EMPOWERING TEAMS: STRUCTURED RISK MANAGEMENT AND FLUENT LEADERSHIP IN MOUNTIAN RESCUE
INTERNATIONAL SNOW SCIENCE WORKSHOP 2026, WHISTLER, CANADA

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ABSTRACT: The Bavarian Mountain Rescue Service (Bergwacht Bayern) strives for the safest possible operational environment and the most challenging yet safe training conditions. This requires a standardized, user-friendly risk assessment tool that is easy to understand, apply, and teach.

We all accept varying levels of risk in our daily lives. Our decisions are being influenced by personal biases and the inherently stressful environment. Factors like fatigue, discomfort, or alertness shape our individual risk tolerance. When navigating complex situations with non-quantifiable variables, decision-making becomes highly subjective. To bring our risk assessment closer to an objective evaluation we need a structure to break down these situations into easy to judge factors. During high-stress operations with limited information a structured decision-making tool and fluent leadership offers significant benefits with minimal drawbacks.

Developing a new risk assessment scheme from scratch demands significant resources and years of training. To ease uptake and reduce training overhead, the DCMR concept is implemented as a proven concept with familiar terms.

D(Dangers) x C (Consequences) – M (Mitigating measures) = R (residual risk)

Originally developed for winter guiding, it has been expanded to meet the additional demands of mountain rescue operations beyond standard recreational use. It is applied not only to avalanche-related decisions but also to non-avalanche scenarios in both winter and summer operations. The method is applied in the Bavarian Mountain Rescue Service to assess risks in training situations or even design training scenarios where specific challenges like darkness or height are intentionally introduced but due to specific measures the overall risk remains low.

We want to share our learnings and experiences with the outdoor community, particularly with search and rescue and mountain rescue teams. We believe this tool has the potential for widespread use in the field and can contribute to safer operations.

KEYWORDS: mountain rescue, risk management, decision making

1. INTRODUCTION

Mountain rescuers operate at the intersection of emergency medicine and mountaineering. In the world of mountaineering, particularly in winter, group and communication phenomena such as the familiarity heuristic or the expert halo are widely known and discussed (McCammon 2002, Haegeli et al. 2023,Streicher and Schwiersch 2025). In mountain sports the focus is educating the individual and give them the best tools to make good decisions(McCammon and Hägeli 2007; Streicher and Schwiersch 2025). In Europe nearly every country has their own framework for decision making in winter environments. For example the German alpine club (Deutscher Alpenverein – DAV) uses the snowcard (Engler et al. 2001), while the Austrian alpine club uses the stop or go method(Larcher 2001).

From the medicine side it is known, that despite very good individual skills and knowledge up to 70% of incidents in emergency medicine are prone to human factors (Rall and Lackner 2010). Lack of education and training in group decision making and hierarchy problems can lead to patient damage and psychological damage for the first responders.

In the medical field, crew resource management (CRM) (DeAndra and Gaba 1990) or excessive use of acronyms like the XABCDE scheme (Collicott 1979) is currently common with checklists

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https://doi.org/10.15788/1790099367

schemes becoming more abundant but not widely adapted yet.

The Bavarian Mountain Rescue Service (Bergwacht Bayern, BMRS) operates in the Bavarian Alps and the Bavarian low mountain ranges as the dedicated mountain rescue organization. As a division of the Bavarian Red Cross, a public-law corporation. The Mountain Rescue Service consists of 4,500 mountain rescuers and is organized into 107 rescue teams across six regions. The Mountain Rescue Service conducts between 4,000 and 6,000 operations per year in the winter and around 3,500 in the summer; these include search and rescue operations as well as medical missions. About 1,600 of these operations involve helicopter support, of which just under 600 are winch operations. All mountain rescuers with the Bavarian Mountain Rescue Service are volunteers; as part of the public emergency medical service, the Mountain Rescue Service is legally required to receive and respond to emergency calls (Kreuz 2026).

As part of the process of restructuring incident commander training for the BMRS, the aim was to implement and provide training on a strategic risk management tool. With the abundance of tools available, we did not want to establish another standard, but to find a tool or concept that is easy to teach and implement, has already been proven as stable and can be used much as a checklist. In addition, we also wanted a system that can be used in a recreational and operational way. To benefit from it as an incident commander it must be quick, reliable and useful.

