APPORTS DE LA RECHERCHE

Risk, uncertainty and decision-making

Improving the effectiveness of group decision-making

Juliane Marold

n° 2015-01

THEME

Human and organizational factors of safety

Les Cahiers de la sécurité industrielle

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Fondation pour une culture de sécurité industrielle

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Résumé

Titre Améliorer la performance de la prise de décision en groupe

Mots-clefs décision, groupes, incertitude, formation, évaluation

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Date de publication février 2015

Les auteurs ont étudié les processus quotidiens de prise de décision en présence d'incertitude, à l'aide d'une étude de terrain (*field study*) dans le secteur médical. Le travail s'inscrit dans la tradition de recherche en *naturalistic decision-making* (NDM), qui vise à comprendre comment des personnes travaillant dans un environnement critique conceptualisent et internalisent les incertitudes, comment ils les gèrent pour parvenir à prendre de bonnes décisions dans leur activité quotidienne.

Les auteurs ont développé et testé un module de formation sur la prise de décision en groupe, en collaboration avec un centre hospitalier universitaire en Autriche. La formation porte sur l'anesthésie et les soins intensifs. Son objectif était d'aider les participants à améliorer leur performance dans les processus de décision en groupe. La formation se focalisait sur l'acquisition des connaissances et de l'expérience nécessaires à une bonne prise de décision.

Ce rapport documente la dernière phase d'un projet de recherche sur la décision en groupe en situation d'incertitude. Il décrit le développement du module de formation, sa mise en œuvre, les résultats obtenus et les améliorations apportées à la suite d'une évaluation effectuée avec les personnes ayant suivi des sessions pilotes.

About the authors

Pendant les travaux de recherche décrits, Juliane Marold était chercheur à l'Institut de Psychologie et d'Ergonomie du département Travail, ingénierie et psychologie organisationnelle de la Technische Universität Berlin.

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Abstract

Title Improving the effectiveness of group decision-making

Keywords decision-making, groups, uncertainty, training, evaluation

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The authors have undertaken a field study of daily decision-making processes in groups under uncertainty, in the health care domain. The work follows the tradition of *naturalistic decision-making* (NDM) research. It aims to understand how groups in this high reliability context conceptualize and internalize uncertainties, and how they handle them in order to achieve effective decision-making in their everyday activities.

In close cooperation with a teaching hospital in Austria, the authors have developed and tested a training course on group decision-making in the field of anesthesia and intensive care. The training course was intended to help participants improve their performance in group decision-making. Training was focused on acquiring the knowledge and experience successfully to make such decisions.

This report documents the last phases of the research project *Decision-making in groups under uncertainty*, in which the authors propose an improvement to group decision-making procedures, in the form of a **training course**. It describes the development of the training course, its implementation, results obtained and improvements made based on feedback from practitioners.

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Contents

Introduction

Context

Making decisions about the care of patients is an essential task in health care. For each patient, many decisions have to be made. In the emergency room, for example, a doctor should decide which patient to see first, decide whether an image diagnostic should be made, and decide how the injury of this specific patient should be treated. This decision-making process can be further complicated by uncertainty about probabilities and outcomes. Nevertheless, a decision has to be made, regardless of the amount of evidence and the extent of uncertainty.

Additional features of group decision-making in health care are particularly present in the front line, when resources are in short supply, time constraints apply and shortcuts are being sought. These situations are described by [Reason 1990] as when "the cognitive reality departs from the formalized ideal".

"Anesthesia is perhaps the prototypical example of a complex dynamic medical world" [Gaba 1992, p. 144]. The anesthesia environment is described as complex, event-driven, subject to rapid time-constraints, with uncertainty and ever-present risk. The complexity of care demands a wide range of skills from anesthetists. Until now the educational training of anesthesiologists has focused on their knowledge base and especially on their technical skills. However, satisfactory patient outcomes will only be realized if appropriate plans can be executed effectively. Non-technical skills (defined as cognitive, social and personal resource skills that complement technical-skills, and contribute to safe and efficient task performance [Flin et al. 2009]), such as decision-making play an important role in good anesthesia practice.

The authors' previous studies on decision-making in groups under uncertainty revealed that expert groups are infrequently well trained in maximizing group-related benefits. For instance, they are not aware of possible inhibiting factors for establishing a discussion culture where people can easily share the necessary information to find the best outcome for patient care.

Objectives

In close cooperation with a teaching hospital in Austria, the authors have developed and tested a training course on group decision-making in the field of anesthesia and intensive care. The training course was intended to help participants improve their performance in group decision-making. Training was focused on acquiring the knowledge and experience successfully to make such decisions.

This report documents the last phases of the research project *Decision making in groups under uncertainty*, in which the authors propose an improvement to group decision-making procedures, in the form of a **training course**. It describes the development of the training course, its implementation, results obtained and improvements made based on feedback from practitioners.

Readers may be interested in two previous documents published by the authors in the same collection as the present document, presenting previous phases of the research:

- The Cahier *Decision-making in groups under uncertainty* [Marold et al. 2012] presents the results of an exploratory field study on decision-making in the medical domain. The work aimed to understand how groups conceptualize and internalize uncertainties and how they handle them in order to achieve effective decision-making in their everyday activities.
- The Cahier *A field study of group decision-making in health care* [Marold et al. 2013] presents more detailed results from the field study and suggests a number of strategies that could be used to improve decision-making performance.

Document structure

Chapter 1 describes the **methods used** in the work to improve group decision-making through training. It cover the design and development of the training material.

Chapter 2 describes the **results obtained** from the training sessions. Feedback from pilot tests of the training was used to improve the training content.

1

Method

1.1 Improving decision-making in groups through training

Our previous studies [Lassalle et al. 2013; Marold 2012; Marold et al. 2012] suggest that the quality of the decision-making process depends on factors such as the availability of data and information and the expertise of the decision-maker. However, the final outcome of the decision is also affected by situational factors (*e.g.* time pressure) and, in case of group decisions, by intragroup factors like active leading of the decision-making process and explicit or implicit communication of uncertainty. Some of the shortcomings observed in our previous studies regarding behavior could be suitably addressed by non-technical skill (NTS) training.

The implementation of formal training in teamwork for health-care workers is also a specific recommendation of the *Institute of Medicines* report, *To Err is Human: Building a Safer Healthcare System*. Team Training is currently suggested as part of a comprehensive *Patient Safety Plan* published by the *Joint Commission Accreditation of Health Care Organizations* (JCAHO), the regulatory agency charged with hospital accreditation in the USA. Pat Croskerry, professor in emergency medicine at Dalhousie University (Canada), an important researcher in the field of patient safety summarized, that one thing they know from research is that experienced clinicians perform better than novices. He points to the fact that practice at clinical decision-making appears to improve performance and calls for "adequate training in critical thinking, problem solving, and a working understanding of the multiple cognitive and affective biases to which they might be vulnerable" [Croskerry 2005, p. R6].

1.1.1 Behavior change through training?

The biggest challenge in training is the **transfer of skills** and information learned during training to the workplace. Indeed, research on this topic shows that transfer should be understood as a process, not as a single event.

The transtheoretical model of behaviour change

Definition

According to this widely used theory, developed in the 1980s by researchers James O. Prochaska and Carlo C. DiClemente, change occurs in five stages. Each stage is necessary before you can successfully move to the next, and stages can't be hurried or skipped. The five stages are:

1. *Precontemplation*: You have no conscious intention of making a behavior change, but outside influences, such as public information campaigns or a family member's concern, may spark your interest or awareness.
2. *Contemplation*: You know that the behavior is a problem and at odds with personal goals (such as being sufficiently healthy to travel), but you're not committed to taking any action. You may weigh and re-weigh whether it's worth it to you to make a change.
3. *Preparation*: You make plans to change, such as joining a health club or buying nicotine patches. You anticipate obstacles and plan ways around them.
4. *Action*: You've changed and are facing the challenges of life without the old behavior. You use the strategies you came up with during the preparation stage.
5. *Maintenance*: You work to prevent relapses, including avoiding situations or triggers associated with the old habit or behavior.

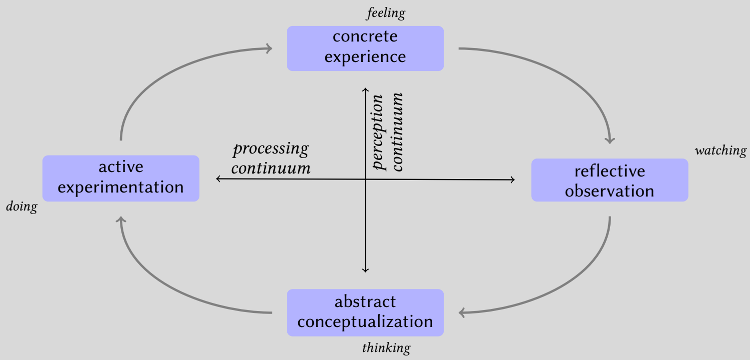
In line with this process perspective, and building upon earlier work by John Dewey and Kurt Levin, David Kolb (Professor of Organizational Behavior), defines learning as "… the process whereby knowledge is created through the transformation of experience" [Kolb 1984, p. 38]. Kolb developed one of the most widely adopted learning models, called experiential learning.

