survey is not convincing and should be repeated (Rodeghier, 1997). It is also crucial to be aware of not insulting people by the formulation of the questions. For instance it may be delicate to ask people if they are going on a ski tour without equipment. They may be ashamed to answer "No". To avoid those situations a well formulated question, with different answers to select, and the circumstance that the people fill in the questionnaire on their own, is helpful.

Concerning personal data, for instance age, some sensitivity is required because some people feel disappointed when they are asked for their age. Therefore the decision was made to request this data with an interval scale because for most people it is easier assigning a category than expose their precise age. This is a good method if it is not necessary to know the exact age of the interviewed person.

2.2. Pretest

It is of greatest importance when feeling that the questions are well-elaborated to pretest them by giving it to friends, colleagues, and at best to the potential target audience to help identify possible weak points of the survey. During the pretest phase 30 questionnaires were filled and evaluated.

Here we found that, for instance, it is better to do the interview without an official vest. The original idea was to give the survey an official character by wearing vests from the university, but when walking up to the people

they immediately showed a defensive attitude. This may be because people nowadays are sometimes overwhelmed by promotion workers and are addressed in everyday life, which is annoying for them and therefore they have a negative attitude when someone is approaching in an unexpected situation. When asking them to fill out the questionnaire without the vest people react very open-minded and friendly. So the conclusion was to do the survey without official vests and just explain to people that the work is done in the context of a master thesis.

Another striking point was that the answer option "Others" was chosen too often which made it necessary to consider additional opportunities to answer. Furthermore, some phrasing mistakes were corrected according to the feedback of the pretest phase.

2.3. Sample and questioning technique

The collection of the data in the current survey was done by a field study. The respondents were interviewed immediately after a ski tour in the field, either at the summit, or afterwards at the parking place, or in the hut on the foot of the mountain. This increases the probability for getting correct answers because interviewed persons tend to give incorrect answers concerning events from years ago (Rodeghier, 1997). After introducing to the people the issue of the survey, the questionnaires were distributed and the respondents filled them independently. The interviewers are at their disposal for questions. This way it is possible to interview several people at the same time. Especially in a survey like this which is done in the backcountry, it is important to ask all the people you meet because often only a few athletes are available.

A field survey also brings along some hurdles. One important point was the weather. As was expected at good weather and snow conditions and at a low avalanche warning level a great number of people were out skiing. In these good conditions, people were very open minded and helpful. That is why on sunny days it was possible to get many completed

questionnaires, especially when not only one but multiple people were in place to conduct interviews. On the other hand, at bad weather conditions only a few people are in the backcountry and those who venture out into the snow feel cold and mostly they were unwilling to fill a questionnaire. Most of the time people are unsatisfied and frustrated and this frame of mind is not a good precondition to ask people for support. This means one has to keep in mind that the long-term weather conditions are of big importance when conducting a backcountry field study. If there is bad weather the entire winter season then the survey can be drawn out over several seasons, and this must be considered in the planning phase. If the goal is to reach the needed number of questionnaires in one season, then it is necessary to have enough interviewers going out in the field, otherwise the survey will fail.

Another point, which implicitly correlates with the weather, is the choice of the equipment needed to make it as comfortable as possible for the people to fill in the questionnaire. When asking people directly at the summit then it is important that you give them a pad so that writing is easier for them. Furthermore, it is better to use a pencil than a ball pen because a ball pen can streak when it gets wet, which can easily happen when working out in the snow.

An advantage of the field study is that we hit exactly the sample we need. By going in the backcountry and asking people on the tour it is impossible to ask somebody who is not part of the target audience, which are namely the backcountry skiers. We have consulted backcountry skiers of all ages all over Austria. Due to the fact that we asked all people passing by there was no focus on a special age, gender, experience level, or hometown. As a result we could find out moderately well which kinds of people are mainly doing this sport, compared to online study where the questionnaire is sent to many people without knowing their preferred sport, resulting in responses from people who are not into the topic. For that reason a field

study was the best method to get information about the backcountry skiers.

2.4. Evaluation Methods

The evaluation of the collected data was done with SPSS. Because it was necessary for the analysis, a data key was determined to enter the data in the statistical program. The first step was a frequency-based analysis of the single questions. In the second step different single questions were combined to answer the two main research questions.

2.4.1. Frequencies

At the beginning we tried to get an overview on our data. We did an evaluation of every single question with the frequency procedure. This is useful to describe many types of variables (Rodeghier, 1997).

2.4.2. Contingency table

Contingency tables show the joined distribution of two or more categoric variables. In a table with two variables each row represents the category of one variable while the category of the second variable is shown a column. From the fields which arise from the intersection of a row and a column, we can read out the frequencies for both categories. Furthermore it was arbitrated if there is a dependency of the two variables by a Chi Square test (Rodeghier, 1997).

2.4.3. Loglinear analysis

If we had a contingency table with more variables with complex relationships then a loglinear analysis was made to illustrate them. For instance to find out the relationship between age, gender, home country, and the number of ski tours per year this method is used because the focus is on the interaction between the variables. In this study we are

working predominantly with dependent variables and therefore the Logit loglinear analysis was used (Rodeghier, 1997)

Furthermore all datasets without an answer for one of the combined questions were neglected. Subsequently the number of respondents does not correlate with the full number of the sample.

3. Result of the empirical investigation (Mayer, M.)

The previous chapters illustrate the current state of research concerning the accident situation in backcountry skiing and the primary factors leading to accidents. It was observed that the number of avalanche fatalities in the last 25 years remains more or less constant although the number of athletes had increased.

Reasons therefore are variously. Technologies of avalanche safety equipment enhanced and therefore makes it easier to find buried people fast enough that their chance to survive increase.

With the avalanche bulletin athletes can get basic information provided by experts about the current avalanche situation in different regions as describes in chapter 1.2. The assumption is that people preliminary know about it, read it and further really understand the information and implement it in reality.

Another reason could be the implementation of the "strategic avalanche awareness". This concept suggests that humans are able to avoid avalanche accidents by exploring the snow pack. The more experienced we are about the conditions of avalanche prone slopes, the more complex and intrinsic the forecast can be about the stability of the slope. Strategic avalanche awareness is based on a small amount of easily accessible information with the aim to reduce the risk of provoking an avalanche (Onnen, 2008). But people tend to act intuitively and rely on their good feeling. Therefore the main cause of avalanche accidents is one or more of the human factors described in chapter 1.3. They affect people's perception and their risk behaviour mostly in a negative way, which leads to wrong decisions and possibly fatal accidents.

With this study the people's handling with the avalanche bulletin and their risk behaviour according to the human factors are investigated. The

results presented in the following chapters are divided in three parts. First part consists of the results of each single question (see 3.1). In Part I (see 3.2) the questions are evaluated in accordance to the effectiveness of the avalanche bulletin while in Part II (see 3.3) the questions are interpreted in the way to illustrate the risk behaviour of the backcountry skiers.

3.1. Results of the questionnaire by single questions

The interview started in November 2011 and was finished in April 2012 in the Austrian Alps. During this period 387 people in different parts of Austria were interviewed. The next few graphs will present the demographic information overview about the interviewed persons as well as the results from every single question from the questionnaire.

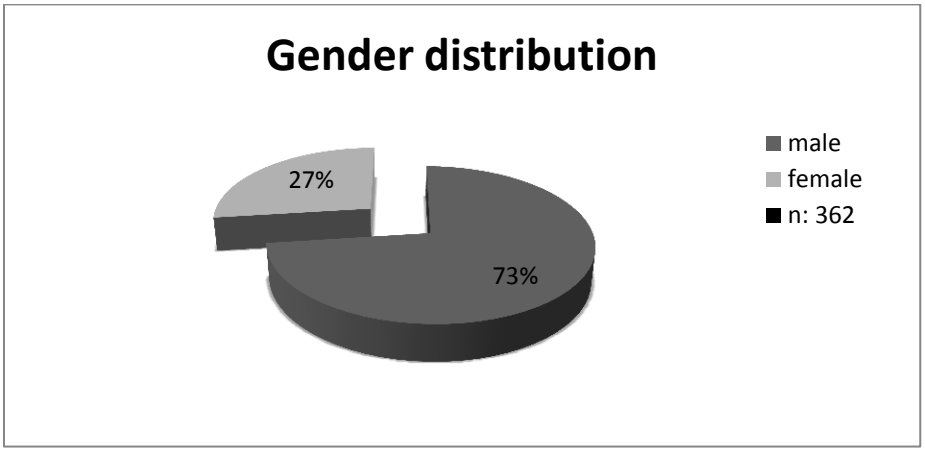


Figure 3-1: Gender distribution of interviewed persons (own illustration)

A share of 27% of all interviewed persons was women, and 73% from a total of 387 interviewed persons were men. (see Figure 3-1)

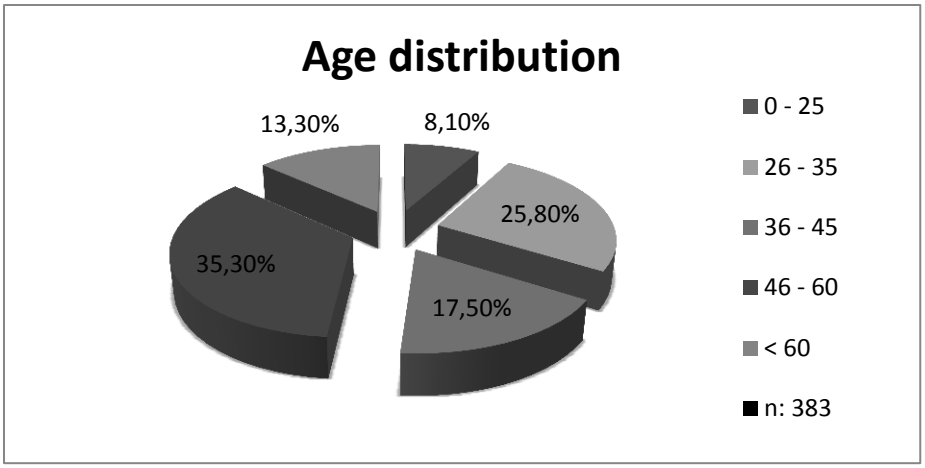


Figure 3-2: Age distribution of interviewed persons (own illustration)

The largest age group is between an age of 46 and 60 with 35% of all interviewed persons. The second largest age group is between an age of 26 and 35 (25%). The smallest group is under an age of 25 years with 8%. The remaining two groups have 17% for the age group between 36 - 45 and 13% for the group over an age of 60. (see Figure 3-2)

Figure 3-3 shows a classification of the origins of the interviewed persons.

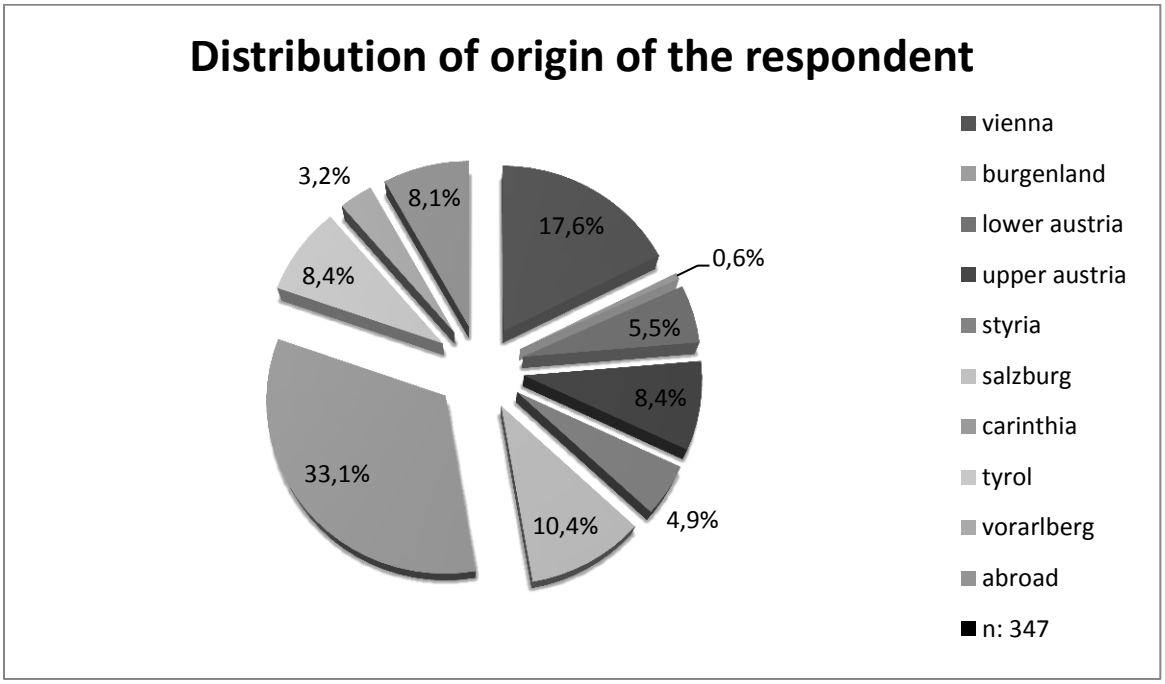


Figure 3-3: Distribution of origin of respondent (own illustration)

The majority of people surveyed are from Carinthia (33,1%) and about 17% are from Vienna. A share of 10% is from Salzburg and the remaining

total is equally distributed. Foreign backcountry skiers were also part of the survey. A total of 28 people from different countries were interviewed. (see Figure 3-3)

3.1.1. Question 1: How long have you been an active backcountry skier?

The results from question 1, is in relation to the avalanche bulletin and the risk behaviour of the backcountry skier. The question was how long the interviewed person is doing backcountry skiing actively? (see Figure 3-4)

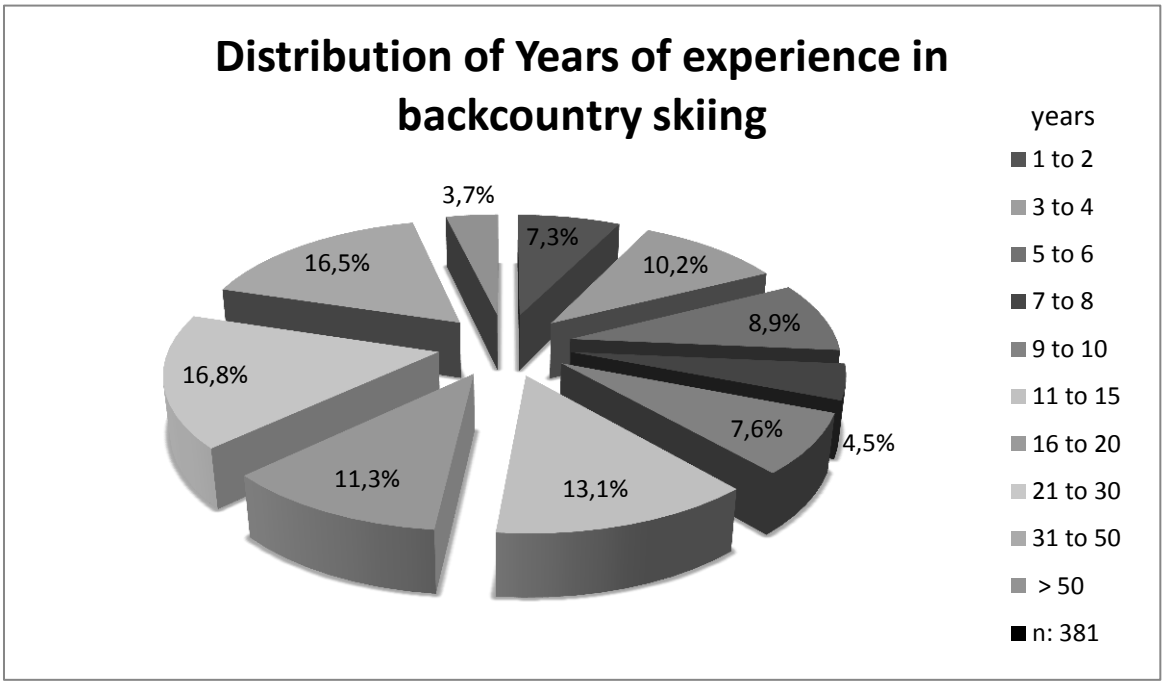


Figure 3-4: Distribution of years of experience in backcountry skiing (own illustration)

The most interviewed persons (16,8 %) are since 21 to 50 years in the backcountry en route. Even 3,7 % from the respondent persons are out in the backcountry since over 50 years. Another bigger part is about 24 %. These are people that are doing ski tours since 11 to 20 years.

3.1.2. Question2: How many ski tours do you make per year on average?

The question number 2 identifies the amount of passed ski tours per year.

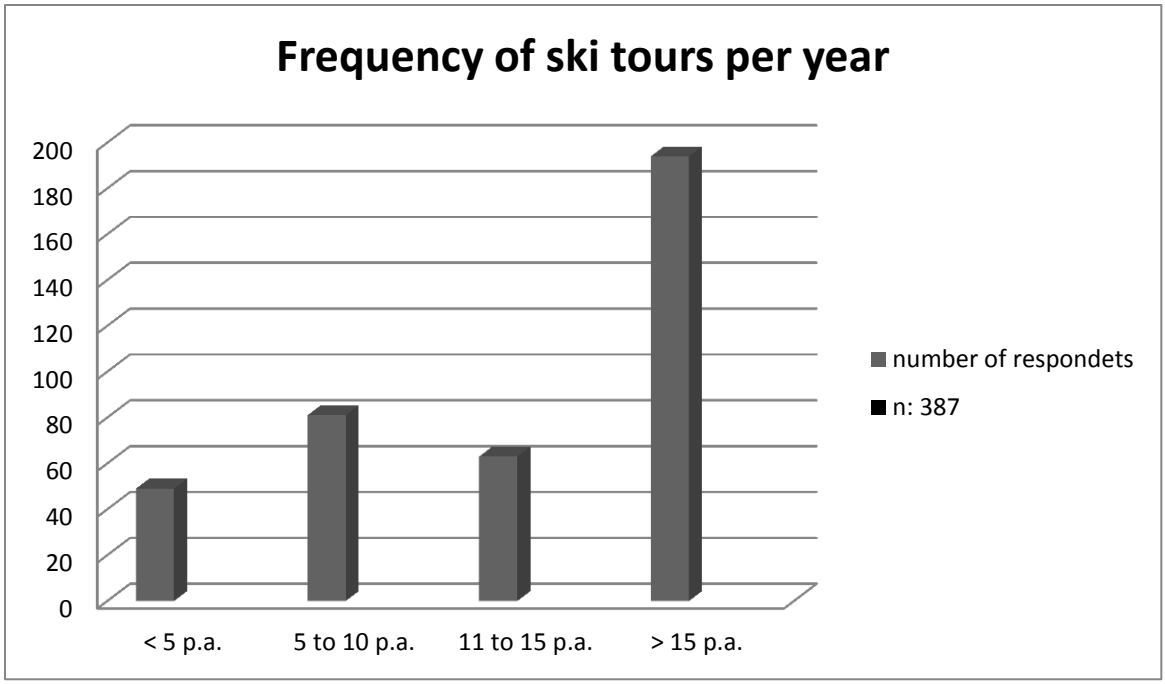


Figure 3-5: Frequency of ski tours per year (own illustration)

Big shares of the interviewed persons (50,1 %) are going more than 15 ski tours per year. A share of 20 % of the respondents was out in the backcountry 5 to 10 times. Furthermore a share of 16% are going 11 to 15 ski tours per year and just about 12% of all respondents are less than 5 times out in the backcountry. (see Figure 3-5)

3.1.3. Question 3: When you are with a group, do you...

Question number 3 was, if people take the lead in a group or if they hand over the responsibility

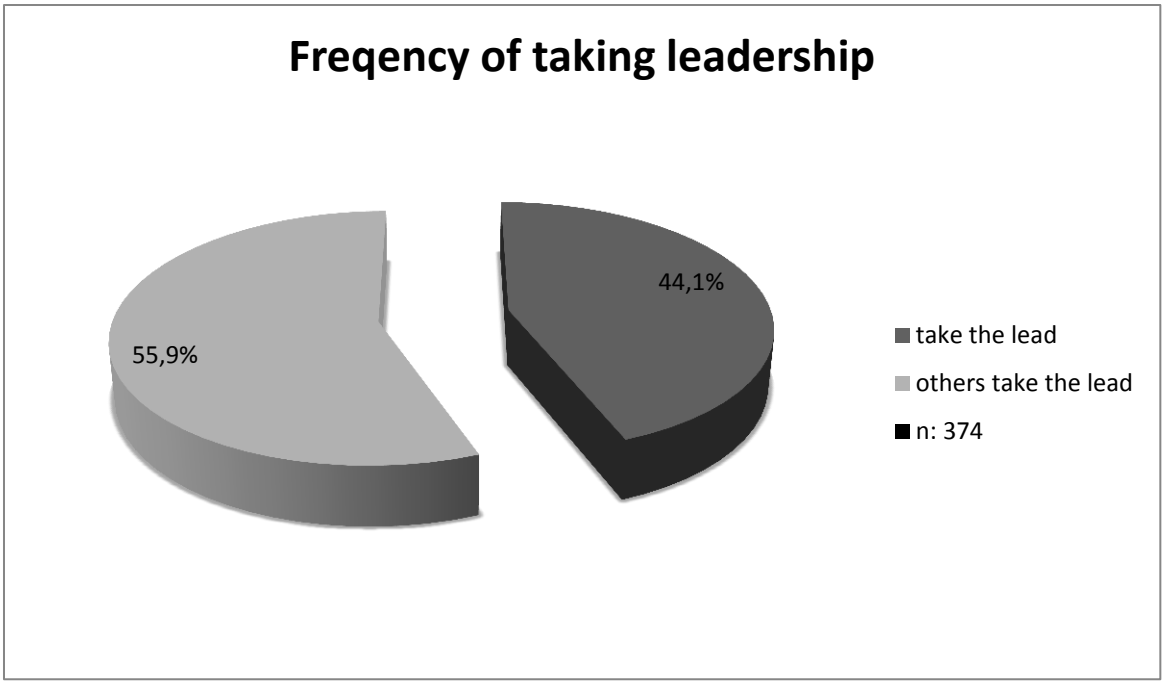


Figure 3-6: Frequency of taking leadership (own illustration)

Summarizing it can be stated that a share about 44% takes the lead when starting or planning a ski tour in the backcountry. A share of 56% of all respondents gives the lead to someone else in the group. (see Figure 3-6).

3.1.4. Question 4: Which of the following statements are most accurate?

This question surveys if the interviewed persons are likely to go the same tour often, making an effort to do many different ski tours, or even venture unknown terrain.

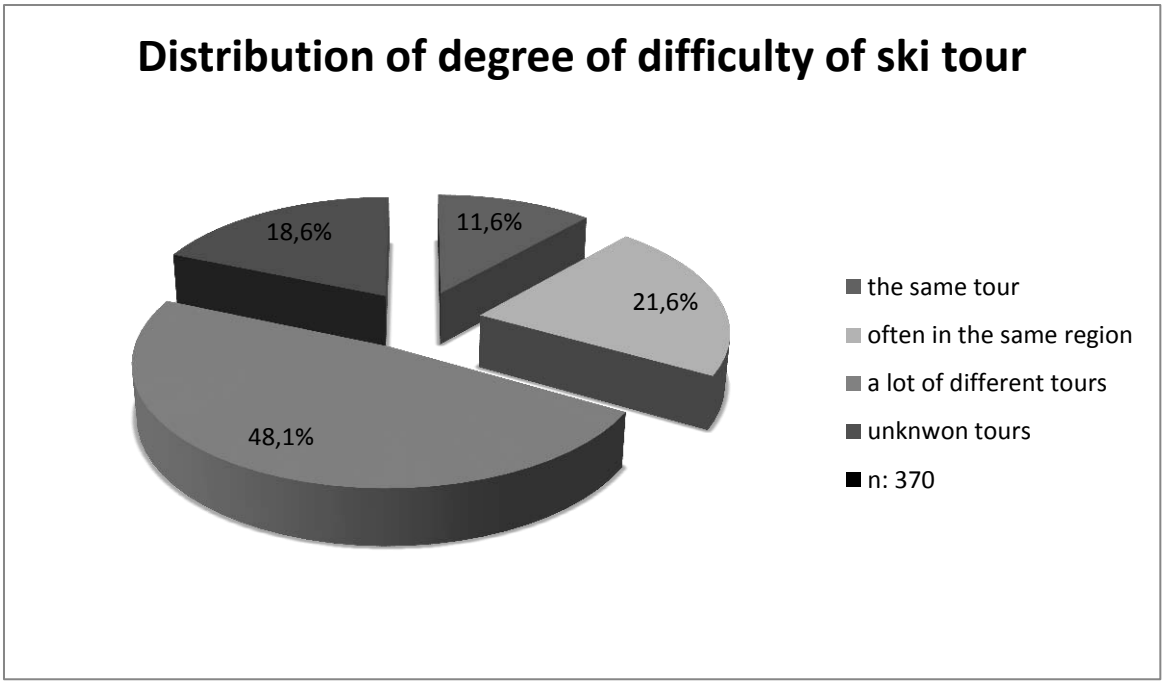


Figure 3-7: Distribution of degree of difficulty of ski tour (own illustration)

A share of 48,1% of the interviewed persons goes on many different tours. 21,6% often go ski tours in the same region. Just 18,6% prefer unknown tours, which they have not done before. Only 11,6% often go on the same tour. (see Figure 3-7)

3.1.5. Question 5: Which of the following reasons best explains your taking part in the tour today?

Question number 5 was a multiple answer question and asked, on the basis of which criteria have you chosen this tour? The following graph shows the distribution of the different answer possibilities and the follows with the numbers of people who marked which answer.

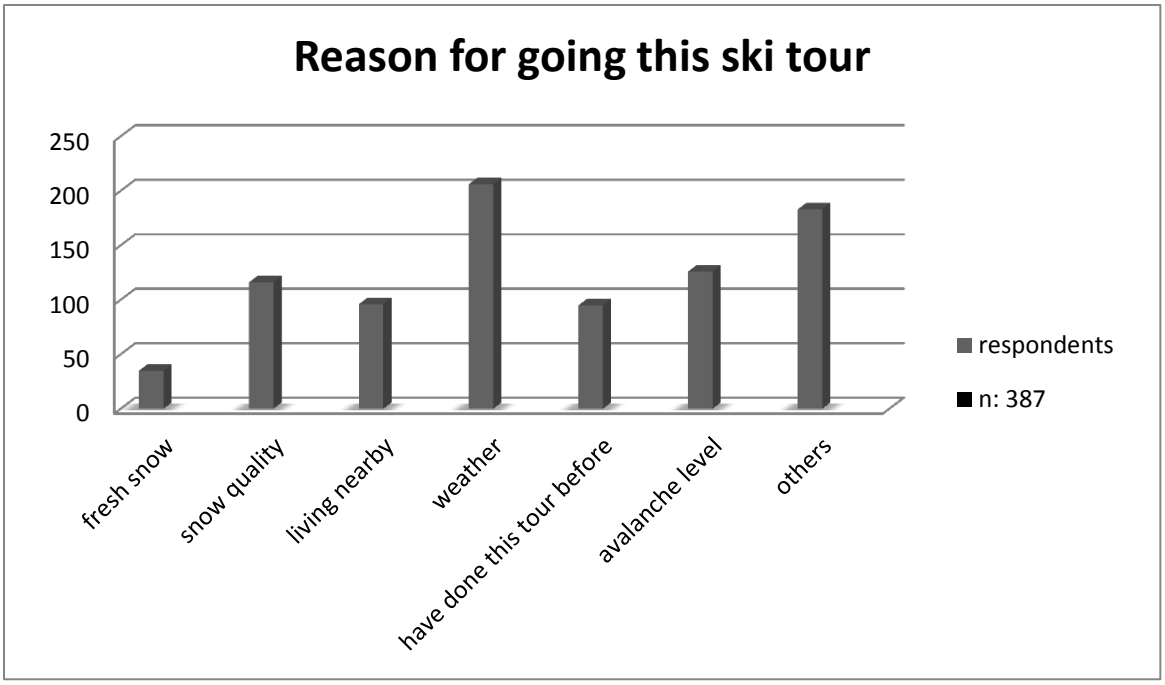


Figure 3-8: Reasons for going ski tour (own illustration)

For the most people a nice weather is the main criteria for choosing a ski tour. In total, 206 persons, over 50% have marked it. Another reason is the avalanche level and at the same time the snow quality. For 126 people the avalanche level is a criterion to choose a certain tour and for 116 people the snow quality is one of the main criteria. For about 90 people the location and the knowledge of the tour is an important factor. (see Figure 3-8) Many people also marked the box 'other', which is shown in Figure 3-9.

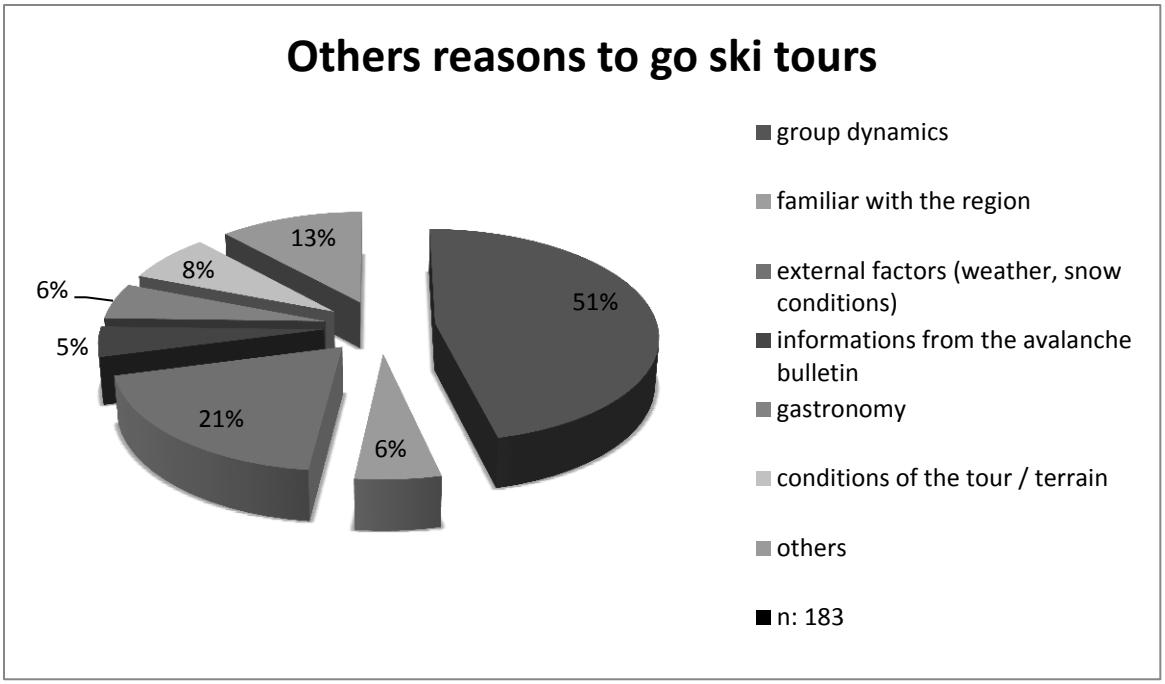


Figure 3-9: Reasons for going ski tours (own illustration)

Over 50 % of the reasons are due to group dynamics, which includes that the leader of the group has made the decision respectively it was the decision of the group. Further it also includes that it was a recommendation of someone or it was planed a long time before. The external factors include the weather and snow conditions, such as suitable aspects and a good snow pack. The category 'other' includes training, holidays, testing new equipment and had time this day.

3.1.6. Question 6: How do you generally find information about the current avalanche danger level?

The next question, number 6, was to find out how people inform themselves about the actual avalanche situation.

