

# Managing uncertainty in Intensive Care Units- Exploring formal and informal coping practices in a university hospital

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Discussion Paper

Management

2014/14

**28th EGOS Colloquium, July 5-7, 2012, Helsinki, Finland**

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## **Introduction**

Facing unexpected events has become a common feature of everyday life. Incidents such as the nuclear power plant catastrophe in Fukushima, the European debt and financial crisis or the swineflu -pandemia in Germany in 2011 only represent the tip of the iceberg. Risk and uncertainty are increasingly felt being distinguishing features of today's (business) life thereby raising the ever more pressing question how to get along with them. Nowadays, risk is no longer understood as fate, rather the idea of managing risk has come to the fore. Risk is a complicated notion. The bulk of more recent (predominantly financial and geo-engineering) approaches interpret risk in terms of likely threats and dangers which can be contained by stochastic calculi. The emphasis is on (correctly) anticipating events and developments. As we all had to learn this common approach cannot actually protect us from experiencing continuously unexpected situations. In many cases it amounts to symbolic management. It therefore is hardly surprising that a second stream of thought has emerged highlighting the other side of the coin, the unexpected, the unavoidable "rest risk", discontinuities etc. In order to survive, organizations have to tackle unexpected events and handle them (Bechky & Okhuysen, 2011; Byers, 2011; Colvin, 2006; Michel, 2007; Michel & Wortham, 2009; Sargut & Gunter McGrath, 2011; Shoemaker, 2002; Taleb, 2010; Weick 2011; Weick & Sutcliffe, 2007).

In organizational theory, dealing with risk and uncertainty is typically conceived in terms of reducing uncertainty (Cyert & March, 1963; Michel, 2007; Michel & Wortham, 2009; Pfeffer & Salancik, 1978; Shoemaker, 2002). Major measures are buffering core structures and creating standard operating procedures in order to avoid feelings of distress (Byers, 2011; McDaniel Jr. et al., 2003; Shoemaker, 2002) and to keep actionable. However, an increasingly complex and uncertain environment of fast-paced changes challenges these extremely simplifying organizational arrangements for uncertainty and calls for new forms that permit more complex, adaptive and spontaneous responses to the unexpected (Bechky & Okhuysen, 2011; Kellogg et al., 2006; Michel & Wortman, 2009; Schreyögg & Sydow, 2010; Weick & Sutcliffe, 2007).

Our research focusses on these flexible responses. We are interested in exploring the texture of uncertainty practices which have been developed in response to situations of unexpected events. In this paper we report on an empirical study conducted in a field of high uncertainty

and high frequency of unexpected incidents: The intensive care unit (ICU) of a university hospital.

The paper is organized as follows: First, we develop a frame of reference based on a brief overview of the concepts of risk and uncertainty and organizational responses. The second part presents our empirical investigation. We briefly report on the results of our exploratory study and then describe first findings of our main study. In part three we will discuss our findings in the light of modern organizational theory. Part four highlights the limitations of our study and discusses implications for further analysis and theoretical conclusions.

### **1. The challenges of risk and uncertainty**

In modern societies, there is a widely shared feeling of an ever increasing amount of uncertainty, surprises and other unexpected events. As a consequence a remarkable number of approaches on managing risk and uncertainty have been developed from various disciplines. Whatever the definition, risk and uncertainty are mostly conceived in contrast to safety or security (for a different perspective see Luhmann (1993) who juxtaposes risk and danger).

Best known is Frank Knight's (1921) distinction between "risk" and "uncertainty" which elaborates on probability theory. Risk is defined by the ascription of distinct probability values whereas a lack of probability values stands for situations of "uncertainty". The general conclusion drawn has been that risky decisions can be made calculable in terms of quantitative modeling; uncertain decisions, on the contrary, are not calculable per definition. Keynes (1936) describes the latter as situations of "true uncertainty", i.e. situations where probability theory fails because no future states can be extrapolated from past data; in other words, statistical modeling combined with utility functions (including concepts of risk assessment, risk attitude, risk profiling etc.) does not apply. Statistical risk models can be understood as a variation of the utility maximization calculus (which is typically based on certainty). In this perspective, reference base for conceiving risk is the individual or the collective actor; s/he can take more or less risky decisions. One can, however, not take uncertain decisions.

Uncertainty is intimately intertwined with the idea of expectations. Expectations are cognitive representations of future states (Dequech, 2003: 154). They are strongly shaped by belief systems, experiences, theories, metaphors, convictions, etc. Expectations derive from frames

of reference on which individuals and systems build their understanding of causalities, anticipations, goals and actions. Uncertainty is commonly framed as a question of actors' knowledge and predictability/expectations, more precisely: events that actors did not expect because of lacking information about possible alternatives, the external environment, causal connections, outcomes and interactive responses of others (Downey & Slocum, 1975). It essentially refers to the encounter of contingency: things unfold in ways different than expected (McDaniel & Driebe, 2005; Weick & Sutcliffe, 2007). Since the future is inherently uncertain, expectations can be met or disappointed (Luhmann, 1995), we experience such disappointments as surprises, crises, shocks, etc.; events differ sharply from what was implicitly or explicitly conceived as future state.