Experiential learning

DEFINITION

Experiential learning is the process of **making meaning from direct experience**, or learning through reflection on doing.

According to Kolb, effective learning is seen when a person progresses through a cycle of four stages: having a concrete experience, followed by observation of and reflection on that experience, which leads to formation of abstract concepts (analysis) and generalizations (conclusions), which are then used to test hypothesis in future situations, resulting in new experiences.



learning styles

Further, Kolb identified four **learning styles** which correspond to these stages. The styles highlight conditions under which learners learn better:

- ▷ *Assimilators*: learn better when presented with sound logical theories to consider;
- ▷ *Convergers*: learn better when provided with practical applications of concepts and theories;
- ▷ *Accommodators*: learn better when provided with "hands-on" experiences;
- ▷ *Divergers*: learn better when allowed to observe and collect a wide range of information.

Although, the model has been criticized from many perspectives, the conception of experiential learning is an established approach in the tradition of education theory. The most direct application of the model is to ensure that teaching activities give full value to each stage of the process.

Behavior change can refer to any transformation or modification of human behavior. Formal approaches to learning and development often have the highest transfer probability and follow a systematic framework. Instructional system design (ISD) is focused on designing training to acheive the goals of the training. One of the most common ISD models is ADDIE, which is an acronym for assessment, design, development, implementation and evaluation. To develop the training session (*cf.* figure 1.1) on group decision-making under uncertainty, the ADDIE model [Branch 2009] was followed.

The next section describes the development of the training session according to the ADDIE steps.

1.2 Training design and development

Discussion with lab experts (§ 1.2.1), observation of a simulation-based training at the lab of the cooperation hospital (§ 1.2.2) and literature research on the field of anesthesia care provided further insights for the definition and analysis of training needs to improve decision-making in groups under uncertainty in the dynamic and complex medical field of anesthesia and intensive care.

We worked in close cooperation with experts from a teaching hospital in Austria, who established a patient simulator lab. The center for simulation in anesthesia, rescue and intensive care, is most of the time used by members of the anesthesia and intensive care unit, who complete simulation-based training at the lab 1 or 2 times a year (as part of their regular work day). We have concentrated on developing a training session on decision-making for this audience.

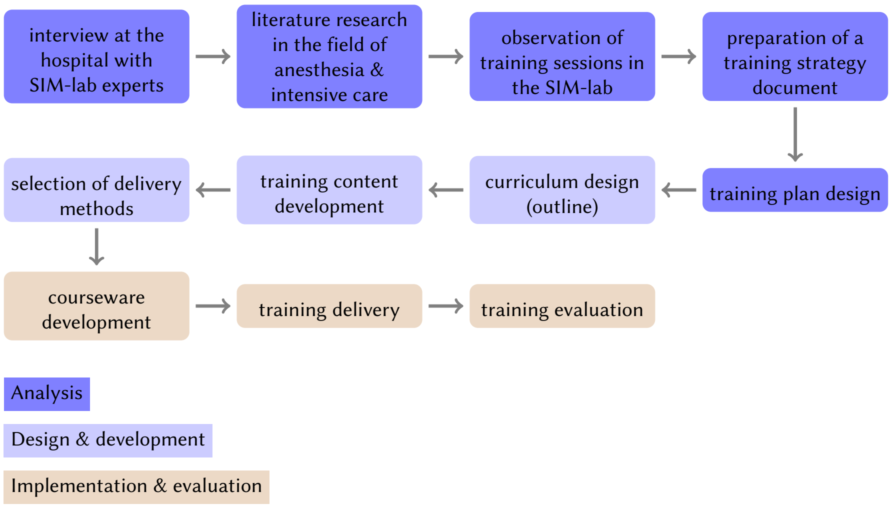


Figure 1.1 – *Approach for developing a training session on decision-making in groups under uncertainty, after* [Branch 2009]

1.2.1 Audience assessment: expert interviews and discussion

For the first meeting with the simulator training experts we prepared a document to illustrate the scope of our work, research questions, results of our previous studies and the description of our needs to set up the study. As part of the meeting, we set up a time schedule for the study (usually they have two simulator sessions per month, except over summer) and defined within our discussion important aspects to set up a scenario for the simulator session. We also talked about the participants and the procedure for inviting them.

1.2.2 Audience assessment: observation

To gain more insights in simulation-based training, we participated in a regular training session at the lab. All impressions from this observation were transcribed. Some of the main aspects will be summarized in the following section.

Participants

One anesthetist and two nurses specialized in the administration of anesthesia participated in the observed simulator session. Two instructors (senior physicians), who mainly were responsible for briefing/debriefing and some assistants, who did the videotaping and controlled the scenario were part of the team at the lab to coordinate all ongoing activities.

Procedure and Setting

After instructors had welcomed participants at the center for simulation in anesthesia, the first exercise started right after briefing the participants on the situation they were going to face and the equipment which could be used. Participants then had to solve a *cardiac arrest simulation* corresponding to the European Resuscitation Council Guidelines. The training program featured a life-sized human patient simulator, which can be operated using a computer interface and realistically portrays many of the physiological and pharmacological responses observed in Advanced Life Support (ALS) situations. Monitoring of *e.g.* arterial oxygen saturation, electrocardiogram, and blood pressure was included in the training program.

In the second scenario, a patient had obvious problems to ventilate after he came back from surgery (difficult airway management scenario). Participants found out when they started to evaluate the situation in the beginning, that is it not possible to place a tube into the trachea. Usually, an intubation is performed to facilitate ventilation of the lungs, including mechanical ventilation, and to prevent the possibility of asphyxiation or airway obstruction. Inability to secure the airway, with subsequent failure of oxygenation and ventilation is a life-threatening complication which if not immediately corrected leads to decreased oxygen content, brain damage, cardiovascular collapse, and death.

For this scenario they used the *Laerdal SimMan*, a wireless life-size patient mannequin that can talk with pre-recorded sounds and speech, breathe with normal and abnormal breath sounds and produce heart sounds, palpable pulses and unilateral/bilateral chest movements. It is connected to a monitor who displays parameters such as oxygen saturation, electrocardiogram trace, pulse rate and blood pressure. These parameters were controlled by the computer. The technology in the mannequin is very sophisticated, and instructors can direct it to respond similarly to a patient. The chest rises and falls and the mannequin's eyes blink; it can talk and has a pulse. The *SimMan* was set up on a standard hospital bed equipped with monitors, and the usual supplies found in the ward. The participants in this scenario had to recognize signs and symptoms of impaired airway protection, understand the mechanism of impaired airway patency and initiate appropriate airway management. The success of the case depends on effective team communication as well as critical thinking skills. The training on the second scenario was recorded on video. Instructors used different cameras and head-sets to capture video and audio data. After the scenario was stopped by the instructor, the debriefing was given after a short consultation between the senior physicians.

Results of observed behaviour

Cardiac arrest simulation. The anesthetist and the two nurses evaluated the situation and the patient. They started the advanced life support algorithm (ALS). Right from the beginning, insufficient communication and collaboration was observed. Each trainee started by themselves to do their own part of the ALS. No explicit leadership was observed. Uncertainty was not communicated explicitly; questions were not answered right away. The algorithm or essential steps (decision points) were not communicated again to other group members to establish a common understanding of the situation. As they could not solve the situation right away in a satisfying manner (pacing at incorrect strength/rate, unnecessary interruptions of CPR as well as significant delays in defibrillation), the instructor stopped the simulation and continued after a short reminder on the Guidelines. Participants finally solved the situation successfully. A short debriefing was given, asking participants to reflect on their decisions and actions, and finally to discuss alternative (better) ways. The observation revealed that some of the shortcomings in handling the situation were due to the quality of leadership, team-structuring and a missing shared understanding of the situation.

Difficult airway management. The participants handled uncertainty in the second scenario by collecting more information, in particular at the beginning. This did not involve trainees communicating explicitly with one another; rather the anesthetist followed his own ideas and tried to find some evidences to confirm his hypotheses. Each trainee started to do their part of the work (the anesthetist tried to place the tube, the male nurse prepared the drugs and the other nurse monitored the patient). Later on, one of the nurses started to ask what the anesthetist was doing right now and also brought in their own ideas to handle the situation ("Should we ask for the otolaryngologist?").