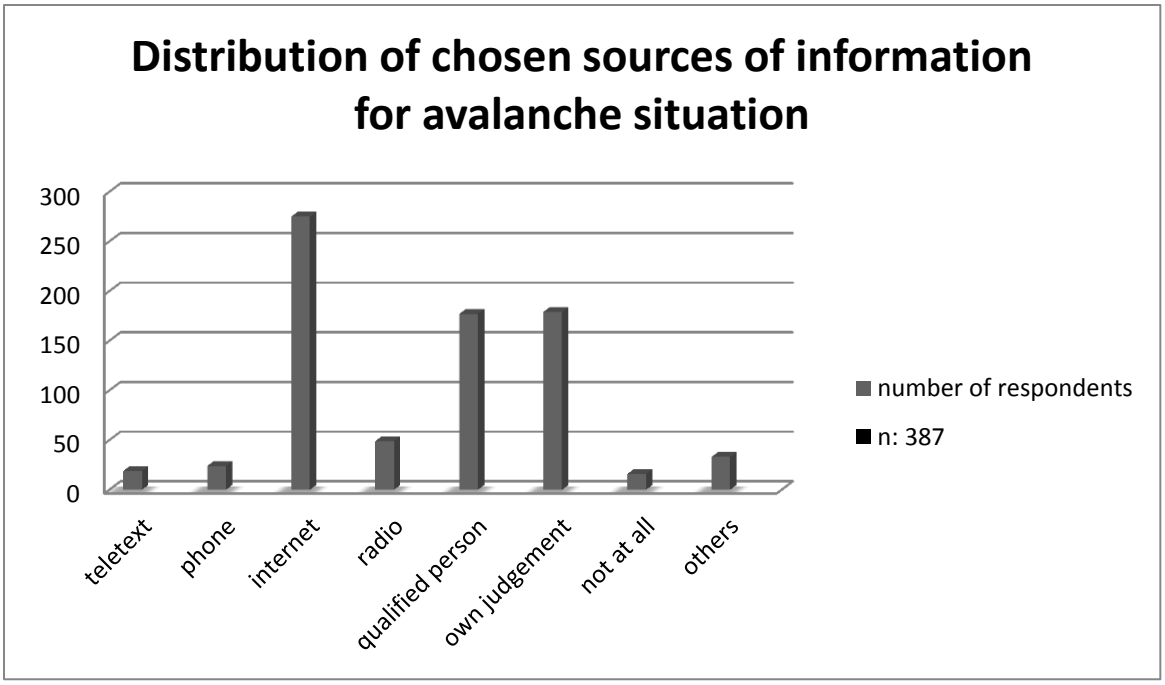


Figure 3-10: Distribution of chosen media for avalanche situation (own illustration)

Backcountry skiers get the information about the actual avalanche situation via radio and Internet. Resulting out of it, 275 people (71,1%) answered that they use the Internet to get further information about the situation in the backcountry and 49 people (12,7%) follow the information on the radio. Not all the people who use the Internet to get the latest information are reading the avalanche bulletin. A small share of about 11% informs themselves via the phone or TV (Teletext). The smallest share of 6% doesn't care about the general situation out in the backcountry. Another interesting result is that about 46% of the respondents relied to their own judgement to estimate the actual avalanche situation. (see Figure 3-10)

The category 'other' includes about 33 persons, which is separated in following categories: mobile phone, information from others and personal research.

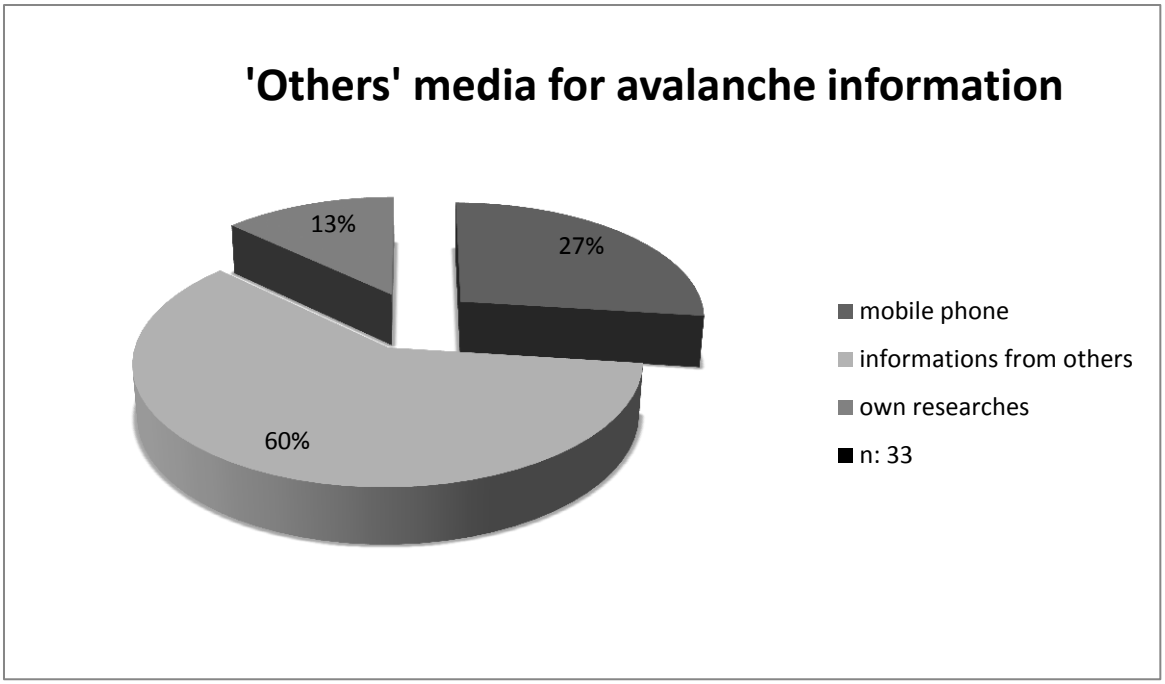


Figure 3-11: Others media for avalanche information (own illustration)

Most of the people (60 %) use second hand information from mountain guides or from friends that were on the same tour. A third of the interviewed persons use mobile phone (27 %) to get the latest information about the conditions in the mountains via snow safe, powder finder or a short message from the avalanche bulletin. Some of the respondents trust on their own researches by score snow profiles and monitor constantly weather dates and forecasts (13 %). (see Figure 3-11)

3.1.7. Question 7: Which measures do you take in order to safely navigate the terrain?

The next question was which measures are taken to move safely in the backcountry. The most often answer was to read the avalanche bulletin and to monitor the weather data's. Some of the interviewed persons just go out in the backcountry when there is an adapt person in the group. Furthermore 89 respondents read the tour forum to be informed. (see Figure 3-12)

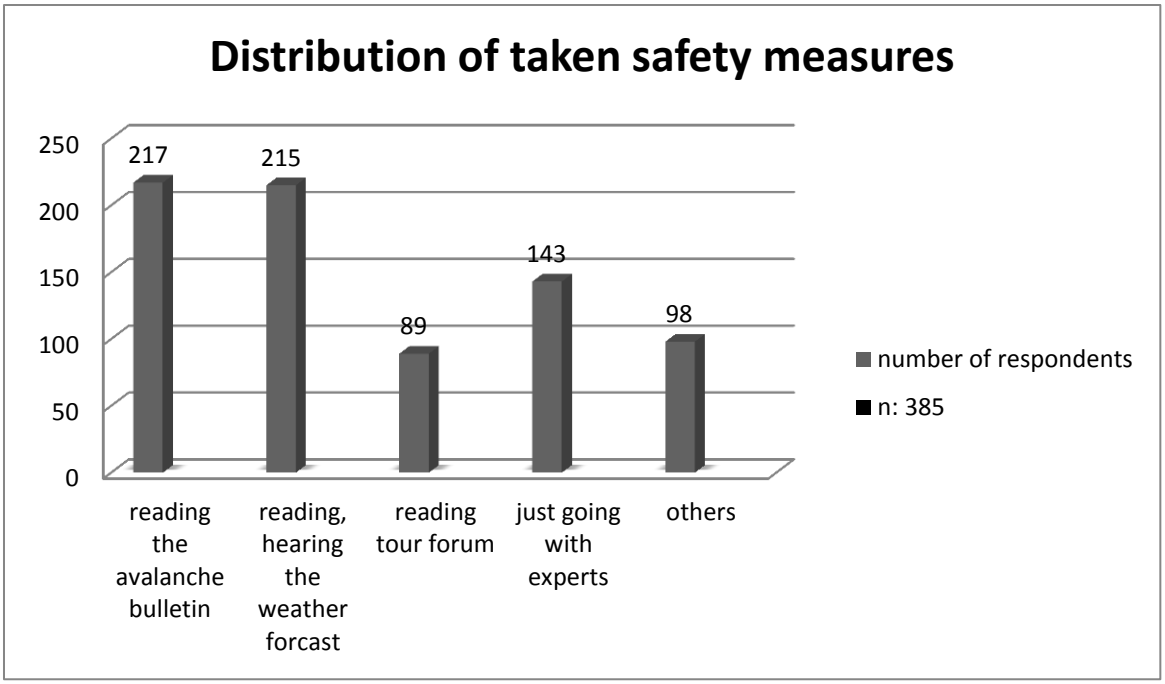


Figure 3-12: Distribution of taken safety measures (own illustration)

About 100 interviewed persons have selected others. Thereby 32% trust their personal responsibility, which includes intuition and feeling as well as to be careful and to make observations. About 25 % plan their tour before they go out in the backcountry. Some of them (8%) use decision supports like Stop or Go (2 Persons) or digging snow profiles (8 Persons) and some do risk reduction with single ski runs or using safe landforms (22 %). Some of them feel safe when they can rely on others by following the instructions or to listen to some friends (13 %). (see Figure 3-13)

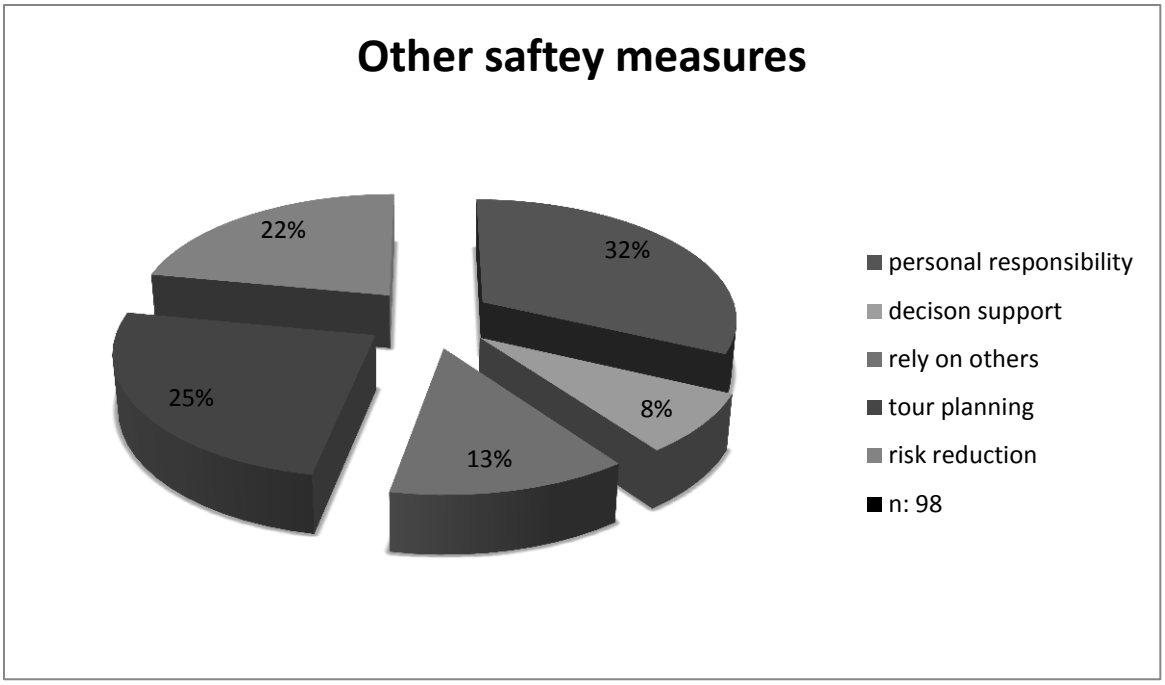


Figure 3-13: Other safety measures (own illustration)

3.1.8. Question 8: What equipment are you wearing or do you have with you today for your safety?

The next question surveys what kind of equipment the respondents have with them today for their own safety. The three most often safety equipment are the mobile phone, shovel and the avalanche beacon. Nearly all of the interviewed persons had these things with them. Over 100 people had a bivouac sack with them to keep someone warm in case of an emergency. Also an ABS backpack and a GPS was part of the equipment of some in the questionnaire. Just a few of the respondents had no safety equipment with them. The first aid kit, bivouac sack, head torch and warm clothing count in the category 'other'. About 32 of 387 respondents had a first aid kit with them. The probe was also mentioned about 100 times, but this is no equipment that is for your own safety. (see Figure 3-14)

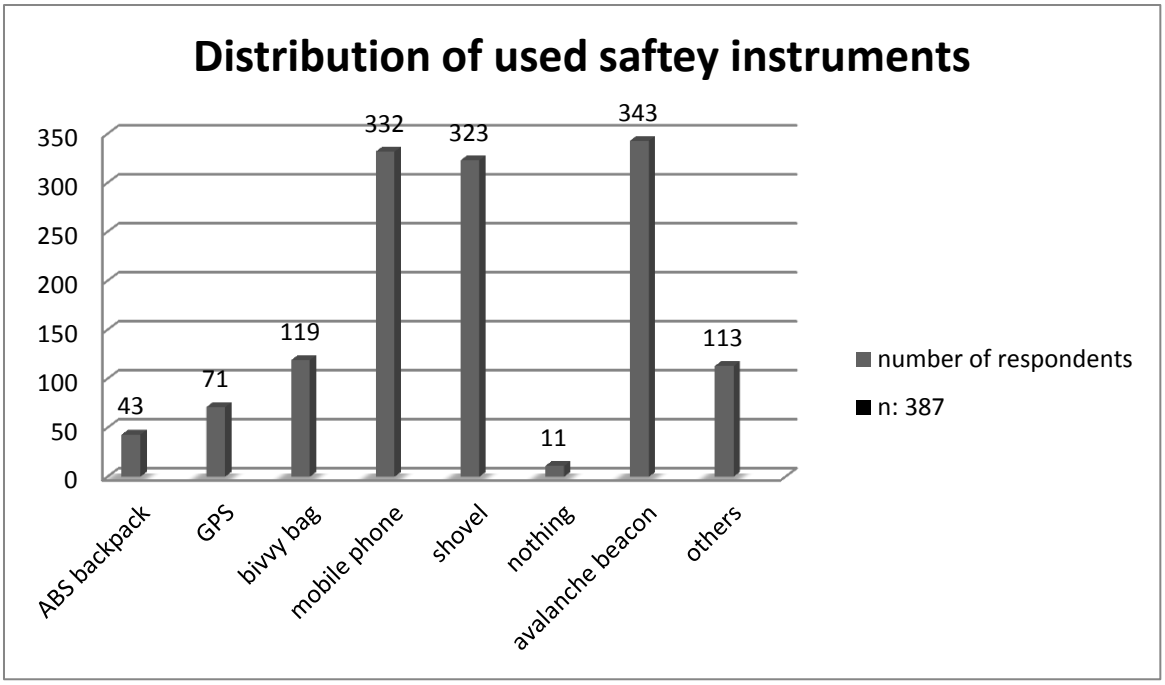


Figure 3-14: Distribution of used safety instruments (own illustration)

3.1.9. Question 9: Have you read the current avalanche bulletin?

The goal for the question was to research if people are familiar with the avalanche bulletin and if the avalanche bulletin was part of the preparation for the ski tour. More than 50 % of all respondent have read the avalanche bulletin. (see Figure 3-15)

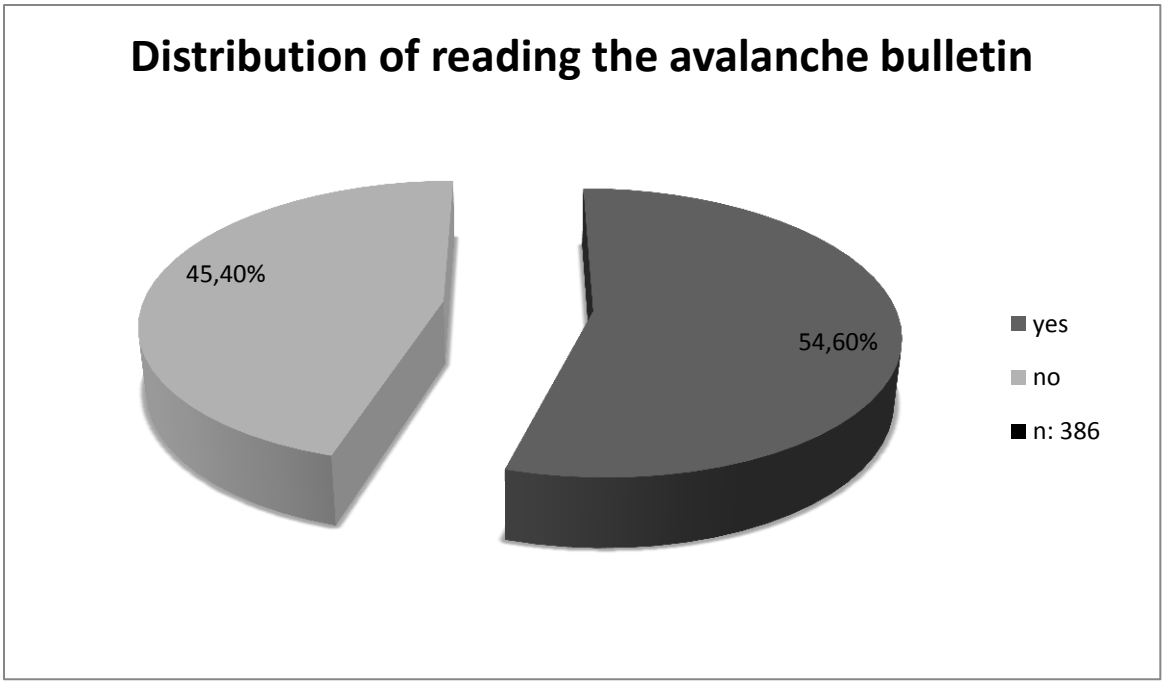


Figure 3-15: Distribution of reading of avalanche bulletin (own illustration)

3.1.10. Question 10: If you answered no, why have you not read the current avalanche bulletin?

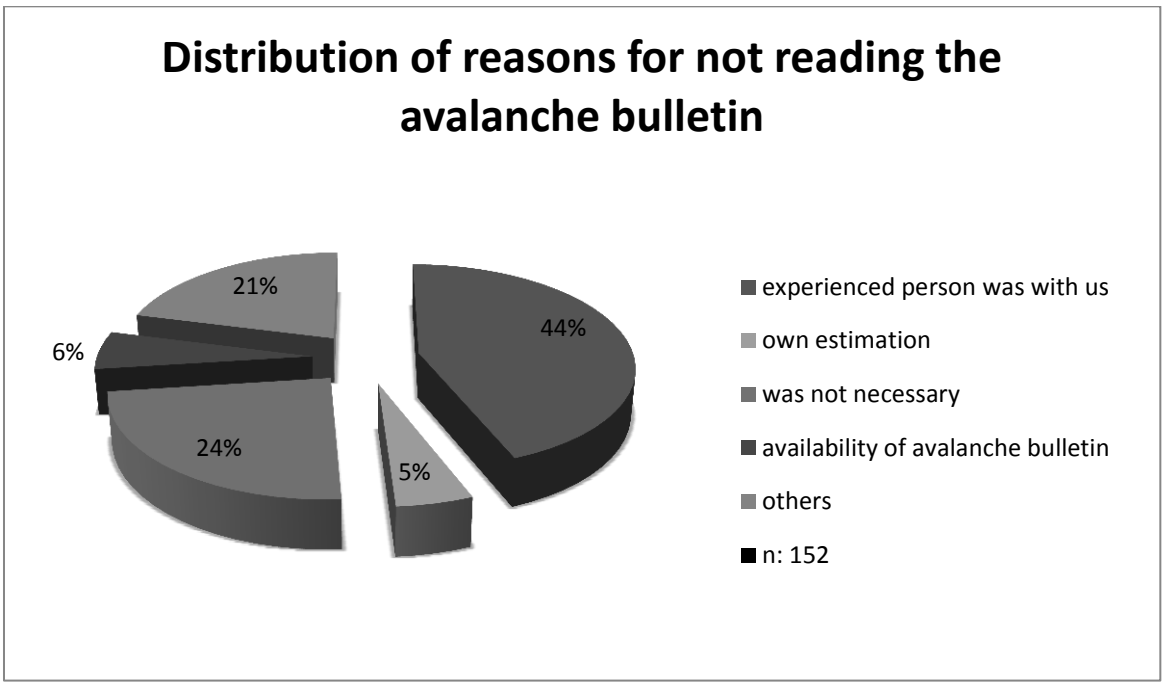


Figure 3-16: Distribution of reasons for not reading the avalanche bulletin (own illustration)

More than 150 persons have not read the actual avalanche bulletin before they went out in the backcountry for their ski tour. The main reason was

that an experienced person was with them on the not guided tour and that they have not mentioned that it would be necessary to get the latest information, that they were not interested, that it is not dangerous, that it is just a short tour and less snow were other reasons for not reading the avalanche bulletin. A few people said that they are more precise than the avalanche bulletin. The category 'availability of avalanche bulletin' include that the avalanche bulletin was presented to late, wasn't in English or it offers just an overview about the situation in the Alps. Some of the interviewed persons forgot or had no interest to read the avalanche bulletin as well as that they did not know that something like the avalanche bulletin exists. These criteria are included the category ‘other’. (see Figure 3-16)

3.1.11. Question 11: If you answered yes, have you observed anything today that confirms the key message of the avalanche bulletin?

In question 11 it has been surveyed if people who have read the avalanche bulletin, could make any kind of matching observations out in the field. About 60 % of the interviewed persons could recognize a statement from the avalanche bulletin. (see Figure 3-17)

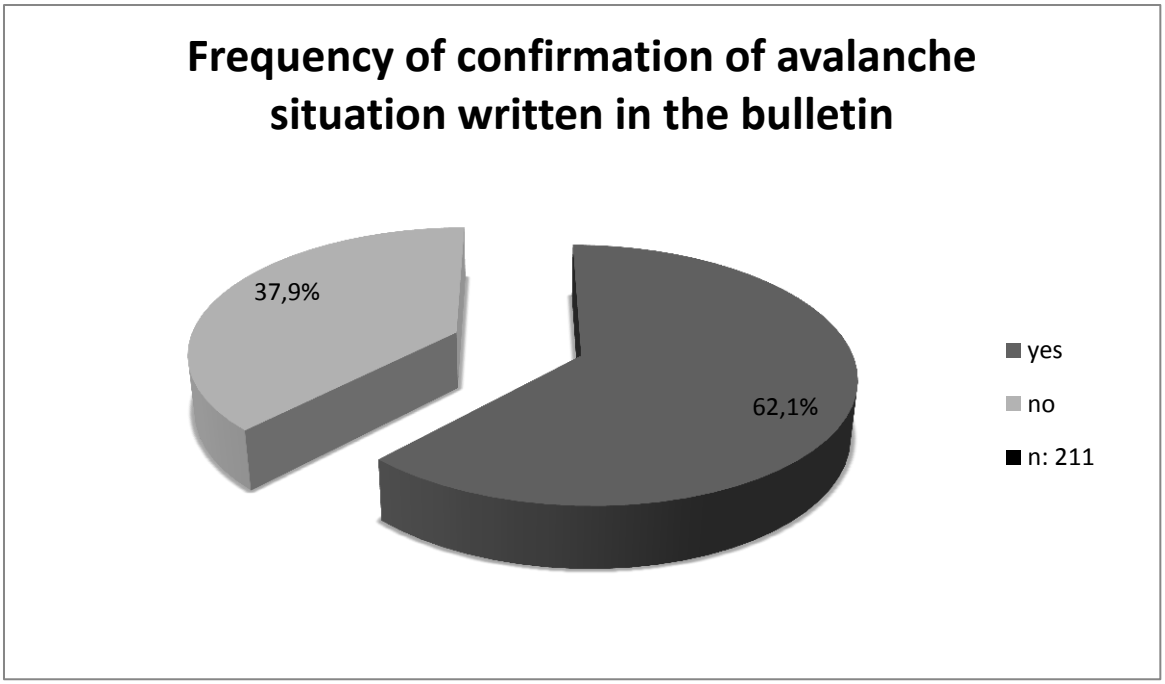


Figure 3-17: Frequency of confirmation of avalanche situation written in the bulletin (own illustration)

3.1.12. Question 12: If yes, which?

Question number 12 shows that about 128 people made an observation based on the avalanche bulletin during their ski tour in the backcountry. The most common catchwords they recognized in the field from the avalanche bulletin were:

- snowdrifts
- wind slab
- avalanche releases
- stable old snowpack
- wind affected gullies
- cornice building
- good settled snow
- a "whumpfing", hollow sound

3.1.13. Question 13: Which of the following statement do you find most accurate?

Regarding the backcountry skier's understanding of the avalanche bulletin, the persons where asked if the reading only of the avalanche bulletin can or cannot reduce the avalanche accidents. Thereby a share of 45% of the respondents thinks that just by reading the avalanche bulletin the avalanche accidents can be reduced. (see Figure 3-18)

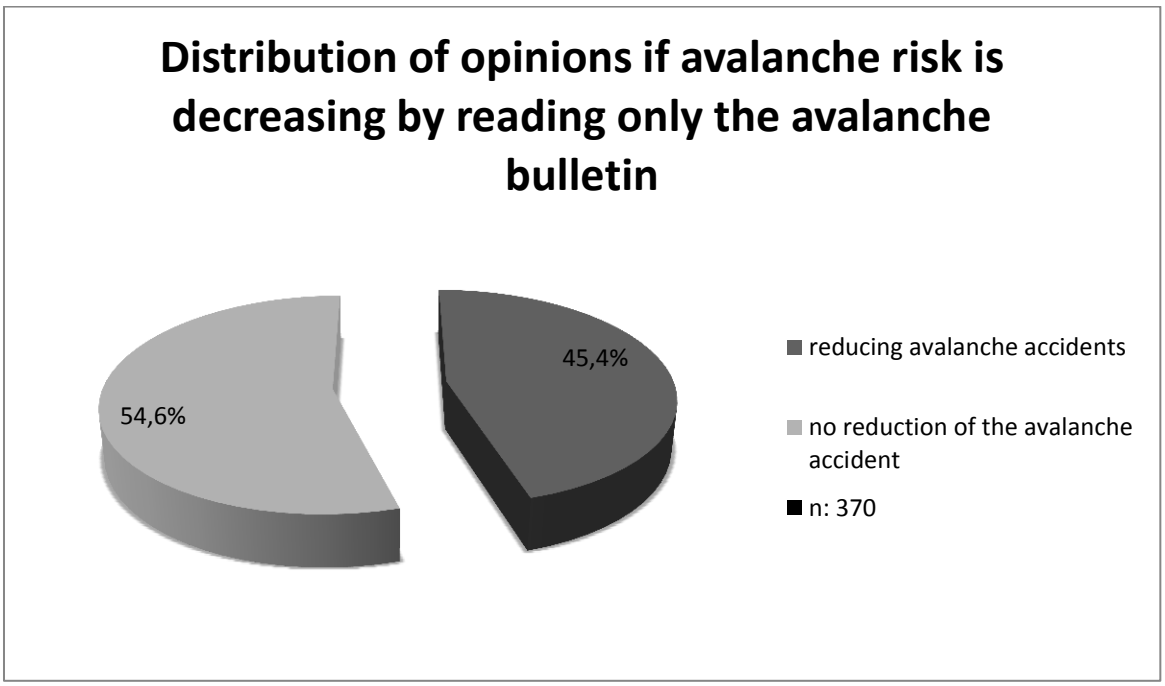


Figure 3-18: Distribution of opinions if avalanche risk is decreasing by reading the avalanche bulletin (own illustration)

3.1.14. Question 14: What criteria do you use to select the slope for departure?

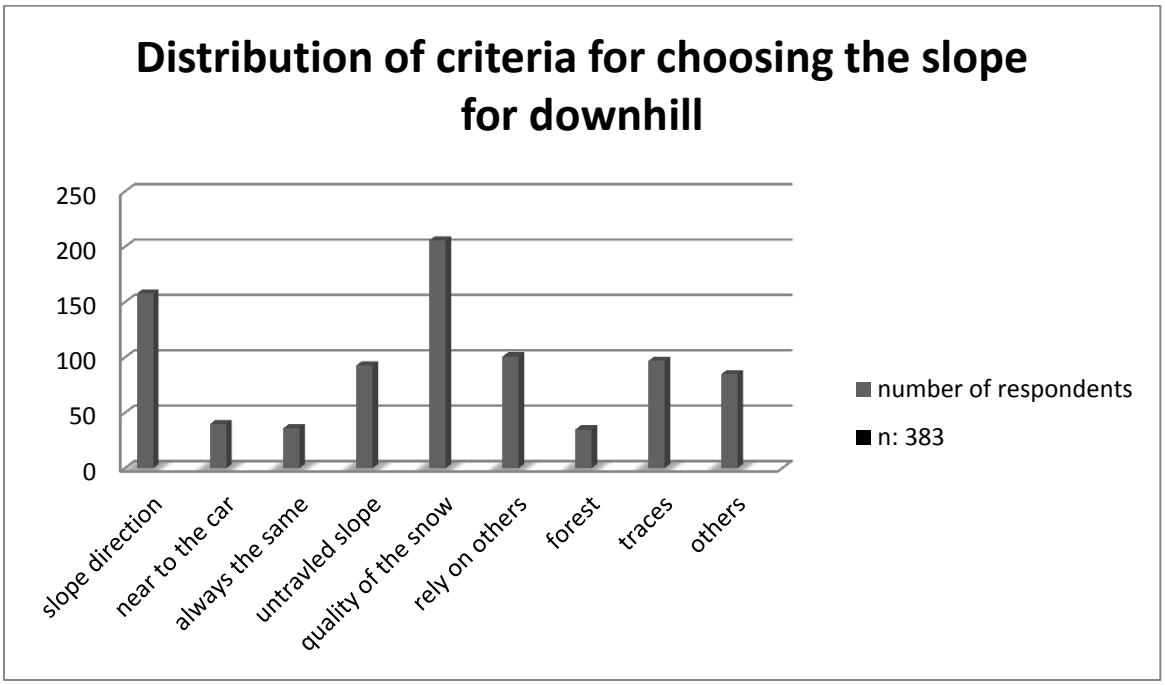


Figure 3-19: Distribution of criteria for choosing the slope for downhill (own illustration)

More than 200 people argued that they take the slope with the best snow quality and about 150 people take the slope with the best slope direction. About 100 people will rely on others to follow them. The same amounts of people are looking for untouched snow, because they want to be the first on this slope. Near to my car and always the same slope was answered by about 40 people. Another 100 people do not want to go into untouched slopes therefore they choose the slope where they can see some traces. Also a few of the interviewed persons choose the forest for going downhill. (see Figure 3-19) What the category 'other' contains will be presented in the Figure 3-20.

