Original Research

Overcommitment: Management in Helicopter Emergency Medical Services in Norway

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A B S T R A C T

Objective: Overcommitment in demanding rescue situations may put both rescuers and patients in danger. This study aimed at identifying individual approaches and organizational strategies that counteract instances in which rescuers commit more than is feasible, desirable, expected, recommended, or compellingly necessary. How is overcommitment managed by professional frontline rescuers during hazardous medical evacuation and rescue situations?
Methods: In a qualitative, exploratory study, 9 focus group interviews were conducted with a total of 30 crewmembers from the Norwegian Helicopter Emergency Medical Service.
Results: In this second article in a series of 2 articles on overcommitment, 12 commitment-moderating factors are presented. Air ambulance personnel pointed at sociological, cognitive, and organizational elements that may influence their degree of commitment in challenging and hazardous rescue situations.
Conclusion: Air ambulance personnel describe a team-based approach to adjust their level of commitment in medical evacuation and rescue missions. They rely on known, however important, nontechnical skills and organizational measures to combat overcommitment in demanding rescue situations. Some of their approaches to safe performance should be adoptable by other rescue units and less experienced voluntary, not-for-profit, rescue organizations.

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The willingness to engage deeply and with individually and professionally based motivation for carrying out a defined mission forms the basis for high-quality rescue performance. As a core driving force, the individual eager to commit to saving lives should not be suppressed. However, one should acknowledge that the eagerness to engage deeply in such activities, often under harsh environmental conditions demanding decisions under a high degree of uncertainty, is not free of risk to those involved. Overcommitment (ie, when rescuers make themselves vulnerable by committing more than is feasible, desirable, expected, recommended, or compellingly necessary) may put both the mission and the rescuers at risk. These actions are commonly judged as isolated impetuous acts but may as well result from complex interactions of *behavior-shaping mechanisms*.[1] Unsafe actions reflect a control problem,[2] not solely along the horizontal axis representing the frontline rescuers but also in the vertical interaction of complex and sociotechnical integrated project organizations[3] like the rescue services.[1] Overcommitment can also imply futile use of resources. Therefore, it could also be analyzed in an economic perspective. Available resources are in general scarce. Therefore, it can often be a sensible question if they can be used with more benefit for other purposes. This is outside the scope of this article. The safety control structure[1,2] of the Norwegian rescue service reflects its systematic organization, implying that the final decisions on joint and coordinated efforts are to remain with the incident commander (IC). The IC relies on feedback from cooperating units (the team) for him or her to maintain an updated risk image,[4] especially because designated ICs may arrive much later than the rescue units handling the operational tasks.[5] Another factor to observe is that according to Norwegian legislation every single unit and person taking part in a rescue mission is obliged to adhere to legal requirements in the acts and regulations relevant to his or her work (eg, the health personnel have

to follow the standards laid down in the health legislation). Therefore, the authority and responsibility for the IC are not in general extended beyond the need of coordinating joint efforts from different specialized resources.

Eivind L. Rake and Ove Njå[5] found that ICs made few decisions and relied on "tacitly understood routines and procedures" executed by the first responding individual rescuers. Regarding safety assessments, this means that the ICs mainly agree to recommendations from frontline rescuers.

What, then, do highly experienced rescuers do to avoid overcommitment in situations dominated by uncertainty and life-threatening hazards? In this article, we present how overcommitment is identified and managed by the frequent first rescue responders in the Norwegian Helicopter Emergency Medical Service (HEMS).

Methodology and Research Design

In this qualitative study, we conducted focus group interviews to explore how HEMS personnel in the Norwegian Air Ambulance Service (NAAS) adjust their level of commitment in various demanding medical evacuation and rescue situations.

The principle aims of this part of prehospital emergency medicine are the following[6]:

1. Bring emergency medical equipment and specially qualified health care professionals quickly to seriously ill or injured patients.
2. Bring patients to an adequate level of treatment in the health service during ongoing monitoring and treatment, including providing emergency medical diagnostics.
3. Perform simple search and rescue operations.