The decision-making process reminds on the RPD-model [Klein et al. 1993]. This is a model of how people make quick, effective decisions when faced with complex situations. In this model, the decision-maker is assumed to generate a possible course of action, compare it to the constraints imposed by the situation, and select the first course of action that is not rejected.

1.2.3 Conclusions concerning audience assessment

Working at the anesthesiology and intensive care unit

The role of the anesthetist in the operating room is defined by multiple tasks. Firstly to ensure that the patient is unaware of and cannot recall any of the surgical stimuli, secondly to provide conditions that will allow the surgeon to carry out the operation and thirdly to ensure that the patient experiences as little morbidity as possible. In summary, the main roles during surgery are:

- Provide continual medical assessment of the patient;
- Monitor and control the patient's vital life functions, including heart rate and rhythm, breathing, blood pressure, body temperature and body fluid balance;
- Control the patient's pain and level of consciousness to make conditions ideal for a safe and successful surgery.

A certified nurse anesthetist cares for a patient before, during and after a medical procedure or surgery by performing a patient assessment, preparing the patient for anesthesia, administering and maintaining the anesthesia to ensure proper sedation and pain management, overseeing patient recovery from anesthesia and caring for the patient's immediate post-operative needs.

Anesthesiologists and nurse anesthetists work in a complex, rapidly changing, time-constrained and stressful work environment. The anesthesia domain is in many ways similar to aircraft cockpits and air traffic control rooms where effective performance demands expert knowledge, appropriate problem-solving strategies, and fine motor skills.

The safe administration of anesthesia requires vigilance (detection of changes in patient condition), time-sharing among multiple tasks, and the ability to make decisions rapidly.

1.2.4 Conclusions concerning training content: obstacles for effective group decision-making

As described, anesthetists do not work in isolation, and while each professional group (anesthetists, surgeons, nurses) have their own set of activities, there is a high level of interdependence between them. Many of the decisions are made by more than one person of this group and they have deal with the occurring uncertainties.

Human perception of information is by no means flawless due to certain biases and distortions and merely provides an approximate reflection of the reality prompting it. Such distortion falls into two groups: simplification arising from individuals' cognitive limitations and the affective influence emerging from a variety of factors ranging from personal beliefs to the opinions of others.

As a result of the literature review and the expert discussion on the influence factors on effective decision-making in groups we identified the topic on (cognitive and social) biases and their failure potential in reaching the optimal decision.

Secondly, we draw our conclusions for setting up the training content from the results of our previous studies on uncertainty in group decision-making [Marold et al. 2012]. As we showed, group decision-making processes are influenced by situational factors such as workload, time pressure and the amount of available information. Moreover, the way the process is organized and structured seems to be important. Last but not least, group-specific aspects like respect and appraisal of different opinions or dealing with hierarchy have crucial influences on decision-making processes. Based on the results, we identified and discussed [Lassalle et al. 2013; Marold et al. 2012] possible obstacles to effective decision-making:

1. a steep hierarchy gradient;
2. a poor discussion culture;
3. a strong need for consensus;
4. insufficient structure and guidance for group decision-making processes.

For each obstacle, we suggested a number of possible remedies:

- Ways to decrease negative effects of hierarchical differentiation focus on leadership behavior and assertiveness;
- Discussion culture can be improved by establishing psychological safety;
- Need for consensus can lead to group think which in turn can be reduced by distinct strategies (*e.g.* devil's advocate, critical evaluators);
- Several prescriptive models exist to improve the structure of group decisions.

Biases in group decision-making

Many different categories of bias exist. Following the work of [Tversky and Kahneman 1974], there has been a continual increase in the number of heuristics and biases acknowledged to influence decision-making. Pat Croskerry provides a useful description used in the context of anesthesia [Croskerry 2005] and he introduced the term *cognitive disposition to respond* (CDR) to avoid the negative associations of bias, fallacy, or error.

Teams are not immune to error: "...it appears that teams often rely on the same rules of thumb as individuals to process information, leading to similar errors in judgment" [Houghton et al. 2000]. Additional factors are introduced through group decision-making. For instance, in groups, self-serving-bias may reinforce any tendency toward groupthink. Interpretation of a situation and the perception of others' opinions may bias decision processes towards supporting one hypothesis by active searches for confirmatory information and denial of contradictory data.

As a result of literature research and the expert interview, for the remainder of our work, four important group phenomena, which could be found in the anesthesia group context and have an important impact on medical decision-making are extrapolated and further described:

- ▷ **Risky-shift** [Wallach et al. 1962]: when people are in groups, they make decisions about risk differently from when they are alone; in the group, they are likely to make riskier decisions, as the shared nature of the risk makes the individual risk less.
- ▷ **Groupthink** [Janis 1972]: occurs when a homogeneous highly cohesive group is so concerned with maintaining unanimity that they fail to evaluate all their alternatives and options; groupthink members see themselves as part of an *in-group* which is working against an *out-group*, which is opposed to their goals.
- ▷ **Shared-information bias/common-knowledge-bias** [Stasser and Titus 1985]: the tendency for group members to spend more time and energy discussing information that all members are already familiar with, and less time and energy discussing information that only some members are aware of; consequences related to poor decision-making can arise when the group does not have access to unshared hidden information profiles in order to make a well-informed decision.
- ▷ **Curse-of-expertise** [Camerer et al. 1989]: the difficulty that results from knowing something; it is the "knowing" of something that makes it difficult to "readily re-create" the state of mind of not knowing and thus understand other group members' reactions.
- ▷ **Social loafing** [Latané et al. 1979]: the tendency for people to exert less effort when being part of a group working on a common task (individuals can feel that their contributions don't matter, and thus decrease their effort and contributions).

> “ *Certainly, a number of strategies exist for reducing the memory limitations and excessive cognitive loading that can lead to diagnostic errors, but the most important strategy may well lie in familiarizing clinicians with the various types of CDRs* [Croskerry 2003, p. 776].

Assertiveness and leadership behaviour

Crises or critical situations are challenging for different reasons and require a well-functioning group work comprising experts from several disciplines working together. In addition, the group is often formed dynmically as the situation develops.

hierarchy effects

Status and **hierarchy effects** are well-known phenomena in group performance. Especially in situations where group members have to handle uncertainties, lower-status members tend to defer to higher-level group members, even if this member is performing poorly. For example, hierarchy between group members is a significant contributor to communication breakdown. The significance of hierarchy effects may be modified by the subordinates' personality characteristics, *e.g.* assertiveness.

[Wilson et al. 2005, p. 305] gave a description of this kind of desired behavior:

> “ *The willingness of team members to communicate ideas and observations in a manner that is persuasive to other team members.*
>
> *Allows team members to provide feedback, state and maintain opinions, address perceived ambiguity, initiate actions, and of potential solutions (a nurse questions a doctor's medication order because of a patient's known allergies).*

The role of the leader is often emphasized. Transferal of leadership from one discipline to another can be difficult, especially when new experts come into the delivery room. Challenges for the leader include the allocation of tasks to the group members and the ability to communicate effectively what is going on: "individuals bring certain resources to the group, but may not use these resources effectively unless they are encouraged to do so." [Henry 1995, p. 191].

Discussion culture through psychological safety and speak-up behaviour

Sharing all the relevant information (irrespective from any status in the group) in a crisis situation is one of the essential tasks for a group when they want to make the best available decision. To foster information sharing, the concept of psychological safety [Edmondson 1999] can play an important role. *Psychological safety* is defined as people's perceptions of consequences for taking inter-personal risk at their place of work [Edmondson 1999]. When people feel psychologically safe, the likelihood of engaging in behaviours that lead to a better information exchange increases. [Edmondson 2004] proposes that psychological safety facilitates one kind of behaviour she calls *speaking up*, because it fosters an environment in which one who makes a mistake and speaks out about it will not be viewed as being inappropriate, but rather as an employee who wants to make a positive contribution to the work.

A similar concept which could stimulate information exchange is called *talking to the room*, described as:

> *a way of communicating that invites other group members to participate in a mutual diagnostic process, as it may increase the chance that the group as a whole pays attention to what is said, detects problems more easily, and feels invited to come up with additional ideas.* [Tschan et al. 2009]

Acronym for helping to structure the process

To improve group decision-making the group can be guided through a more systematic decision process. Structured decision-making describes a process for a carefully organized analysis of problems in order to reach decisions that are focused clearly on achieving fundamental objectives. Physicians stated in our first study [Marold et al. 2012] that a low level of structure and organization is an inhibiting factor for group decisions. Moreover, a high quality of analysis is valued as an attribute of effective decisions. The quality of analysis is not only correlated with the quality of decisions but also with the degree of structure of the decision process [Croskerry 2002; Hunink et al. 2001]:

> *[...] formal interventions can improve knowledge integration within groups with specialized knowledge by helping group members to self-organize fruitful attempts at improving their processes and to pace those attempts with task execution.* [Okhuysen and Eisenhardt 2002, p. 384]

Karl Weick, from the School of Business University of Michigan, developed a script for giving directions, which Gary Klein (author of *The Power of Intuition*) captured with the acronym STICC [Klein 2003]. It summarizes the following group process:

Situation	Here is what I think we face
Task	Here is what I think we should do
Intent	Here is why I think we should do this
Concern	Here is what we should keep our eyes on since, if that changes, we are in a new ballgame
Calibration	Now talk to me

Table 1.1 – *The steps in the STICC script* [Klein 2003]

In the calibration step of STICC, you are trying to get people to shift from passive listeners to active listeners. You want them to imagine how they are going to carry out your intentions. One reason we are explaining our intentions is to help people improvise when they run into trouble.