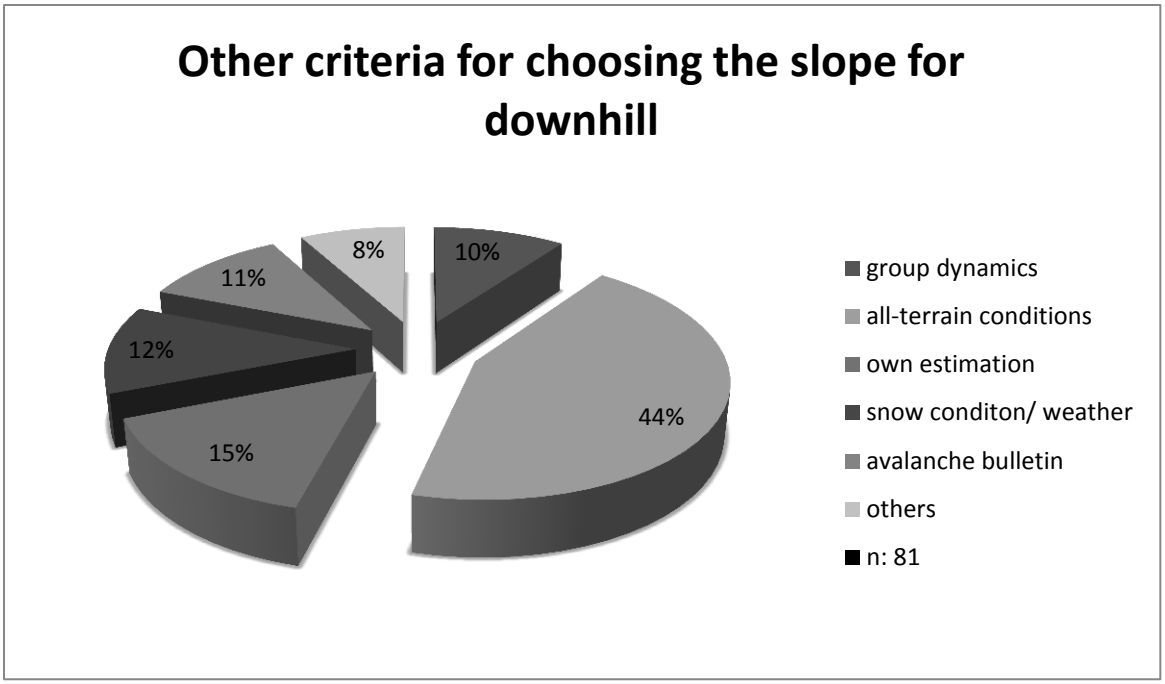


Figure 3-20: Other criteria for choosing the slope for downhill (own illustration)

A share of 44% of the respondent that marked 'other' looks about the all-terrain conditions, which includes the slope angle, channels and grooves. 15% prefer their own estimation and choose the way back down like they went up or listen to their feelings. A few of the interviewed people choose the way back, where they know the snowpack properties and another few, about 11% check the non hazardous areas in the avalanche bulletin. In this case 'other' includes slopes free of trees and away from many people.

3.1.15. Question number 15: Today, the avalanche danger level is x. Would you also do this tour if the avalanche danger level was x + 1?

The goal of the question was to figure out the risk behaviour of the backcountry skier. This is permissible because most of the tours, which were done were avalanche danger level was 2. As described in chapter 1.2.3 the step from 2 to 3 is a crucial one, meaning that doing the tour at danger level 3 implies that athletes take a higher risk. About 60% of the

interviewed persons wouldn't do the same ski tour if the danger level rises by one. (see Figure 3-21)

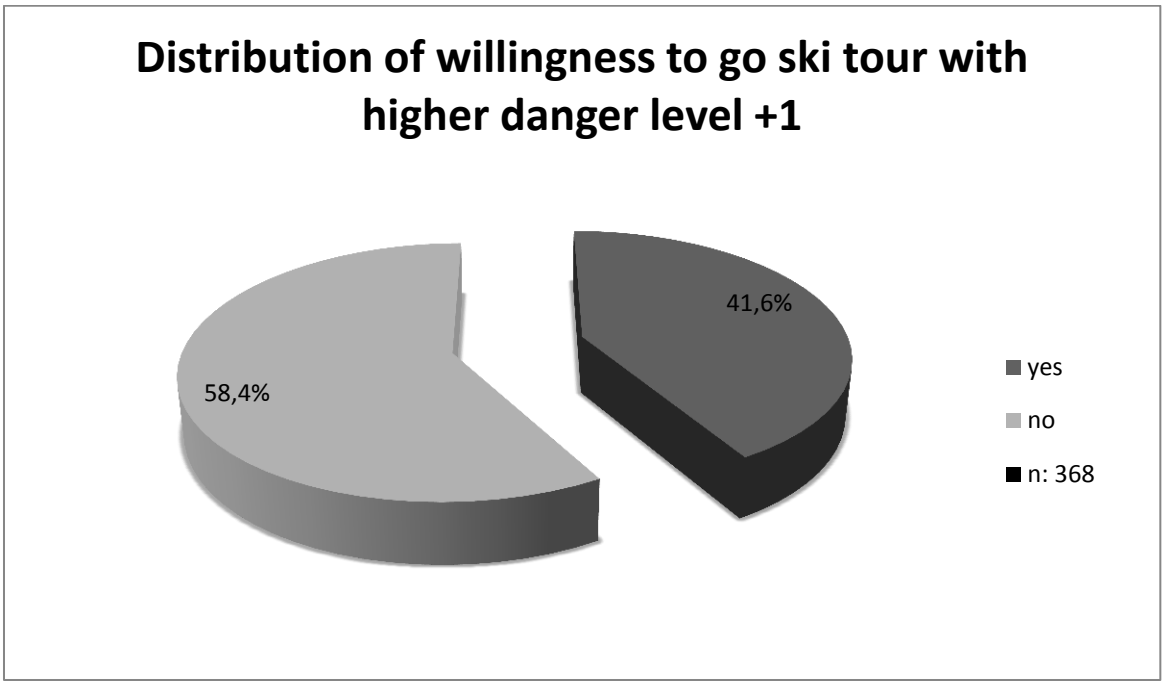


Figure 3-21: Distribution of willingness to go ski tour with higher danger level (own illustration)

3.1.16. Question 16: If you answered yes, because?

In a few situations the interviewed persons would go the same tour, also when the danger level rises by one. Figure 3-22 shows the different answers.

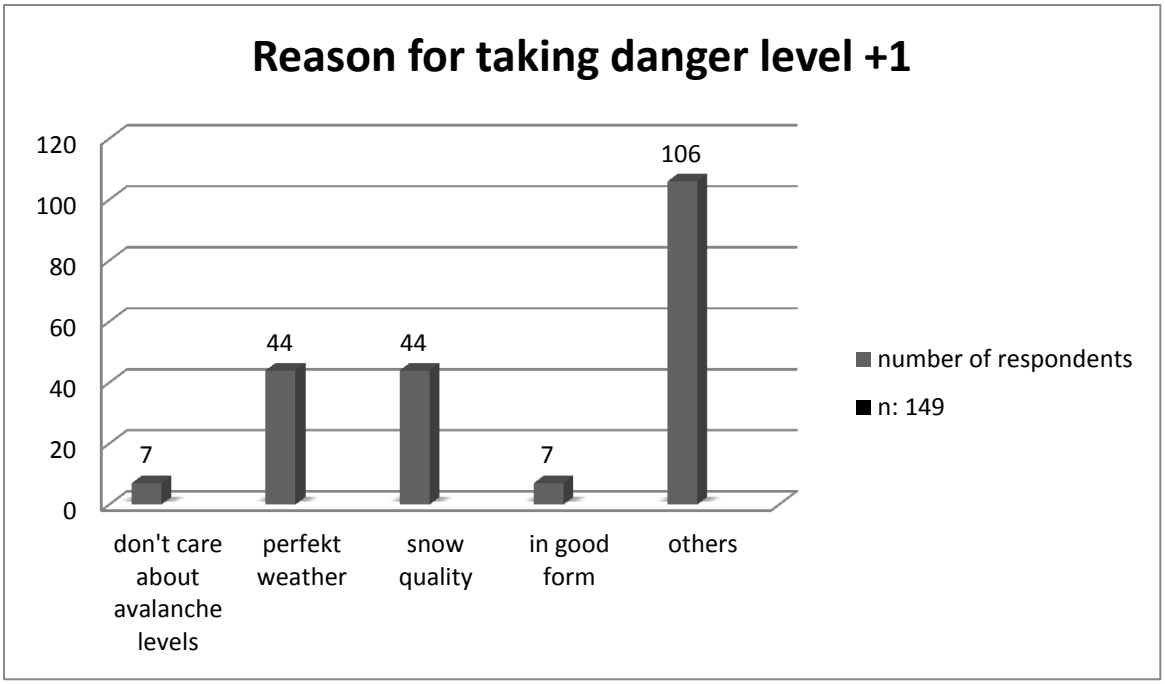


Figure 3-22: Reasons for taking danger level +1 (own illustration)

Perfect weather and good snow quality are reasons why people would go the same tour with a higher danger level. Also some individuals would go on their own, because they are in a good fitness condition. Furthermore there are a few persons, which don't care about the avalanche levels from the avalanche bulletin. Figure 3-23 includes the category of 'other' from Figure 3-22.

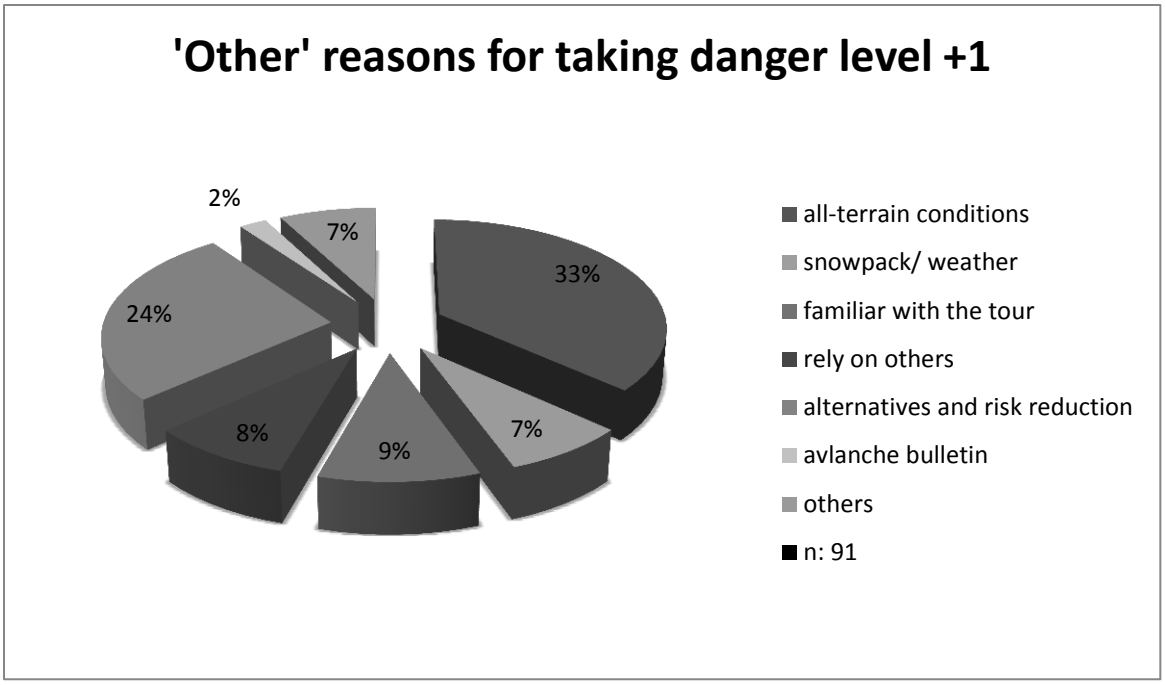


Figure 3-23: Other Reasons for taking danger level +1 (own illustration)

The interviewed people would go the same tour with a higher avalanche level when the terrain conditions allow a higher level, like a low slope angle. Some other people would go because the tour offers an alternative way up and back down where they can avoid slopes over 30 degrees. Another few persons would go, because they are so familiar with the tour and they are well aware of all the dangerous spots. Others would check first the snowpack conditions and weather before they go or cancel the tour. Also in this case interviewed people answered that they rely on others respectively are following behind. Just a few said that the avalanche bulletin is too regional and that the avalanche level is not true for a specific slope. In the category 'other' persons answer that it is a well known, beautiful tour with no danger.

3.1.17. Question 17: Which of the following statements apply to you?

The question number 17 surveys the experience of backcountry skiers.

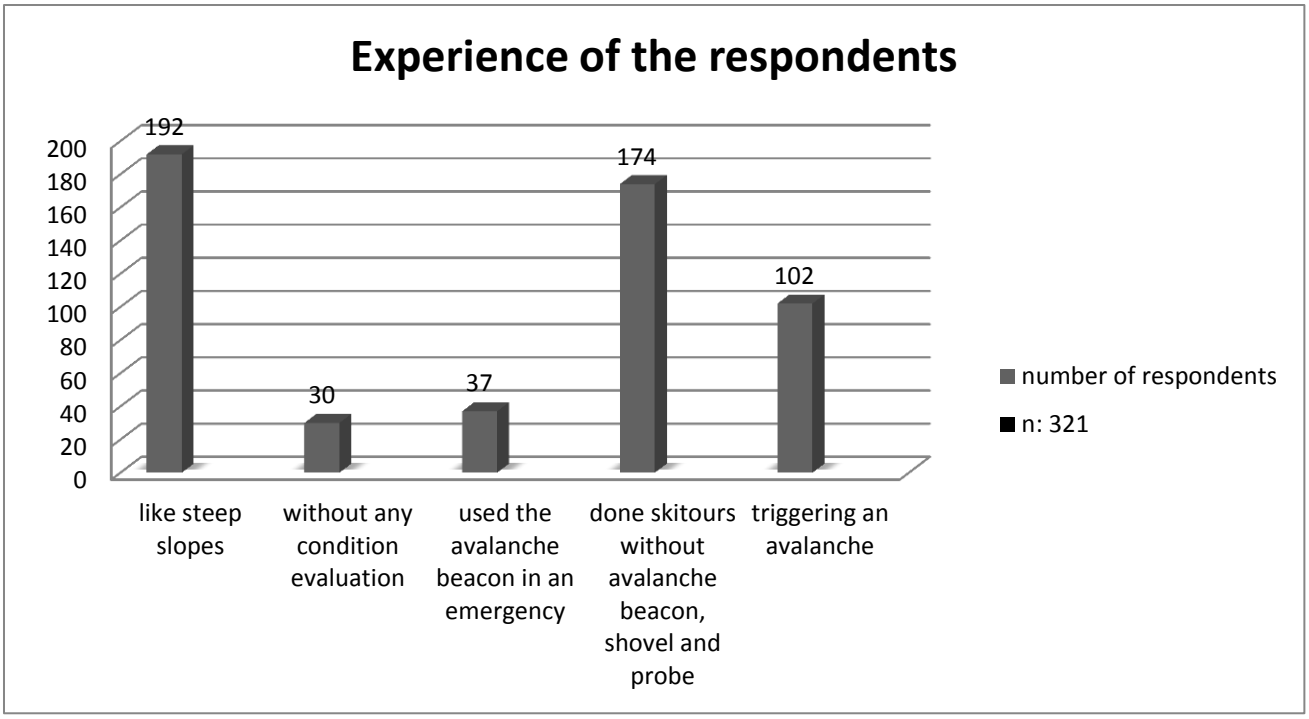


Figure 3-24: Distribution of back county skier's experiences (own illustration)

Over 190 people like to go down a steep slope, where an avalanche easier can be triggered. About 45% of all interviewed people have done a ski tour in the backcountry without any safety equipment, like an avalanche beacon, shovel or probe. Furthermore 30 people have answered that they went down a slope without checking the conditions. More than one quarter of the respondents have already triggered an avalanche and 10% of the respondents had to use the avalanche beacon in an emergency. (see Figure 3-24)

3.1.18. Question 18: Which of the following statements do you find most accurate?

Question number 18 shows if people who have read the avalanche bulletin, understand its content. It is assumed that if the respondent answered that the avalanche bulletin is clearly worded, that he or she has fully understood the content. In the opposite case when the respondent finds the avalanche bulletin vaguely worded it is assumed that the reader does not fully understand the message. A share of 67% of the readers says that the avalanche bulletin is clearly worded (understandable

verbalised). Furthermore a big portion of about 25% only partly understands the avalanche bulletin. Even about 8% of the people state that the avalanche bulletin is often not clearly worded (rarely understandable). (see Figure 3-25)

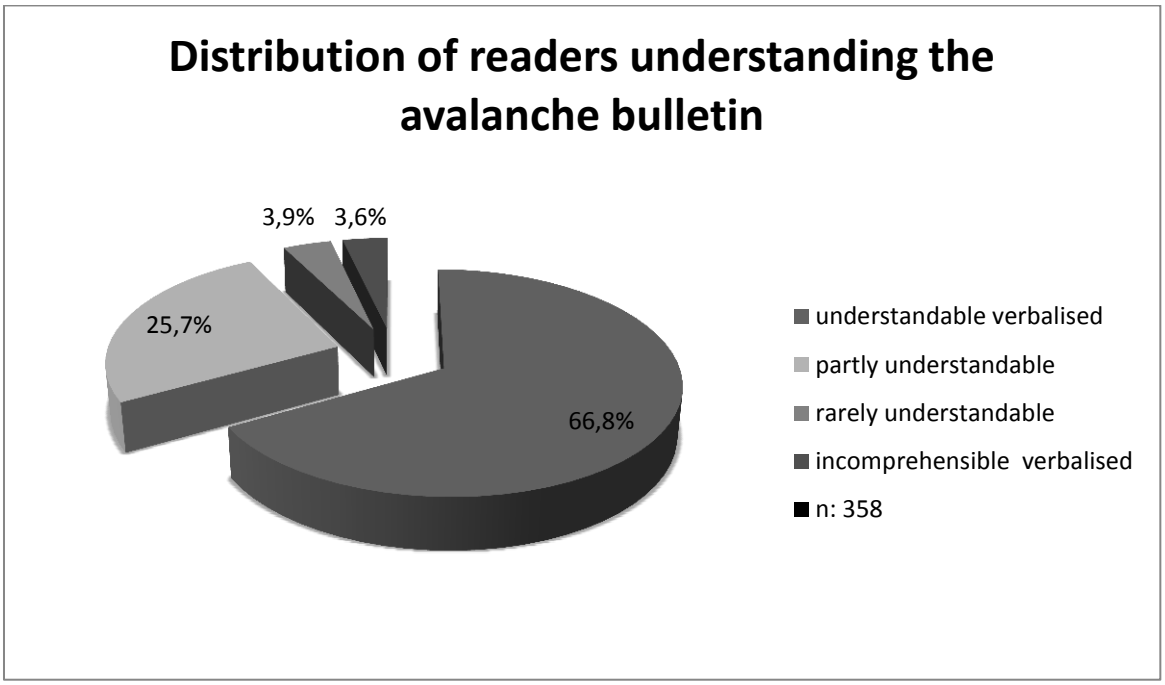


Figure 3-25: Distribution of readers understanding the avalanche bulletin (own illustration)

3.1.19. Question 19: Can you please show me on the enclose map where we are?

The goal of the last question of the questionnaire was to find out if interviewed persons know where they were geographically. A share of about 63% of respondents could point out the right place on the map where they were. A share of 21% could sketch the right region within the same forecast region in the avalanche bulletin. Unfortunately 16% could not point out the right region where they currently were. (see Figure 3-26)

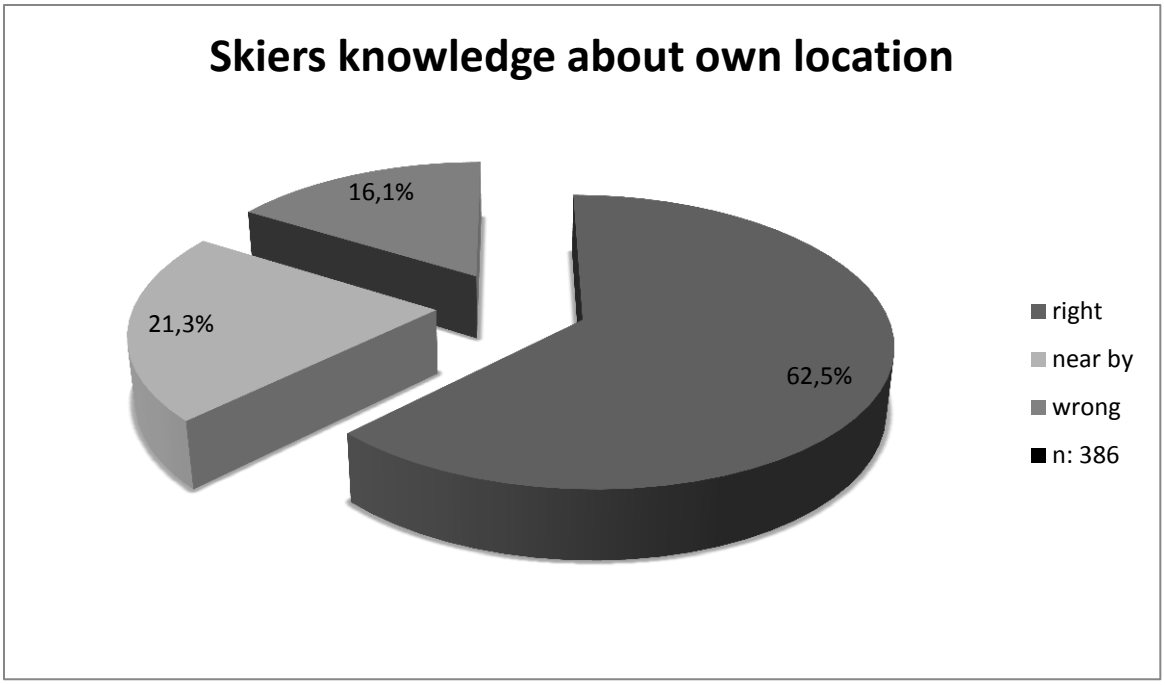


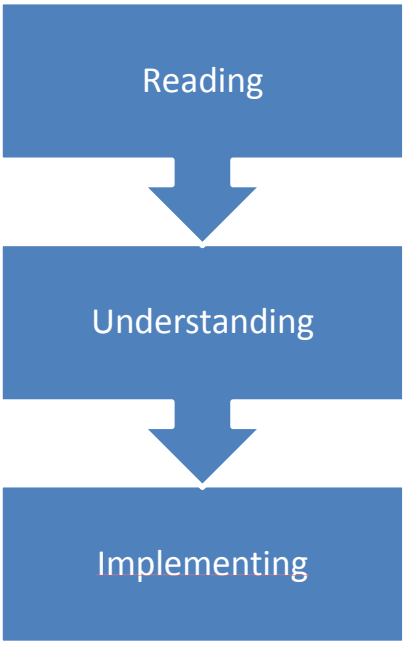
Figure 3-26: Skiers knowledge about own location (own illustration)

3.2. Part I: Characteristics of backcountry skiers and the effectiveness of the avalanche bulletin (Mayer, M.)

In the following paragraphs the results of the survey are presented and analysed. First, the characteristics of backcountry skiers in relation to the avalanche bulletin are discussed. This includes whether they read the avalanche bulletin or not and how they implement the received information in the field. Furthermore the comprehension and the behaviour of the backcountry skier who have read the avalanche bulletin are reviewed. The following steps show how this section is composed.

3.2.1. From reading to act

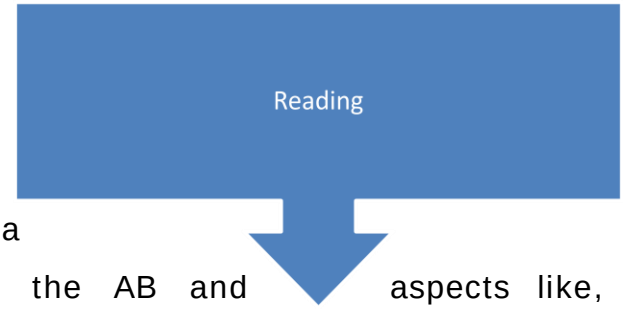
The knowledge chain from reading to acting correctly in the field can be defined with the following steps:



A precondition to acting correctly in the field is to have knowledge about the formation of avalanches and the current weather situation. If knowledge is gained by reading the avalanche bulletin it is essential to understand its content. Having excellent knowledge, and acting responsibly and risk averse, is not necessarily connected to merely reading the avalanche bulletin. The avalanche bulletin can only help to give a general overview about the avalanche situation in a certain region for experienced as well as inexperienced people. Nevertheless, it is indispensible that backcountry skiers of any kind of experience level inform themselves before going out in the backcountry about the recent weather situation, as well as to have knowledge about snow metamorphism in alpine regions.

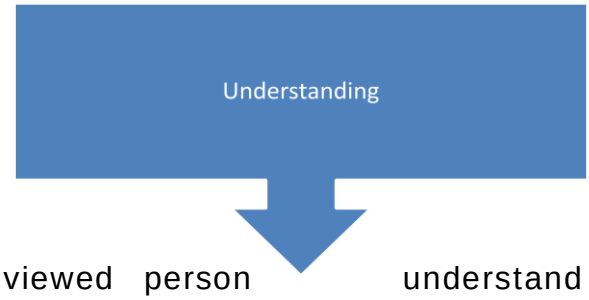
Therefore, only reading the avalanche bulletin cannot prevent accidents in the alpine area. The steps understanding and implementing the avalanche bulletin play also a predominant role in preventing accidents caused by avalanches.

- **Who is reading the avalanche bulletin?**



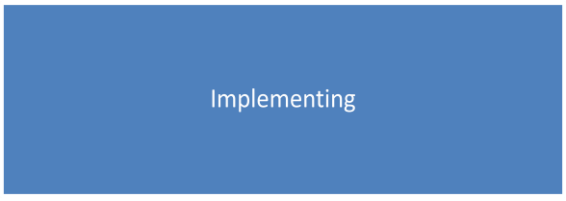
Chapter 3.2.2 will detect a potential relation of reading the AB and aspects like, gender, age and leadership and number of completed ski tours per year of the interviewed people. This should help to understand who is reading the avalanche bulletin and what hinders people to read the avalanche bulletin.

- **Does the interviewed person understand its content?**



To analyse whether the interviewed person understand the content of the avalanche bulletin or not is important to tell if the avalanche bulletin is the right media to transport information. The interviewed persons were asked about the verbalisation of the avalanche bulletin and if the avalanche accident can be reduced only by reading the avalanche bulletin.

- **Does the interviewed person implement the knowledge from the avalanche bulletin correctly?**



It is essential that people remember the context of the avalanche bulletin and implement the received information. The reader's understanding has been tested by checking their observation out in

the backcountry that confirms any key message of the avalanche bulletin as well as to know in which region they are going to do the ski tour.

3.2.2. Reading the avalanche bulletin

According to the survey with a sample of 386 backcountry skiers, a share of 55% has read the avalanche bulletin before they started the tour (see question 9). Those people who have read the avalanche bulletin were 39% of all interviewed women and 61% of all interviewed men. The gender distribution of persons who have not read the avalanche bulletin was 61% of all interviewed women and 39% of all interviewed men. (See Figure 3-27) As additional information 25 people did not indicate their gender.

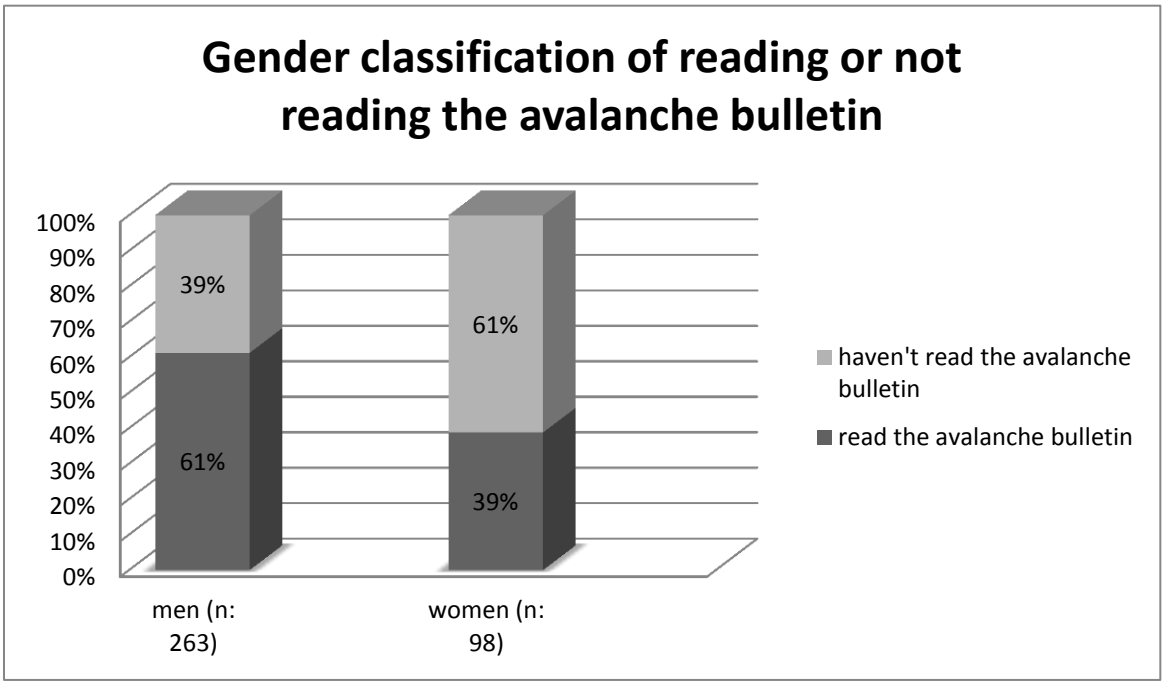


Figure 3-27: Gender classification of reading or not reading the avalanche bulletin (own illustration)

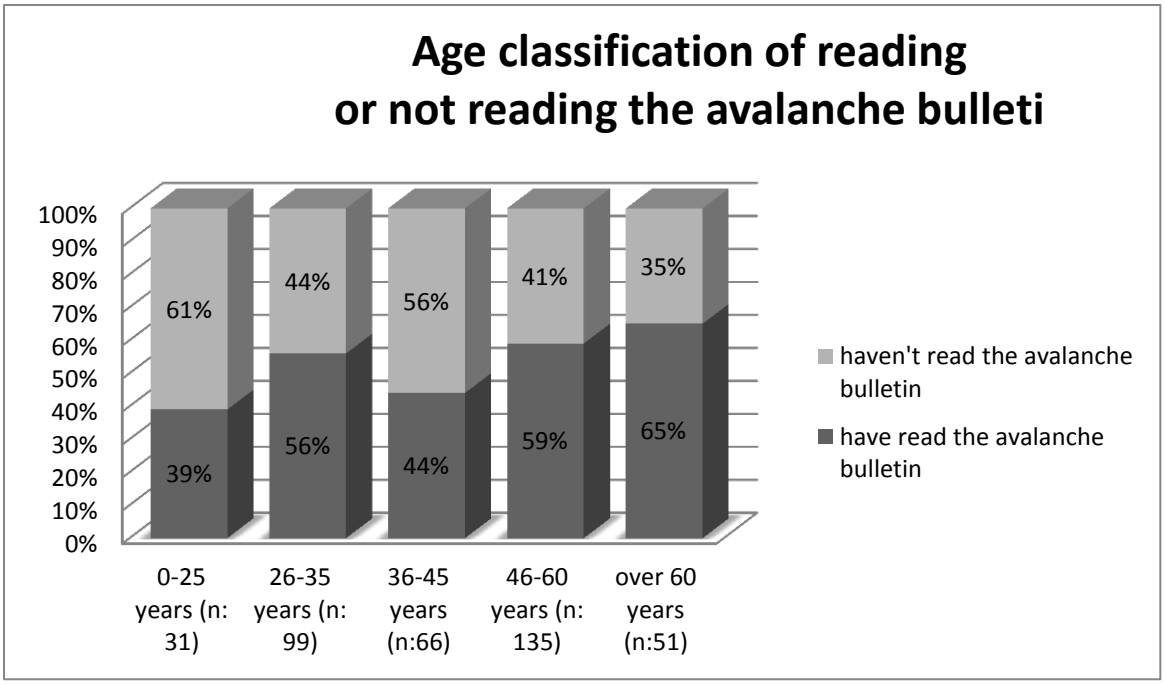


Figure 3-28: Age classification of reading or not reading the avalanche bulletin (own illustration).

Young people from 0-25 years, which is also the smallest group, with 11 interviewed women and 20 interviewed men has the largest contribution of people who have not read the avalanche bulletin. The older they become, the more interest they have in reading the avalanche bulletin. For the age between 36-45 years there is a small increase in reading the avalanche bulletin (56%). The reason for that could lie in the fact that in this age group more women were interviewed, who tend to not read the avalanche bulletin (for whatever reasons). In this group the relation between women (27), men (37) and 2 without any statement of the gender are the smallest. (see Figure 3-28) Therefore as shown in the Figure 3-27 less women are reading the avalanche bulletin.