1.1 Risk in Mountain rescue

The main goal of every mountain rescue or search and rescue operation is that everyone gets home safely. But every mountain rescuer is to some degree a mountaineer which has a different approach to taking risks. The overall accepted risk in mountaineering or mountain rescue is much higher than in the general society (Wickens et al. 2015) and also higher compared with height related work branches or other first responders. For example, in Germany the general rule for safety in heights requires mandatory use of fall protection when working within 2 meters of an edge (DGUV-I 212-001 2023). The 2 meters can be extended but never shortened. If all occupational safety regulations were to be complied with during mountain rescue operations, the missions would no longer be feasible.

A risk management tool was needed that could demonstrate that certain risks were consciously accepted in order to carry out rescues as quickly and safely as possible. We didn't want a tool that would turn us into mere executors, with clear-cut black-and-white distinctions, but rather a tool that would aid our own decision-making.

In mountain rescue, the principle of voluntary, qualified self-endangerment is followed. In the German legal system, a responsible citizen has the right to put him or herself in danger. It is allowed to smoke, drive very fast, or climb mountains on the most challenging routes possible. Most of the casualties you encounter as a mountain rescuer have put themselves in that situation voluntarily. As mountain rescuers, however, we must go one step further. We must carry out our self-endangerment in a qualified manner. We have a responsibility for our actions toward our patients, families, and superiors in mountain rescue.

The core requirement for an active member of the BMRS is personal responsibility. Everyone must be able to take accountability for their own decisions and actions. If that is not the case, the individual must communicate this on their own initiative. In order to voluntarily put myself in danger as a mountain rescuer, I need to understand and be aware of the risks involved. Only then the risks we take are voluntary and informed and our self-endangerment is qualified. Our requirements for voluntary, qualified self-endangerment are: (1) being of legal age (in accordance with German law) (2) having completed training as an active member of the BMRS (3) Having received sufficient continuing education (4) Having no health or mission-specific limitations.

This brings us back to a risk management tool, which gives every team member the possibility to evaluate the risk, to decide how much risk they are going to take and communicate this decision within the group of first responders. For a person who is lost but well equipped to survive a day or night outside we won't risk our personal health. For a young child with severe risk of hypothermia most of us would push to the limits of safety. This is the environment in which we work and in which we need a robust risk management tool.

1.2 DCMR in winter sports

The idea of an integrated risk management concept for recreational winter sports was made by Reuter and Semmel (2018) and introduced for the German mountain guide association (Verband Deutscher Berg- und Skiführer, VDBS). It was further developed and shaped into the DCMR concept that is in use today (Reuter et al. 2020):

$$D\ (Danger) x\ C(Consequences) - M(Mitigation\ Measures) = R\ (Risk)$$

DCMR aims to specify the local risk and close the gap between the regional scale of avalanche

forecasting and individual decisions in the field. Other systems rely on strict rules and leave close to no room for decisions. These rule-based tools are excellent for beginners and nonprofessionals (Mersch and Behr 2009). They can build up experience in a safe environment. Our aim was a tool that can be used across experience levels e.g. for beginners and training new mountain rescuers, but also at an advanced operation prone level.

The DCMR concept forces the user to separate between the danger and the consequences and to investigate both before deciding. It guides the user to closely examine a complex situation and break it down into its components. Then the user evaluates those components and builds his understanding of the local situation from scratch.

2. CREW RESSOURCE MANAGEMENT

It is well established that a large number of incidents in the emergency medicine is due to the human factors and not necessarily lack of skill or training (DeAndra and Gaba 1990).

Some high-risk work fields have implemented initially cockpit, now crew or crisis resource management systems (CRM). They identified that human factors (e.g. setting the wrong priorities or not double checking) lead to fatal problems in their line of work. Those human factors are quite similar to those discussed in the winter sport domain (McCammon 2002).

The goal of the CRM system is to enable teams to overcome the difficulties which occur when people work together in highly stressful and challenging environments. CRM aims to minimize the human factors and target specific mistakes which led to accidents in the past. CRM has been repeatedly demonstrated as a reliable system capable of saving lives at rates that most other interventions cannot achieve (Haerkens et al. 2015).

Because of its efficiency CRM is increasingly used in medical environments and has been introduced and applied in the medical training for mountain rescuers. In the crew resource management systems, there are different tools for different situations. Only two are listed below to illustrate the types of uses within the BMRS.

2.1 CRM Principles

The tool that was initially developed consists of the 15 principles of CRM (Rall et al. 2010). The following section lists only a few principles that are directly related to DCMR and its use in mountain rescue.