STICC is also used as an emergency briefing format. It works well in emergency situations where the leader can brief the team, explore hazards and reach consensus.

We developed an acronym in German according to the STICC script **[Klein 2003]**. Therefore, we translated the steps for structuring the decision-making process into the German language. And the script is then called STARK:

Situation	Hier ist was ICH glaube, mit WAS wir es zu tun haben
Tat	Hier ist was ICH glaube, dass wir TUN sollten
Absicht	Hier ist WARUM ICH glaube, dass wir das tun sollten
Risiko	Hier ist, WORAUF WIR achten sollten
Kommunikation	SAGT MIT EURE Meinung dazu

Table 1.2 – *Structuring the process by using the acronym STARK (in German)*

All results of these steps (literature research, observation and interview) were summarized in a training strategy document **[Marold 2012]** and a training plan was designed. For this, it was necessary to think of possible methods which could be used in the training.

1.2.5 Selecting the methods for skill improvement

There are a variety of ways to help ensure that the knowledge and skills learned in the training program will “stick” and are applied back on the job, both immediately and over the long term. Regarding the learning cycle, different teaching activities can support different aspects (table 1.3).

Concrete experience	Reflective observation	Abstract conceptualization	Active experimentation
readings fieldwork laboratories problem sets trigger films observations simulations/games	logs journals discussion brainstorming thought questions rhetorical questions	lectures papers projects analogies model building	projects fieldwork homework laboratory work case studies simulations

Table 1.3 – *Teaching activities supporting the learning cycle* **[Mobbs 2013]**

For our training, we wanted to combine different methods in order to address all stages of the learning cycle. Because of the existing human patient simulator at the lab we wanted to integrate this kind of teaching activity in our training program.

Human patient simulators seem especially well suited to providing the conditions needed for adult learners, such as medical residents. As research showed, learning is more effective when it relates to real life situations **[Kaufman 2003]**. Learners are given opportunities to practice knowledge and then to reflect on their performance and listen to feedback from instructors. Our training uses various strategies that should facilitate guided practice and immersive simulation. Timely feedback is critical to allow team to adjust their knowledge.

Simulation in medicine

The aviation industry was the first to broadly employ simulation for educational purposes. Anesthesia was the first medical field to find equivalents to aviation's educational needs. The first anesthesia simulator was developed in 1969, but it was not until the mid-1980s that simulation was routinely used in anesthesia training **[Gaba et al. 2001]**.

Simulation is a technique to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner **[Gaba 2004, p. i2]**. Simulation applications are diverse and can be categorized according to Gaba along 11 dimensions. Any particular application of simulation can be categorized as a point or range in each dimension.

Purpose and participants

- ▷ purpose and aims of the simulation activity
- ▷ type of knowledge, skills, attitudes or behaviours addressed in simulation
- ▷ unit of participation in the simulation: individuals or teams
- ▷ experience level of simulation participants
- ▷ health care domain in which the simulation is applied
- ▷ health care disciplines of personnel participating in the simulation

Setup

- ▷ Age of the patient being simulated
- ▷ Technology applicable or required for simulations
- ▷ Extent of direct participation
- ▷ Site of simulation: *in situ* clinical setting or dedicated simulation center
- ▷ Feedback method accompanying simulation

Figure 1.2 – *Dimensions to consider when setting up simulation exercises* **[Gaba 2004]**

The technology dimension differentiates verbal, standardized patients, part-task trainers, computer patient, and electronic patient. Verbal simulation is role playing. Standardized patients are actors used to educate and evaluate physical examination skills, communication, and professionalism. Part-task trainers may be simple anatomical models of body parts. Computer patients are interactive and may be software-based or part of an Internet-based virtual world. Electronic patients can be either mannequin or VR-based, and replication of the clinical environment is integral.

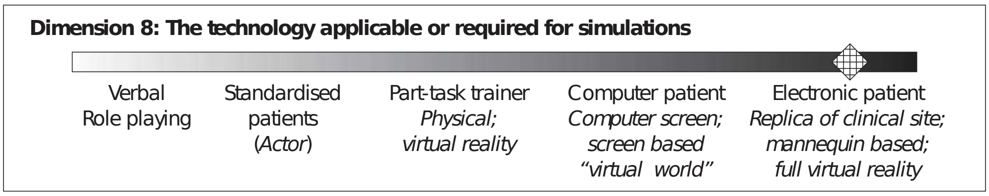


Figure 1.3 – *Simulation applications regarding the technology used* **[Gaba 2004]**

Human patient simulators (HPS) are high-tech virtual patients used to teach a wide range of medical skills by realistically recreating patient physiology. Some of the functions that HPS units (figure 1.3) can simulate include blinking, pupil dilation, tearing, bleeding, drooling, chest movement with inhalation and exhalation, talking and urinating. Participants can see the results of their actions in a real-time scenario. They can simulate both normal and abnormal body functions. The scenarios include nearly all human medical emergencies. Training sessions are usually videotaped for critique and feedback. Referring to comprehensive patient simulators, **[Gaba 2004]** explained a patient simulator was a "system that presents a fully interactive patient and an appropriate clinical work environment" (p. i5).

Debriefing is a fundamental part of the simulation technique. During debriefing participants are led through a detailed discussion of their experiences. The goal during debriefing is to explore alternatives, and to recognize and discuss aspects of behavior which were either executed or foregone in the scenario. Instructors can use the log in debriefing sessions. A

Figure 1.4 – *SimMan™, a Human patient simulator (HPS)*

clinical log is recorded for every participant, the event log is time dated. Log data can be used for self-reflection and evaluation of skill sets.

Research shows that simulation-based training (such as Anesthesia Crisis Resource Management, ACRM) has a high impact: "The evaluations conducted so far suggest that simulator-based ACRM training is a powerful technique that both novice and experienced anesthesiologists believe to be highly beneficial and may improve clinical performance." **[Gaba et al. 2001, p. 186]**.

1.2.6 Designing the training evaluation

Perhaps the best known evaluation methodology for judging learning processes was first published in a series of articles in 1959 in the *Journal of American Society of Training Directors* by Donald Kirkpatrick. His technique for conducting an evaluation includes four steps:

- At *reaction* level one asks learners, usually through 'happy sheets' to comment on the adequacy of the training, the approach and perceived relevance.
- The *learning* level is more formal, requiring a pre- and post-test. This allows you to identify those who had existing knowledge, as well as those at the end who missed key learning points.
- At the *behavioral* level, the transfer of learning to the job is measured. This may require a mix of questionnaires and interviews with the learners, their peers and their managers. Observation of the trainee on the job is also often necessary. It can include an immediate evaluation after the training and a follow-up after a couple of months.
- The *results* level looks at improvement in the organization. This can take the form of a return on investment (ROI) evaluation. The costs, benefits and payback period are fully evaluated in relation to the training deliverables.

Over time, a number of adaptations to the model have been proposed, particularly in regard to the measurement of learners' initial reaction to the learning activity (level one) and the measurement of its benefit to the organization (level four). At its centre though, is a framework which takes into account both the individual learner and the organization, and can provide learning professionals with valuable information about the effectiveness of their learning interventions within the workplace **[Kirkpatrick and Kirkpatrick 2006]**.

Assessing training effectiveness is critical. Each successive level of evaluation adds precision to the measure of effectiveness but requires more time consuming analysis and increased costs. There are several challenges: which skills to measure (TS, NTS or both), who to evaluate (individual, group) and how to do it (develop validated evaluated tools).

There are studies that describe positive effects for simulation-based training on the reaction level **[Gardner et al. 2008; Morey et al. 2002]**, but there are a limited number of high-quality studies showing the effect on outcome measures like learning and safety. For example, **[Wayne et al. 2008]** showed improved quality of care provided by residents during cardiac arrest, in a randomized controlled study.

2

Implementation

In this chapter, we describe the implementation of the training course whose development was described in the previous chapter, which aims to help participants acquire the knowledge and experience to successfully make medical decisions under uncertainty in groups.