The next two figures add the influence of the gender to the relation between age and reading the avalanche bulletin. (see Figure 3-28) It is illustrated how many women and men have read the avalanche bulletin in a certain age group. (see Figure 3-29)

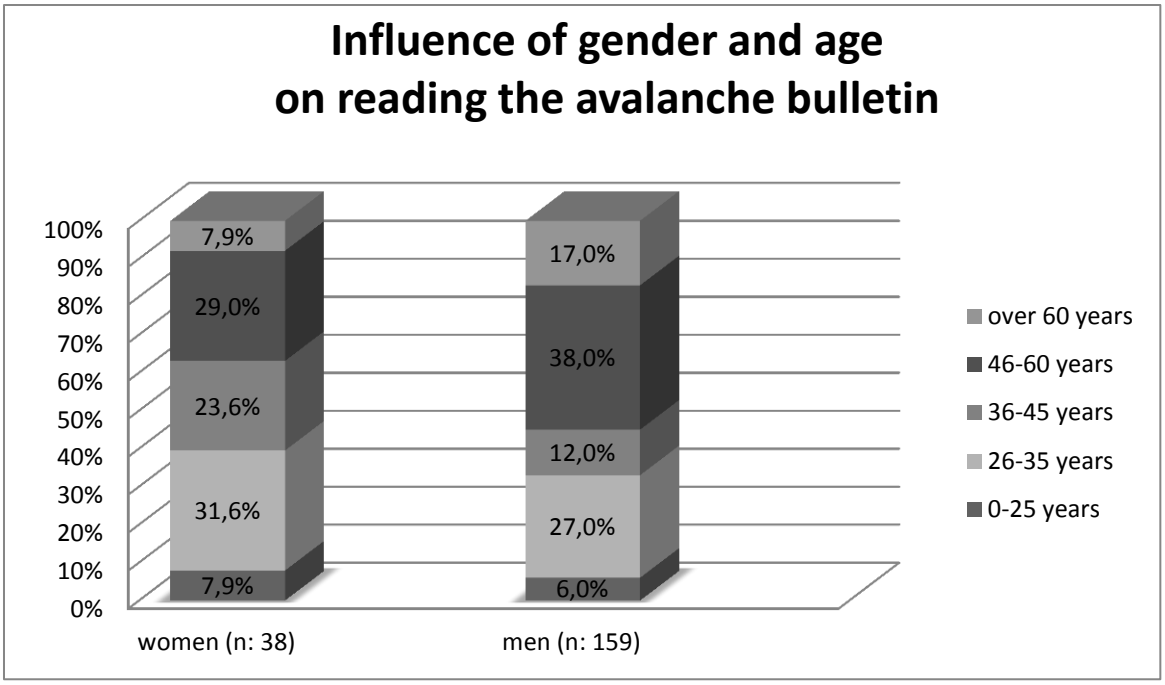


Figure 3-29: Influence of gender and age on reading the avalanche bulletin (own illustration)

This graph shows that women who are reading the avalanche bulletin are more or less balanced, because it reflects the age structure of the female population. When you compare it with the men, there is a high decline of reading the avalanche bulletin in the age group from 36 - 45 years. In exchange the age group of 46 - 60 years is the largest with 38% of all men who have read the avalanche bulletin.

To make this statement more significant, the relation between having read the avalanche bulletin and taking the lead has been observed. Furthermore of great importance is how many people who have read the avalanche bulletin take the lead on a ski tour. (see chapter 3.3.2)

Figure 3-30 and Figure 3-31 show all men who have read the avalanche bulletin and take the lead in a group. The result is separated between different age groups.

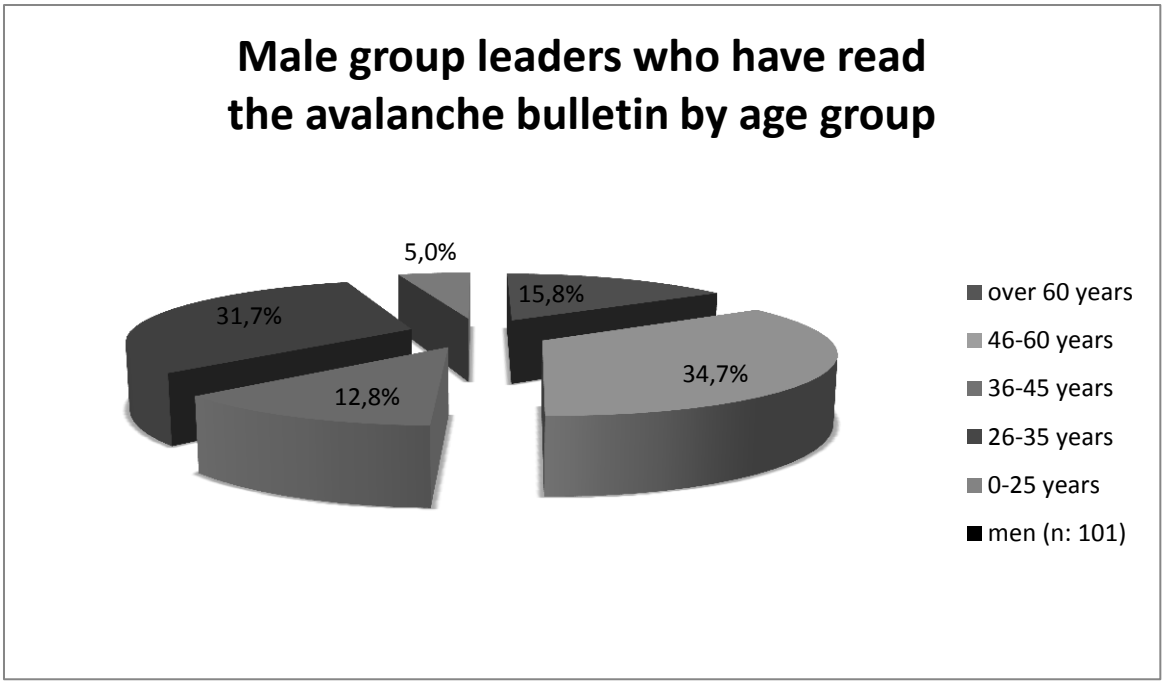


Figure 3-30 Male group leaders who have read the AB by age groups (own illustration)

Another interesting result of this survey is that group leaders are mostly between 46 and 60 old. (see Figure 3-30) This was not only the biggest group in the survey with about 135 people but also the group with the highest number of people who are taking the lead without reading the avalanche bulletin, as you can see in the following graph.

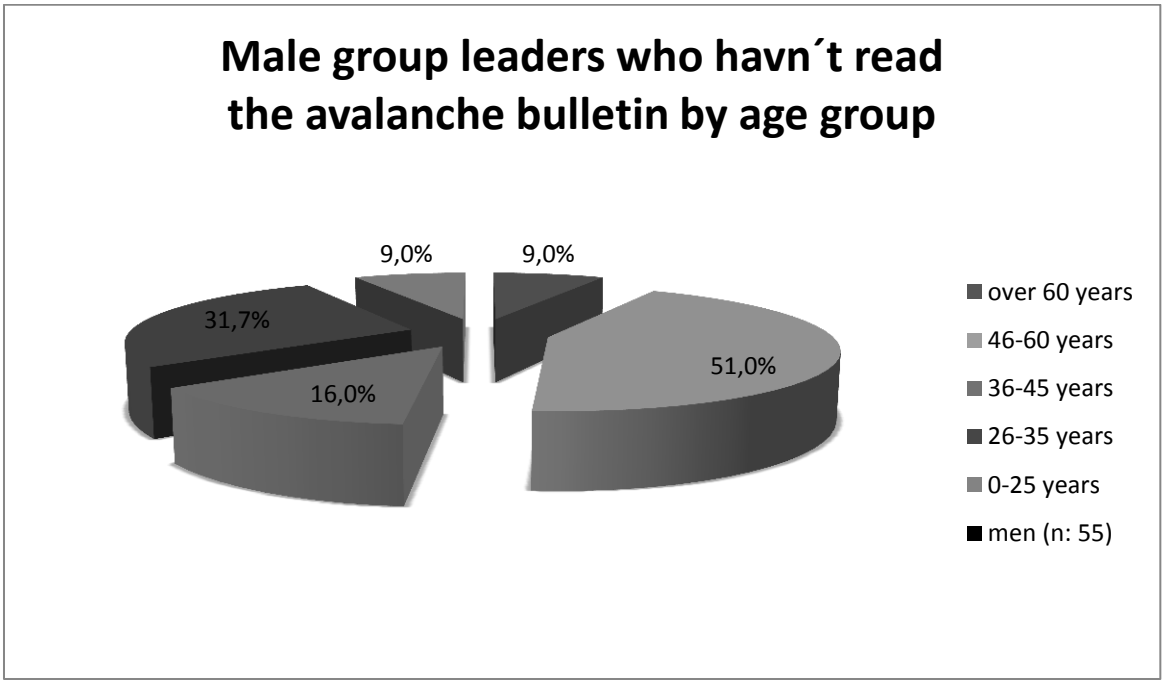


Figure 3-31 Male group leaders who have not read the AB by age groups (own illustration)

If the relationship between the origin of the interviewed people and the avalanche bulletin reading habits of backcountry skiers is analysed it is shown that in this survey a high share (90%) of the interviewed skiers from Vorarlberg read the avalanche bulletin. The interviewed people from Upper Austria tend to read the avalanche bulletin more seldom. This result can vary in different surveys and cannot be considered as a general statement.

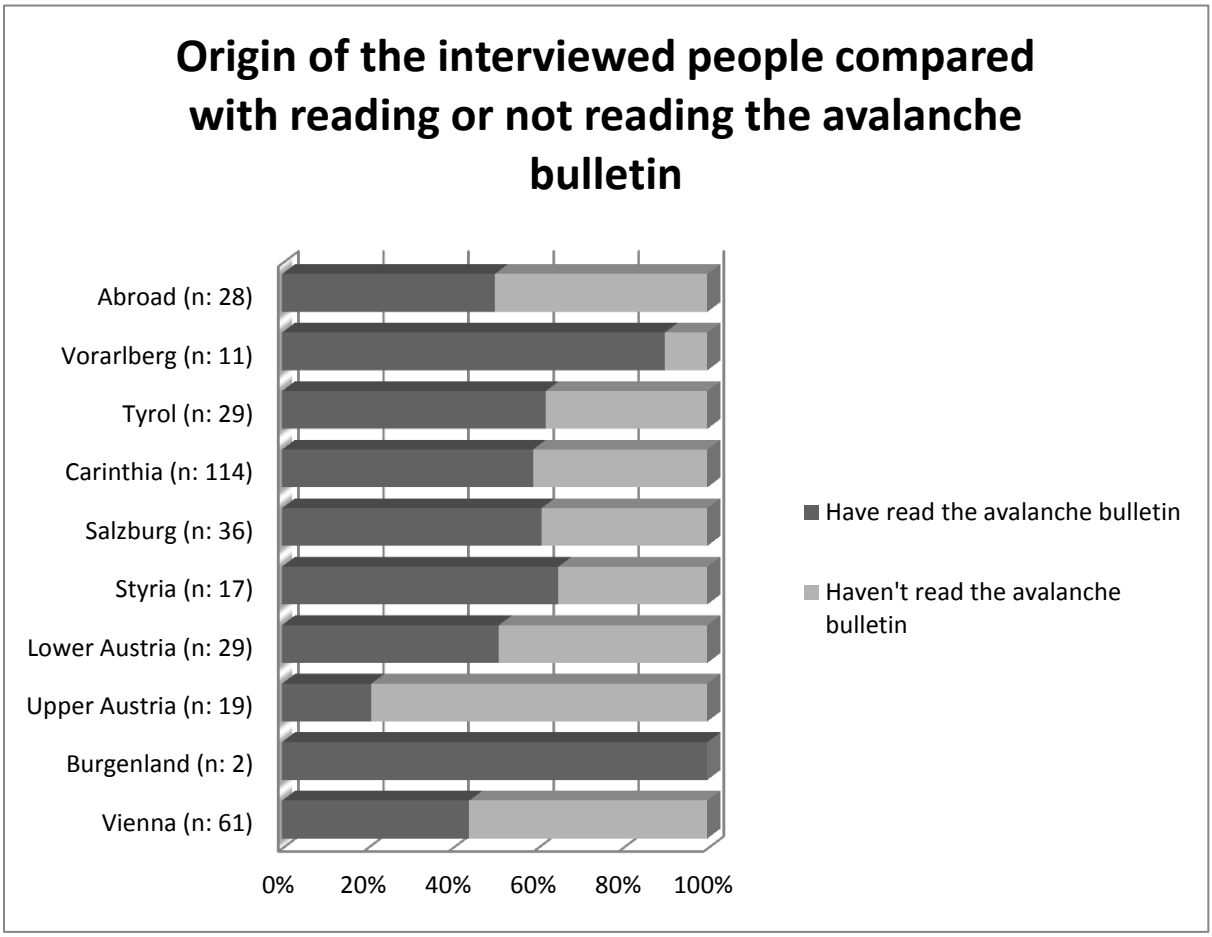


Figure 3-32: Origin of the interviewed people compared with reading or not reading the avalanche bulletin (own illustration)

A share of 55% of all interviewed people has read the avalanche bulletin. The question was to find out the reason for the other 45% to not read the avalanche bulletin. The results of this scientific question can help to spread the publicity and effectiveness of the avalanche bulletin. In Table 3-1 and Table 3-2 a list of why people have not read the avalanche bulletin is shown. One of the most reasons was that an experienced person was with them on the tour. The number of persons who have not

read the avalanche bulletin is 174 people (45%), wherefrom 152 listed an additional statement on the questionnaire. About 50% of these people rely on others and one quarter hasn't perceived it for necessary. The statements of the interviewed people are shown in the table below.

Statements	
not reading the avalanche bulletin	**not perceived as necessary**
• I rely on my partner (without exactly knowing if he/she has read it)	• There is less snow
• Others take care of it	• The tour is not dangerous
• The companion has read it	• It wasn't necessary
	• Nothing changed to yesterday

Table 3-1: Statements of the interviewed people I (own illustration)

The last quarter of all interviewed persons is composed of different answers, which are headed in the following table.

• I have read it yesterday and it was very pessimistic that why I have not read it for today;	• I have read the avalanche bulletin from another federal state
• I do not know the avalanche bulletin	• have not done it before
• I forgot to read it	• no interest
• didn't know how	• no idea
• have not found any avalanche bulletin	• no possibility

Table 3-2: Statement of the interviewed people II (own illustration)

3.2.1. Reader's comprehension

The interviewed people were asked about the reduction of an avalanche accident by reading the avalanche bulletin (see question 13) and if the avalanche bulletin is comprehensible (see question 18). The question of the comprehensibility of the avalanche bulletin for the different age groups and the influence on the perception of a potential reduction of avalanche accidents by reading the avalanche bulletin is of high interest.

First of all, the number of ski tours per year of the interviewed persons is brought into relation with the question, if they think that one can reduce the avalanche accident by only reading the avalanche bulletin. Figure 3-33 and Figure 3-34 show the relation between the completed ski tours per year and the perception of a potential reduction of avalanche accidents by reading only the avalanche bulletin. Figure 3-33 illustrates this relation of interviewed persons who have read the avalanche bulletin while in Figure 3-34 all interviewed persons are included.

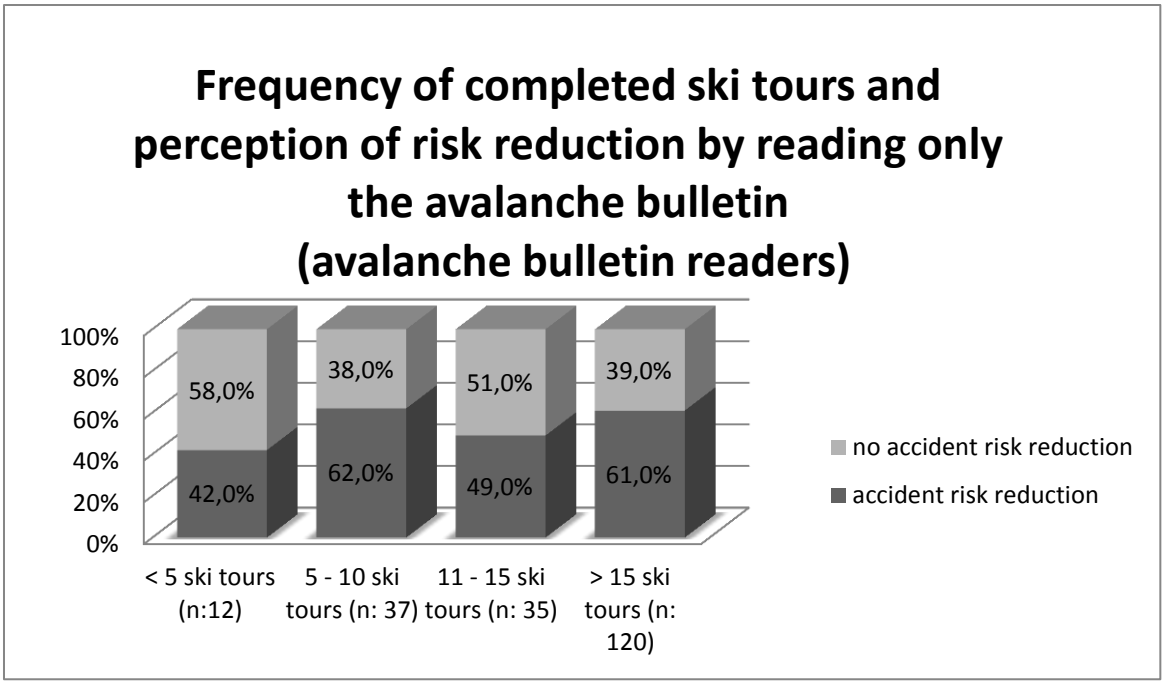


Figure 3-33: Frequency of completed ski tours and perception of risk reduction by reading only the avalanche bulletin, avalanche bulletin readers (own illustration)

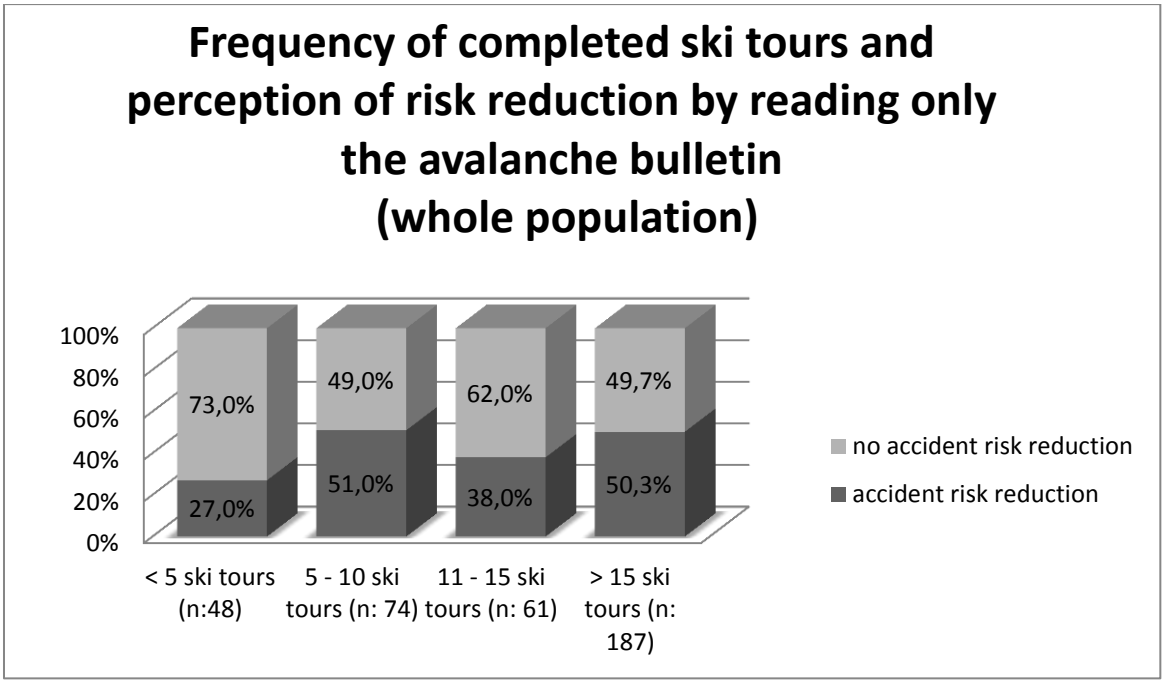


Figure 3-34: Frequency of completed ski tours and perception of risk reduction by reading only the avalanche bulletin, whole population (own illustration)

As shown above, there is no significant difference between those who have read the avalanche bulletin and all interviewed persons. Nevertheless there exists a relation between avalanche bulletin readers and non-readers and their opinion to the accident risk reduction. (see Figure 3-35)

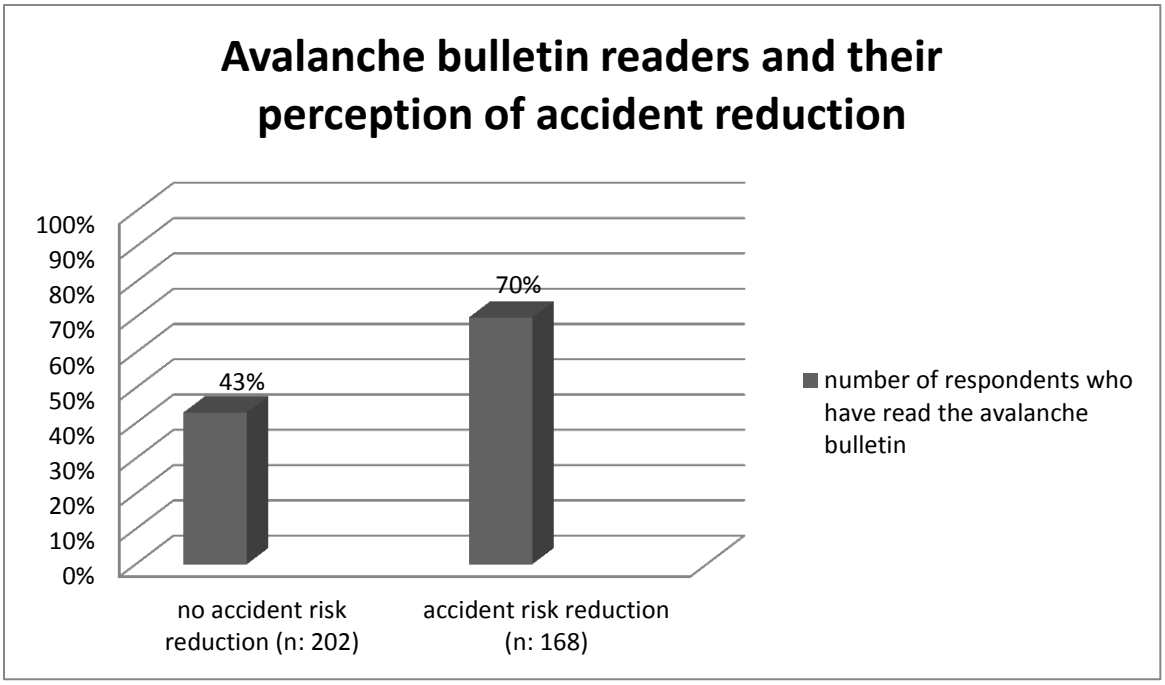


Figure 3-35: avalanche bulletin readers and their perception of accident reduction (own illustration)

It is shown that 202 people think that reading only of the avalanche bulletin cannot reduce the accident risk. From the 202, only 86 people (43%) have read the avalanche bulletin. On the other hand, 168 people think that only reading the avalanche bulletin can reduce the risk of an avalanche accident. From those 168 persons, 118 (70%) have actually read the avalanche bulletin. That means the majority of the respondents are reading the avalanche bulletin in order to reduce the risk of an avalanche accident.

In order to be able to assess the understanding of backcountry skiers, the number of completed ski tours per year and the different age classes are set in relation to the understandability of the avalanche bulletin.

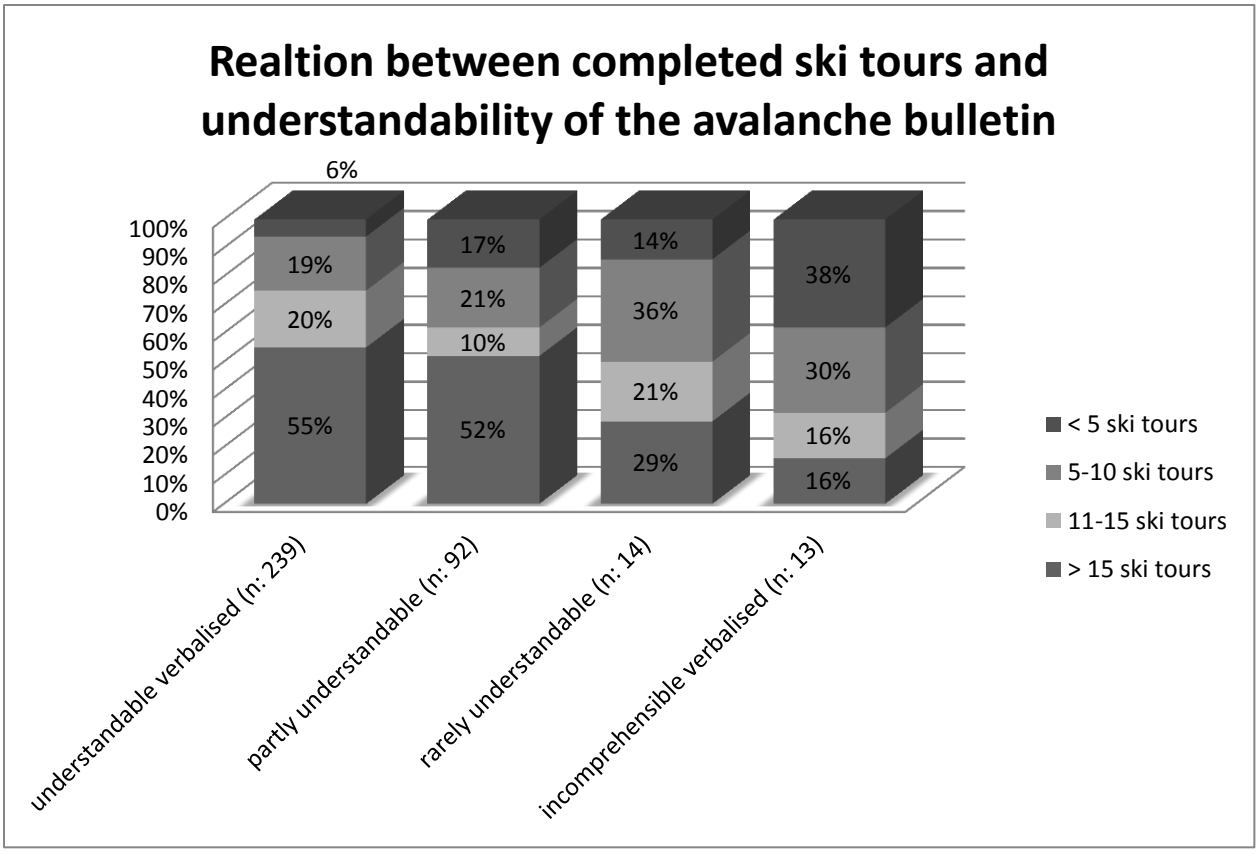


Figure 3-36: Relation between completed ski tours and comprehensibility of the avalanche bulletin (own illustration)

It is shown that the respondents with more than 15 ski tours per year interpret the avalanche bulletin as understandable verbalised. The graph shows that the more ski tours the people are going the more understandable the avalanche bulletin is for them. There are also people who are doing more than 15 ski tours per year but said that the avalanche bulletin is rarely understandable or incomprehensible verbalised. This minority spread over all age groups up to 60 years. The tendency is the less they find it well verbalised and understandable. (see Figure 3-36)

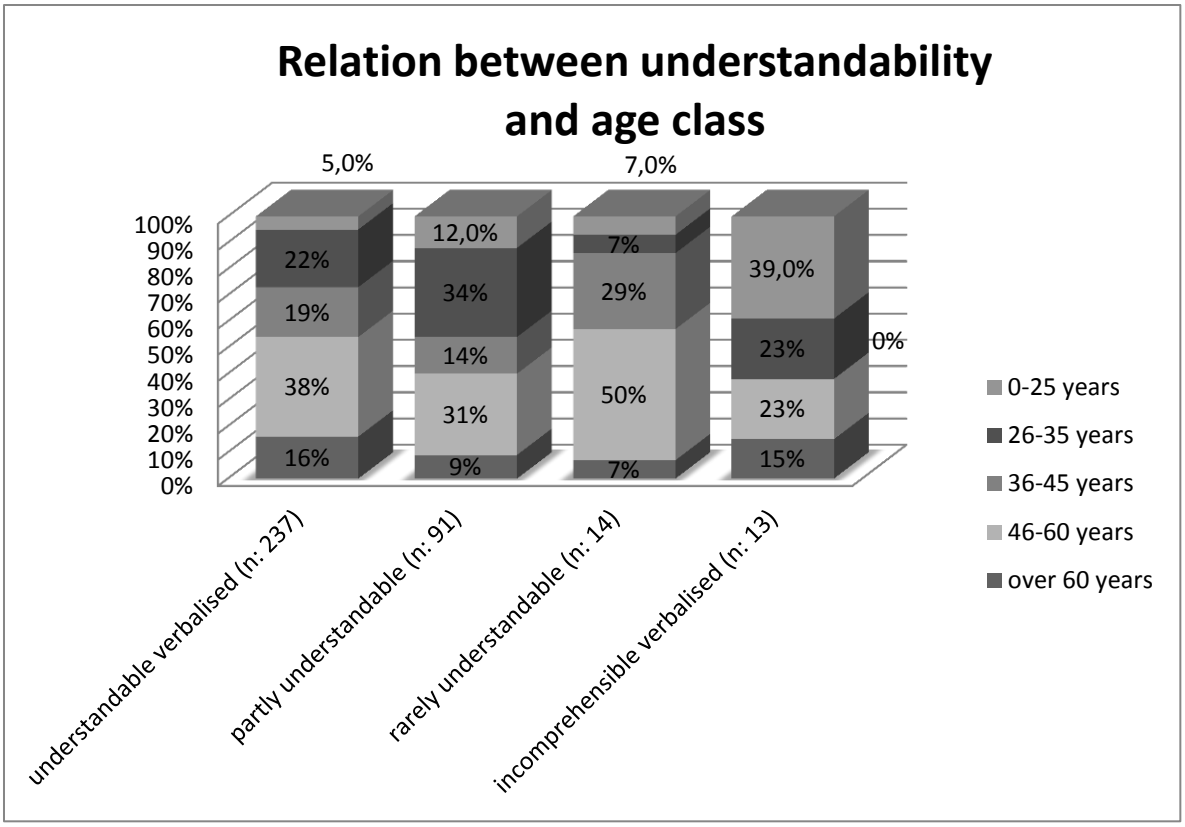


Figure 3-37: Relation between understandability and age class (own illustration)

That the understandability of the avalanche bulletin is well distributed over the different age group. It is demonstrated that especially the younger backcountry skiers find the avalanche bulletin incomprehensible verbalised. This can be attributed to the increasing experience of ski tours with increasing age. (see Figure 3-37)

3.2.2. Reader's implementation

In this part of the paper, the implementation of the avalanche bulletin in the field will be presented. Question 9 shows the result of how many people have read the avalanche bulletin and question 11 shows the result of how many people have done any observation that is presented in the avalanche bulletin. In total, 211 of 386 interviewed people have read the avalanche bulletin, where from 130 people have made some observation on their ski tour. 64 People have read the avalanche bulletin but have not made any observation. From that 211 people, 17 people have not made any statements.

To categorise the statements of the respondents it is split into two parts. The first part sums up the simple statements of the avalanche bulletin while the second part includes more scientific sophisticated statements.