Uncertainty grows out of a number of different circumstances, including: state of the field, i.e. the technical and social complexity of a field of activity and resulting lack of understanding; effect, i.e. lack of cause-effect-knowledge; response, i.e. the interdependency of actions ('circular interdependence') and out of it the limited possibility to anticipate reactions of others (Milliken, 1987). More broadly, uncertainty is related to the dissolution of traditional modes of thought, behavior and routines, and accelerated cycles of change and innovation (e.g., 'hypercompetition') (Bogner & Barr, 2000; D'Aveni, 1994; Drucker, 1980; Duncan, 1972; McCann & Selsky, 1984) which make actions more volatile and less predictable for actors.

Coping with the unexpected such as surprises, disruptions, crises, disasters, hazards, volatility, or accident often amounts to significant challenges individuals, organizations or societies have to face (Michel & Wortham, 2009; Shoemaker, 2002; Taleb, 2010; Weick & Sutcliffe, 2007). By implication individuals and systems may be surprised by very different things depending on their expectations and the underlying cognitive system (Holling, 1986). An extreme case of such surprises are Taleb's (2010) so-called "black swan"-events which refer to situations of "unknown unknowns" that were never thought of or experienced before and therefore cannot be expected. If unexpected events occur emphasis is shifted from building expectations to managing the unexpected (Weick & Sutcliffe, 2007), to adaptive sensemaking and flexible response (Weick, 2011).

Managing the unexpected is a particularly demanding endeavor. Situations are mostly characterized by confusion and ambiguity (Weick, 1993), or by erratic information that

cannot be processed along routine information systems (Tsang, 2004: 96; Weber & Johnson, 2009: 56). Furthermore, they are characterized by high stress and pace, parallel and overlapping processes (Coget & Keller, 2010: 56). The unexpected is therefore often perceived as crisis (Pearson & Sommer, 2011: 27-29; Tinsley et al., 2011: 92) or potentially damaging extreme situations (Hannah et al., 2009: 897-899).

Although experiencing and coping are in the fore of current uncertainty discourse, organization science does not yet cover the topic extensively. The major emphasis has been on “*known unknowns*” referring to events that are uncertain with respect to their time of occurrence but not concerning their content. These events can be anticipated by organizational arrangements such as programs or standards (Cyert & March, 1963). The underlying logic urges to reduce uncertainty to an actionable level. Less emphasis has been devoted to the “*unknown unknowns*” that are uncertain in terms of timing and content and thus cannot be organizationally anticipated. The well-known studies on high reliability organizations are the exceptions of the rule (Weick & Sutcliffe, 2007). But the challenge of the unexpected not only refers to rare events and is not only pivotal in very special organizations (aircraft carriers, nuclear power plants, etc.), it is everywhere. Yet, we do not know enough about the everyday practices of coping with the unexpected. We aim at contributing to fill this gap and therefore conduct an empirical investigation in a field that is marked by a high frequency and intensity of uncertainty: The ICU of a university hospital.

## **2. Empirical investigation**

### **2.1. Frame of reference**

A promising avenue for studying how individuals, organizations or societies get along with uncertainty is offered by the recently widely acclaimed practice approach (for an overview: Feldman & Orlikowski, 2011; Miettinen et al., 2009; Reckwitz, 2002; Sandberg & Tsoukas, 2011; for application: Bechky & Okhuysen 2011). A practice is generally understood as a skillful performance or integrated behavioral pattern that individual or collective actors develop and use to fulfill specific tasks (Geiger & Koch, 2008; Gherardi, 2001, 2009; Jarzabkowski et al., 2007; Nicolini et al., 2003; Reckwitz, 2002). They are seen as holistic unities consisting of elements such as know-how, heuristics, emotions, and skills learned through experience (Miettinen et al., 2009; Reckwitz, 2002; Simpson, 2009). We explore arrangements and practices that organizations (successfully) employ when facing the unexpected, focusing on practices that allow individual organizational actors as well as

organizational units and organizations as a whole to cope with the unexpected (Lipshitz & Strauss, 1997). In particular, we study practices that help organizations to remain flexible and adaptable in situations of the unexpected to respond to them effectively and try to describe the texture of those practices and their functionality in detail.