2.1 Implementing the [getSAFE] training

The goal of the present study is to explore how the training works in practice and develop recommendations to improve the training content and methods. Observations of a simulation exercise were complemented by a questionnaire which allowed us to collect subjective evaluations of training participants and a questionnaire on safety awareness which was answered two times, before and after the training.

2.1.1 Setting and participants

The training took place in an Austrian teaching hospital, and was delivered by the first author and two senior physicians from the anesthesia and intensive care unit who are responsible for the patient simulator lab. Members from the anesthesia and intensive care unit (physicians, nurses) were invited to attend the training course as part of their regular simulator-based training session at the anesthesia and intensive care unit.

2.1.2 Training program

A 1½ to 2-hour course on group decision-making skills was developed in which we aimed to equip participants with skills to improve the processes when they have to make decisions in groups. The training content was chosen regarding the analyzed shortcomings in our previous studies on decision-making processes under uncertainty [Marold et al. 2013] and a literature survey on core concepts. The structure of the training course was derived regarding three broad themes of the World Health Organization report [Andermann et al. 2011] on patient safety: safety awareness, safety analysis and safety improvement. A description of the content alongside the educational modalities can be found in table 2.1.

In the first section, participants were given some insights on safety science (important definitions and wordings) and its importance to clinical practice. Then, participants were introduced to the concept of human factors and decision-making as an essential safety skill before viewing a video on a case in the operation room (Elaine Bromiley)[1].

[1] An interesting overview of the history of this case study, and of one vector for the introduction of human and organizational factors analysis in healthcare, is at http://www.newstatesman.com/2014/05/how-mistakes-can-save-lives.

Dimension	Content	Examples	Delivery method
Safety awareness	Patient safety in the anesthesia and intensive care context	Adverse events, incidents, accidents, human error, patient safety, facts & figure, system approach to safety	lecture, video: case study, discussion
Safety analysis	Contributing factors	causes, analyzing errors and events	lecture, video: case study discussion
	Group decision-making in anesthesia and intensive care context	critical situations in anesthesia and intensive care context	lecture, group discussion "moon landing": team-building game
	Errors in group decision-making	group think, common-knowledge bias, risky shift	lecture, video
Safety improvement	How to avoid failures	coaching-behavior; speak-up behavior/assertiveness; STARK	lecture, video
	Group decision-making in the field		Simulation: hands-on practice

Table 2.1 – *Outline of a [GetSAFE] training session*

Operation room case study[2]

"In 2005 Elaine Bromiley, a 37-year-old woman attending hospital for what was supposed to be a routine operation on her nasal air passages, suffered catastrophic brain damage after unexpected complications occurred at the start of the procedure. An emergency had arisen shortly after the anesthetic drugs had been injected. Elaine's airway — the path from her mouth to her lungs through which air normally flows — had become obstructed. It was a rare event, of the type that occurs in fewer than one in 50,000 routine cases. But that day the anesthetic team suddenly found themselves unable to assist Elaine's breathing or get fresh oxygen into her lungs. During a desperate struggle that lasted some 20 minutes the medical team were unable to remedy the situation. As a result Elaine's brain became starved of oxygen. She was transferred to the intensive care unit but died several days later."

Training participants then discussed how these behaviors could hinder or enhance safety while they also reflected on their own experiences.

The second session started with a lecture on basics of safety analysis and the system approach to safety. Then we discussed on the subject of the case study on Elaine Bromiley possible active and latent failures in the situation.

The third session on safety improvement focused on one of the social factors contributing to safety (group aspects). It illustrated in what kind of situations group decision-making could be an important factor to be concentrated on in delivering safety. To get a sense of possible phenomena which could be observed in groups and also to show the potential of working in groups, a short version of the *Moon Landing* (originally designed by the U.S. National Aeronautics and Space Administration) exercise was conducted as part of the training.

Assignment for the group exercise Moon Landing

"You are a member of a space crew scheduled to rendezvous with a mother ship on the lighted surface of the moon. However, due to mechanical difficulties, your own ship was forced to land at a spot 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip. Items are listed as being intact and undamaged after landing. Your task is to rank them in terms of their importance for your crew, to allow them to reach the rendezvous point."

An initial ranking was established by each participant working individually. In a second step, they had the chance to discuss the ranking within the group and agree on a final ranking through consensus. The 'expert' answers were compiled by a team of scientists and engineers

[2] Retrieved from http://www.bbc.co.uk/news/health-21829540 on 24.7.2013.

at NASA. This official NASA ranking and a brief statement explaining the reasoning for each decision were then presented to the group. Usually, the ranking established by groups are much closer to the NASA ranking than are most individuals' rankings. As part of the debriefing, participants discussed the following questions:

▷ How were decisions made?

▷ Who influenced the decisions and how?

▷ How could better decisions have been made?

Next, there was a lecture on potential pitfalls during group decision-making (*e.g.* groupthink) and certain kinds of required behavior that could avoid failures arising from working in groups was described and illustrated by video examples. At the end of this topic, an acronym for structuring decision-making in the situation (which can also help to remember training issues) was introduced and the STARK cards distributed.

Figure 2.1 – *STARK card (in German)*

After answering some questions concerning the lectures and examples, the last section in the simulator started right away.

2.1.3 Simulation equipment

The *Advanced Life Support Simulator* is a realistic interactive training mannequin for simulating a wide range of advanced life-saving skills in medical emergencies. The simulator responds to clinical intervention, instructor control, and preprogrammed scenarios for effective practice of diagnosis and treatment of a patient. With spontaneous breathing, airway control, voice, sounds, ECG, and many other clinical features, the ALS Simulator is a fully functional emergency care simulator.

Figure 2.2 – *Advanced Life Support Simulator (Laerdal)*

The *SimMan™* is a fully computer-operated total body simulator. *SimMan™* offers comprehensive clinical functionality to teach the core skills of airway, breathing, cardiac and circulation management. The SimMan™ allows instructors to enter a variety of scenarios for training.

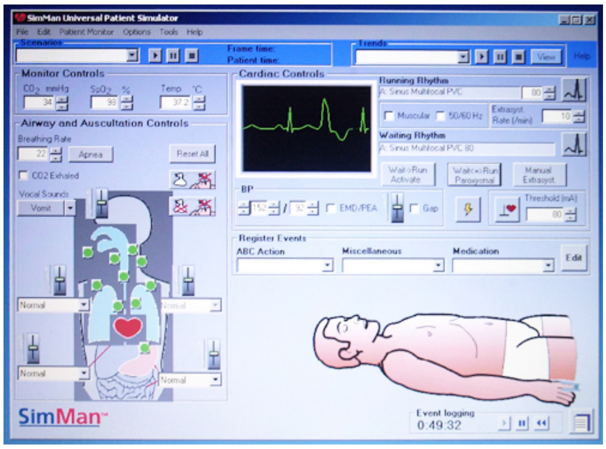


Figure 2.3 – *SimMan™ (left) with the simulator display (right)*

2.1.4 Participant assessment

Safety awareness

Immediately before the course and some weeks after it, *safety awareness* was assessed qualitatively by participants completing free text observations on a patient incident. The questionnaire contained two sections:

1. Describe a safety-critical situation from your daily work
2. Comment this situation from your perspective

The questionnaire (to assess safety awareness before the training) was sent out by the lab experts together with a letter of invitation to the training. The follow-up questionnaire was sent out by the lab experts either by mail or handing it out to the training participant.

Evaluation questionnaire (Happy Sheet)

The *Evaluation Questionnaire* assessed the subjective rating concerning the training session. It was filled out by all participants attending the training after the simulation. This questionnaire contained the following statements:

1. I really enjoyed the training session
2. The content was clearly presented
3. The training content was relevant for my work
4. I have learned something in the training what I want to practice in my work
5. The training would be helpful and relevant for my colleagues

All responses were on a scale from 1 (*totally disagree)* to 7 *(totally agree*). In addition, participants had to answer two open questions at the end of the questionnaire:

1. I particularly liked: ....
2. Ways, ideas to improve this training: ....

In addition to the training evaluation, we asked some questions regarding the STARK acronym.

1. If all supervisors and colleagues knew STARK, it could be a useful tool, to make better decisions in the group.
2. If supervisors used STARK in an exemplary manner, it could be a useful tool, to make better decisions in the group.
3. The elements of STARK are understandable and plausible for me.
4. I think that I could avoid failures through the use of STARK.
5. The effort for using STARK is too high, although failures could be avoided.

2.1.5 Observation

As the training session on group decision-making was part of the regularly conducted simulator-based training, we used the behavior that the participants showed in the scenario for our evaluation. We wanted to discuss the situation and their decision-making processes in the debriefing session and ask their opinion regarding the relevance of the training issues and recommendations we gave during the training on how to handle those situations.