The NAAS operates with 3-man crews: the pilot, medical doctor, and HEMS rescue paramedic. On-duty crewmembers stay on the base 24/7 for up to 1 week at a time. The composition of the crews varies over time, but crewmembers are employed at 1 specific air ambulance base. More detailed descriptions of the NAAS can be found in the studies by Zakariassen et al[7] and Lunde and Braut.[8]

The interviewees were selected by way of convenience sampling.[9] Although the bases were selected by location, crewmembers were selected by random. Following general information about the project via NAAS channels, crews were contacted before or in the beginning of their duty period. All crewmembers were informed that participation was voluntary, and no one refused to take part.

Malterud et al[10] present a model for the assessment of sample size in qualitative studies in which information power is given by certain items. In this exploratory study, reflecting the broad aim, we interviewed a sufficiently large number of participants to counteract a biased data collection. Air ambulance crews were chosen because of their unique experience from prehospital critical care, allowing a smaller number of cases. Characteristic phenomena of overcommitment were expected to reflect established safety theory, effectively reducing the need for a large sample. A cross-case strategy of analysis was a natural choice to "produce new knowledge and augment existing knowledge and experience."[11] Although cross-case analysis requires a larger sample, this may complicate the analysis.[10]

Material

In the end, 9 crews, altogether 30 crewmembers, were interviewed in the period from March 2017 until April 2018. The interviewees were 3 women and 27 men aged between 30 and 60 years, with a mean age of 45. The mean length of experience from this kind of service was 10 years.

These focus group interviews were tape recorded, transcribed, anonymized, and summarized in written reports. Linguistic pause fillers and formulaic language were omitted. Group interaction was

not considered a major issue in this study because air ambulance crews are small and the crewmembers are well acquainted. All reports were sent to the interviewees for comments and validation, in line with Plummer-D'Amato's member checking,[12] to enhance credibility and trustworthiness. All reports were approved without corrective comments. All tape recordings were deleted immediately after transcription.

The first author moderated the interviews. He is a member of volunteer mountain rescue organizations and a police officer. In these positions, he frequently cooperates with air ambulance crews. The second author is a medical doctor and professor in risk management and societal safety.

The interviews followed a common structure, with an initial presentation of the background for the study followed by a clarification of specific concepts and practical considerations. The interview guide contained 5 main themes: 1) associations with the concept of overcommitment, 2) recognition and sharing of operational cues, 3) causal factors in overcommitment, 4) preventive factors in overcommitment, and 5) overcommitment and learning. We did not apply strict limitations to the topics and discussions that arose from introducing the main themes.

The interviews were exported to the software program QSR International NVIVO 11 (QSR International, Melbourne, Australia) to aid in the necessary steps of systematic text condensation.[13] Starting from the original 5 main themes of the interview guide, the first step of the analysis resulted in a set of broad categories. A further subdivision yielded a number of "meaning units"[13] (ie, key words that describe and conceptualize the main findings of the study).

A more detailed description of methodology is presented in the first article in this series titled "The Concept of Over-Commitment in Rescue Operations: Some Theoretical Aspects based upon Empirical Data."

Results

The interviews of air ambulance crews elicited 12 key words summarizing their reflections on what may prevent overcommitment in hazardous situations. In the following sections, the interviewees are referred to by an uppercase letter and a number (eg, A1).

Anticipation

HEMS crewmembers often pointed at factors that enhance their ability to anticipate danger. D2 suggested, "Training, experience and communication, which can in some way capture the dangers and that some start it (anticipation) by just expressing the problem before we arrive." H3 said, "And we are always talking about the mission on the way out, going through where we are going, flight operative and medical things." D1 offered the following example: "And if there's mountain farm, there's a zip line." Thinking ahead of their present position, either when treating a critically ill patient or in low-altitude flying, was strongly dependent on acquisition and interpretation of the available information.

Contingency Planning

Closely linked to anticipation is contingency planning. F3 stated, "Then, I think we are quite good at this; OK, time out, new plan." Initial callout information is often scarce, and this requires constant adjustment of mental models as new information is available. To this end, crewmembers continuously exchange views on how to meet the situation. E2 explained, "On our way out, we will always discuss; what can we expect?" and then "make a coarse plan and fine-tune it." Their contingency plans also involve other resources, both to ensure as short a response time as possible and to release some of the pressure put on them to reach the patient's position. G1 said, "Yes … yes …, I always have a plan C, then, which is … It may be an emergency procedure."