To learn more about the unexpected, we conduct a study in an empirical field that is characterized by a high frequency of unexpected events and therefore promises a rich encounter of uncertainty practices (“purposive sampling” Patton, 2002: 230). More precisely, we are investigating an Intensive Care Unit (ICU) of a university hospital which is characterized by high processual density (Braun, 2010) and intense time pressure in situations that are dangerous or life-threatening for patients; crises or unexpected events occur frequently. Additionally, activities in medicine are inevitably susceptible to mistakes (Edmondson, 2004: 68-71; Paget, 1988) as the processes of diagnosis and therapy are troubled by ambiguity and incomplete knowledge (Paget, 1988). Therefore, the ICU can be understood as a prime example of an organizational unit that has to deal with a high degree of uncertainty and the unexpected on a regular basis. ICU’s characteristics resemble those features that describe uncertainty and the unexpected in general very closely.

In our study we are focusing on a multidisciplinary ICU whose primary clientele consists of patients that need around- and aftercare for cardiac surgery. Additionally, patients in a very critical state from other medical disciplines such as urology, gynecology, otorhinolaryngology etc. are transferred to this unit. Additionally, especially during longer stays, patients may develop multiple problems (most likely pneumonia or multiple organ failure/organ substitution needs) so that a multitude of medical disciplines is to be involved. The ICU’s staff itself understands its unit as a service center that provides critical care to all patients in such a need, i.e. the ICU is a service unit for all other disciplines.

## **2.2. Exploratory study**

We started with an exploratory study based on semi-structured interviews. We conducted 5 interviews of 1.5-2 hours length with experienced members of the ICU (2 senior physicians, 2 ward physicians, 1 head nurse) with work experience ranging from 8-31 years with the aim to get orientation in the research field and to structure it for further investigation.

Very early we learned that uncertainty results from a variety of different factors, it is a blended causality. The situations studied contained at least 3 categories of factors: *Organizational* factors, *medical* factors and *cross-sectional* factors. In the ICU, the most important *organizational* uncertainty emerges from the distribution of beds and the design of shift schedules. *Medical* uncertainty factors stem from a lack of standards, complex (unexpected) courses of diseases and diverging expert opinions on the same case. *Cross-sectional* uncertainty resulted from abrupt interventions, diverging subcultures or operating systems between one's own and neighboring subunits. In sum, processes are troubled by high complexity, information density and time pressure as well as the threat of incorrect decisions with far reaching consequences. The potential of sudden or unexpected events is a factor constantly conscious to all the staff being permanently alert as they understand this as a characterizing feature of their work and organizational unit. Therefore we can state that the ICU can be understood as a prime example for studying uncertainty.

In our exploratory study, a second emphasis was placed on exploring clusters of practices actually employed to master the unexpected that could be investigated in more detail in a more encompassing main study. Not surprising the major approach was the traditional approach: utilizing medical guidelines and hospital-specific standard operating procedures (SOP's) designed to support physicians during prevention, diagnosis, therapy and aftercare according to contemporary medical knowledge (Bohmer, 2010: 64; Reinhart et al., 2010: 4). However, as already mentioned these practices do only apply to the management of "known unknowns" and were accordingly reported to be insufficient to tackle the unexpected. Also, all informants reported that the patient clientele that is to be treated in the unit at hand does not fit into those standards or guidelines and can only partially be treated according to standard diagnosis and therapy patterns. Therefore, the interviews focused primarily on approaches to cope with the "unknown unknowns".

First of all we learned that the medical staff reacted with a complex interplay of formal and informal practices when facing the unexpected. Surprisingly enough formal lines of command and control of medical hierarchy are temporarily displaced by spontaneous and ad hoc teaming up based on expertise, availability and personal contact. The ICU as well as the overarching hospital were formally organized along prescribed lines of command and reporting, i.e. the well-known medical hierarchy. The formal organization included the classical guideline on how to handle extraordinary events and tasks: involving the higher



hierarchical level (upward communication). Surprisingly enough we experienced a different behavioral pattern clearly deviating from the regular guideline. We learned that more often than not, when unexpected incidents occur, hierarchical structures are temporarily suspended. Formal channels of communication are circumvented and hierarchy is bypassed. Informal communication and expert networks come to the fore. This holds true for cross-departmental communication as well as coordination between physicians and nurses, often meaning that the first rely on the latter if they are more experienced (“downward communication”). This finding of a temporarily fluidized hierarchy differs from Weick’s and Sutcliffe’s (2007) idea of a loosened hierarchy when responding to the unexpected. The authors basically assume that formal hierarchy is replaced by a hidden hierarchy of expertise that comes to the fore in situations of the unexpected. But when facing the unexpected in our ICU, physicians’ decision making is not only simply rearranged along a hierarchy of expertise. Instead, in our case they extensively draw on networks for cooperative consultation which consist of members inside and outside their units and even extra-organizational experts. As such, it is common to seek advice from colleagues (doctors as well as nurses) from other departments or units to obtain their ideas on an unexpected case and expand the perimeter of participating expertise. To effectively utilize those networks, however, a certain amount of professional experience is essential to understand who is to be approached in a given unexpected situation.