Training scenarios can be fast-paced and complex, so it is helpful to use a standardized instrument to obtain results from the observation. An initial and critical step in designing measurement tools is to clearly define the content. Technical skills (TS) and non-technical skills (NTS) are generally taught and assessed as separate attributes of performance. Rating tools such as the Anesthetists' Non-Technical Skills (ANTS) scale or the Ottawa global rating scale have been validated for the assessment of behavioral performance.

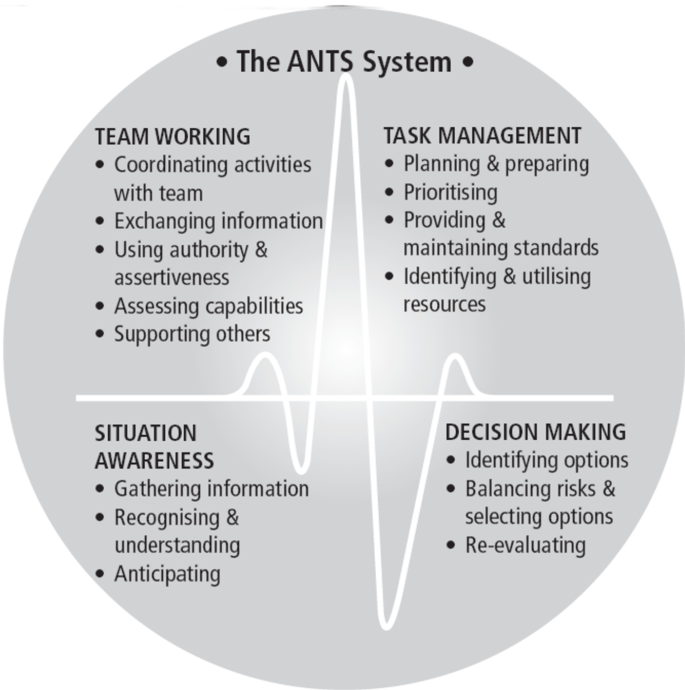


Figure 2.4 – *Non-technical Skills in anesthesia*

The tools represent some of the instruments available in the published literature. However, these tools were not developed specifically for use in a training environment, especially not for observing group decision-making and necessary behavior in avoiding possible shortcomings.

Developing and testing a Behavioural Marker System on group decision-making processes

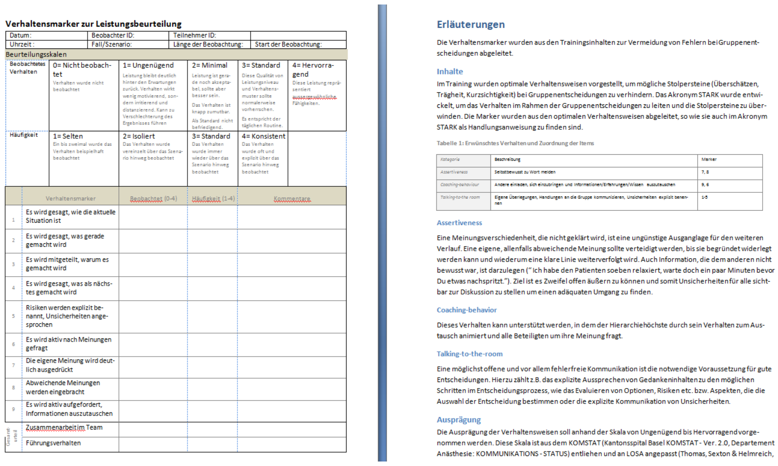
As part of our development of an evaluation strategy, we set up a *Behavioral Marker List* to discuss and refine through discussions with the experts at the lab. They did not previously use a standardized list to evaluate training performance.

We developed an own instrument (behavioral marker system) according to the ANTS **[Fletcher et al. 2003]** scale but specifically regarding the behavior talked about in the training, which can also be assigned to the STARK acronym. We also added the teamwork aspect and the observer had to give some comments on the leadership of the team.

In the first section of the checklist (figure 2.5), administrative data is collected (date, time, observer ID, scenario type, participant ID, duration of observation, start time for observation).

The first rating scale on the observed behavior is chosen according to KOMSTAT *Team Achievement Indicators* developed at the University of Basel-Kantonsspital based on the *Operating Room Checklist* **[Helmreich and Sexton 1995]**, which uses a scale for different phases of the operation and considering the aesthetic and surgical team perspectives and the interface between the two groups. The rating scale anchors are:

1. Not observed



Verhaltensmarker zur Leistungsbeurteilung

Datum:	Beobachter ID:	Teilnehmer ID:	
Uhrzeit:	Fall/Szenario:	Länge der Beobachtung:	Start der Beobachtung:

Beurteilungsskalen

Beobachtetes Verhalten	0= Nicht beobachtet Verhalten wurde nicht beobachtet	1= Ungenügend Leistung bleibt deutlich hinter den Erwartungen zurück. Verhalten wirkt wenig motivierend, sondern irritierend und distanzierend. Kann zu Verschlechterung des Ergebnisses führen	2= Minimal Leistung ist gerade noch akzeptabel, sollte aber besser sein. Das Verhalten ist knapp zumutbar. Als Standard nicht befriedigend.	3= Standard Diese Qualität von Leistungsniveau und Verhaltensmuster sollte normalerweise vorherrschen. Es entspricht der täglichen Routine.	4= Hervorragend Diese Leistung repräsentiert aussergewöhnliche Fähigkeiten.
Häufigkeit	1= Selten Ein bis zweimal wurde das Verhalten beispielhaft beobachtet	2= Isoliert Das Verhalten wurde vereinzelt über das Szenario hinweg beobachtet	3= Standard Das Verhalten wurde immer wieder über das Szenario hinweg beobachtet	4= Konsistent Das Verhalten wurde oft und explizit über das Szenario hinweg beobachtet	

	Verhaltensmarker	Beobachtet (0-4)	Häufigkeit (1-4)	Kommentare
1	Es wird gesagt, wie die aktuelle Situation ist			
2	Es wird gesagt, was gerade gemacht wird			
3	Es wird mitgeteilt, warum es gemacht wird			
4	Es wird gesagt, was als nächstes gemacht wird			
5	Risiken werden explizit benannt, Unsicherheiten angesprochen			
6	Es wird aktiv nach Meinungen gefragt			
7	Die eigene Meinung wird deutlich ausgedrückt			
8	Abweichende Meinungen werden eingebracht			
9	Es wird aktiv aufgefordert, Informationen auszutauschen			
Gesamturteil	Zusammenarbeit im Team			
	Führungsverhalten			

Erläuterungen

Die Verhaltensmarker wurden aus den Trainingsinhalten zur Vermeidung von Fehlern bei Gruppenentscheidungen abgeleitet.

Inhalte

Im Training wurden optimale Verhaltensweisen vorgestellt, um mögliche Stolpersteine (Überschätzen, Trägheit, Kurzsichtigkeit) bei Gruppenentscheidungen zu verhindern. Das Akronym STARK wurde entwickelt, um das Verhalten im Rahmen der Gruppenentscheidungen zu leiten und die Stolpersteine zu überwinden. Die Marker wurden aus den optimalen Verhaltensweisen abgeleitet, so wie sie auch im Akronym STARK als Handlungsanweisung zu finden sind.

Tabelle 1: Erwünschtes Verhalten und Zuordnung der Items

Kategorie	Beschreibung	Marker
Assertiveness	Selbstbewusst zu Wort melden	7, 8
Coaching-behaviour	Andere einladen, sich einzubringen und Informationen/Erfahrungen/Wissen auszutauschen	9, 6
Talking-to-the room	Eigene Überlegungen, Handlungen an die Gruppe kommunizieren, Unsicherheiten explizit benennen	1-5

Assertiveness

Eine Meinungsverschiedenheit, die nicht geklärt wird, ist eine ungünstige Ausganglage für den weiteren Verlauf. Eine eigene, allenfalls abweichende Meinung sollte verteidigt werden, bis sie begründet widerlegt werden kann und wiederum eine klare Linie weiterverfolgt wird. Auch Information, die dem anderen nicht bewusst war, ist darzulegen (" Ich habe den Patienten soeben relaxiert, warte doch ein paar Minuten bevor Du etwas nachspritzt."). Ziel ist es Zweifel offen äußern zu können und somit Unsicherheiten für alle sichtbar zur Diskussion zu stellen um einen adäquaten Umgang zu finden.

Coaching-behavior

Dieses Verhalten kann unterstützt werden, in dem der Hierarchiehöchste durch sein Verhalten zum Austausch animiert und alle Beteiligten um ihre Meinung fragt.

Talking-to-the-room

Eine möglichst offene und vor allem fehlerfreie Kommunikation ist die notwendige Voraussetzung für gute Entscheidungen. Hierzu zählt z.B. das explizite Aussprechen von Gedankeninhalten zu den möglichen Schritten im Entscheidungsprozess, wie das Evaluieren von Optionen, Risiken etc. bzw. Aspekten, die die Auswahl der Entscheidung bestimmen oder die explizite Kommunikation von Unsicherheiten.