Communication

Most crews listed communication, in all phases of missions, as a key factor in adjusting their level of commitment. E2 states, "It's the communication in the crew, then everybody is likely to sit with the same situation awareness …" Premission briefings, exchange of information with collaborating rescue units, and a constant verbalization of observations as they approached the accident site are crucial communication techniques to increase and equalize team situation awareness (G1). J3 pointed at "filters" to prevent overcommitment, of which the first one is to "take a brief time-out" to allow people to exchange views on the nature of the mission, specifically about the patient's condition (E2). The initial internal discussion contributes to determine the degree of urgency and inherent risks. "We can get into real trouble if we do not clarify to the team, what we are up against" (G3). C1 mentioned that some new HEMS rescue paramedics "want to respond to everything" and explained humorously that he sometimes had to say "That will be without me." C2 explained, [This is] "how they facilitate (adjustment of commitment) if someone is very eager to go; it's through communication; by explaining and telling what you think, and then discuss."

Cue Recognition

"Personally, I dont think I've become much better at thorough assessments and neat decision making, but I'm much better at capturing the signals around me …" (G2). D2 explained that they pass various "layers," zooming in as they approach the accident site; first the map, then topography, terrain, high mountains, camping sites, and houses. "You know, always, as long as there's a road, there's often either wires next to it, or is it house, then it needs electricity." Cue recognition, communication, "gut feeling," and a low threshold for commenting on dangers and failures were often mentioned in the same breath, obviously linked to risk awareness. C1 illustrated this by saying, "You've been here before … that is, now you are here … It nearly went wrong here 5 years ago … " The following conversation between crewmembers C1 and C2 clarify how they see "stomach feeling" with relation to experience: "What you say now is that you have a stomach feeling." "Yes, or experience, then." "And the stomach feeling comes from experience. Many talks about stomach feeling, but you cannot rely on your stomach feeling before you have experience."

Equipment and Sensors

Obviously, air ambulance personnel commit themselves to flying in less than ideal conditions, often over long distances, across climate zones and varying weather systems. In darkness and changing visibility, equipment like night vision goggles and a network of Web cameras increase their effective line of sight, thus reducing the need to "make a try." Crewmember E2 considered specialized equipment as a "a pretty obvious risk barrier." As C1 put it, "You should not go that far - you must cancel before you get there, because then it's often too late." C2 commented, "… earlier, when flying in darkness, they didnt know what kind of weather they would meet, but now, we actually see the weather (by NVG)."

Experience

Crewmembers found that both task-specific and volume-based experience allowed crewmembers to choose more optimal solutions. "Because you do actually have the ability, because you are so well prepared with training and experience that; No, we will not do this." A2 reflected on his own decision making, "I was not so good, the first months, to assess the circumstances of what we did, then …" D1 concluded convincingly, "We will never have 2 rookies in the cockpit … That's in any case a requirement that we have." A1 remarked, "One thing we try to be a little conscious of is that we have a slightly different level of experience." They used affirmative questions as a common strategy to balance inequalities in the crew. E3 found experience

"absolutely necessary" because "sometimes when it's difficult, you're in the borderland where it's the experience that decides." C1 thought that "It may have something to do with how we think, how we work together. We have been on many missions and we are maybe a little ahead."

Risk and Vulnerability Awareness

Crewmembers find that risk and vulnerability awareness can have a restraining effect on commitment. G2 stressed the importance of attention, saying "It's important to focus on what you are actually doing, rather than what you are going to do." In line with this, D2 reasoned about overcommitment and their perception of risk, "I think it's how you are as a person and how you're trained and how you interact with the rest of the crew, how you understand the danger, and that you describe that danger as real as possible." He continued, "To talk about a hazard, a concrete problem, is much better than just speculating about a possible future problem."

With reference to many sad accidents and their own experience with close calls, realizing one's own vulnerability was a game changer. G4 said, "The last accident made me realize that there is a certain risk involved, even if accidents are seldom." G2 referred to a specific mission, "No, we were, in a way, very much reminded of our vulnerability. We finished trying things …" From feeling invincible and on top of all situations, feeling vulnerable leads them to a more defensive approach.