Half of the interviewed persons made simple observations. To make this observation it is not necessary to have special avalanche skills. This statement can be easily made without special knowledge about avalanche metamorphism. The other half of the population made scientific sophisticated observations. (see Table 3-3 and Table 3-4)

Simple observations	
wind speed	snow slab
wind direction	avalanche releases
snowdrifts	wind effected gullies
avalanche warning level	cornice building
weather	

Table 3-3: Simple observations from the avalanche bulletin out in the field (own illustration)

Scientific sophisticated observations	
surface hoar between new snow and old snow - the sliding surface	clear night frozen snow cover
melt freeze crust with new snow on top	"whumpfing" noise
settled snow	wet snow avalanche
depth hoar	

Table 3-4: Scientific sophisticated observations from the avalanche bulletin out in the field (own illustration)

The following figure shows the influence of reading the avalanche bulletin of the geographical awareness of the interviewed persons. This analyse has been conducted in order to find out, if persons read the avalanche bulletin from the right region. The result for the people who have read the avalanche bulletin is astonishing. (see Figure 3-38)

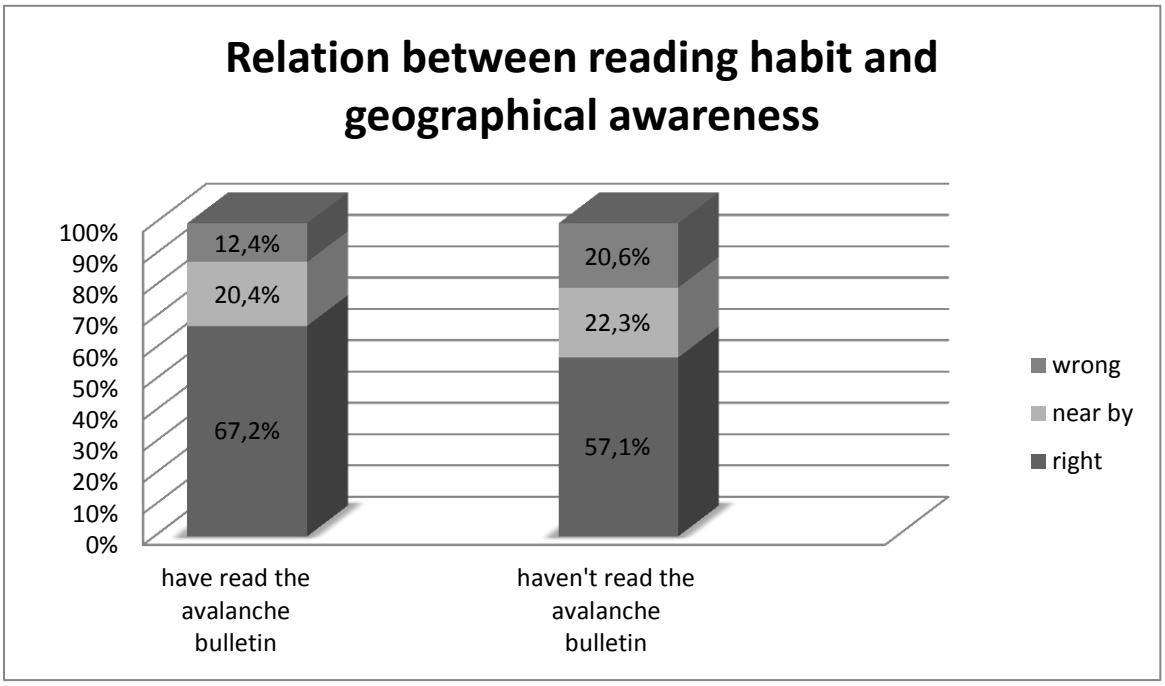


Figure 3-38: Relation between reading habit and geographical awareness (own illustration)

3.2.3. Improvement proposals of respondents

The Improvement proposals of the respondents for the avalanche bulletin in Austria were collected. The interviewed people were asked how they would improve the avalanche bulletin. That is to help people who are publishing the avalanche bulletin to make it more attractive for everyone and to reach a higher number of backcountry skiers.

1. use simple words	2. publish by early evening, for the next day
3. two times a day	4. standardize in all federal states
5. earlier than 7:30 am	6. in English
7. more regional	8. more detailed maps
9. description of terms	10. emphasise of danger spots

Table 3-5: Summary of the most replies to improve the avalanche bulletin. The answers were ordered by their frequency (own illustration)

Furthermore the following answers are important too.

- more people out in the backcountry who are observing the situation
- a platform where people can post actual events
- danger spots marked with links, to explain how they can be seen
- electronic message for the avalanche bulletin in the afternoon
- more detailed for experts
- important terms explained in pictures
- to use Smartphones more often and find other medias to present the avalanche bulletin
- photos of the danger spots
- description of the maps with snow height
- more subdivisions in a region

These were all suggestions for improving the avalanche bulletin in Austria. The respondents did not only criticise the avalanche bulletin, but they also praised the Austrian bulletin for specific federal states like Tyrol, and also the bulletin from Switzerland.

3.3. Part II: Risk behaviour of backcountry skiers (Pschernig, V.)

Risk sports like backcountry skiing requires not only high concentration and physical fitness from the athletes. It also claims a certain readiness to assume risk. The level of risk we are willing to take is very subjective. Most of the time we are exposed to different factors, changing our level of risk unconsciously. A part of this factors is described in chapter 1.2 as the human factors. In this part of the survey we want to examine the risk behaviour of the backcountry skiers and as far as possible find out if and how the human factors and perception traps are influencing it.

To get the needed results the questions illustrated in chapter 3.1 are interlinked in different combinations and presented in the following chapters. Afterward we interpret the presented results with focus on risk behaviour.

3.3.1. Risk behaviour in general

To find out something about the risk behaviour of the backcountry skiers questions 5,6,14, 15, and 17 contain particular answer choices dealing with risk. The single results are shown in chapter 3.1. Following we are combining question number 15 with questions 1,2 and 21 we can see how the risk behaviour is distributed concerning age and experience. Question 15 shows that 41,6% of the respondents would do the ski tour at a higher avalanche danger level. Their age distribution is shown in Figure 3-39. 35,7% of the respondents who are willing to take a higher risk are younger than 35 years. The biggest part is represented by them who are between 46 and 60 years what correlates with the biggest age group of the whole sample.

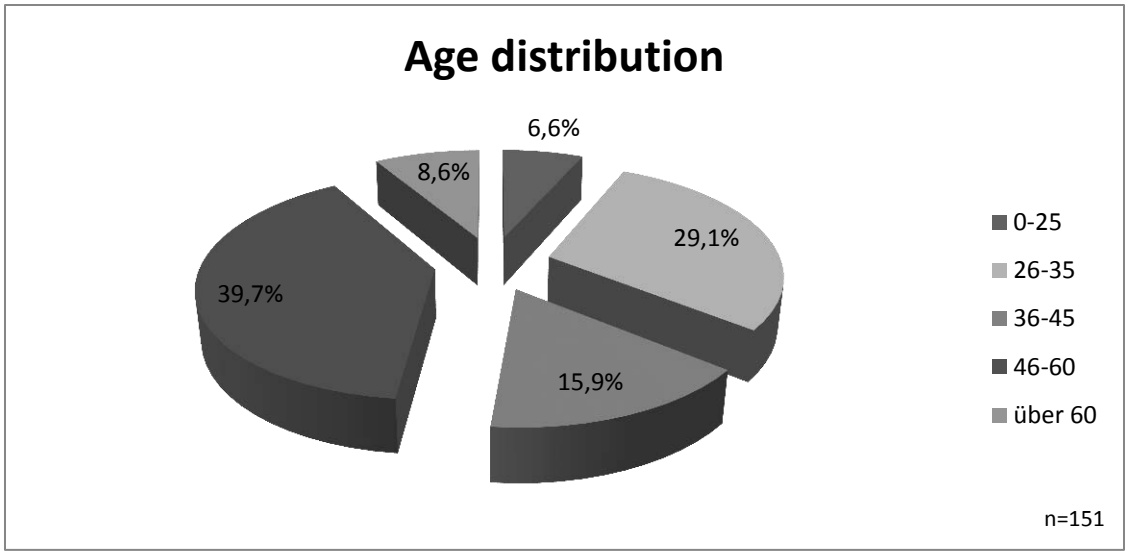


Figure 3-39: Age distribution of athletes who state that they would do the tour when avalanche danger level is high (own illustration)

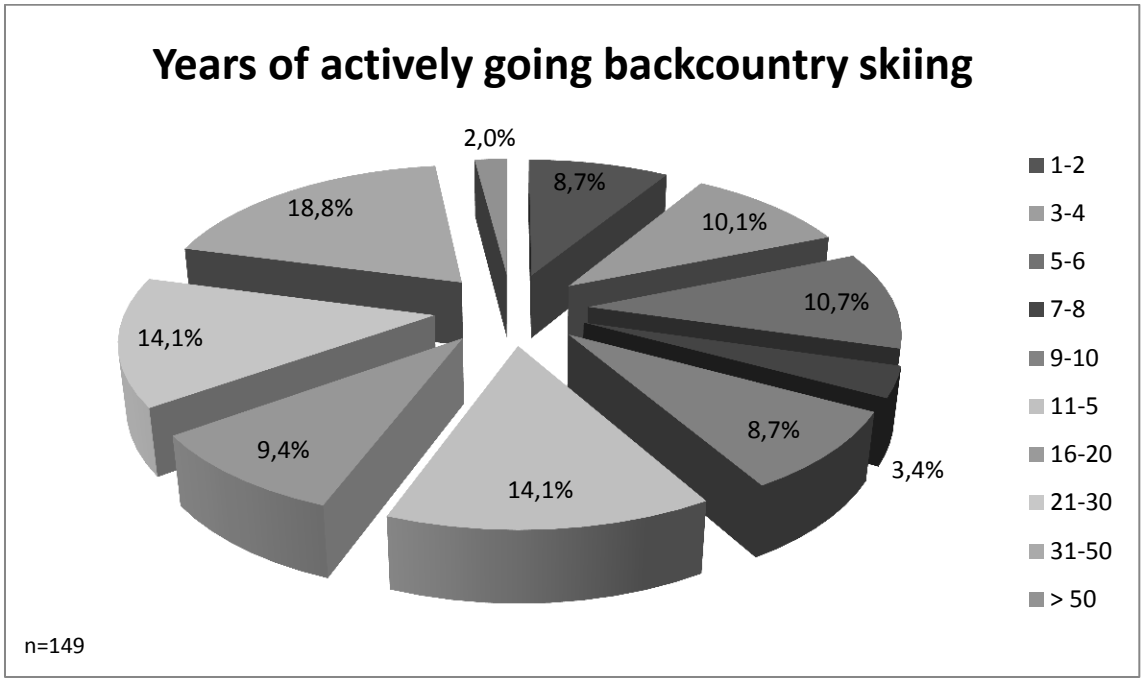


Figure 3-40: Years of actively going backcountry skiing of those athletes who would do the tour when avalanche danger level is high (own illustration)

The figure above depicts how many years the athletes who take a higher risk are active backcountry skiers. As shown, the distribution is some kind of consistent, which means that the willingness to take higher risk is not dependent on how long the athletes exercise the sport.

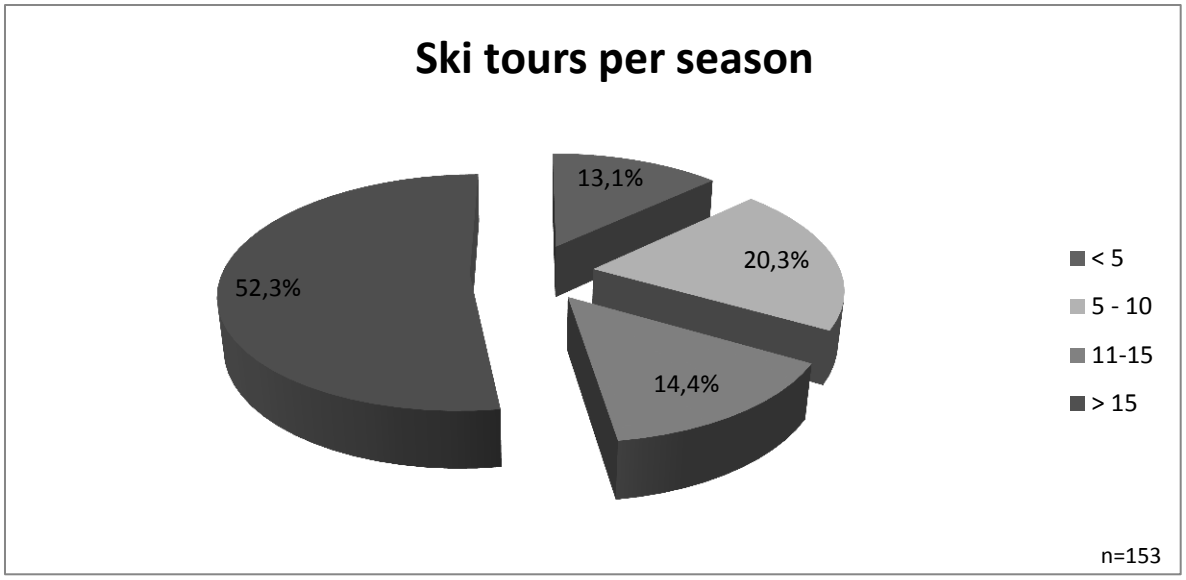


Figure 3-41: Illustration of number of ski tours done by those athletes who would do the tour when avalanche danger level is high (own illustration)

52,3% of the backcountry skiers do more than 15 tours per season which can be an indicator for more experience. (see Figure 3-41)

3.3.2. Gender

Figure 3-1 illustrates that 27% of the interviews people are women and 73% are men. In the following part the differences in risk behaviour between men and women will be highlighted.

Nearly 60 % of the male athletes do more than 15 ski tours per year. Most of the women, about 30%, do 5-10 ski tours per year. This can leads to the assumption that men are more experienced in this sport. (see Figure 3-42)

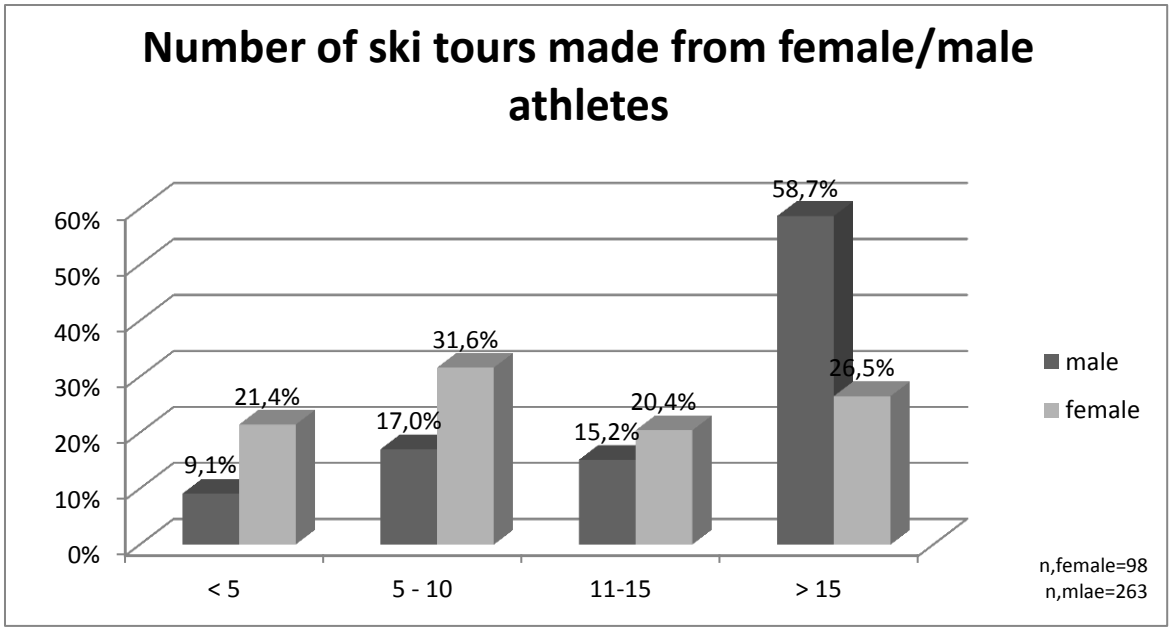


Figure 3-42: Illustration of the number of ski tours made by female and male athletes (own illustration)

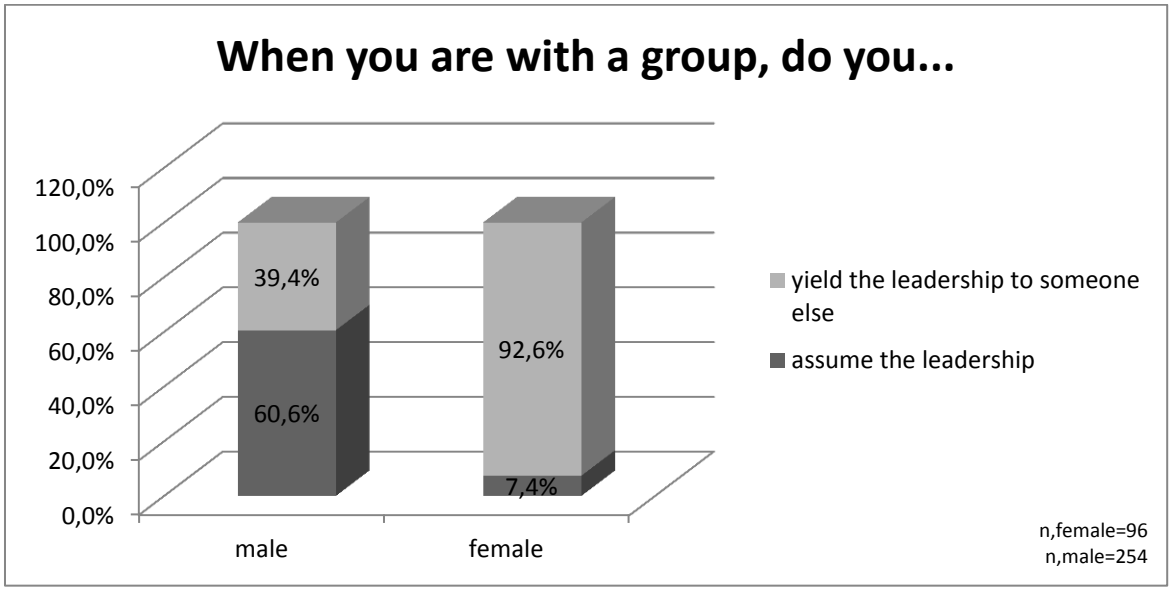


Figure 3-43: Difference between men and women in leadership behaviour (own illustration)

Question number three of the questionnaire targeted the leadership behaviour of the athletes when they are on tour with a group. Question 3 points out that 44,1% of the respondents would assume the leadership, while 55,9% would yield the leadership to someone else. When differ between male and female respondents we find a big gender gap. Over 60% of the male respondents would assume the leadership but only 7,4% of the women would act this way. This means contrariwise that over 90%

of the female athletes are not willing to take the leadership but follow another person. This is only true for about 40 % of the male athletes.

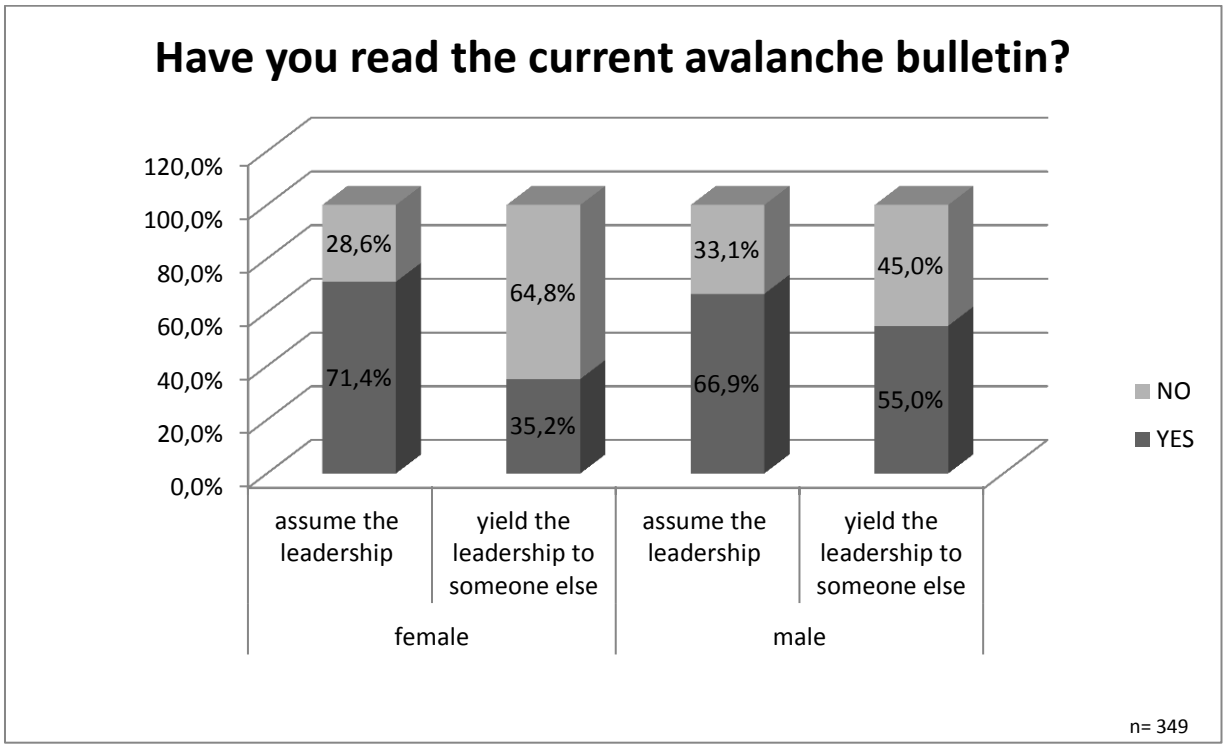


Figure 3-44: Relationship between leading or not leading a group and reading the avalanche bulletin according to gender (own illustration)

When leading a group the bigger part of the respondents are reading the avalanche bulletin. 66,9% of the male and 71,4% of the female athletes assuming the leadership have also read the current avalanche bulletin. More interesting is that only 55% of the men who are following another person nevertheless read the avalanche bulletin while only 35% of women do so. (see Figure 3-44)

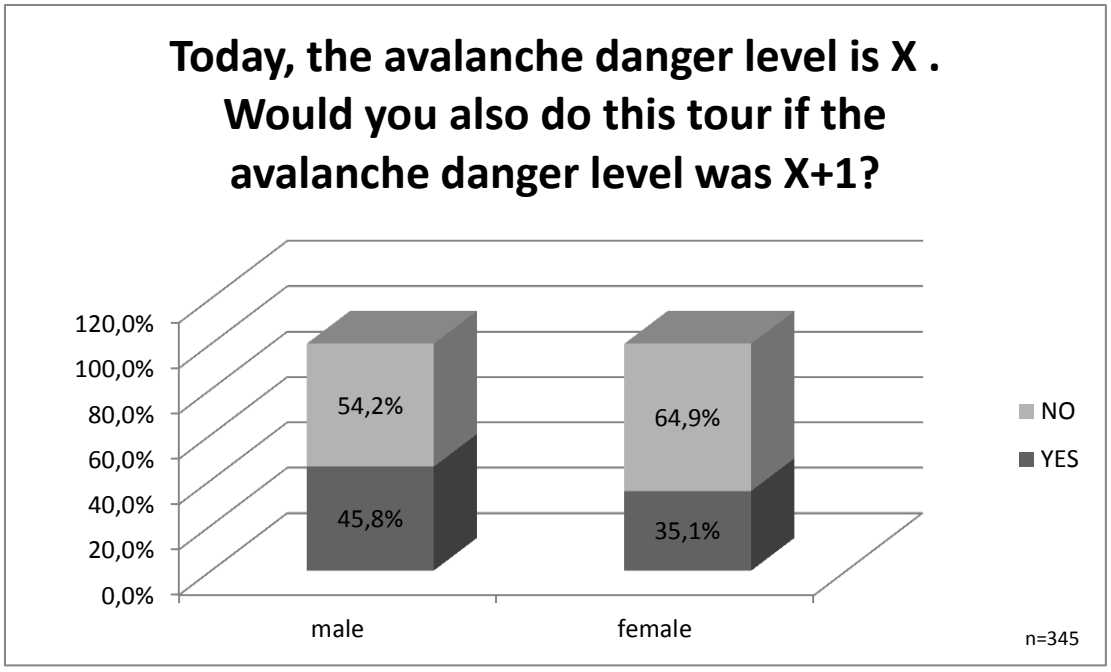


Figure 3-45: Difference between men and women concerning their readiness to assume risk (own illustration)

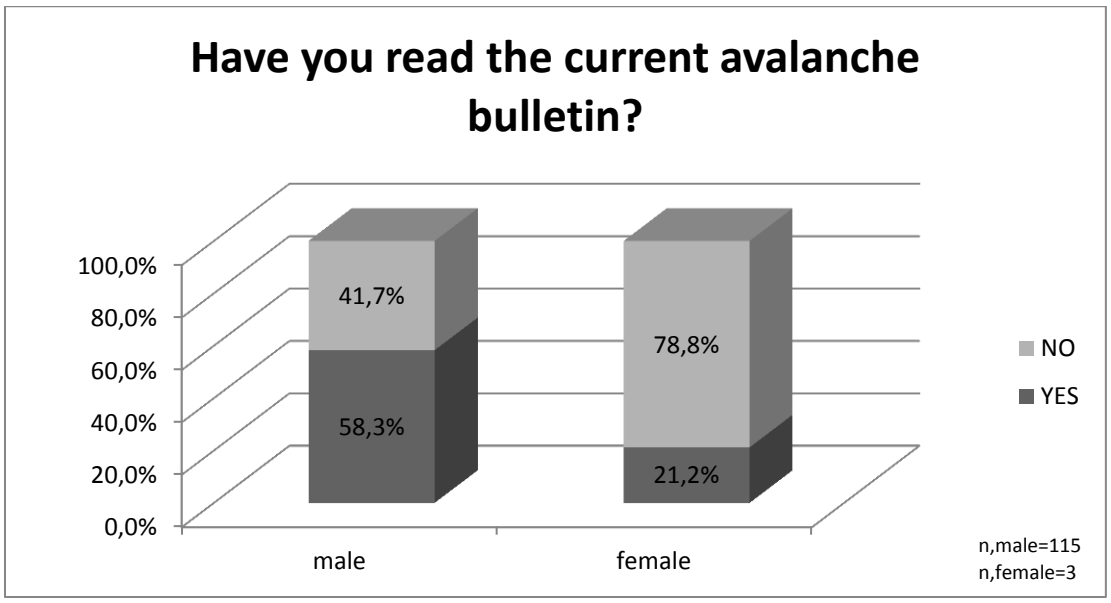


Figure 3-46: Illustration of how many of the athletes who would go at a higher level of risk, have read the actual avalanche bulletin (own illustration)

Question number 15 deals with the readiness to assume risk. (see Figure 3-21) Generally speaking we can see that there is no big difference between male and female respondents. 45,8% of the male athletes would have done the ski tour also if the avalanche level would have been one degree higher than on the day of the questionnaire. Among the female respondents also 35,1%, only 10% less, would go at a higher avalanche

danger level. (see Figure 3-45) The reasons for taking a higher level of risk were requested with question number 16. (see Figure 3-22 and Figure 3-23)

53,3% of the male respondents who would go at a higher avalanche level have read the actual avalanche bulletin but only 21,2% of the women did. (see Figure 3-46)

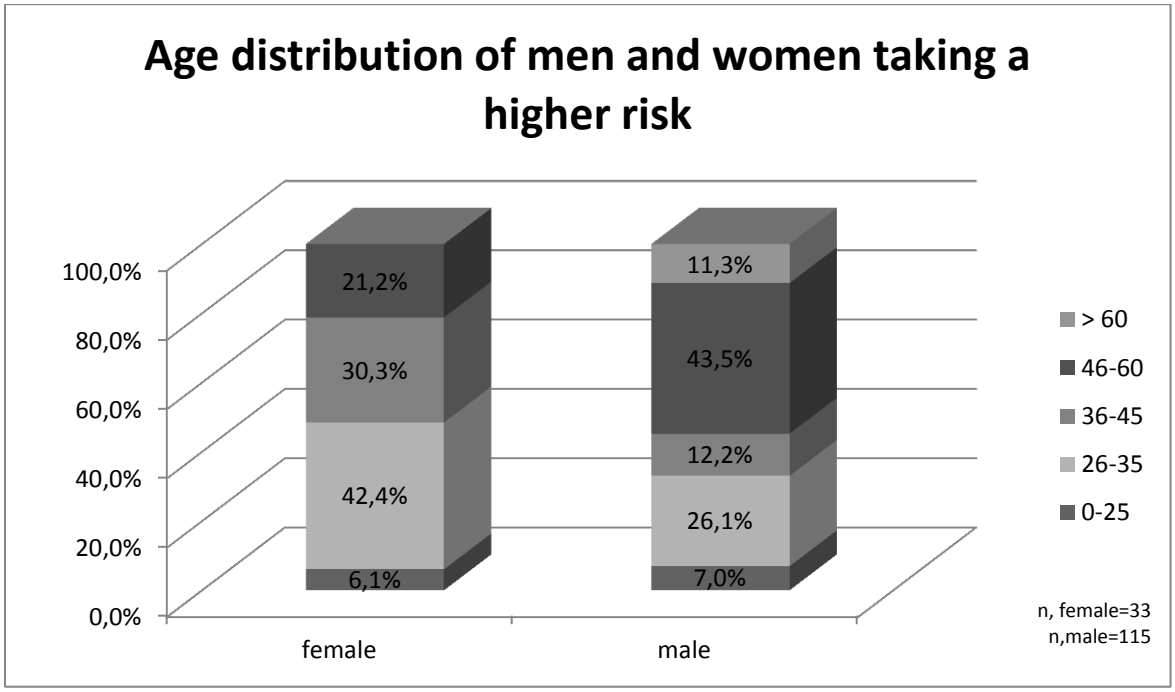


Figure 3-47: Age distribution of those female and male athletes who are willing to do the ski tour at a higher avalanche danger level (own illustration)

Most of the female respondents, 42,4%, with a higher readiness to assume risk are between 26 and 35. Followed by the group of 36 to 45 year olds with 30,3%. Among men most of the athletes who are willing to take a higher risk are between 46 to 60 years old. Remarkable is also that no women older than 60 years would take the higher risk and make the tour at a higher avalanche level but 11,3% of the men would do it. Among the under 25 year old athletes 6,1% are female and 7% are male. (see Figure 3-47)

3.3.3. Habituation

When the athletes are familiar with the region where they are doing their sports then they tend to underestimate the hazard of an avalanche. As explained in chapter 3.1, question number 4 was concerned to find out the habitude of the backcountry skiers concerning their selection of the tours they do. By combining this question with the number of ski tours, it is possible to find out if the way they select their tours correlates with how many tours they have done. A Chi-Square test has validated that the two variables, number of ski tours and the way of selecting the tour, are highly dependent.