Ausprägung

Die Ausprägung der Verhaltensweisen soll anhand der Skala von Ungenügend bis Hervorragend vorgenommen werden. Diese Skala ist aus dem KOMSTAT (Kantonsspital Basel KOMSTAT - Ver. 2.0, Departement Anästhesie: KOMMUNIKATIONS - STATUS) entliehen und an LOSA angepasst (Thomas, Sexton & Helmreich,

Figure 2.5 – *GetSAFE Behavioral Marker System*

2. Insufficient – achievements are clearly behind expectations. Behaviors seem to be insufficiently motivated, more irritated and dissociated. Could lead to a reduction of outcome.
3. Minimal – achievements are acceptable, but should be better. Behavior is reasonable but rarely sufficient. As a standard, not satisfactory.
4. Standard – this quality and level of achievements and behavior should the norm. It corresponds to the daily routine.
5. Outstanding – this achievement represents outstanding abilities

The second scale captures the frequency of behavior with the rating scale anchors:

1. Seldom
2. Isolated
3. Standard
4. Consistent

The last page (p. 3) describes the defined behavior regarding the STARK acronym and the GetSAFE training to explain it to the observer in detail.

2.1.6 Data analysis

Data from the *Evaluation Questionnaire* was inserted into SPSS and Microsoft Excel. Analyzes were run to obtain standard measures such as mean, standard deviation and frequencies. Data from the Safety Awareness *Questionnaire* was inserted into Microsoft Excel. Statements concerning the open questions were simplified and analyzed in terms of recurrent themes. Qualitative emergent theme analysis was used to analyze the free text observation in the operating theater. The GetSAFE behavioral marker system was tested in the simulation session and was filled out by the first author.

2.1.7 Results

The *GetSAFE* training was conducted three times (end of 2012–start of 2013) at the teaching-hospital in Austria as part of the regularly scheduled simulator-based training sessions at the unit of anaesthesia and intensive care. All physicians were in the specialty of anaesthesia and intensive care.

Subjects

A total of 14 people participated in the training program (male = 7, female = 7), which we did three times at the hospital. Senior Anaesthetists (n=4), residents (n=2) and nurses from the anaesthesia and intensive care unit (n=8) took part in the training. In the first part of the safety awareness questionnaire we asked for some participant data (tables 2.2 and 2.3).

Session	N	gender		position		
		male	female	Senior	Assistant	Nurse
1	4	1	3	1	1	2
2	5	3	2	2	0	3
3	5	3	2	1	1	3
Total	14	7	7	4	2	8

Table 2.2 – *Participant data (gender, position)*

Most of them have been working for more than 7 years (n=6) at the hospital and are more than 35 years old (n=9).

Session	N	age			tenure					
		< 35	> 35	missing value	> 7 yrs.	3-7 yrs.	1-2 years	6-11 months	< 6 months	missing value
1	4	4	0	0	3	0	0	0	1	0
2	5	2	1	2	1	1	0	1	0	2
3	5	3	1	1	2	1	1	0	0	1
Total	14	9	2	3	6	2	1	1	1	3

Table 2.3 – *Participant data (age, tenure)*

Safety awareness

Eleven out of 14 questionnaires were completed and returned. A qualitative analysis revealed that before attending the course, participants' observations tended to concern the themes of time pressure, equipment problems (including medication), inexperience, and communication problems especially between disciplines or status. In table 2.4 some examples are derived.

Example	**Category**
"resuscitation in the gym, tube between oxygen and bag valve mask was missing" (SA8)	Equipment
"ampoule-alikeness *Atropin*: *Xylanäest*", "Alikeness: *Elomel* flex bag and *NaCXl* 1 l flex bag" (SA5)	Medication
"there was no communication between surgeon and anesthetist...anesthetist has focused on the surgery situation too late" (SA1)	Communication

Table 2.4 – *Verbatims illustrating participants' safety awareness in the workplace, before training*

Only 2 of the 14 follow-up questionnaires were completed and returned. After the training course, participants recorded some more observations directly associated with decision-making issues. In addition, their comments on the situation were much more precise and they thought about a set of contributing factors instead of focusing on a single aspect.

Example	Category
"...causes were carelessness, maybe inattention, or simply fatigue... the decision was made together... the person with more expertise in emergency management took over in the situation." (SA13)	group decision-making, cause analysis
"[...] there has to be a lot of effort to apply in order to coordinate all relevant group members in the decision-making process and on the other side to guarantee the implementation of the process in daily work practice..." (SA12)	group decision-making

Table 2.5 – *Verbatims illustrating participants' safety awareness in the workplace, after training*

Course evaluation

Altogether, N=13 participants filled out the course-evaluation form. Participants' quantitative evaluation of the course was very positive, with all ratings above the scale midpoint (3).

	satisfaction	delivery	relevance	learning	recommendation
valid	13	13	13	13	13
missing	0	0	0	0	0
mean value	6.54	6.92	6.69	6.46	6.69
standard deviation	0.877	0.277	0.480	0.660	0.630
minimum	4	6	6	5	5
maximum	7	7	7	7	7

Table 2.6 – *GetSAFE evaluation (Happy Sheet)*

As illustrated in figures 2.6, 2.7, and 2.8 most participants were happy with the training ($M_{approval}$=6.5), the content ($M_{relevance}$ =6.7) and the transfer of content to participants ($M_{delivery}$ =6.9). The maximal possible rating on each dimension was 7.

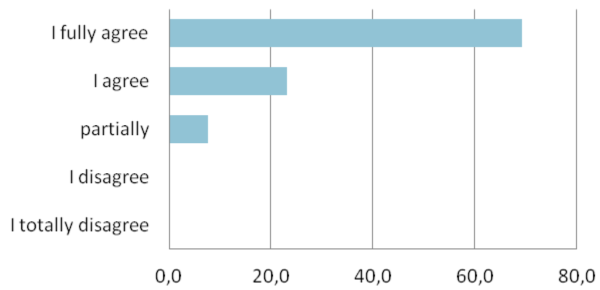


Figure 2.6 – *Evaluation results (satisfaction): "I really enjoyed the training session"*

Performance

Data from the *behavioral checklist* was used to analyze the behavior as observed in the simulator regarding decision-making processes as trained in the *GetSAFE* unit. Each scenario lasted between 20 and 45 minutes. The participants had to handle the scenario right after the training session on group decision-making processes.

Performance observation with the checklist. In this simulator session, one senior anesthetist and two nurses had to deal with a *difficult airway management scenario*. Overall, the behavior recommended in the training and described using STARK was observed very rarely, and with a very low intensity.

Performance observation with the detailed checklist for each group member. To gain more insight in possible group differences, the checklist was further developed to add extra

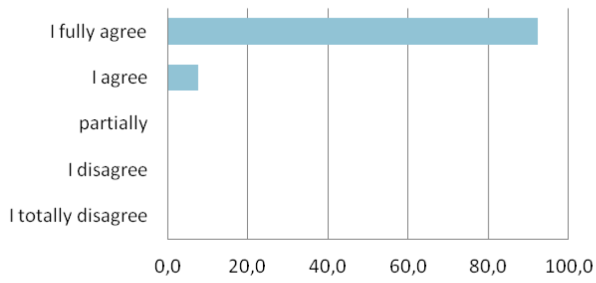


Figure 2.7 – *Evaluation results (delivery): "The content was clearly presented"*

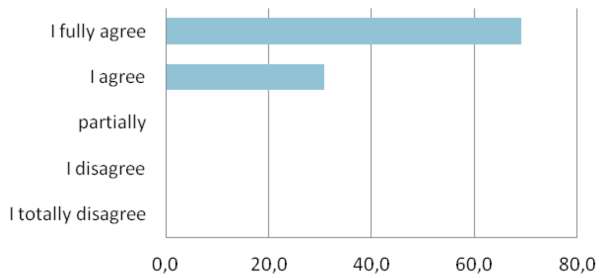


Figure 2.8 – *Evaluation results (relevance): "The training content was relevant for my work"*

STARK Acronym	**Behaviour**	**frequency**	**intensity** (0-4)
Situation	Here is what I think we face	2	2
Task	Here is what I think we should do	2	2
Intent	Here is why I think we should do this	0	0
Concern	Here is what we should keep our eyes on since, if that changes, we are in a new ballgame	1	1
Calibration	Now talk to me	0	0

Table 2.7 – *Results on behavior in the complex scenario at the third training session (BCL-1.2)*

categories for each group member. Right after the third training session at the lab, one senior anesthetist and two nurses had to deal with a simulated *handing over procedure* in the operating room at the lab. Taken observations regarding the behavior checklist together, it becomes clear that almost all of the recommended behavior in the training session was shown in the scenario very rarely. Just one of the participants (senior anesthetist) tended to orient his own behavior on the STARK principle (table 2.8).