Quality and Flow of Information

Crewmembers pointed at acquisition and processing of information in the early stages of rescue operations as important factors affecting their level of commitment. J2 stated, "It's about gathering as much information as possible, from callout till you meet the patient, to be able to make as good an assessment as possible." A3 underlined that the dispatchers at the Emergency Medical Coordination Centre (EMCC) "get in a lot of information that makes them perceive the patient as really bad" and when they arrive " the world is completely different." Aiming at short response times, the crews seldom stall their flight for more information. As D2 put it, also demonstrating the dilemmas facing the first responders, "Firstly, if we are going to spend fifteen, twenty minutes before we go, there's no point in going at all - because then the patient is dead. We must have systems that make us go straight into the helicopter and save people." Especially in short-approach operations, the crew will not have time to adjust to the current situation, forcing them into premature and sometimes unprepared action.

Training and Preparedness

H3 found their position in the Norwegian rescue service as quite unique "because we spend our entire time at work just to be ready for action, go on missions and train …" J1 stated that "… they have many training missions, where they go through all the points listed in the SOP, type of mission, potential hazards, route, fuel, status of aircraft and crew, weather …" Unlike other responding units, from the ambulance or the police, they have no trainees or aspirants. This puts them in a "buffering" position, making them aware of how a certain level of knowledge and training influences their decision making in demanding situations. C2 stated, "In terms of overcommitment in the rescue service, I think it relates to knowledge. You want some doctors to assist the most critical patients, and similarly, you want some pilots to be flying when conditions are marginal." In line with this, F2 said, "I certainly believe that our (training) makes us more robust, because we have a similar mind-set, how we want this to work …" Important parts of this training are crew resource management (CRM)[14] and the type of cross-training that results from assisting each other during missions. Indirectly, the dispatcher's level and type of training will affect the rescuers' degree of commitment. As C2

pointed out, "When people call the police for help, they do not get the same questions about the condition of the patient as if they call the EMCC."

Standard Procedures

Crewmembers experienced that standardization of training and procedures served as a mediator of commitment. F1 felt relieved by flight regulations, "If we fly to (a town) on a cerebral hemorrhage or respond to an avalanche accident in the mountains somewhere, we still fly through the same square tunnel … And then I can sit here, not having to take that decision about flying or not … to that baby. It's already taken for me." On the ground, the limits of safe practice are still subject to professional judgment, although checklists and procedures support standardized solutions. "They have checklists for avalanche rescue missions, so that they can go through them without getting all stressed up—it helps enormously" (J1). E2 referred to "a bottom line" of competence for all HEMS crewmembers represented by "The National Standard for HEMS Rescue Paramedics in the Air Ambulance Service."[15] H3 pointed out that they have "thousands of constellations of different crews in a year, as employees change bases and shifts," but this does not affect their general way of working "since everyone is in the same school."

Teamwork Behavior

Collegiality and rapport were frequently mentioned as essential factors for a sound decision environment. A3 commented that "it is about trusting each other's professional knowledge and it is part of their strength to be in a group with completely different skills." G1 said the following about detecting danger signs and communicating it: "What's good is that we live together and have dinner together, all week. That's the number 1, I think. We know each other." H2 found that "It's something about having this as our everyday experience which might be an advantage. We are used to sitting in a debriefing situation, we are relatively familiar with each other. Knowing each other makes it easier. Knowing each other's professions."

They also have a culture for expressing their own assessments and concerns, regardless of age and experience. C2 commented that "You need someone to ask all the critical questions," to "ignite the fuse," to make colleagues aware of dangerous situations. J4 said, "We have this culture; if anyone objects … if anyone is not happy, then we easily take a time-out." F3 said, "What is very important is the concept that all voices have equal value," referring to young volunteer rescuers who may find it difficult to speak up, even if they are rightly scared. F3 stated, "That`s a fine principle here; even though I don`t know much about flying, I actually have the right to ask questions

and to be listened to …" A pilot commented, "Either we turn back, or I can try to explain what's my plan, so you can feel safer."

D1 explained that "we take the time we need to do it safely, and that permeates a lot of what we are doing; we dont have to prove that we will get down there, no matter what." Crewmembers experienced that their safety culture had changed over time, "possibly, and especially after the accidents we've experienced." C2 underlined the importance of the team, "When we started working, we said there were two things guiding our work; it was the momentum theory and the chaos theory. No matter how much chaos surrounding us, we would have to stick together—find the right patient, do the right things—and leave."