1. Know your environment
2. Distribute the workload
3. Mobilize all available resources (people and technology)
4. Communicate clearly and effectively
5. Use alle available information
6. Prevent and recognize fixation errors
7. Reevaluate the situation repeatedly
8. Foster good teamwork (support others and coordinate)
9. Set priorities dynamically

These principles are taught both in the medical aspect of mountain rescue and in the field of incident command. Due to the length of the checklist and its abstract wording, the points are often difficult to grasp during actual operations.

2.2 10 for 10

A tool developed later in the CRM landscape is called the “10 for 10”. It means investing 10 seconds to plan the next 10 minutes, where the correct number of seconds or minutes is more of a symbolic nature, in mountain rescue it can be a 10 minutes for 10 hours.(Rall et al. 2008)

A “10 for 10” is started with a clear command e.g. “Stop!” and is not continued until the current team leader feels that everyone is mentally on board with the “10 for 10” and is giving it their full attention.

For the “10 for 10,” all non-essential or non-safety-related activities are suspended, and full attention is focused on the team meeting (Rall and Lackner 2010).

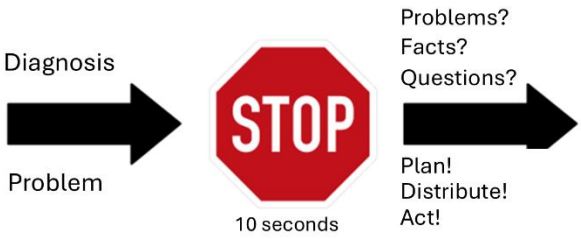


Figure 1 The 10 for 10 tool as a graphic. Source: (Thumser, 2026)

The “10 for 10” principle is widely used in the medical field and in the mountain rescue service; however, for non-medical decisions the questions are not specific enough. For complex decisions, such as those made on a critical avalanche slope, the questions in the GKMR concept are more fitting.

3. FLUENT LEADERSHIP

During the redesign of the incident commander training program, the concept of fluent leadership emerged as a highly suitable supplemental principle for managing the complexities and stresses of training and operations. In this context, fluent leadership, as practiced in the BMRS, serves as a dynamic leadership tool that enables a team leader to temporarily delegate authority in specific areas or overall leadership to the team member with the greatest expertise, depending on the requirements of the situation.

This approach reflects established protocols in medical operations, where leadership is routinely delegated to the most qualified person ranging from a rescuer trained in basic life support to a physician specializing in trauma depending on the demands of the situation. To extend this principle beyond medical scenarios in mountain rescue, we have integrated it into our training as a complementary leadership strategy and closely linked it to the DCMR concept. For example, if avalanche experts are present in the rescue team during winter field operations, leadership for decisions related to avalanches is delegated to these individuals in order to leverage their expert judgment. It is important to note that these short-term adjustments to the group hierarchy have no bearing on communication or responsibility outside the group. The original team leader remains the point of contact for the overall incident commander and facilitates or concludes the fluent phase.

4. USING DCMR IN MOUNTAIN RESCUE

The DCMR concept was implemented in the incident commander training due to its highly adaptable framework, comprehensive development with structured training materials, and the decentralized decision-making authority it provides regarding risk acceptance. The system is characterized by minimal absolute restrictions (hard no-go's), with the ultimate responsibility for risk assessment and decision-making being assigned to the on-site operational group**.** The DCMR concept also stood out due to its potential to accommodate users with varying levels of expertise within the same concept.

Initially, the system was applied as designed e.g. in field-based, collaborative decision-making scenarios**,** such as the evaluation of ski descent safety through group deliberation.

Equally important is the human factor, which plays a central role in the DCMR concept. It allows users to make their own decisions, whether taking a more risk-oriented or defensive approach to a situation, while keeping the decision-making process transparent and information driven.

4.1 DCMR as a CRM Tool

Following the initial training sessions, the DCMR concept was progressively adapted for use as a CRM (Crew Resource Management) tool, employing an approach analogous to the "10 for 10" methodology in group leadership. Under this framework, all team members were granted the authority to request a DCMR "break" to articulate their observations and insights.

Additionally, it was observed that the questions and methodologies employed in conducting the DCMR reflect multiple aspects of the CRM method. By systematically addressing hazards or explicitly stating potential consequences, heightened situational awareness was fostered among all participants, thereby enhancing operational safety. The DCMR approach was found to be effective even in cases where no immediate mitigating actions were taken, as the mere discussion of risk acceptance contributed to more resilient decision-making, mitigating the influence of human factors such as fatigue, cold, or hunger.