Acronym	Behaviour	frequency			intensity		
		anesthetist	nurse_1	nurse_2	anesthetist	nurse_1	nurse_2
Situation	Here is what I think we face	10	1	1	4	1	1
Task	Here is what I think we should do	2	2	0	2	2	0
Intent	Here is why I think we should do this	2	0	0	2	0	0
Concern	Here is what we should keep our eyes on since, if that changes, we are in a new ballgame	2	0	0	2	0	0
Calibration	Now talk to me	1	0	0	1	0	0

Table 2.8 – *Results behavior in the complex scenario at the third training session (BCL-3.2)*

2.1.8 Discussion

Non-technical skill training, especially as developed in this project regarding the decision-making skills under uncertainty, can be delivered through such a training programme with positive educational outcomes. Such a course may allow important aspects on how to handle uncertainty for patient safety, to be integrated into the curriculum.

We developed the training session in close cooperation with the experts of the lab and based on the results of our previous studies in the field. The ADDIE model **[Branch 2009]** was very helpful to adopt a structural approach in designing the training session. We used the assessment phase to gain a profound insight into the subject. After analyzing those assessment results we designed and developed the training session and have chosen relevant content. The training contained various learning methods to address various learning styles and allow the learners to process through different levels to develop their experience **[Kolb 1984]**. To gain important results on how the training works, we evaluated the training on different levels **[Kirkpatrick and Kirkpatrick 2006]**. We first used a happy sheet, which was filled out by the participants right after the training session. We also used a safety awareness questionnaire, which we adapted and used two times. Participants had to answer the questions before and about 8 weeks after the training.

After the training session, the participants managed a scenario at the medical simulator in the lab. To give detailed feedback on their performance we developed a behavioural marker checklist, which we tested also in as part of this case study.

All participants in the training appreciated the training approach to improve their skills, especially to get the chance to exercise and discuss the cases and scenarios within the group. The participants highly recommend the training to be completed by their colleagues. They further benefit from the methods used. They rated the content as highly important and meaningful for their daily work. However, observed behaviour change on a simulated medical setting was disappointingly low.

Our results are specific for one training program (GetSAFE) and for one hospital. A larger trial with randomized design and is needed to determine whether our findings can be reproduced in different settings, and whether benefit can be directly demonstrated. Further, a complete evaluation study is needed to determine long-time effects also on organizational outcome **[Kirkpatrick and Kirkpatrick 2006]**.

To enhance safety in health care, it is essential that health care professionals are adequately trained to recognize, prevent and mitigate errors during decision-making processes. Modern training with simulators is designed to reduce the frequency of human errors **[Gaba et al. 2001]** and to teach anesthesiologists how to deal with the consequences of such errors.

Further, it must be noted that any long-term improvement in safety skills is likely to require a systematic approach encompassing ongoing faculty and time commitment. Attention to the system is important.

Safety in medicine has to be institutionalized, in a sense of being a major focus of hospital medical activities. Lessons from human factors research in other industries such as aviation and nuclear should be applied to the practice of hospital medicine.

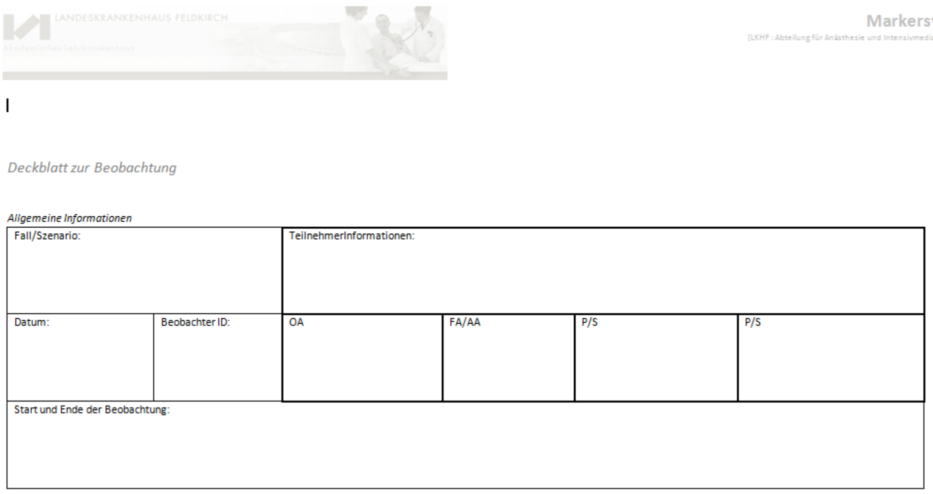
2.2 Proposed improvement

To further develop the training session we draw some conclusions out of the 1) training evaluation results and 2) interviews with the lab experts and the training participants regarding this first training implementation. The conclusions refer to the following aspects:

1. Performance assessment: Adaption of the Behavioral marker checklist and planning an observer training for handling the behavioral marker checklist by themselves during simulation sessions;
2. Optimizing the training evaluation process: development of an online questionnaire to strengthen commitment in answering the formula.

2.2.1 Adaption of the performance checklist (behavioral marker)

During the application of the behavioral marker checklist we gained some important know-how in using the checklist. In the first version we had two different rating scales and it was very complex to analyze behavior. Therefore, we wanted to make the checklist easier to handle.


LANDESKRANKENHAUS FELDKIRCH
Akademisches Lehrkrankenhaus

Markersystem
[LKHF : Abteilung für Anästhesie und Intensivmedizin] – Seite 1

Deckblatt zur Beobachtung

Allgemeine Informationen

Fall/Szenario:		TeilnehmerInformationen:			
Datum:	Beobachter ID:	OA	FA/AA	P/S	P/S
Start und Ende der Beobachtung:					

Figure 2.9 – *GetSAFE Behavioral Marker System, improved version – page 1*

The administrative data is now written on an extra page (figure 2.9), which could be filled out just before the simulation scenario starts.

We concentrated in the second (improved) version on a single rating scale regarding the *value* of the observed behavior (figure 2.10). The rating scale is chosen according to *KOMSTAT Team Achievement Indicators* developed at the University of Basel-Kantonsspital based on the *Operating Room Checklist* **[Helmreich and Sexton 1995]**. The rating scale anchors are:

1. Not observed
2. Insufficient – achievements are clearly behind expectations. Behaviors seem to be not motivated enough, more irritated and dissociated. Could lead to a reduction of outcome.
3. Minimal – achievements are still acceptable, but should be better. Behavior is still reasonable but rarely sufficient. As a standard is not satisfactory.

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Beurteilungsskala

Ausprägung des beobachteten Verhaltens	0= Nicht beobachtet	1= Ungenügend	2= Minimal	3= Standard	4= Hervorragend
	Das Verhalten wurde nicht beobachtet.	Leistung bleibt deutlich hinter den Erwartungen zurück. Verhalten wirkt wenig motivierend, sondern irritierend und distanzierend. Kann zu Verschlechterung des Ergebnisses führen.	Leistung ist gerade noch akzeptabel, sollte aber besser sein. Das Verhalten ist knapp zumutbar. Als Standard nicht befriedigend.	Diese Qualität von Leistungsniveau und Verhaltensmuster sollte normalerweise vorherrschen. Es entspricht der täglichen Routine.	Diese Leistung repräsentiert außergewöhnliche Fähigkeiten.

Beurteilungsschema

Verhaltensmarker		Häufigkeiten				Ausprägung (0-4)				Kommentare
		OA	AA	P/S	P/S	OA	AA	P/S	P/S	
1	Es wird gesagt, wie die aktuelle Situation ist (S)									
2	Es wird gesagt, was gerade gemacht wird (T)									
3	Es wird mitgeteilt, warum es gemacht wird (A)									
4	Es wird gesagt, was als nächstes gemacht wird (A1)									
5	Risiken werden benannt, Unsicherheiten angesprochen (R)									
6	Es wird aktiv nach Meinungen gefragt (K)									
7	Die eigene Meinung wird deutlich den anderen gegenüber ausgedrückt									
8	Abweichende Meinungen werden eingebracht									
9	Es wird aktiv aufgefordert, Information auszutauschen									
Gesamturteil	Zusammenarbeit im Team									
	Führungsverhalten									

Anmerkungen:

Figure 2.10 – *GetSAFE Behavioral Marker System, improved version – page 2*

4. Standard – this quality and level of achievements and behavior should the norm. It corresponds to the daily routine.
5. Outstanding – this achievement represents outstanding abilities.

In the first column, which has to be filled out by the observer, a simple frequency regarding the observed behavior could be marked.

The last page (p. 3) describes the defined behavior regarding the STARK acronym and the GetSAFE training.

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