Discussion

The nontechnical strategies used by HEMS personnel to stay safe in a complex rescue environment link in to known theoretical elements from high-reliability organizing,[16,17] collective mindfulness,[18] naturalistic decision making,[19,20] resilience,[21] CRM,[14] and teamwork behavior.[22] Listening to the crews leaves an impression that CRM is institutionalized, and uncertainty coping skills are operationalized (Table 1).

The multiprofessional composition of the HEMS crews added to their general experience from a variety of relevant sports and leisure-time activities creates a diversity that enables them to capture and understand more of the danger signals from their surroundings. "High Reliability Organizations (HROs) cultivate requisite variety and assume that it takes a complex system to sense a complex environment."[18] HEMS crews have learned through experience and CRM training that a constant and collective awareness of even the slightest sign of abnormality or danger will help them to avoid overcommitment and failure. As formulated by a HEMS rescue paramedic, "it is important to focus on what you are actually doing, rather than what you are going to do …" Mindfulness allows them to observe, recognize, react, and adapt to changes and variations in the rescue environment,[21] thus avoiding and curbing surprises and "unforeseen events" in a resilient manner. Recalling that the HEMS crewmembers constantly aim at balancing patient safety[23] and rescuer safety in all conditions and situations, a personal commitment is needed to build an "organizational culture of reliability."[16] Laws and regulations may have an indirect effect on the framework of rescue performance. HEMS crewmembers maintain that their final decisions to act safely are mainly based on knowledge- and skill-based competencies,[22] attitudes, experience, and teamwork behavior of rescuers (Fig. 1). This is much in congruence with the findings of Neal et al[24] that knowledge and motivation are "important determinants of safety behaviors." A major challenge, then, is that both

Table 1
Operational Uncertainty Management

Alarm	Seek information about *patient situation* and *rescue situation* (R) (2), use *equipment*/remote sensors/Web cameras (R) (2), ask affirmative questions (1), "red teaming" (1), active *communication*, «Huddle up» (R) (1), temporary *triage*, Is the mission possible?, *anticipate* situations and hazards (A) (3), call out back-up resources (F) (3).
En route	Connect with coordinators and other rescue units, *anticipate* situations (A) (3), discuss possible scenarios (A) (3), *communicate*, constant verbalization of observations (R) (2) (3), use remote sensors (R) (2), *contingency planning* (A) (3), *cue recognition* (2), ask affirmative questions (1), "red teaming" (1), report unease (1) (3), closed-loop *communication, share high-quality information* (R) (3), Say No (F). *Triage*, Possible to complete the mission?.
Arrival	Reconnaissance landing sites/hazard sites (F) (2), use established landing sites (F) (2), connect with rescuers on the ground (R) (2) (4), *contingency planning* (A) (3), *cue recognition* (2), request observation of obstructions (R) (F), *share high-quality information* (R), constant verbalization of observations (R) (2) (3), report unease (1) (3), ask affirmative questions (1), "red teaming" (1), Say No (F), Triage.
Response	*Cue awareness* (2), Connect with rescue specialists (R) (2) (3) (4). Report unease (1) (3). Say No (F). *Triage*, "red teaming" (1), apply *standard procedures* (F), constant verbalization of observations (R) (2) (3), stay/play/load and go (3).