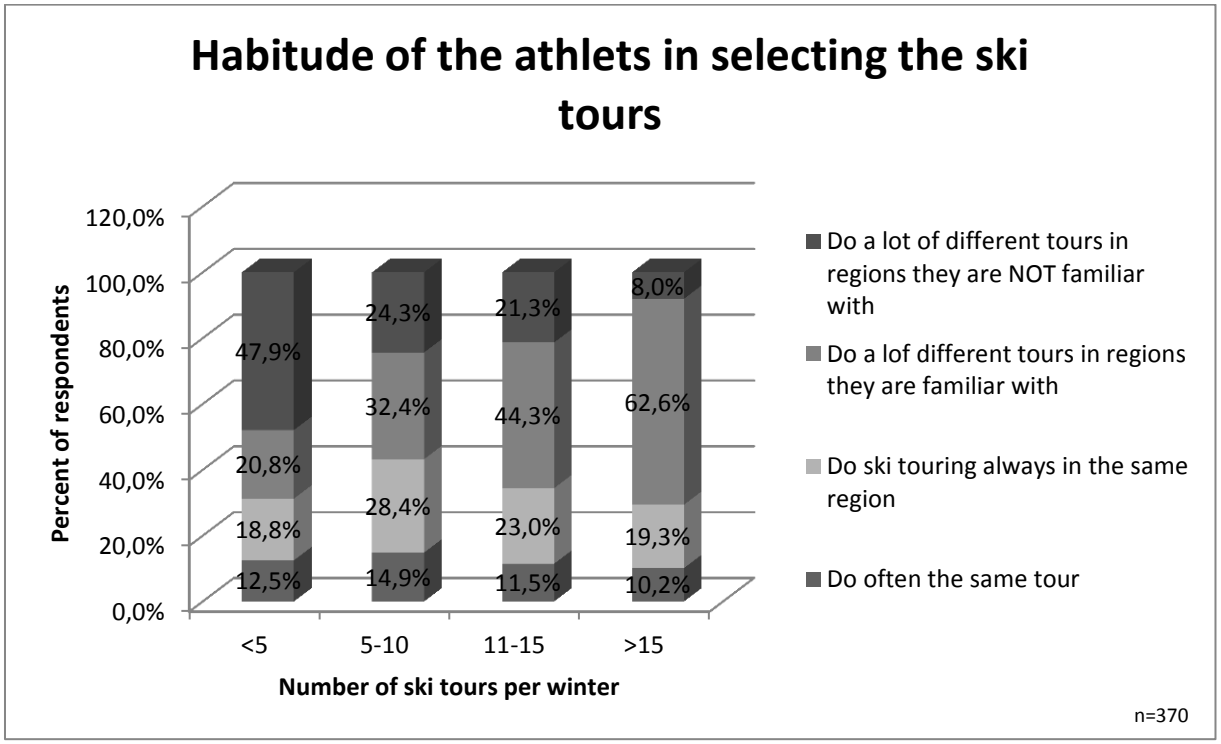


Figure 3-48: Relationship between the number of ski tours per winter and the habituation of the athletes concerning the selection of their tours (own illustration)

In all categories, expect <5, most of the respondents do backcountry in different regions they are familiar with. Among those who do more than 15 tours per season over 60% belong to this category. Interesting is that, the more ski tours athletes do the lesser they explore unfamiliar region, what is logically, because they already explored a lot regions. 47,9% of those who do less than 5 tours per winter do it in different and for them

unfamiliar regions. This percentage is getting lesser and lesser the more tours people do. Among those athletes who are doing more than 15 tours per season only 8% of them explore unknown regions. The percentage of those who do often the same tour and those who do backcountry skiing mostly in the same region are nearly the same in all categories.

Most of the people do different ski tours in familiar regions. (see Figure 3-48) To find out how their experiences are we have to look on their answers for question number 17 and afterwards compare it with the experience of other athletes who, for instance, go tours in unfamiliar regions (see Figure 3-50) or those who do often the same tour (see Figure 3-51). Therewith we can make a declaration about differences in experience respectively if their habituation has an influence on what experiences they made. As mentioned in chapter 3.1.17 due to multiple responses had been possible for question number 17, percentage of answers does not equal 100% but exceeds it. Several people picked more of the available answers.

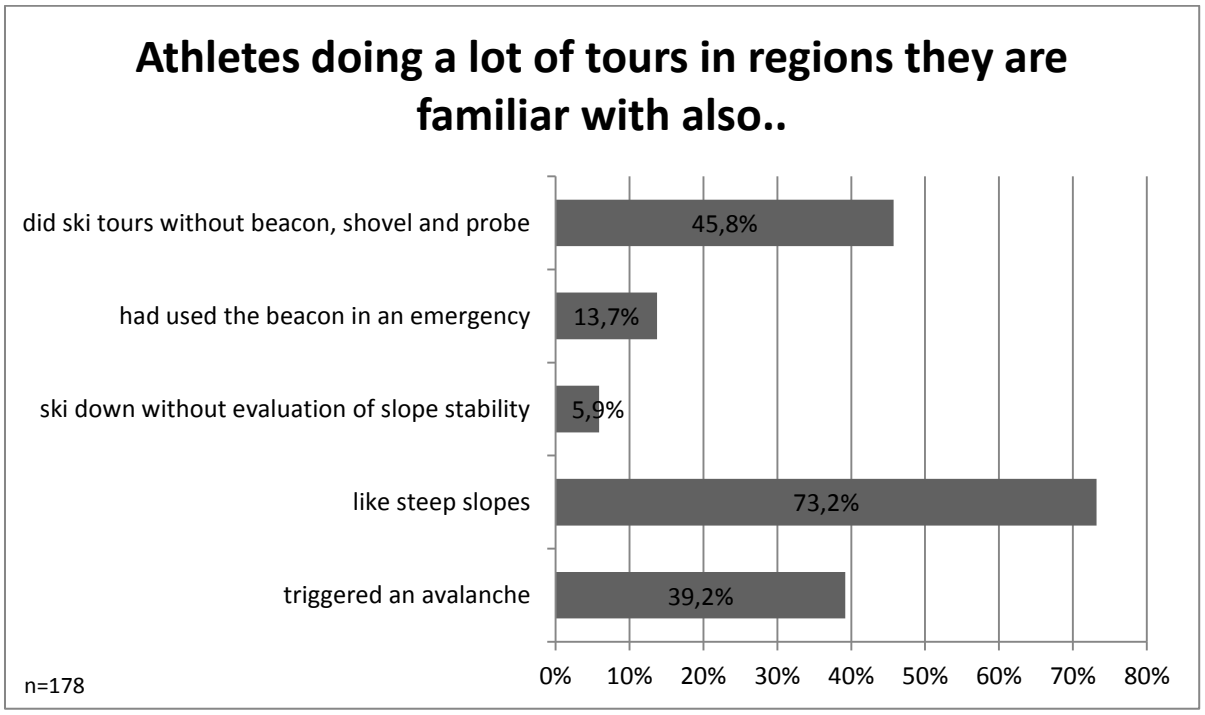


Figure 3-49: Depiction of the experience of those athletes, who do backcountry skiing in familiar regions (own illustration)

Among the 153 athletes, who do many tours in different but familiar regions, 39,2% states that they had already triggered and avalanche but 13,7% had used the avalanche beacon in an emergency. 73,2% like steep slopes but only 5,9% ski down slopes without evaluating its stability. 45.8% athletes admit that they already did tours without appropriate equipment.

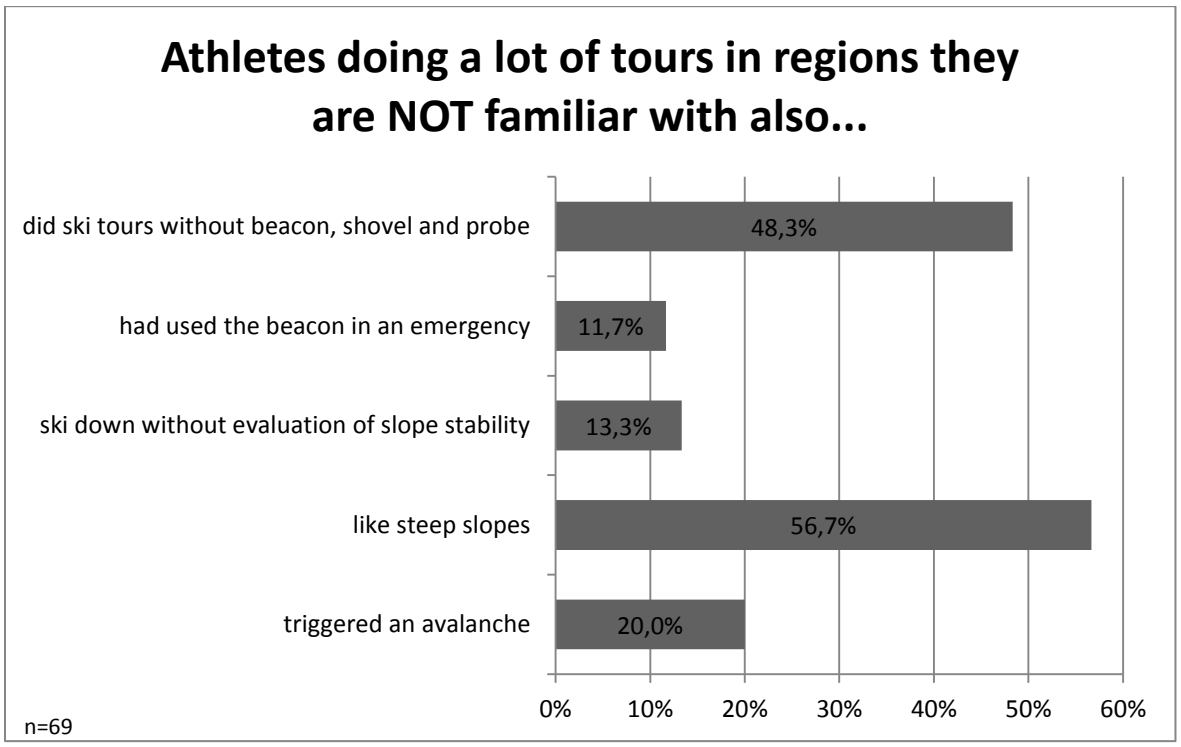


Figure 3-50: Depiction of the experience of those athletes, who do backcountry skiing in regions they are NOT familiar with (own illustration)

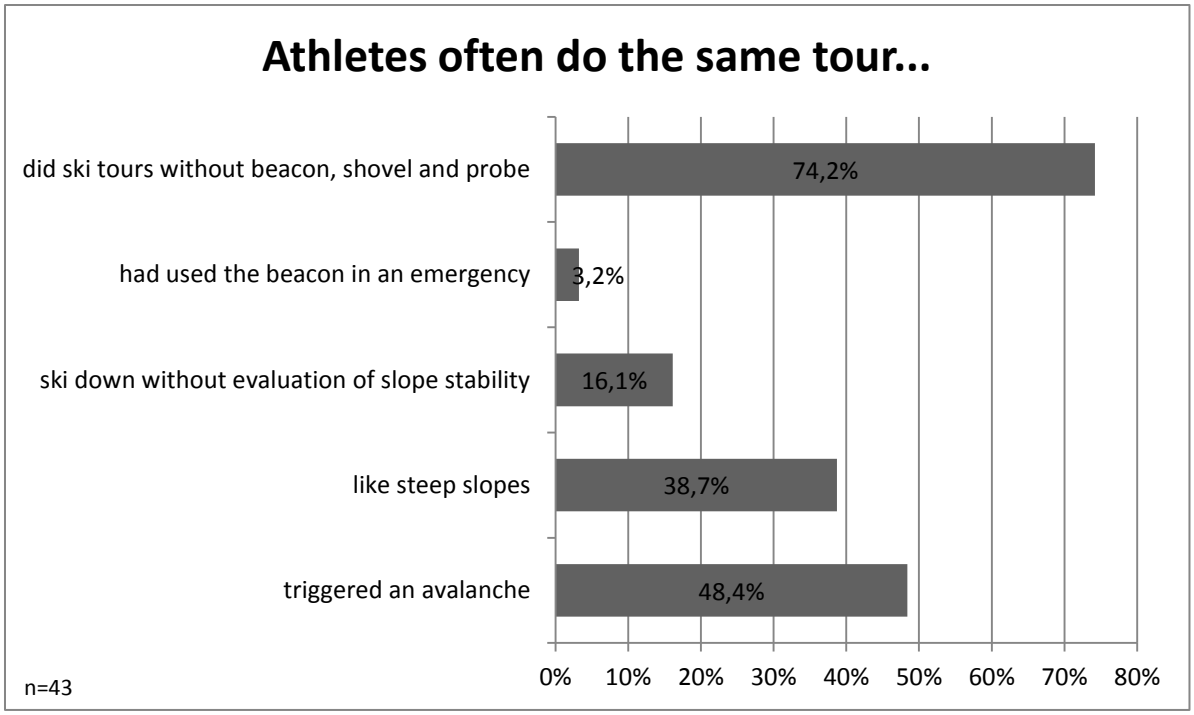


Figure 3-51: Depiction of the experience of those athletes, who do often the same tour (own illustration)

Figure 3-50 illustrates how the experiences of those backcountry skiers are who do ski tours in different unfamiliar regions. Interesting is, that only 20% of them had already triggered an avalanche. This is half of the percentage from Figure 3-51. Here only 56,7% like steep slopes and 13,3% ski down without checking the slope stability. This is also true for the experience of those athletes who do often the same tour. The big difference is that 74,2% of them state that they already did ski tours without beacon, shovel, or probe. This is 20% more than among those who do different tours. Moreover it is apparent that only 38,7% like steep slopes. (see Figure 3-51)

Question number 5 was also concerned with the reasons for backcountry skiers taking part of the tour. 95 people states that the fact that they have done the tour before was a criteria for doing it. Another 11 indicate at "Others" that they did the tour because they are familiar with it.

3.3.4. Group dynamics and self-responsibility

In chapter 1.3.7 the possible problems when going with a group had been pointed out. In this part we try to explore how the respondents of this survey behave. More precisely we want to know, if they are influenced by group dynamics and if they are willing to take self-responsibility or if they tend to shift responsibility. Furthermore it should be clarified if the just mentioned factors affect the risk behaviour of the backcountry skiers.

As mentioned the chapter before, question number 5 deals with the reasons for backcountry skiers going on a ski tour. 51% of the respondents state some kind of group dynamics as a reason.

Further there are several questions where one of the possible answers provides information about the ability or willingness of the athletes to take self-responsibility and/or if they tend to rely on other maybe more experienced persons. One is question number 6, which deals with the information procurement process of the backcountry skiers about the actual avalanche situation. About 45% of the athletes rely on the judgement of other persons while 46% assess the situation on their own and 6% do nothing at all to get information about the avalanche situation.

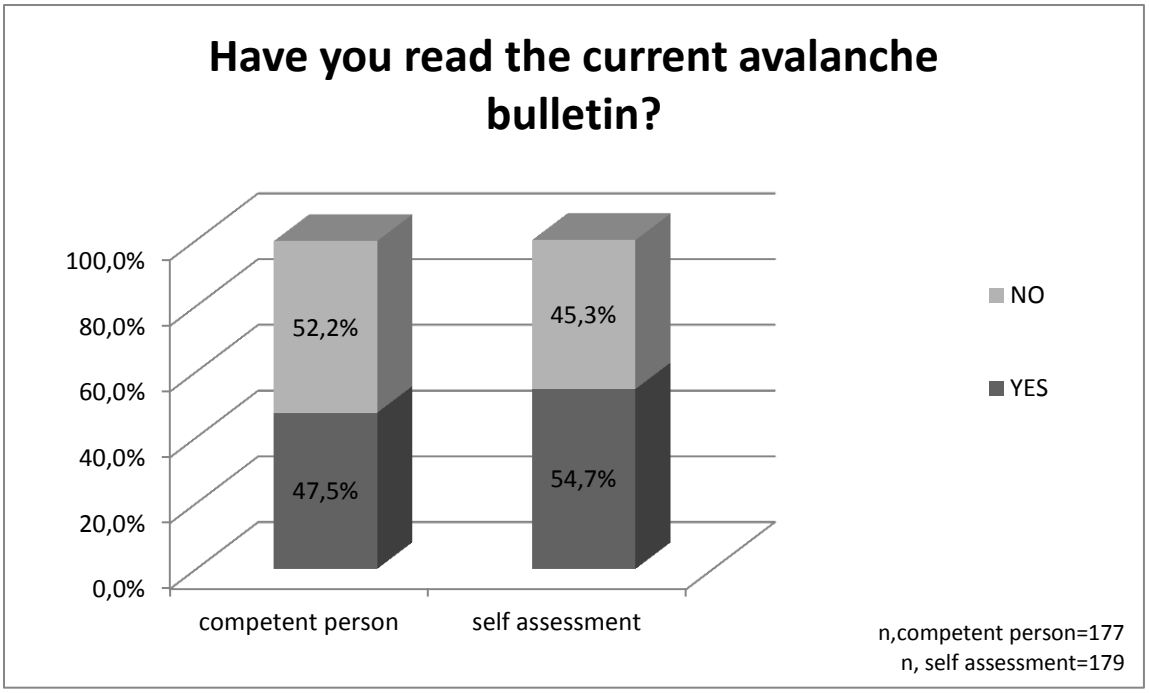


Figure 3-52: Relationship between athletes who rely on other persons and those who assess the situation on their own concerning reading of the avalanche bulletin (own illustration)

Those 6% who do nothing at all to get information logically do not read the avalanche bulletin. More interesting is, that 47,5% of those respondents who state that they faith in the judgement of another person, nevertheless read the avalanche bulletin. In contrary 45,3% of those who belief in their own assessment have not read the current avalanche bulletin (see Figure 3-52) but nevertheless 28,4% of them state that they normally read the avalanche bulletin. (see Figure 3-54)

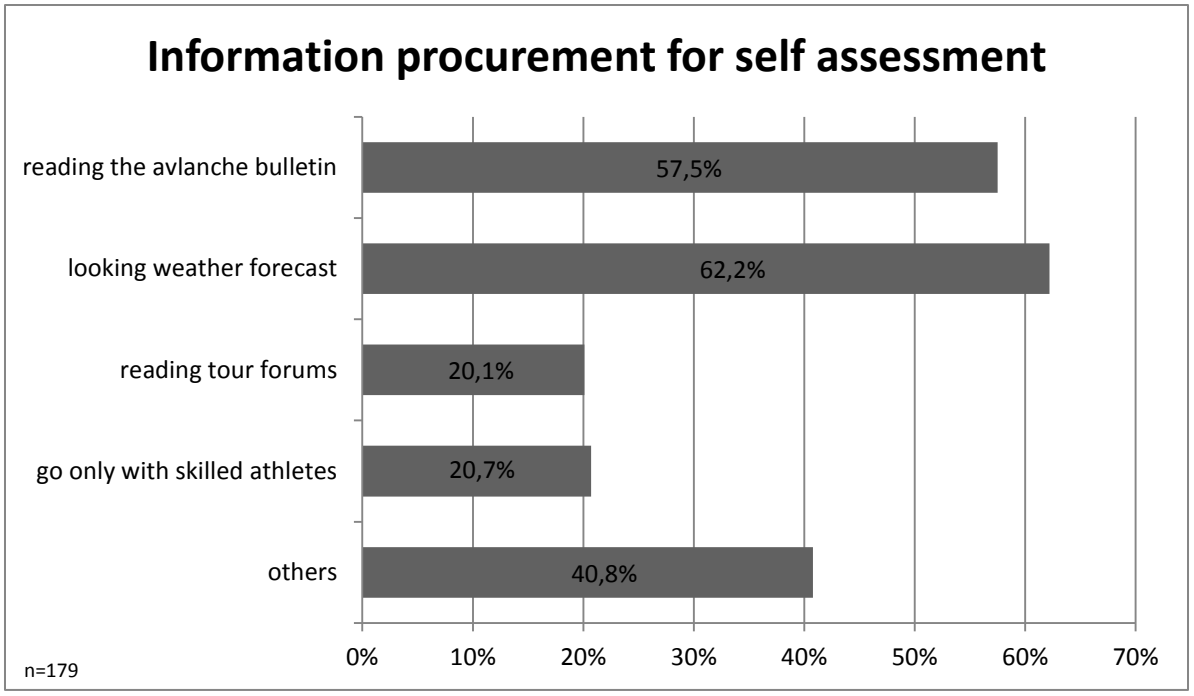


Figure 3-53: Information procurement of those athletes who states that they assess the avalanche situation on their own (own illustration)

Besides reading the avalanche bulletin, most of the respondents who do a self assessment state that they are looking the weather forecast. It is fair to assume that most of them also read the avalanche bulletin because multiple responses were possible for question number 6. Moreover they get their information from tour forums (20,1%) or they do ski tours only with skilled persons (20,7%).

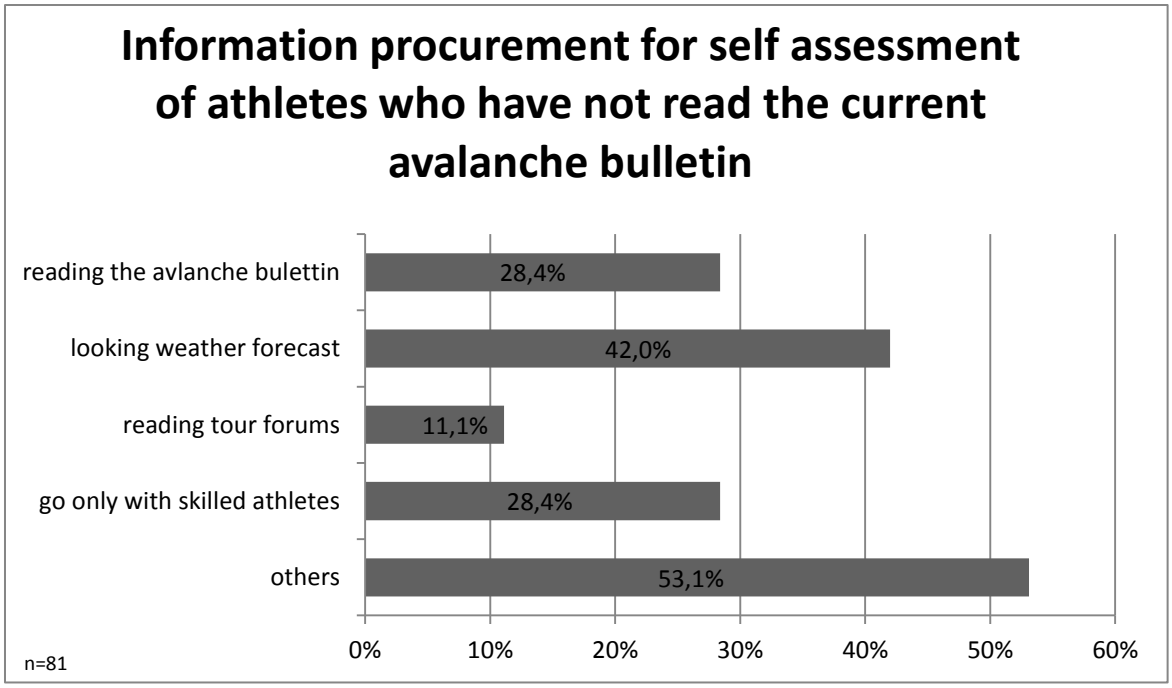


Figure 3-54: Information procurement for self assessment of those people who have not read the current avalanche bulletin (own illustration)

Due to the fact, that 43% of the athletes who count on their self assessment have not read the avalanche bulletin, we want to know, where they get their information from. (see Figure 3-54) Among those who picked "Others" over 60% indicate that they get information from other persons. (see question 6)

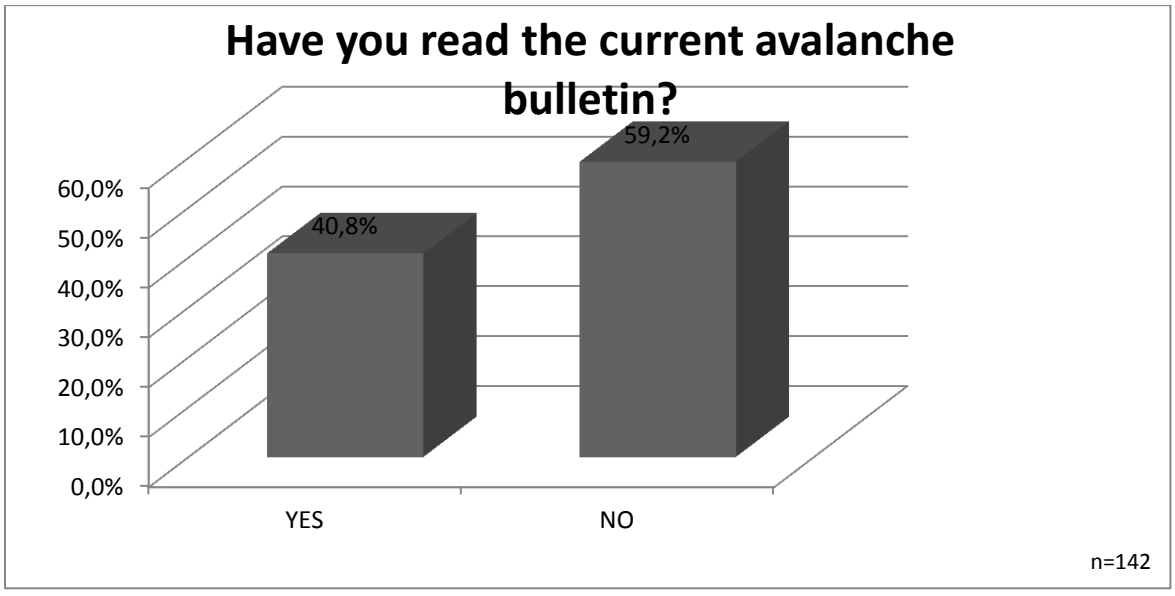


Figure 3-55: Distribution of athletes, who are going on a tour only with an experienced person, according to reading the avalanche bulletin (own illustration)

Question number 7 also contributes to find out more about the self-responsibility of the backcountry skiers, it displays the distribution of measures, which athletes take to safely navigate through avalanche prone terrain. 142 respondents state that they only do backcountry skiing with experienced persons. Nevertheless, 40,8% of them have read the current avalanche bulletin and therewith gathered information on their own (see Figure 3-55).

3.3.5. Sensation Seeking

In chapter 1.5 it says that it is possible to explain the willingness of people to assume a higher level of risk with the concept of "sensation-seeking". This means athletes will take a higher level of risk in pursuit of an exciting experience.

The table bellow shows that, beside group dynamic phenomena (see chapter 3.3.4) good snow quality and nice weather are often the reason for going on a ski tour.

New snow	35
Good snow quality	116
Live nearby	96
Nice weather	206
Have already done the tour	95
Low avalanche warning level	126
Others	183

Table 3-6: Question 5: Which of the following reasons best explains your taking part in the tour today? (Select all that apply) (own illustration)

To find out, if the concept of Sensation Seeking also applies to the sample of our survey, we have a look on question number 16. Therewith we can see, for instance, if athletes would take a higher risk when snow quality is good.

Nice weather	44
Good snow quality	44
I am in good form	7
Do not care about avalanche level	7
Others	105

Table 3-7: Question 16: Reasons for doing the tour at a higher avalanche danger level (own illustration)

Table 3-7 depicts the answers for question number 16. Only 44 people say that good snow quality is a reason for taking a higher risk. Most of the respondents picked "Others". Within these, 33% state the morphology of the terrain allows it to do the tour at a higher avalanche danger level and only 7% would take more risk because of the condition of the snow (see Figure 3-23).

Slope direction	158
Ski down to get near to the car	40
Ski down always the same slope	36
I prefer untraveled slope	93
Quality of the snow	206
I rely on others	101
I prefer sparse forest	35
I ski down on slopes with traces	97
Others	85

Table 3-8: Question 14: What criteria do you use to select the slope for departure? (own illustration)

Question number 14 also contains some information about the preferences of the athletes. It seems that the quality of the snow is of course a reason why people choose the slope for departure. The prospect of an untraveled slope seems not to be a main reason. As well as before, the morphology

of the terrain was indicated most often among "Others" (see Figure 3-20). A little bit more than 50% of those athletes who like untraveled slopes would take a higher level of risk. (see Figure 3-56)

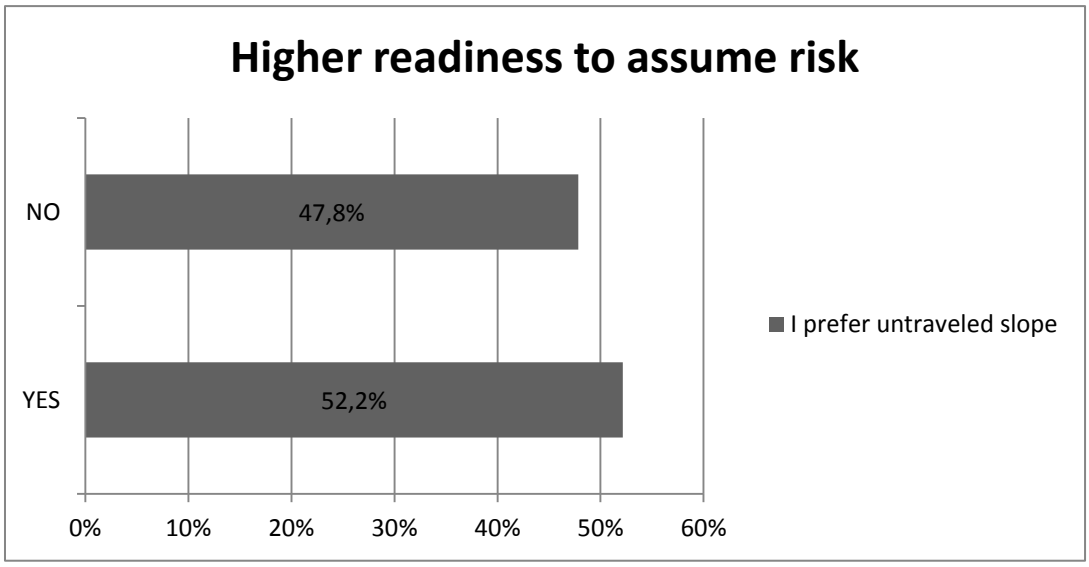


Figure 3-56: Willingness to take more risk for ski down when on an untraveled slope or when the snow quality is good (own illustration)

4. Conclusions (Mayer, M.)

This chapter summarizes the outcomes of the survey and its conclusions. First the outcomes of Part I are presented in Chapter 4.2, which lead to recommended improvement measures for the further development of the avalanche bulletin. Further the outcomes of Part II are presented in Chapter 4.3.

4.1. Conclusion according to the effectiveness of the avalanche bulletin (Mayer, M.)

As mentioned in the introduction, the effectiveness of the avalanche bulletin constitutes a combination of reading, understanding and implementing the information of the avalanche bulletin. The degree of the effectiveness is dependent on the ability of the backcountry skiers to fulfil the different steps of the knowledge chain.

Not every step has to be taken to act correctly in the field when going ski tours. Having knowledge about avalanche formation and finally acting responsible and risk averse is not necessarily connected to reading the avalanche bulletin. Just reading the avalanche bulletin cannot prevent accidents in the alpine area.

The central question is who reads the avalanche bulletin? From this survey the general statement can be stated that more men than women are reading the avalanche bulletin. Further, the older the people are the more often they read the avalanche bulletin. The age group from 46 to 60 years read the avalanche bulletin the most, but it is simultaneously also the group with the highest percentage of people who are not reading the avalanche bulletin and are taking the lead of a group. Among the women in this survey, the age group from 26 to 35 years and also from 46 to 60 are reading the avalanche bulletin the most. Another interesting outcome is that only 55% of the men who are not taking the lead of a group are

reading the avalanche bulletin. In contrast only 35% of the women are reading the avalanche bulletin when she is not taking the lead of a group (see chapter 3.3.2). To promote backcountry skiers informing themselves by reading the avalanche bulletin, information material can be developed or a television ad can be run.

To figure out if the respondents understand the content of the avalanche bulletin, they were asked about their perception of a potential avalanche accident reduction by the only reading the avalanche bulletin. Further they were interviewed about the understandability of the avalanche bulletin. A share of 70% of the persons who stated, that an avalanche accident can be reduced by only reading, actually has read the avalanche bulletin. In contrast a share of 43% of the respondents, who answered that an avalanche accident can't be reduced only by reading the avalanche bulletin, has read the actual avalanche bulletin. To assess the understandability of the avalanche bulletin, persons could choose how understandable and incomprehensible the avalanche bulletin is verbalised. The result shows that the majority of the respondents with more than 15 ski tours per year interpret the avalanche bulletin as understandable verbalised respectively partly understandable. In other words, the more ski tours the persons go, the more understandable the avalanche bulletin is for them. The survey shows that young respondents in the age group from 0 to 25 years tend to have problems with understanding of the avalanche bulletin. This might be point of contact to address improvement measures regarding the understandability to younger people. This can be reached by using young media to transport knowledge (see Chapter 4.2)

The implementation of the avalanche bulletin was an important part of the survey and the result shows that nearly all people who have read the avalanche bulletin could make some observation during their ski tour. To figure out if the answers were significant, the specified observations were split into two groups. It can be shown that it is not necessary to have special avalanche skills to make observation like wind direction, avalanche

releases, weather, cornice building. On the other hand scientific sophisticated observations like depth hoar, surface hoar between new snow and old snow, settled snow require special knowledge about snow mechanics and avalanche formation. The result showed that the answers were equal, about 50% of the interviewed persons made a simple observation. The other half of the population made a scientific sophisticated observation. To find out if the persons have read the right avalanche bulletin form the right region, they were asked to show the current location on a map. A surprising result was that 12,4% of the people who have read the avalanche bulletin could not tell their actual location. A share of 20,4% could sketch the right region with the right avalanche bulletin for this area. 67,2% of the reading persons could sketch the exact place on the attributive map. In order to improve the implementation, field courses should be promoted to teach the correct behaviour going ski tours in the alpine region.