Furthermore, the DCMR framework was extended to summer operations and broader risk management applications. Due to its open-ended risk assessment structure, factors such as rockfall, heat, and insect-related hazards could be systematically categorized under the danger assessment, and when combined with consequence analysis, enabled qualified, risk-informed decisions regarding acceptable risk levels.

4.2 Human Factors

One major part in the DCMR concept is the human factors. Those determine to a great part how much risk we are willing or able to take on any given day (Streicher and Schwiersch 2025). The incident commanders in training are trained to reflect on their decision focusing on the effects of pressure from the outside or inside, perceptual illusions, group phenomena and lack of or insufficient communication. In addition, they are taught about the IMSAFE concept and the concept of green beads (Richter 2002) in order to better assess their own performance and decision-making ability or that of their group.

4.3 DCMR in Training

The DCMR concept can be effectively used to design training scenarios and to support the training of alpine climbers and mountain rescuers. Every decision made in the field whether during recreational ski tours, mountaineering expeditions, or

mountain rescue training can be systematically analyzed using the DCMR concept.

Experienced mountain rescuers and instructors continuously assess the risks associated with outdoor operations. Using the DCMR framework, decisions and the underlying decision-making processes can be communicated to less experienced team members, thereby ensuring transparency and knowledge transfer.

Furthermore, the DCMR framework can be used to develop customized training scenarios for rescue teams. Scenarios with increased potential for danger but minimal consequences can be designed, such as installing a fixed rope near the ground, where mistakes lead to falls with minor consequences. Conversely, scenarios can also be designed with low inherent danger but serious consequences, such as multi-pitch climbing or nighttime training exercises.

4.4 DCMR in rescue operations

Currently, there is no nationwide quantitative assessment of the frequency of use. Although isolated reports suggest growing acceptance, and individual cases have been documented in which its use led to operational advantages, tactical adjustments, or negative consequences resulting from its non-use, these observations have not been confirmed by systematic data.

Cases in which no tactical adjustments were made, operational delays occurred, or the DCMR framework was completely disregarded were neither systematically recorded nor statistically analyzed. Consequently, there is no comprehensive, evidence-based assessment of usage patterns.

4.5 Challenges during the process

One major remaining challenge is that we are repeatedly challenged to prove the value of the proposed novel approach. A common response is that people work through the steps anyway, but on their own and not in the prescribed order. We attribute this to the fact that most mountain rescuers are independent mountaineers that make informal risk checks all the time. Those who have completed the incident commander training course with intensive DCMR training generally see the benefits very clearly.

Another task is to align the training priorities between DCMR trainers. For some, the mountaineering approach is more important; for others, it's the group dynamics or leadership skills approach. Therefor we mostly train with small groups up to five people and switch trainers every half day. This ensures that each group gains outdoor experience in varied scenarios with different trainers, exposing them to diverse training methods. As a result, they can develop their own leadership style and apply the DCMR concept effectively.

5. FUTURE WORK

Our next step is to evaluate the use for the DCMR concept in mountain rescue operations to provide an empirical base for its efficacy and potential future improvements and modifications. For this we plan on making a digital tool to document the use of DCMR. For every documented case we can use a questionnaire to determine whether the use in this situation was beneficial or just delaying the rescue operation. Another goal is to follow up with those who have successfully completed the incident commander course after one year to gather feedback and ask whether they were able to apply what they learned, and if not, why not.

6. CONCLUSION

The DCMR concept is increasingly used in the Bavarian Mountain Rescue Service to conduct a joint risk assessment in small groups or prior to larger operations. In this context, it serves as a Crew Resource Management tool, creating a space where personal risk tolerance can be discussed and where everyone can identify potential dangers or consequences. Combined with the principle of fluent leadership, this process allows the most suitable team leader to be identified to guide the team through the next steps.

ACKNOWLEDGEMENTS

We would like to thank the Bavarian Mountain Rescue Service and the BW ZSA team, as well as all the volunteer and full-time members who helped with the incident commander training or who, after participating, provided feedback that helped us improve.

Use of AI: AI-based tools were used to assist with language editing. All AI-generated content, including text and code, was independently reviewed and verified by the authors, who take full responsibility for the accuracy and integrity of the work.

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