Suggested activities to increase reliability, reduce and handle uncertainty, and prevent overcommitment in the various phases of ongoing medical evacuation and rescue missions. Words in italics are summarizing key words derived from the statements of helicopter emergency medical services crewmembers. Capital letters in parentheses indicate tactics of coping with uncertainty based on the R.A.W.F.S. heuristic.[a] Numbers in parentheses indicate elements of mindfulness.[b]
[a] R: Reduction, A: Assumption-based reasoning, W: Weighing pros and cons, F: Forestalling, and S: Suppression.
[b] 1: Reluctance to simplify interpretations, 2: Sensitivity to operations, 3: Commitment to resilience, and 4: Deference to expertise.
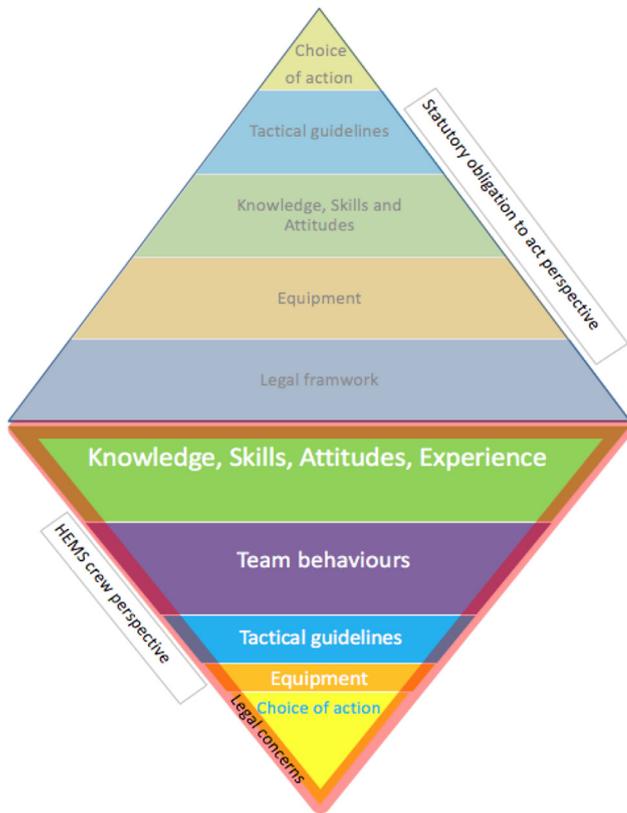
Figure 1. HEMS crewmember decision fundamentals. Factors identified by Norwegian HEMS crewmembers to prevent overcommitment reflected from the formalistic statutory obligation to act.[25]

tactical and strategic managers have to make decisions based on information from first responders who are novices or nonexperts. This lack of predictability regarding the quality of observations and information from the accident site affect the risk and necessity assessments that are made by the approaching rescuers and, subsequently, the choice of rescue response.

Naturally, divergence in professional background, experience, resources, and rescue focus is an integral part of organized rescue activity. This may reflect the observed differences in how uncertainty is perceived and handled by the air ambulance personnel and other rescue units.[8] Crewmembers observed different reactions to signals of danger in members from the various organizations depending on their level of training and expertise. When responding to natural hazard incidents, cues like avalanche activity, wind direction, temperature changes, type of precipitation, and snow cover characteristics mean different things to different people. Over time, even danger signs may be perceived as normal, "weak, mixed signals that soon become treated mindlessly..."[18] as does the way we react to them. Only in hindsight is the pattern recognizable as a path to tragedy. This inherent variety of the rescue service may contribute to increased signal detection and failure-seeking behavior,[18] thus constituting a "conceptual slack"[26] that aids in self-evaluation and correction of performance. Of course, differing organizational cultures may also influence the common safety climate in an ongoing rescue operation,[24] causing a conflict about risk assessments and safety behavior.[27]

The CRM training encourages crewmembers to constantly verbalize "real-time observations and assessments of observations based on relevant cues in the clinical situation,"[28] so-called "online commentaries." Simultaneously, cross-training (ie, their knowledge of each other's professional duties) creates redundancy and mutual trust. It

enables them to monitor the assessments and decisions of their colleagues, encouraging their colleagues to speak up if anything seems unreasonable.[22,29] Both anticipation and contingency planning are based on the crewmembers' mental models of the current situation. By verbalizing their thoughts on possible scenarios, they invite their colleagues to object and present alternatives, so-called "red teaming."[30] This will contribute to equalize their situational awareness. As interviewee C2 explained, "It's important that one of the crewmembers is the grumpy one and asks critical questions. If we all are very positive, we'll end up in situations where we shouldn't be ..." This is of great importance in rescue situations in which success is strongly dependent on the effort of single crewmembers. The assumption is that objections to the chosen course of action may counteract suppression of uncertainty in critical decision making.

The HEMS crews' perception of the "3-crew concept" appears to be central to their general performance and also to the prevention of overcommitment. They rely on teamworking to keep them safe. Flin et al[22] explained teamwork skills as "behavioral interactions and attitudes that team members must develop before they can function effectively as a team." The reflections made by crewmembers indicate that the same "big 5" elements[31] making teams work effectively also make them work safely. The interviewees accentuated the value of active and trustful communication in their approach to avoid accidents. In line with the concept of resilience engineering,[21] safety is considered an integral part of HEMS operations.