4.2. Recommended improvement measures of avalanche bulletin (Mayer, M.)

The following recommended measures about the improvement of the avalanche bulletin can help to make it more understandable for everyone and to make it more present in the counter value of backcountry skiers. These measures can raise the effectiveness of the avalanche bulletin as an instrument to inform about the avalanche situation.

In general the avalanche bulletin describes the development of an avalanche situation as exact as possible. Often the avalanche bulletin gives recommendations, but the receiver of the message is not clear. An avalanche bulletin should not give recommendations without aiming a certain group of people. For example: Big avalanches could burry traffic roads. The avalanche committee has to stick to these recommendations, although they might have arguments against this warning (Alpinforum, 2012).

Furthermore the avalanche bulletin should not use general educational sentences if they do not have relevance for the actual danger level. The exact description of theoretical knowledge about avalanche formation is written on another place on a surrounding homepage. Links can direct to these pages, which contain specific knowledge in a compact way (see 4.2.1) (Wiesinger, 2012b).

The avalanche bulletin should be verbalised always in the same structure and same level of detail, so that it is not visible that the forecaster might have changed (Wiesinger, 2012b).

The persons who make forecasts underlie human factors. Therefore it is to recommend that other forecasters check forecasts before they are published. Human factors like time pressure and antipathy under colleges can lead to errors and misunderstanding (Wiesinger, 2012b).

A forecaster can create an avalanche bulletin only on the computer, without being in the field. On the other hand there are forecasters who spend a lot of their time out in the field observing the snow pack and making snow profiles. Sometimes this can lead to a overrepresentation of small areas in the forecast and therefore to a bias of the forecast. The goal is to combine the forecast on the computer with observations in the field. This improves the image of reality in the backcountry and better forecasts (Wiesinger, 2012b).

4.2.1. Online links

More information can be added on the homepage of the avalanche bulletin by including online links in the avalanche bulletin. Special pages with all necessary basic background knowledge should be supplied in neighbour pages. Thereby persons who read the avalanche bulletin can get further detailed information about foreign words and danger spots. That means, when the avalanche bulletin warns for any spot or situations in the backcountry the online link will direct the readers to the certain page

where it is explained. The basis background knowledge can be shown in graphs or pictures with detailed information how special snow situations occurs or how the snow metamorphism works. Thereby unskilled persons gain more information about avalanche formation and an image reminder that can easily be remembered when they are out in the backcountry. This will lead to an improvement of the implementation of the readers.

4.2.2. Information Platform

A backcountry skier information platform could be a possibility to spread actual information about the avalanche situation as well as experiences and danger events. People from different regions can make statements about their observations and can share their experiences with other users, in order to have actual information from certain ski tours and not just a general information about a region. It should also include a list of the different federal states and individual not that famous ski tours. It should be a tool from backcountry skier to backcountry skiers. Goal is that persons can document their personal experience from their individual tours in order to give others the latest information and also some experience values about it. The information on the Platform should be checked by qualified persons like mountain guides so that, the statements are controlled and correct.

4.2.3. Smartphone Application

Smartphone applications are getting more and more important in our society, therefore it is from major importance for further development such media to raise the security in the alpine region. Potential existing Smartphone applications can be extended by the improvement of access, which is free for everyone. A single comprehensive application including all avalanche bulletins all over the country should ease the usage of this tool. Further it should reach more and younger people and move with the times.

The current Smartphone application represents the avalanche bulletin, which can be downloaded from the avalanche forecasting page. To make it more specific it has to work automatically. That means, the GPS-Data from your Smartphone checks the weather data from the last few days and the persons just have to add some relevant information on-site. This can include the actual snow high, aspect, altitude, inclination, actual weather and temperature to give an overview of the specific slope. This app can also be designed as a learning tool to improve their knowledge. A handbook how to enter data correctly can help the user to learn more about avalanche formation. The application can calculate for example a STOP or GO result. This tool cannot individualise decisions and can raise the danger awareness of the backcountry skiers.

Again this information can just be a technical support for the backcountry skier to estimate danger levels on his or her tour. It has to be clearly stated that this can only be an estimation to help the backcountry skier to make decisions. It is not and cannot be the one and only base for decisions made by the backcountry skier.

Introducing more applications and tools requires on the other hand much more expert manpower than at the moment available. The forecaster is confronted with more work, which has to be done in the same time and also big distances to the mountains. Sometimes an improvement of the design of the tools is connected with a decline of quality of statements. Human resources might have to be supplied for the technical realisation of the forecasting to assure a good quality of the app.

4.2.4. Information material

The people who are going ski tours need more information. That means the avalanche bulletin should include more information about education courses of the Austrian Alpine Association and other institutions. A program list for guided tours in the region could be linked to the pages of the avalanche bulletin. Those persons who don't have the experience and

want to go on a specific tours can get the tour date directly from surrounding pages of avalanche bulletin.

Not only information over the avalanche bulletin is important but also brochures and flyers, which can be attached to the daily newspapers. Additional information in daily newspapers like special articles regarding right behaviour in case of emergency, necessary equipment for backcountry skiing or where further information can be found (internet page of avalanche bulletin and Austrian Alpine Association) should be presented from the beginning of winter.

Also recommendations for special literature can be given. Television advertisements as well as thematic focus to call attention to this topic can be run. This can be done in the beginning of the winter and maybe during the winter in order to keep the danger of alpine regions in mind and link to useful information media to inform oneself. The goal is to help people understand processes out in alpine regions and help them to learn how to act right and responsible when going ski tours.

4.3. Interpretation and discussion of PART II: Risk behaviour (Pschernig, V.)

Following the results of Part III: Risk behaviour will be interpreted. The theoretical part of the thesis serves as a basis to understand the results. Mainly the psychological background like the human factors and chapter 1.2 one should keep in mind when evaluating the results.

4.3.1. Risk behaviour in general

Backcountry skiing is seen as a high risk sports in society which also involves accidents. If an accident happens or not can be influenced by the athletes and their behaviour in the backcountry. As described in chapter 1.4 people have different levels of readiness to assume risk and the level of the acceptable risk also varies greatly.

It seems that most of the respondents of this survey have lower readiness to assume risk. Nearly 60 % of them would not take a higher level of risk for doing the ski tour. Interestingly this bias is not dependent on the years of experience or the age of the athletes. It is like this, that the amount of ski tours people do is responsible therefore. The more tours they do in winter the more risk they are willing to take. One could say that this is a logical conclusion because the more tours per winter the more people know about the overall situation. They are steadily informed about weather and snow pack and as a consequence they are able to assess the situation in the most effective way. This might be true, but many athletes state that they have already done ski tours without any equipment. Maybe this had been harmless ski tours concerning avalanches but nevertheless it is some kind of negligent. Mostly people overestimate their own abilities and underestimate nature. This is represented by many answers saying "I know that this tour is not dangerous", or "Nothing happened here before, so nothing will happen now". These are excellent examples for the thesis, that human factors and heuristics are influencing the athletes.

4.3.2. Gender

The results show, that one third of the respondents are female and two third are male. This gender distribution also correlates with results from other surveys (see Fredston & Fesler, 1999; Schwiersch, 2005).

More than 90 % of the female athletes yield the leadership to someone else while more than 60% of the male athletes assume the leadership. A reason therefore can be, that men do more ski tours per season which means, that they can gain more experience and therefore are rather willing to take the leadership and the responsibility for a group. However Figure 3-44 shows that from the small group of women, who would take the leadership, over 70% read the avalanche bulletin. It is assumed that therewith women try to compensate their lack of experience and furthermore it is an indicator for their sense of responsibility toward other human beings.

In the survey of Onnen (2008) women performed poorly in the field of avalanche skills (Onnen, 2008) which would explain why the majority of women yield the leadership to someone else and state that they rely on other more experienced persons. Only one third of the women would nevertheless read the avalanche bulletin. Most of the male athletes indeed, take responsibility for their self too by reading the avalanche bulletin although they yield the leadership to someone else. Maybe this is partly because of the acceptance heuristic. Even though they are not the leader of the group men maybe think, that they can impress other group members with information.

When regarding the risk behaviour of female and male backcountry skiers it seems that there is no big difference. Only 10% less women would do a ski tour at a higher level of risk. In contrary McCammon (2004) states that it looks like women avoid those groups were the risk of being involved in an accident is higher. According to the results of this survey men and women have the same readiness to assume risk. Consequently the theory, that testosterone is a main contributor to avalanche accidents (Fredston & Fesler, 1999) is unconfirmed in this survey. But the fact, that most of the athletes who take a higher risk have read the avalanche bulletin can also be an indicator for the concept of "risk homeostasis". Reading the avalanche bulletin is a measure of precaution whereby the athletes feel safer and they have no reason for adjusting their level of risk.

4.3.3. Habituation

By looking at the result from chapter 1.3.3 it is obvious, that the more familiar backcountry skiers are with the terrain, or especially one tour, the more risk they take. It seems that they fall completely in one of the heuristic traps namely familiarity. When they know the region and the tour the athletes get more and more careless about safety and do ski tours without any equipment. They have a false sense of security and as a consequence they even do not think about that something can happen.

Actually the results show that the more familiar the respondents are with a region, the more risk they take. The fact that many of them do backcountry skiing without equipment makes is more difficult to help them when an accident occurs. If is crucial and one or more group members are buried then the chance that they will survive is extremely low when they do not carry a beacon.

4.3.4. Group Dynamics and self-responsibility

Due to the fact that human beings are very social creatures it is not surprising, that the main cause of doing a ski tour is the requirement of being together with other people. When doing backcountry skiing in group most of the time some kind of role allocation emerges. Usually one person is assuming the leadership and mostly the other group members rely on the judgement of the leader. But this certainty should not expulse that we do not get information about the tour and the avalanche situation on our own. Nearly half of the respondents state, that they rely on the judgement of another person concerning the actual avalanche situation or that they only go on a tour together with experienced persons. Nevertheless most of them read the avalanche bulletin and inform their self about the actual situation. Logically this should contribute to a risk reduction if more people are informed about the avalanche situation. To prove this theory further investigations would be necessary.

The same number of respondents self assess the situation. Half of them state that they usually read the avalanche bulletin, although they have not read it at the day of the questionnaire. On the one hand one can assume that they take self responsibility by gaining information on their own. On the other hand the question remains why they did not read it on the date of the interview.

4.3.5. Sensation Seeking

For many athletes, good weather, perfect snow quality and the prospect of skiing down an untraveled slope are the main incentive for doing backcountry skiing. But, this does not automatically mean, that the athletes would take a higher level of risk to find one or more of these conditions which is state by the concept of sensation seeking. Among the sample of this survey only 5% more athletes would take a higher level of risk than those who would not. It seems that a nice downhill with good snow quality is indeed preferable but it is not worth it to endanger them selves.

It is possible that this result is due to the age distribution of our sample. Most of the people are older than the group which is seeking an adrenalin rush, namely those who are below 35 years or even younger.

The assumption that more male than female athletes fit in the concept of "Sensation Seeking" could not be validated with the available data.

4.3.6. Recommendations

Although this survey shows that human factors and heuristics are influencing backcountry skiers, the exact way how it works requires more detailed investigation. An examination about different avalanche accidents in Austria, like McCammon (2000) did for Canada would be helpful to gain more insight in this field. Group size and communication within a group should be part of this investigation.

Moreover it would be interesting to combine the risk behaviour with the level of avalanche skills of the athletes. This way a more precise statement can be made about the accuracy of the concept of "risk homeostasis" among backcountry skiers.

5. Figures

6.Tables

7.References

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Universität für Bodenkultur Wien
University of Natural Resources
and Life Sciences, Vienna

H87 Department of Civil
Engineering and Natural
Hazards

Master Thesis - Annexe

An empirical investigation of avalanche bulletin effectiveness and the risk behaviour of Backcountry Skiers in Austria

Pschernig Verena, Mayer Michael

October, 2012

Adviser University of Natural Resources and Life Sciences Vienna (BOKU)

Univ. Prof. Dipl.-Ing. Dr.nat.techn. Johannes Hübl

Ao.Univ.Prof.Dipl.-Ing. Dr.nat.techn. Peter Schwarzbauer

Mag. Dr. Thomas Wiesinger

1.Questionnaire in German

Befragung zu den Gewohnheiten von Skitourengehern

Durchgeführt vom Institut für Alpine Naturgefahren (Universität für Bodenkultur Wien)

1. Wie viele Jahre sind Sie schon aktiver Skitourengeher?

.....

2. Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?

□ <5 □ 5-10 □ 11-15 □ >15

3. Wenn Sie in einer Gruppe unterwegs sind

□ übernehmen Sie die Führung

□ überlassen Sie die Führung anderen Personen

(Bitte nur eines ankreuzen)

4. Welche der folgenden Aussagen trifft am ehesten auf Sie zu? *(Bitte nur eines ankreuzen)*

□ Ich gehe oft dieselbe Tour.

□ Beim Aussuchen der Tour, beschränke ich mich meist auf dieselbe Region.

□ Ich gehe viele verschiedene Touren in unterschiedlichen mir bekannten Regionen

□ Ich gehe vorwiegend Touren in mir unbekannten Regionen.

5. Auf Grund welcher der folgenden Kriterien wurde die Entscheidung getroffen heute hier auf diese Tour zu gehen? *(Mehrfachantworten möglich)*

□ Neuschnee

□ gute Schneequalität

□ wohne in der Nähe (< 50 km)

□ schönes Wetter

□ bin diese Tour schon gegangen

□ niedrige Lawinenwarnstufe

□ Sonstiges, und zwar:.....

.....

6. Wie informieren Sie sich im Allgemeinen über die aktuelle Lawinensituation? ***(Mehrfachantworten möglich)***

□ Teletext
□ Telefon
□ Fax
□ Internet
□ Radio
□ fachkundige Person
□ eigene Beurteilung
□ gar nicht
□ Sonstiges, und zwar: .....
.....

7. Welche Maßnahmen ergreifen Sie, um sich im Gelände sicher zu bewegen? ***(Mehrfachantworten möglich)***

□ Lesen des Lawinenlageberichtes (LLB)
□ Lesen/hören des Wetterberichtes
□ Tourenforen lesen
□ ich gehe nur mit erfahrenen Personen
□ Sonstiges, und zwar: .....
.....

8. Welches Equipment tragen Sie heute zu Ihrer Sicherheit bei sich? ***(Mehrfachantworten möglich)***

□ Verschütteten Suchgerät
□ Handy
□ Schaufel
□ Ich trage nichts von dem genannten Equipment bei mir
□ ABS-Rucksack
□ GPS
□ Biwaksack
□ Sonstiges, und zwar: .....
.....

9. Haben Sie den aktuellen Lawinenlagebericht gelesen?

□ JA □ NEIN

10. Wenn NEIN: Warum haben Sie den aktuellen Lawinenlagebericht (LLB) nicht gelesen?

.....

11. Wenn JA: Haben Sie heute eine Beobachtung gemacht, die die Kernaussage aus dem Lawinenlageberichtes bestätigt?

□ JA □ NEIN

12. Wenn JA: Welche?

.....

13. Welche der folgenden Aussagen halten Sie für am ehesten zutreffend? *(Bitte nur eines ankreuzen)*

□ Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.

□ Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.

14. Nach welchen Kriterien wählen Sie heute den Hang für die Abfahrt aus?*(Mehrfachantworten möglich)*

□ Ich fahre lieber dort wo Spuren schon vorhanden sind

□ Hangrichtung

□ Ich nehme die Abfahrt, die mich am Nähesten zum Auto bringt

□ Ich fahre die Abfahrt, die ich immer fahre

□ Ich bevorzuge unbefahrene Hänge

□ Qualität des Schnees

□ ich verlasse mich auf andere

□ Ich bevorzuge lichten Wald (gegenüber freien Hängen), da fühle ich mich sicherer

□ Sonstiges und zwar:

.....

15. Heute herrscht Gefahrenstufe . Würden sie diese Tour auch gehen wenn heute Gefahrenstufe herrschen würde?

□ JA □ NEIN

16. Wenn JA: Weil:

□ das Wetter so schön ist

□ die Schneequalität super ist

□ ich so gut in Form bin

□ ich nichts von Lawinenwarnstufen halte

□ Sonstiges, und zwar.....

(Mehrfachantworten möglich)

17. Welche der folgenden Aussagen trifft auf sie zu? *(Mehrfachantworten möglich)*

□ Ich habe schon einmal eine Lawine ausgelöst.

□ Ich befahre gerne steile Hänge.

□ Ich musste das Verschüttetensuchgerät schon in einem Notfall benützen.

□ Ich habe schon Skitouren ohne

(Über 30 Grad Hangneigung) LVS, Schaufel und Sonde gemacht.

□ Ich befahre Hänge ohne sie vorher

auf ihren Zustand zu beurteilen.

18. Welche der folgenden Aussagen halten Sie für am ehesten zutreffend? *(Bitte nur eines ankreuzen)*

□ Der Lawinenlagebericht ist verständlich formuliert.

□ Der Lawinenlagebericht ist teilweise verständlich.

□ Der Lawinenlagebericht ist kaum verständlich.

□ Der Lawinenlagebericht ist unverständlich formuliert.

19. Können Sie mir bitte auf der beigelegten Karte zeigen, wo wir uns befinden?

Demographische Fragen

Geschlecht □ w □ m

Alter: □ 0-25 □ 26-35 □ 36-45 □ 45-60
□ >60

Heimatland/Wohnort: .....

Wie glauben Sie, kann der LLB verbessert werden?

.....

.....

Möchten Sie uns in diesem Zusammenhang, sonst noch etwas mitteilen?

2.Questionnaire in English

Questionnaire regarding the habits of backcountry skiers

Conducted by the Institute of Mountain risk engineering (University of Vienna University of Natural Resources and Life Sciences, Vienna)

1. How long have you been an active backcountry skier?

.....

2. How many ski tours do you make per year on average?

□ <5 □ 5-10 □ 11-15 □ >15

3. When you are with a group, do you …

□ assume the leadership

□ yield the leadership to someone else

(please select only one)

4. Which of the following statements are most accurate? (please select only one*)*

□ do often the same tour

□ do ski-touring always in the same region

□ do a lot of different tours in regions I'm familiar with

□ do a lot of different tours in regions I'm NOT familiar with.

5. Which of the following reasons best explains your taking part in the tour today? (select all that apply)

□ new snow

□ good snow quality

□ live near by (< 50 km)

□ good weather

□ have already done the tour

□ low avalanche danger level

□ others: .....

.....

6. How do you generally find information about the current avalanche danger level? (select all that apply)

□ Teletext
□ Phone
□ Fax
□ Internet
□ Radio
□ competent person
□ self assessment
□ nothing at all
□ others: .....
.....

7. Which measures do you take in order to safely navigate the terrain? (select all that apply)

□ reading the avalanche bulletin
□ reading /listening the weather forecast
□ reading tour-forum
□ doing tours only with skilled athletes
□ others: .....
.....

8. What equipment are you wearing or do you have with you today for your safety? (select all that apply)

□ avalanche beacon
□ mobile phone
□ shovel
□ carry nothing of the above mentioned with me
□ ABS- backpack
□ GPS
□ bivy bag
□ others: .....
.....

9. Have you read the current avalanche bulletin?

□ YES □ NO

10. If you answered no, why have you not read the current avalanche bulletin?

.....

11. If you answered yes, have you observed anything today that confirms the key message of the avalanche bulletin?

□ YES □ NO

12. If yes, which?

.....

13. Which of the following statements do you find most accurate? (please select only one*)*

□ only by reading the avalanche bulletin I can reduce the risk of an avalanche accident.

□. only by reading the avalanche bulletin I cannot reduce the risk of an avalanche accident

14. What criteria do you use to select the slope for departure? (please select only one*)*

□ I prefer tracks on the slope

□ I prefer untraveled slopes

□ snow quality

□ aspect

□ I rely on other persons

□ I take the downhill which takes me near to the car

□ I prefer clear forest (in contrary to open slopes), there I feel safe

□ Take always the same downhill

□ other:

.....

15. Today, the avalanche danger level is X, would you also do this tour if the avalanche danger level was X+1 ?

□ YES □ NO

16. If you answered yes, because:

□ nice weather

□ I'm in good condition

□ the snow quality is perfect

□ I don't care about avalanche danger levels

□ others: .....

(select all that apply)

17. Which of the following statements apply to you? (select all that apply)

□ I have already triggered an avalanche

□ I have already used the avalanche beacon in an emergency

□ I like steep slopes (> 30°)

□ I did ski-tours without beacon, shovel and probe

□ I skied down without evaluation of slope stability

18. Which of the following statements do you find most accurate? (please select only one)

□ The avalanche bulletin is understandable verbalised

□ The avalanche bulletin is partly understandable

□ The avalanche bulletin is rarely understandable

□ The avalanche bulletin is incomprehensible verbalised

19. Can you please show me on the enclose map where we are?

Demographic questions

Sex: □ f □ m

Age: □ 0-25 □ 26-35 □ 36-45 □ 45-60 □ >60

Country of origin/ city of residence:.....

How do you think the avalanche bulletin could be improved?

.....

.....

In this context, is there anything else you would like to share with us?

3. Results of the questionnaire by single questions (SPSS)

3.1. How long have you been an active backcountry skier?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	6	1,6	1,6	1,6
	1 bis 2	28	7,2	7,2	8,8
	3 bis 4	39	10,1	10,1	18,9
	5 bis 6	34	8,8	8,8	27,6
	7 bis 8	17	4,4	4,4	32,0
	9 bis 10	29	7,5	7,5	39,5
	11 bis 15	50	12,9	12,9	52,5
	16 bis 20	43	11,1	11,1	63,6
	21 bis 30	64	16,5	16,5	80,1
	31 bis 50	63	16,3	16,3	96,4
	ueber 50	14	3,6	3,6	100,0
	Gesamt	387	100,0	100,0	

3.2. How many ski tours do you make per year on average?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	unter 5	49	12,7	12,7	12,7
	5 - 10	81	20,9	20,9	33,6
	11-15	63	16,3	16,3	49,9
	über 15	194	50,1	50,1	100,0
	Gesamt	387	100,0	100,0	

3.3. When you are with a group, do you (please select only one)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	13	3,4	3,4	3,4
	übernehmen Sie die Führung	165	42,6	42,6	46,0
	überlasse ich die Führung anderen Personen	209	54,0	54,0	100,0
	Gesamt	387	100,0	100,0	

3.4. Which of the following statements are most accurate? (please select only one)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	17	4,4	4,4	4,4
	ich gehe oft dieselbe Tour	43	11,1	11,1	15,5
	Beim Aussuchen der Tour beschränke ich mich meist auf dieselbe Region	80	20,7	20,7	36,2
	Ich gehe viele verschiedene Touren in unterschiedliche mir bekannten Regionen	178	46,0	46,0	82,2
	Ich gehe vorwiegend Touren in mir unbekannten Regionen	69	17,8	17,8	100,0
	Gesamt	387	100,0	100,0	

3.5. Which of the following reasons best explains your taking part in the tour today? (select all that apply)

		Antworten		Prozent der Fälle
		N	Prozent	
Kriterien um auf die Skitour zu gehen	Kriterien_Neuschnee	35	4,1%	9,0%
	Kriterien_Schneequalität	116	13,5%	30,0%
	Kriterien_Wohne nahe	96	11,2%	24,8%
	Kriterien_Wetter	206	24,0%	53,2%
	Kriterien_Tour schon gegangen	95	11,1%	24,5%
	Kriterien_Lawinenwarnstufe	126	14,7%	32,6%
	Kriterien_Soonstiges	183	21,4%	47,3%
Gesamt		857	100,0%	221,4%

3.6. How do you generally find information about the current avalanche danger level? (select all that apply)

		Antworten		Prozent der Fälle
		N	Prozent	
Infos über aktuelle Lawinensit[a]	Informationen über Teletext	19	2,5%	4,9%
	Informationen über Telefon	24	3,1%	6,2%
	Informationen über Internet	275	35,6%	71,1%
	Informationen über Radio	49	6,3%	12,7%
	Informationen über fachkundige Person	177	22,9%	45,7%
	Informationen über eigene Beurteilung	179	23,2%	46,3%
	Informationen über gar nicht	16	2,1%	4,1%
	Informationen Sonstiges	33	4,3%	8,5%
Gesamt		772	100,0%	199,5%

3.7. Which measures do you take in order to safely navigate the terrain? (select all that apply)

		Antworten		Prozent der Fälle
		N	Prozent	
Maßnahmen um sich sicher zu bewegen	Maßnahmen_Lesen LLB	217	28,5%	56,4%
	Maßnahmen_Wetterbericht	215	28,2%	55,8%
	Maßnahmen_Tourenforen	89	11,7%	23,1%
	Maßnahmen_Inur mit erfahrenen Personen	143	18,8%	37,1%
	Maßnahmen_Sonstiges	98	12,9%	25,5%
Gesamt		762	100,0%	197,9%

3.8. What equipment are you wearing or do you have with you today for your safety?

		Antworten		Prozent der Fälle
		N	Prozent	
Equipment für die eigene Sicherheit	Equipment_Verschüttetensuchgerät	343	25,3%	88,6%
	Equipment_Handy	332	24,5%	85,8%
	Equipment_Schaufel	323	23,8%	83,5%
	Equipment_nichts	11	,8%	2,8%
	Equipment_ABS-Rucksack	43	3,2%	11,1%
	Equipment_GPS	71	5,2%	18,3%
	Equipment_Biwacksack	119	8,8%	30,7%
	Equipment_Sonsiges	113	8,3%	29,2%
Gesamt		1355	100,0%	350,1%

3.9. Have you read the current avalanche bulletin? (select all that apply)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	1	,3	,3	,3
	JA	211	54,5	54,5	54,8
	NEIN	175	45,2	45,2	100,0
	Gesamt	387	100,0	100,0	

3.10. If you answered no, why have you not read the current avalanche bulletin (LLB)?

Kategorie	**Anzahl der Antworten**
Fachkundige Person war mit auf der Tour	32
Begleitperson hat gelesen	4
Infos von dritten	1
andere kümmer sich	9
habe mich auf Partner/in verlassen	21
Eigene Einschätzung	
kenne mich im Gebiet gut aus	5

bin erfahren	2
Selbsteinschätzung	1
Wurde nicht für notwendig empfunden	
kein Bedarf	1
war nicht erforderlich	8
bei der Tour nicht notwendig	3
hier gibt es keine Lawinen	2
zu wenig Schnee	8
ist nicht gefährlich	7
kleine Tour	1
hielt es nicht für notwendig	2
keine Veränderung zu gestern	4
LLB	
Ausgabe war zu spät	6
war nicht auf Englisch	1
bietet nur groben Überblick	2
Andere	
vergessen	2
habe keinen gefunden	2
kein Interesse	4
Keine Möglichkeiten	7
kenne den LLB nicht	4
aktuell kein Internet	1
hatte keine Zugang	1
wusste nicht wie	4
wo kann man das???	1
keine Ahnung mach ich nie	3
habe ihn gestern gelesen, war sehr pessimistisch, deshalb las ich ihn heute nicht mehr	1
kein Empfang	1
habe den von einem anderen Bundesland gelesen, sind fast immer gleich	1

Result in percentage:

Fachkundige Person war mit auf der Tour	67	44
Eigene Einschätzung	8	5
Wurde nicht für notwendig empfunden	36	24
Lawinenlagebericht	9	6
Andere	32	21
	152	100

3.11. If you answered yes, have you observed anything today that confirms the key message of the avalanche bulletin?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	176	45,5	45,5	45,5
	JA	131	33,9	33,9	79,3
	NEIN	80	20,7	20,7	100,0
	Gesamt	387	100,0	100,0	

3.12. If yes, which?

Kategorie	**Anzahl der Antworten**
128 haben etwas beobachtet	
einfach:	
starker wind/ windrichtung	6
schneeverfrachtung	15
eingewehte Rinnen mulden	4
lawinenwarnstufe	1
schneebrett	4
lawinenabgang	6
wächtenbildung	6
keine risse beim spuren	1
wetter	16
hangrutsch	5
	64
schwer:	
firn	
neuschnee altschnee, gleitfläche	
harscht mit geringer pulverschneeauflage	
gesetzer schnee	
gefästigte altschneedecke	
entspannung der schneedecke	
rutschblocktest	
wumm geräusch	
über 35 grad erhöhte lawinengefahr	
klare nacht, durchfrierung der schneedecke	
tageszeitlicher anstieg der lg ist gut ersichtlich	
gut gesetzer schnee	

entladene hänge
frühjahressituation
eingewhehter oberflächenreif in kammlage
durchfeuchtung der schneedecke
schwimmschnee
nasschneelawinen
triebschnee
64

3.13. Which of the following statements do you find most accurate? (please select only one)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	16	4,1	4,1	4,1
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	168	43,4	43,4	47,5
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	202	52,2	52,2	99,7
	3	1	,3	,3	100,0
	Gesamt	387	100,0	100,0	

3.14. What criteria do you use to select the slope for departure? (select all that apply)

		Antworten		Prozent der Fälle
		N	Prozent	
Kriterien für die Wahl der Abfahrt	Abfahrt_Spuren	97	11,4%	25,3%
	Abfahrt_Hangrichtung	158	18,6%	41,3%
	Abfahrt_nahe Auto	40	4,7%	10,4%
	Abfahrt_die ich immer fahre	36	4,2%	9,4%
	Abfahrt_unbefahrene Hänge	93	10,9%	24,3%
	Abfahrt_Qualität des Schnees	206	24,2%	53,8%
	Abfahrt_verlasse mich auf andere	101	11,9%	26,4%
	Abfahrt_lichter Wald	35	4,1%	9,1%
	Abfahrt_Sonstiges	85	10,0%	22,2%
Gesamt		851	100,0%	222,2%

3.15. Today, the avalanche danger level is X . Would you also do this tour if the avalanche danger level was X+1?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	19	4,9	4,9	4,9
	JA	153	39,5	39,5	44,4
	NEIN	215	55,6	55,6	100,0
	Gesamt	387	100,0	100,0	

3.16. If you answered yes, because: (select all that apply)

Kategorie	**Anzahl der Antworten**
Geländebeschaffenheit	
Gelände lässt höhere Stufe zu	8
Hangneigung	3

meist sehr flach	11
sicheres Gelände	5
kann Gelände ausnutzen	2
Waldgebiet	1
Schneedecke/Wetter	
geringe Schneehöhe	3
Schneedecke ok	2
solange keine Spontanabgänge beobachtet werden	1
Vertrautheit mit der Tour	
kenne die Tour	5
ungefährliche Tour	3
Verlasse mich auf andere	
folge vorhandenen Spuren	1
fahre nur mit	4
verlasse mich auf den Führenden	1
jemand anderer übernimmt die Verantwortung	1
Alternativen/Risikoreduktion	
gute Route wählen	4
Gefahrenbeurteilung vor Ort	7
einzeln Abfahren	2
Vermeidung von > 30 Grad	3
Alternative Route	6
LLB	
LLB ist überregional, trifft nicht auf alle Orte zu	1
LLB ersetzt nicht die Einzelhangbeurteilung	1
Andere	
stark begangene Tour	1
keine Gefahr	8
eigene Beurteilung	1
weil die besten Bedingungen des Winters herrschen	1
ja aber nur in Bergführer begleitung	1
es ist für mich normal bei 3 zu gehen	1
Abfahrt ist schön	1
gehe immer diese Tour bei 4	1
Arbeit	1

Result in percentage:

Geländebeschaffenheit	30	33
Schneedecke/ Wetter	6	7
Vertrautheit mit der Tour	8	9
Verlasse mich auf andere	7	8
Alternativen/ Risikoreduktion	22	24
Lawinenlagebericht	2	2
Andere	16	17
	91	100

3.17. Which of the following statements apply to you? (select all that apply)

		Antworten		Prozent der Fälle
		N	Prozent	
Welche Aussage trifft zu	Lawine ausgelöst	102	19,1%	31,8%
	fahre gerne steile Hänge	192	35,9%	59,8%
	fahre ohne Zustandsbeurteilung	30	5,6%	9,3%
	LVS schon verwendet	37	6,9%	11,5%
	Touren ohne Equipment	174	32,5%	54,2%
Gesamt		535	100,0%	166,7%

3.18. Which of the following statements do you find most accurate? (please select only one)

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	29	7,5	7,5	7,5
	Der Lawinenlagebericht ist verständlich formuliert.	239	61,8	61,8	69,3
	Der Lawinenlagerbericht ist teilweise verständlich.	92	23,8	23,8	93,0
	Der Lawinenlagebericht ist kaum verständlich.	14	3,6	3,6	96,6
	Der Lawinenlagebericht ist unverständlich formuliert.	13	3,4	3,4	100,0
	Gesamt	387	100,0	100,0	

3.19. Can you please show me on the enclose map where we are?

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	falsch	62	16,0	16,0	16,0
	noch der gleiche LLB	82	21,2	21,2	37,2
	richtig	242	62,5	62,5	99,7
	3	1	,3	,3	100,0
	Gesamt	387	100,0	100,0	

3.20. Sex

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	25	6,5	6,5	6,5
	weiblich	98	25,3	25,3	31,8
	männlich	264	68,2	68,2	100,0
	Gesamt	387	100,0	100,0	

3.21. Age groups

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	4	1,0	1,0	1,0
	0-25	31	8,0	8,0	9,0
	26-35	99	25,6	25,6	34,6
	36-45	67	17,3	17,3	51,9
	46-60	135	34,9	34,9	86,8
	über 60	51	13,2	13,2	100,0
	Gesamt	387	100,0	100,0	

3.22. Country of origin / city of residence

		Häufigkeit	Prozent	Gültige Prozente	Kumulierte Prozente
Gültig	ka	40	10,3	10,3	10,3
	Wien	61	15,8	15,8	26,1
	Burgenland	2	,5	,5	26,6
	Niederoesterreich	19	4,9	4,9	31,5
	Oberoesterreich	29	7,5	7,5	39,0
	Steiermark	17	4,4	4,4	43,4
	Salzburg	36	9,3	9,3	52,7
	Kaernten	115	29,7	29,7	82,4
	Tirol	29	7,5	7,5	89,9
	Vorarlberg	11	2,8	2,8	92,8
	Ausland	28	7,2	7,2	100,0
	Gesamt	387	100,0	100,0	

4. Result of Part I: Characteristics of backcountry skiers and the effectiveness of the avalanche bulletin (SPSS)

4.1. Gender classification of reading or not reading the avalanche bulletin

Haben Sie den aktuellen Lawinenlagebericht gelesen? * Geschlecht Kreuztabelle

		Geschlecht			Gesamt
		ka	weiblich	männlich	
Haben Sie den aktuellen Lawinenlagebericht gelesen?	ka	0	0	1	1
	JA	12	38	161	211
	NEIN	13	60	102	175
Gesamt		25	98	264	387

4.2. Age classification of reading or not reading the avalanche bulletin

Haben Sie den aktuellen Lawinenlagebericht gelesen? * Alter Kreuztabelle

		Alter						Gesamt
		ka	0-25	26-35	36-45	46-60	über 60	
Haben Sie den aktuellen Lawinenlagebericht gelesen?	ka	0	0	0	1	0	0	1
	JA	3	12	55	29	79	33	211
	NEIN	1	19	44	37	56	18	175
Gesamt		4	31	99	67	135	51	387

4.3. Influence of gender and age on reading the avalanche bulletin

Geschlecht * Alter Kreuztabelle

		Alter						Gesamt
		ka	0-25	26-35	36-45	46-60	über 60	
Geschlecht	ka	1	0	0	1	7	3	12
	weiblich	0	3	12	9	11	3	38
	männlich	2	9	43	19	61	27	161
Gesamt		3	12	55	29	79	33	211

4.4. Male group leaders who have read the AB by age groups

respondents who have read the avalanche bulletin and take the lead

Geschlecht * Alter Kreuztabelle

		Alter						Gesamt
		ka	0-25	26-35	36-45	46-60	über 60	
Geschlecht	ka	0	0	0	0	1	0	1
	weiblich	0	0	2	3	0	0	5
	männlich	2	5	32	13	35	16	103
Gesamt		2	5	34	16	36	16	109

4.5. Male group leaders who have not read the AB by age groups

respondents who have not read the avalanche bulletin and take the lead

Geschlecht * Alter Kreuztabelle

		Alter						Gesamt
		ka	0-25	26-35	36-45	46-60	über 60	
Geschlecht	ka	1	0	0	1	1	0	3
	weiblich	0	0	0	2	0	0	2
	männlich	0	5	8	6	27	5	51
Gesamt		1	5	8	9	28	5	56

4.6. Origin of the interviewed people compared with reading or not reading the avalanche bulletin

		Wohnort											Gesamt
		ka	Wien	Burgenland	Niederoesterreich	Oberoesterreich	Steiermark	Salzburg	Kaernten	Tirol	Vorarlberg	Ausland	
Haben Sie den aktuellen Lawinenlagebericht gelesen?	ka	0	0	0	0	0	0	0	1	0	0	0	1
	JA	21	27	2	4	15	11	22	67	18	10	14	211
	NEIN	19	34	0	15	14	6	14	47	11	1	14	175
Gesamt		40	61	2	19	29	17	36	115	29	11	28	387

4.7. Frequency of completes ski tours and perception of risk reduction by reading only the avalanche bulletin, avalanche bulletin readers

just respondents who have read the avalanche bulletin

Welche der folgenden Aussagen halten Sie für am ehesten zutreffen? * Wie viele Skitouren gehen Sie im Durchschnitt pro Saison? Kreuztabelle

		Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?				Gesamt
		unter 5	5 - 10	11-15	über 15	
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	ka	1	1	1	4	7
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	5	23	17	73	118
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	7	14	18	47	86
Gesamt		13	38	36	124	211

4.8. Frequency of completes ski tours and perception of risk reduction by reading only the avalanche bulletin, whole population

all respondents

Welche der folgenden Aussagen halten Sie für am ehesten zutreffen? * Wie viele Skitouren gehen Sie im Durchschnitt pro Saison? Kreuztabelle

		Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?				Gesamt
		unter 5	5 - 10	11-15	über 15	
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	ka	1	7	2	6	16
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	13	38	23	94	168
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	35	36	38	93	202
	3	0	0	0	1	1
Gesamt		49	81	63	194	387

4.9. avalanche bulletin readers and their perception of accident reduction

Welche der folgenden Aussagen halten Sie für am ehesten zutreffen? * Haben Sie den aktuellen Lawinenlagebericht gelesen? Kreuztabelle

		Haben Sie den aktuellen Lawinenlagebericht gelesen?			Gesamt
		ka	JA	NEIN	
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	ka	0	7	9	16
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	1	118	49	168
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	0	86	116	202
	3	0	0	1	1
Gesamt		1	211	175	387

4.10. Relation between completed ski tours and comprehensibility of the avalanche bulletin

Welche der folgenden Aussagen halten Sie für am ehesten zutreffen? * Haben Sie den aktuellen Lawinenlagebericht gelesen? Kreuztabelle

		Haben Sie den aktuellen Lawinenlagebericht gelesen?			Gesamt
		ka	JA	NEIN	
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	ka	0	7	9	16
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	1	118	49	168
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	0	86	116	202
	3	0	0	1	1
Gesamt		1	211	175	387

4.11. Relation between understandability

Alter * Welche der Folgenden Aussagen halten Sie für am ehesten zutreffend? Kreuztabelle

		Welche der Folgenden Aussagen halten Sie für am ehesten zutreffend?					Gesamt
		ka	Der Lawinenlageberi cht ist verständlich formuliert.	Der Lawinenlagerber icht ist teilweise verständlich.	Der Lawinenlageberi cht ist kaum verständlich.	Der Lawinenlageberi cht ist unverständlich formuliert.	
Alter	ka	1	2	1	0	0	4
	0-25	3	11	11	1	5	31
	26-35	12	52	31	1	3	99
	36-45	5	45	13	4	0	67
	46-60	6	91	28	7	3	135
	über 60	2	38	8	1	2	51
Gesamt		29	239	92	14	13	387

4.12. Relation between reading habit and geographical awareness

Haben Sie den aktuellen Lawinenlagebericht gelesen? * Können Sie bitte auf der eigelegten Karte zeigen, wo wir uns befinden? Kreuztabelle

		Können Sie bitte auf der eigelegten Karte zeigen, wo wir uns befinden?				Gesamt
		falsch	noch der gleiche LLB	richtig	3	
Haben Sie den aktuellen Lawinenlagebericht gelesen?	ka	0	0	1	0	1
	JA	26	43	141	1	211
	NEIN	36	39	100	0	175
Gesamt		62	82	242	1	387

5. Result of Part II: Risk behaviour of backcountry skiers (SPSS)

5.1. Age distribution of athletes who state that they would do the tour when avalanche danger level is high

			Alter					
			0-25	26-35	36-45	46-60	über 60	Total
Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	JA	Count	10	44	24	60	13	151
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	6,6%	29,1%	15,9%	39,7%	8,6%	100,0%
		% of Total	6,6%	29,1%	15,9%	39,7%	8,6%	100,0%
Total		Count	10	44	24	60	13	151
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	6,6%	29,1%	15,9%	39,7%	8,6%	100,0%
		% of Total	6,6%	29,1%	15,9%	39,7%	8,6%	100,0%

5.2. Years of actively going backcountry skiing e of those athletes who would do the tour when avalanche danger level is high

			Aktiver Skitourengeher										
			1 bis 2	3 bis 4	5 bis 6	7 bis 8	9 bis 10	11 bis 15	16 bis 20	21 bis 30	31 bis 50	ueber 50	Total
Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	JA	Count	13	15	16	5	13	21	14	21	28	3	149
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	8,7%	10,1%	10,7%	3,4%	8,7%	14,1%	9,4%	14,1%	18,8%	2,0%	100,0%
		% of Total	8,7%	10,1%	10,7%	3,4%	8,7%	14,1%	9,4%	14,1%	18,8%	2,0%	100,0%
Total		Count	13	15	16	5	13	21	14	21	28	3	149
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	8,7%	10,1%	10,7%	3,4%	8,7%	14,1%	9,4%	14,1%	18,8%	2,0%	100,0%
		% of Total	8,7%	10,1%	10,7%	3,4%	8,7%	14,1%	9,4%	14,1%	18,8%	2,0%	100,0%

5.3. Illustration of number ski tours done by those athletes who would do the tour when avalanche danger level is high

			Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?				
			unter 5	5 - 10	11-15	über 15	Total
Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	JA	Count	20	31	22	80	153
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	13,1%	20,3%	14,4%	52,3%	100,0%
		% of Total	13,1%	20,3%	14,4%	52,3%	100,0%
Total		Count	20	31	22	80	153
		% within Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	13,1%	20,3%	14,4%	52,3%	100,0%
		% of Total	13,1%	20,3%	14,4%	52,3%	100,0%

5.4. Illustration of the number of ski tours made by female and male athletes.

			Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?				
			unter 5	5 - 10	11-15	über 15	Total
Geschlecht	weiblich	Count	21	31	20	26	98
		Row %	21,4%	31,6%	20,4%	26,5%	100,0%
	männlich	Count	24	45	40	155	264
		Row %	9,1%	17,0%	15,2%	58,7%	100,0%
Total	Count		45	76	60	181	362
	Row %		12,4%	21,0%	16,6%	50,0%	100,0%

5.5. Difference between men and women in leadership behavior

			Wenn Sie in einer Gruppe unterwegs sind....		
			übernehmen Sie die Führung	überlasse ich die Führung anderen Personen	Total
Geschlecht	weiblich	Count	7	88	95
		% within Geschlecht	7,4%	92,6%	100,0%
	männlich	Count	154	100	254
		% within Geschlecht	60,6%	39,4%	100,0%
Total		Count	161	188	349
		% within Geschlecht	46,1%	53,9%	100,0%

5.1. Relationship between leading or not leading a group and reading the avalanche bulletin according to gender

					Haben Sie den aktuellen Lawinenlagebericht gelesen?		
					JA	NEIN	Total
Geschlecht	weiblich	Wenn Sie in einer Gruppe unterwegs sind....	übernehmen Sie die Führung	Count	5	2	7
				Row %	71,4%	28,6%	100,0%
			überlasse ich die Führung anderen Personen	Count	31	57	88
				Row %	35,2%	64,8%	100,0%
		Total		Count	36	59	95
				Row %	37,9%	62,1%	100,0%
	männlich	Wenn Sie in einer Gruppe unterwegs sind....	übernehmen Sie die Führung	Count	103	51	154
				Row %	66,9%	33,1%	100,0%
			überlasse ich die Führung anderen Personen	Count	55	45	100
				Row %	55,0%	45,0%	100,0%
		Total		Count	158	96	254
				Row %	62,2%	37,8%	100,0%

5.2. Difference between men and women concerning their readiness to assume risk

		Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?		
		JA	NEIN	Total
Geschlecht	weiblich	33	61	94
		35,1%	64,9%	100,0%
	männlich	115	136	251
		45,8%	54,2%	100,0%
Total		148	197	345
		42,9%	57,1%	100,0%

5.3. Illustration of how many of the athletes who would go at a higher level of risk, have read the actual avalanche bulletin

					Haben Sie den aktuellen Lawinenlagebericht gelesen?		
					JA	NEIN	Total
Geschlecht	weiblich	Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	JA	Count	7	26	33
				Row %	21,2%	78,8%	100,0%
			NEIN	Count	30	31	61
				Row %	49,2%	50,8%	100,0%
		Total	Count		37	57	94
			Row %		39,4%	60,6%	100,0%
	männlich	Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?	JA	Count	67	48	115
				Row %	58,3%	41,7%	100,0%
			NEIN	Count	87	48	135
				Row %	64,4%	35,6%	100,0%
		Total	Count		154	96	250
			Row %		61,6%	38,4%	100,0%

5.4. Age distribution of those female and male athletes who are willing to do the ski tour at a higher avalanche danger level

			Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch ghen wenn heut Gefahrenstufe x+1 herrschen würde?					
			JA					
			Alter					
			0-25	26-35	36-45	46-60	über 60	Total
Geschlecht	weiblich	Count	2	14	10	7		33
		Row %	6,1%	42,4%	30,3%	21,2%		100,0%
	männlich	Count	8	30	14	50	13	115
		Row %	7,0%	26,1%	12,2%	43,5%	11,3%	100,0%
Total	Count		10	44	24	57	13	148
	Row %		6,8%	29,7%	16,2%	38,5%	8,8%	100,0%

5.5. Relationship between the number of ski tours per winter and the habituation of the athletes concerning the selection of their tours

			Wie wählt man Tour aus /Region				
			ich gehe oft dieselbe Tour	Beim Aussuchen der Tour beschränke ich mich meist auf dieselbe Region	Ich gehe viele verschiedene Touren in unterschiedliche mir bekannten Regionen	Ich gehe vorwiegend Touren in mir unbekannten Regionen	Total
Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	unter 5	Count	6	9	10	23	48
		% within Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	12,5%	18,8%	20,8%	47,9%	100,0%
		% of Total	1,6%	2,4%	2,7%	6,2%	13,0%
	5 - 10	Count	11	21	24	18	74
		% within Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	14,9%	28,4%	32,4%	24,3%	100,0%
		% of Total	3,0%	5,7%	6,5%	4,9%	20,0%
	11-15	Count	7	14	27	13	61
		% within Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	11,5%	23,0%	44,3%	21,3%	100,0%
		% of Total	1,9%	3,8%	7,3%	3,5%	16,5%
	über 15	Count	19	36	117	15	187
		% within Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	10,2%	19,3%	62,6%	8,0%	100,0%
		% of Total	5,1%	9,7%	31,6%	4,1%	50,5%
Total		Count	43	80	178	69	370
		% within Wie viele Skitouren gehen Sie im Durchschnitt pro Saison?	11,6%	21,6%	48,1%	18,6%	100,0%
		% of Total	11,6%	21,6%	48,1%	18,6%	100,0%

5.6. Depiction of the experience of those athletes, who do backcountry skiing in familiar regions

			Aussagen				
			Lawine ausgelöst	fahre gerne steile Hänge	fahre ohne Zustandsbeurteilung	LVS schon verwendet	Touren ohne Equipment
Wie wählt man Tour aus /Region	Ich gehe viele verschiedene Touren in unterschiedlichen mir bekannten Regionen	Count	60	112	9	21	70
		Row %	39,2%	73,2%	5,9%	13,7%	45,8%
Total		Count	60	112	9	21	70
		Row %	39,2%	73,2%	5,9%	13,7%	45,8%

5.7. Depiction of the experience of those athletes, who do backcountry skiing in regions they are NOT familiar with

		Aussagen					
		Lawine ausgelöst	fahre gerne steile Hänge	fahre ohne Zustandsbeurteilung	LVS schon verwendet	Touren ohne Equipment	Total
Ich gehe vorwiegend Touren in mir unbekannten Regionen	Count	12	34	8	7	29	60
	Row %	20,0%	56,7%	13,3%	11,7%	48,3%	100,0%

5.8. Depiction of the experience of those athletes, who do often the same tour

			Aussagen					
			Lawine ausgelöst	fahre gerne steile Hänge	fahre ohne Zustandsbeurteilung	LVS schon verwendet	Touren ohne Equipment	Total
Wie wählt man Tour aus /Region	ich gehe oft dieselbe Tour	Count	15	12	5	1	23	31
		Row %	48,4%	38,7%	16,1%	3,2%	74,2%	100,0%
Total	Count		15	12	5	1	23	31
	Row %		48,4%	38,7%	16,1%	3,2%	74,2%	100,0%

5.9. Relationship between athletes who rely on other persons and those who assess the situation on their own concerning reading of the avalanche bulletin

			Haben Sie den aktuellen Lawinenlagebericht gelesen?		
			JA	NEIN	Total
Informationsbeschaffung	Informationen über Teletext	Count	15	4	19
		Row %	78,9%	21,1%	100,0%
	Informationen über Telefon	Count	20	4	24
		Row %	83,3%	16,7%	100,0%
	Informationen über Fax	Count			
		Row %			
	Informationen über Internet	Count	192	83	275
		Row %	69,8%	30,2%	100,0%
	Informationen über Radio	Count	26	23	49
		Row %	53,1%	46,9%	100,0%
	Informationen über fachkundige Person	Count	84	93	177
		Row %	47,5%	52,5%	100,0%
	Informationen über eigene Beurteilung	Count	98	81	179
		Row %	54,7%	45,3%	100,0%
	Informationen über gar nicht	Count		16	16
		Row %		100,0%	100,0%
	Informationen Sonstiges	Count	19	13	32
		Row %	59,4%	40,6%	100,0%
Total	Count		211	175	386
	Row %		54,7%	45,3%	100,0%

5.10. Information procurement of those athletes who states that they assess the avalanche situation on their own

			Maßnahmen					
			Maßnahmen_Lesen LLB	Maßnahmen_Wetterbericht	Maßnahmen_Tourenforen	Maßnahmen_nur mit erfahrenen Personen	Maßnahmen_Sonstiges	Total
Informationen über eigene Beurteilung	angekreuzt	Count	103	112	36	37	73	179
		Row %	57,5%	62,6%	20,1%	20,7%	40,8%	100,0%
Total	Count		103	112	36	37	73	179
	Row %		57,5%	62,6%	20,1%	20,7%	40,8%	100,0%

5.11. Information procurement for self assessment of those people who have not read the current avalanche bulletin

					Informationen über eigene Beurteilung	
					angekreuzt	Total
Haben Sie den aktuellen Lawinenlagebericht gelesen?	NEIN	Maßnahmen	Maßnahmen_Lesen LLB	Count	23	23
				Column %	28,4%	28,4%
			Maßnahmen_Wetterbericht	Count	34	34
				Column %	42,0%	42,0%
			Maßnahmen_Tourenforen	Count	9	9
				Column %	11,1%	11,1%
			Maßnahmen_nur mit erfahrenen Personen	Count	23	23
				Column %	28,4%	28,4%
			Maßnahmen_Sonstiges	Count	43	43
				Column %	53,1%	53,1%
		Total	Count		81	81
			Column %		100,0%	100,0%

5.12. Distribution of athletes, who are going on a tour only with an experienced person, according to reading the avalanche bulletin

			Haben Sie den aktuellen Lawinenlagebericht gelesen?		
			JA	NEIN	Total
Maßnahmen	Maßnahmen_Lesen LLB	Count	164	53	217
		Row %	75,6%	24,4%	100,0%
	Maßnahmen_Wetterbericht	Count	149	66	215
		Row %	69,3%	30,7%	100,0%
	Maßnahmen_Tourenforen	Count	66	23	89
		Row %	74,2%	25,8%	100,0%
	Maßnahmen_nur mit erfahrenen Personen	Count	58	84	142
		Row %	40,8%	59,2%	100,0%
	Maßnahmen_Sonstiges	Count	42	56	98
		Row %	42,9%	57,1%	100,0%
Total	Count		211	173	384
	Row %		54,9%	45,1%	100,0%

5.13. Illustration of experience of athletes divided by their perception of the avalanche bulletin

			Aussagen					Total
			Lawine ausgelöst	fahre gerne steile Hänge	fahre ohne Zustandsbeurteilung	LVS schon verwendet	Touren ohne Equipment	
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	Count	39	91	13	14	60	136
		Row %	28,7%	66,9%	9,6%	10,3%	44,1%	100,0%
		Column %	39,4%	48,9%	44,8%	38,9%	36,1%	44,3%
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	Count	60	95	16	22	106	171
		Row %	35,1%	55,6%	9,4%	12,9%	62,0%	100,0%
		Column %	60,6%	51,1%	55,2%	61,1%	63,9%	55,7%
Total	Count		99	186	29	36	166	307
	Row %		32,2%	60,6%	9,4%	11,7%	54,1%	100,0%
	Column %		100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

5.14. Illustration of risk behaviour of athletes divided by their perception of the avalanche bulletin

			Heute herrscht Gefahrenstufe x. Würden Sie diese Tour auch gehen wenn heut Gefahrenstufe x+1 herrschen würde?		
			JA	NEIN	Total
Welche der folgenden Aussagen halten Sie für am ehesten zutreffen?	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles reduzieren.	Count	68	95	163
		Row %	41,7%	58,3%	100,0%
		Column %	45,9%	45,5%	45,7%
	Alleine durch das Lesen des LLB kann ich das Risiko eines Lawinenunfalles gar nicht reduzieren.	Count	80	114	194
		Row %	41,2%	58,8%	100,0%
		Column %	54,1%	54,5%	54,3%
Total	Count		148	209	357
	Row %		41,5%	58,5%	100,0%
	Column %		100,0%	100,0%	100,0%

6. Improvements for the questionnaire concerning Part II: Risk behaviour of the backcountry skiers

While evaluating the questionnaire it became clear that the results for Part II are not as desired. This is due to the questionnaire. To come up with more profound results, some of the questions should have been worded differently and more questions with focus on risk and risk behaviour would have been needed.

Decidedly questions concerning, for instance,

- the amount of accidents, they have been involved in
- how often they had triggered an avalanche AND if something had happened (group member buried, injuries) or not
- how often does it happen, that they do tours without appropriate equipment.

Further some important points had been extracted during working, which had been unregarded when preparing the questionnaire. One is the level of education concerning the avalanche skills of the respondents. Especially with focus on the level of risk people take, this is a striking point which should be promoted by the questionnaire.

Another point is the group size. As mentioned in the thesis, there are a lot of studies which found that group size has an impact on risk behaviour. Therefore group size should also be noted when doing a questionnaire.

It would also be helpful to ask the respondents if they use measures from the "stragtegischen Lawinenkunde" to evaluate situations and if they base their decisions on it.

7. Summary of the open- ended question (Excel File)

7.1. Which of the following reasons best explains your taking part in the tour today? (select all that apply)

Kategorie	Anzahl der Antworten
Gruppendynamik	
andere haben es vorgeschlagen	18
Freunde	10
Geburtstagsfeier	7
Enscheidung der Gruppe	4
War schon lange geplant	5
haben andere bestimmt	4
mit Freunden vereinbart	2
Schitourenwoche	3
Bergführer hat entlschieden	4
gehe mit Tourengruppe	1
Ausschreibung des Alpenvereins	2
mitgehangen mitgefangen	1
Ausbildung	8
von anderen Gruppen schon gegangen	1
weil Runde	1
habe mich spontan einer unbekannten Gruppe angeschlossen	2
mitfahrende brifen	1
wurde vom Vater bestimmt	1
wurde mitgenommen	1
Empfehlung	3
Eltern entscheiden	2
Gruppe hatte Zeit	1
Bergführer	1
erfahrene Personen dabei	1
mein Freund hat nur heute Zeit	1
habe Termin schon lange mit Freund ausgemacht	1
Familie	1
Mitfahrgelegenheit	1
Programm AV	1
Empfehlung Hüttenwirt	1
passt zur Gruppe	3
Urlaub mit Freunden	1
Einladung von Kollegen	1
Zustimmung erfahrene Personen	1
	96

Vertrautheit der Region	
kenne das Gebiet gut	2
schöne Tour	1
Lieblingstour	1
schöner Berg	1
in der Nähe	2
war im Somme schon hier	1
selbe Tour	1
gehe von der Haustür weg	1
klassische Tour	1
	11
äußere Fatktoren (Wetter, Schneebedingungen)	
starker Wind	1
günstige Exposition	4
gute Schichtbildung	1
keine Schwachschichten in den ersten 100 cm	1
windarmes Gebiet	1
Wärme	1
Wetter	1
hier hat es Schnee	1
Seehöhe gegen Schneequalität	3
genug Schnee	5
top Bedingungen	2
	21
Informationen des LLB	
hohe Lawinenwarnstufe	5
get auch bei höherer Stufe	2
An Lawinenwarnstufe angepasst	1
nieders Lawinenrisiko	1
heute bei den Bedingungen machbar	1
	10
Gastronomie	
gutes Essen	3
Eis	1
Gastronomie am Berg	5
Hütte hat geöffnet	1
Übernachtung	1
	11
Beschaffenheit der Tour/ des Geländes	
langer Tiefschneehang	1
alpiner Charakter der Besteigung	1
high light	1
herausforderndes Gelände	1
lohnende Abfahrtsvariante	1
sah Gelände aus der Ferne und es gefiel mir	1
Länge unter 3 Stunden	1
Länge der Tour	2
Großglockner Besteigung	2
mir unbekannte Tour	1

sehr flach	1
Neigung und Schitechnische können passen zusammen	1
schöne gegend, kurz,	1
	15
Andere	
gehe nur zu Trainingszwecken, egal wo	1
gehe da wo keine Menschen sind	1
neue Schuhe testen	2
Termin	1
täglich im Gelände sein	1
Arbeit	3
Führer Literatur	2
sind eine Woche hier	1
hatte heute Zeit	1
Nähe aber mehr wie 50km	1
Arbeitseinsatz für NP	1
Freizeit	2
bin Bergführer	1
Relaxen	1
Urlaub	3
Konditionstest	1
wollte gute Spur anlegen	1
	24

Result in percentage:

Gruppendynamik	96	51,06
Vertrautheit der Region	11	5,85
äußere Faktoren (Wetter, Schneebedingungen)	21	11,17
Informationen des LLB	10	5,32
Gastronomie	11	5,85
Beschaffenheit der Tour/ des Geländes	15	7,98
Andere	24	12,77
Gesamt	188	100

7.2. How do you generally find information about the current avalanche danger level? (select all that apply)

Kategorie	**Anzahl der Antworten**
Handy	
snow safe	2

powder finder	1
sms von LWD	1
	4
Informatinsbeschaffung von anderen Personen/Einrichtugen	
lokale Bergführer	1
Pistendienst	3
Messstation/Wetter	2
LLB auf der Hütte	2
Befragung von Kollegen	1
	9
eigene Untersuchungen	
Schneeprofil	1
Wetter beobachten	1
	2

7.3. Which measures do you take in order to safely navigate the terrain? (select all that apply)

Kategorie	**Anzahl der Antworten**
Eigenverantwortung/Selbsteinschätzung	
Informatin und Intuition	1
Hausverstand	1
Erfahrung/Eigenverantwortung	7
gehe nur sichere Touren	2
Aubildung	3
mein Gefühl	5
eigene Beobachtung	5
ständige Auseinandersetzung mit dem Thema	1
gutes Skikönnen	2
bin vorsichtig	2
bin hier sehr oft Gelände	1
zusammenbleiben	1
Wald und Wiesenglände	1
Bergführer	1
vorsichtig, und kenne Gebiet	1
ich gebe Regeln aus	1
	35
Entscheidungshilfen	
Stop or Go	2
Geländebeurteilung	5
Schneeprofil	2
	9
verlassen sich auf andere	
erfahrene Personen Befrgen	7
mit Personen reden die die Tour kennen	1

halte mich Anweisungen	1
klare Anweisungen	2
beobachte die anderen in der Gruppe	1
gehe nur mit Leuten die ich kenne	2
	14
Tourenplanung	
Tourenplanung	6
Karte studieren	7
Zeitmanagement	5
gute Kommunikation	4
defensive Spurwahl	3
Wetter und Schnee über Tage beobachten	1
Routenwahl	1
	27
Risikoreduktion	
sicher Geländeform nutzen	3
Einzelfahrten/Entlasungsabstände	13
Aufmerksam sein und die Zeichen der Natur lesen	4
Verhalten an die Situation anpassen	3
wenn ich nicht sicher bin kehre ich um	1
	24

Result in percentage:

Eigenverantwortung/ Selbseinschätzung	35	32
Entscheidungshilfe	9	8
verlassen sich auf andere	14	13
Tourenplanung	27	25
Risikoreduktion	24	22
	109	100

7.4. What equipment are you wearing or do you have with you today for your safety?

Kategorie	**Anzahl der Antworten**
Erstehilfeset	32
Karte	4
Seil	3
Funkgerät	2
Stirnlampe	2
GPS	2
warme Kleidung	2
Helm	2
Sonde	87
	136

Result in percentage:

Fachkundige Person war mit auf der Tour	67	44
Eigene Einschätzung	8	5
Wurde nicht für notwendig empfunden	36	24
Lawinenlagebericht	9	6
Andere	32	21
	152	100

7.5. What criteria do you use to select the slope for departure? (select all that apply)

Kategorie	**Anzahl der Antworten**
Gruppendynamik/verlassen sich auf andere	
erfahrene Person	7
folge Vorschlag von anderen	1
	8
Geländebschaffenheit	
Hangneigung	20
Abfahrt auf Piste	4
Mulden, Rinnen	4
Geländeform	3
Rücken	3
lange Abfahrt	1
Auslauf	1
	36
Eigene Beurteilung	
selber	3
selber Weg wie Aufstieg	7
Bauchgefühl	1
wo ich mich auskenne	1
	12
Schneebeschaffenheit/Wetter	
Schneedeckenaufbau	4
Temperaturverlauf	1
hohe Temperaturen	1
Bruchharsch umfahren	1
dort wo es kälter ist	1
Wetter der letzten Tage	2
	10
LLB	
LLB Gefahren	5

kritische Exposition lt. LLB vermeiden	2
Lawinenanzeichen	1
Bericht der letzten Wochen	1
	9
Andere	
Abseits der vielen Leute	3
möglichst Baumfrei wegen Wärmeabstrahlung	1
folge alten Spuren	1
Anreiz	1
	6

Result in percentage:

Gruppendynamik/ verlassen sich auf andere	8	10
Geländebeschaffenheit	36	44
Eigene Beurteilung	12	15
Schneebeschaffenheit/ Wetter	10	12
Lawinenlagebericht	9	11
Andere	6	8
	81	100