We see that mindful organizing may prevent some acts of overcommitment (eg, those described as organizational overcommitment, low-risk−high-frequency overcommitment, and rule bending). Some situations will still be dominated by uncertainty in the last and decisive moments. Indecision is paid by the patient's chance of survival. There is no more available information, and a rescue effort is immediately required to save a life. When rescuers ignore this remaining uncertainty and make decisions based on their "stomach feelings" or just take a chance, they suppress uncertainty.[32] These are the moments that create heroes or fools. In such high-risk situations, postponing or stalling a rescue effort should always be an acceptable decision[33] based on the cautionary principle.[34] This is also the recommended approach in the Norwegian rescue services.[35] Forestalling, scenario and contingency planning, anticipation, assumption-based reasoning, and reconnaissance before landing/entering a hazard zone are all examples of cautious and mindful behavior.

Nontechnical skills or CRM is not a regular part of the training for nonflying rescue personnel in Norway, so conscious and focused teamwork behavior cannot be expected between rescue units. Based on the findings in this study, one may recommend specific interorganizational training based on "communication strategies within the relevant activity type that trigger actions that are relevant to safe practices."[28] Kruke and Olsen[36] suggest a foundation for reliability-seeking networks built on elements of high-reliability organizing and collective mindfulness. Although not all HRO characteristics occur simultaneously,[37] organized rescue operations display important HRO elements, which is in support of considering the Norwegian rescue service as a reliability-seeking network. Aiming at reducing the prevalence of overcommitment in rescue operations, future training of rescuers could benefit from a stronger focus on nontechnical skills.

Conclusion

HEMS personnel describe a team-based approach to adjust their level of commitment in medical evacuation and rescue missions. Their organizational structure, on-base duty time, CRM training, and frequent debriefing of missions enhance trustful and direct online team talk.[28] They recommend active communication and "red teaming" to increase individual and team awareness of both likely and unlikely accident scenarios, thus avoiding dangerous actions in dangerous

conditions. In demanding missions, they rely on a combination of non-technical skills, standard operational procedures, and organizational measures to identify and avoid harm's way. The most important measure to counteract overcommitment in the Norwegian rescue service may be an increased focus on interorganizational CRM-like training. This might create a safety climate that makes the complex and multifaceted rescue organization act like a team. Challenges will remain regarding the start-up phase of rescue operations in which highly motivated and less trained rescuers are tempted to engage in hasty and impetuous action. Managerial levels need to guide and support autonomous rescue units through the elements of operational uncertainty management to ensure that they stop in time.

References

1. Rasmussen J. Risk management in a dynamic society: a modelling problem. *Safety Sci*. 1997;27:183–213.
2. Leveson N. *Engineering a Safer World Systems Thinking Applied to Safety*. Cambridge, MA: MIT Press; 2011.
3. Brandshaug H. *Den norske redningstjenesten: en studie av en kompleks samhandling. The Norwegian Rescue Service: a study of complex interaction. Molde, Norway: Høgskolen i Molde; 2011.*
4. Braut GS, Rake EL, Aanestad R, Njå O. Risk images as basis for decisions related to provision of public services. *Risk Manag*. 2012;14:60–76.
5. Rake EL, Njå O. Perceptions and performances of experienced incident commanders. *J Risk Res*. 2009;12:665–685.
6. HOD. Helse— og omsorgsdepartementet. Forskrift om krav til akuttmedisinske tjenester utenfor sykehus (av 18. mars 2005). Oslo: Ministry of Health and Care Services. 2005.
7. Zakariassen E, Uleberg O, Røislien J. Helicopter emergency medical services response times in Norway: do they matter? *Air Med J*. 2015;34:98–103.
8. Lunde A, Braut GS. The concept of over-commitment in rescue operations. Some theoretical aspects based upon empirical data. Submitted. 2018.
9. Etikan I, Musa SA, Alkassim RS. Comparison of convenience sampling and purposive sampling. *Am J Theor Appl Stat*. 2016;5:1–4.
10. Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res*. 2016;26:1753–1760.
11. Khan S, VanWynsberghe R. Cultivating the under-mined: cross-case analysis as knowledge mobilization. *Forum Qual Soc Res*. 2008;9:34.
12. Plummer-D'Amato P. Focus group methodology. Part 2: considerations for analysis. *Int J Ther Rehabil*. 2008;15:123–129.
13. Malterud K. Systematic text condensation: a strategy for qualitative analysis. *Scand J Public Health*. 2012;40:795–805.
14. Cooper GE. Resource management on the flightdeck. In: Paper presented at: Proceedings of a NASA/Industry Workshop; 1980.
15. Luftambulansetjenesten. Nasjonale standarder for luftambulanseleger (helikopter), flysykepleiere og redningsmenn (National standards for air rescue medical doctors, nurses and HEMS paramedics), Oslo. 2010.
16. La Porte TR. High reliability organizations: unlikely, demanding and at risk. *J Contingencies Crisis Manag*. 1996;4:60–71.
17. Weick KE, Sutcliffe KE. *Managing the Unexpected: Assuring High Performance in an Age of Complexity*. San Francisco, CA: Jossey-Bass; 2001.
18. Weick KE, Sutcliffe KM, Obstfeld D. Organizing for high reliability: processes of collective mindfulness. *Crisis Manag*. 2008;3:31–66.
19. Lipshitz R, Klein G, Orasanu J, Salas E. Taking stock of naturalistic decision making. *J Behav Decis Mak*. 2001;14:331–352.
20. Klein G. Naturalistic decision making. *Hum Factors*. 2008;50:456–460.
21. Hollnagel E, Woods DD, Leveson N. *Resilience Engineering: Concepts and Precepts*. Farnhame, UK: Ashgate Publishing, Ltd; 2007.
22. Flin R, O'Conner P, Crichton M. *Safety at the Sharp End. Boca Raton, FL: CRC Press Taylor & Francis Group; 2008:330.*
23. Saunes IS, Svendsby PO, Mølstad K, Thesen J. *Kartlegging av Begrepet Pasientsikkerhet/About the Term Patient Safety. Oslo, Norway: Norwegian Knowledge Centre for the Health Services; 2010.*
24. Neal A, Griffin MA, Hart PM. The impact of organizational climate on safety climate and individual behavior. *Safety Sci*. 2000;34:99–109.
25. Myhrer T-G. Hvor langt går handlingsplikten? (How far does the statutory obligation to act go?). In: Mortvedt OM, Mathisen G, eds. *Politiforum*, Oslo: Politiforbundet. 2013. https://doi.org/10.1016/j.amj.2018.11.007.
26. Schulman PR. The negotiated order of organizational reliability. *Adm Soc*. 1993;25:353–372.
27. Finne S. Skred gjekk i området etter redningsaksjonen/avalanche release on accident site after rescue operation. *Hordaland*. 2015;16:14.
28. Gundrosen S, Andenñs E, Aadahl P, Thomassen G. Team talk and team activity in simulated medical emergencies: a discourse analytical approach. *Scand J Trauma Resusc Emerg Med*. 2016;24:135.
29. Salas E, Rhodenizer L, Bowers CA. The design and delivery of crew resource management training: exploiting available resources. *Hum Factors*. 2000;42:490–511.
30. Masys A. Black swans to grey swans: revealing the uncertainty. *Disaster Prev Manag*. 2012;21:320–335.
31. Salas E, Sims DE, Burke CS. Is there a "big five" in teamwork? *Small Group Res*. 2005;36:555–599.
32. Lipshitz R, Strauss O. Coping with uncertainty: a naturalistic decision-making analysis. *Organ Behav Hum Decis Process*. 1997;69:149–163.
33. Ash JS, Smallman C. Rescue missions and risk management: highly reliable or over committed? *J Contingencies Crisis Manag*. 2008;16:37–52.
34. Aven T. Risk, Surprises and Black Swans: Fundamental Ideas and Concepts in Risk Assessment and Risk Management. Abingdon-on-Thames, UK: Routledge; 2014.
35. Regjeringen. *Håndbok for Redningstjenesten* (*Handbook for the Norwegian Rescue Service*). Oslo: Justis- og Beredskapsdepartementet (Ministry of Justice and Public Security); 2018.
36. Kruke BI, Olsen OE. Reliability-seeking networks in complex emergencies. *Int J Emerg Manag*. 2005;2:275–291.
37. Roberts KH, Rousseau DM. Research in nearly failure-free, high-reliability organizations: having the bubble. *IEEE Transactions*. 1989;36:132–139.