Instead of formal hierarchy that is held responsible for sensible decision-making we learned that more complex (organizational) arrangements are situationally activated when an unexpected incident occurs. Hierarchical lines of command and control do not prove as fix as it may appear at first glance but rather oscillating. And importantly, the observed reaction pattern did not replace hierarchy rather an interplay between formal and informal activities proved most important. The formal organization proved interwoven with an informal network structure. Therefore we aimed at investigating this complex interplay of formality and informality in more detail in our main study, understanding its activators and its functionality in detail as well as its outcomes.

## **2.3. Main study**

### **2.3.1. Research setting and methods**

In order to arrive at the aim to investigate the complex interplay of formal and informal sphere to manage the unexpected in more detail, we designed a main study that is based on three methodological columns. To gain a most encompassing insight into the complex

combinative processes of formal and informal working sphere we are conducting a study that combines (1) an ethnographic approach with elements of shadowing (Czarniawska, 2007; McDonald, 2005) and participant observation in the ICU (Sprenger, 1989), (2) a social network analysis (Borgatti & Foster, 2003; Weyer, 2011) and (3) additional interviews for complementation and validation of insights from the first two methodological columns. Archival material complements the data triangulation.

In this paper, we will report on first insights from the ethnographic research that has been conducted since February 2012. As it stands, one additional month is to follow. Afterwards, the social network analysis, addressing all clinical members working in the ICU sector will take place. Eventually, an encompassing data analysis phase will follow including another round of interviews in late 2012.

The ethnographic study that is being carried out currently takes place in a multidisciplinary ICU ward in a university hospital which primarily treats cardiac surgery patients as well as other (surgical) patients in need for critical care. The ward comprises 10 beds and 1 emergency bed spot. It is part of a larger center for anaesthesiology and surgical intensive medicine that belongs to a university hospital. The ward itself is led by a senior physician (“Oberarzt”), accompanied by a ward physician (“Stationsarzt”) who lead a team of a varying number of resident physicians (“Assistenzärzte”) that are working in a three shift system, so that the ward is serviced by a physician 24 hours a day. Besides the physicians’ team there is a nursing team that is led by a head nurse (“pflegerische Stationsleitung”). The team is also working according to a three shift system; every shift is staffed with 5-6 nurses so that every nurse needs to take care of 2 patients that are in critical condition. The ward is supervised by a leading senior physician (“leitender Oberarzt”) that oversees the whole intensive care and intermediate care sector and is held responsible for the coordination of bed spots. The center then is led by a supervisory board of which the leading senior physician is a member as well. The nursing team is subordinated to a nursing director.

One of the researchers was admitted to this unit as observer and participates in all unit’s routines and activities full-time and is therefore fully integrated in the unit’s shift system. The first part of the ethnographic study (3 months) was conducted in terms of “shadowing” (Czarniawska 2007; McDonald, 2005) in order to gain detailed insight into the different activities and practices of diverse hierarchical levels. The researcher followed the senior

physician, the ward physician and a resident physician for time spans of 3 to 5 weeks and lived through their working days from shift beginning to end, including night, weekend and on-call shifts. This not only led to detailed time protocols of the daily routines of the actors but also provided the opportunity to learn about their interpretations and evaluations of situations as well as taken (and not taken) courses of action. Furthermore, the shadowing technique gave the researcher the chance to quickly learn basic medical knowledge, terminology and routines to be able to competently follow the workflow and the communication in an ICU. Last but not least, whenever unexpected incidents occurred, the researcher left her shadowing role and went into a mode of participant observer to capture the whole situation's content and the actions of all participating actors. By doing so, the researcher gained encompassing insight into the roles and responsibilities of different hierarchical levels on the one side as well as the suspension of these roles and routines and substitution by other organizational coordination forms on the other. Furthermore, the researcher could observe and identify a variety of practices that are applied in situations of the unexpected. After three months of shadowing and a first analysis of the data, the research team decided to change perspective. We switched the mode of observation to a tracer study meaning that the participant observer is now following medical cases entering the ICU and documenting the analyzed practices as they unfold during these cases.

As the ethnographic study is still in progress, for this paper we will draw on 35 protocols (= 35 days) of daily work in the ICU that were collected during shadowing the senior physician and a resident physician. In this paper we will present the most interesting practices that could be extracted at the interface between formal and informal sphere, aiming to capture the complex interplay of hierarchical and spontaneous, ad hoc coordination and decision-making mechanisms that are set into place when unexpected incidents occur. We will describe these practices and accompanying sub-practices in detail, providing exemplary incidents that were tackled by these practices.

### **2.3.2. Results**

#### **Oscillating hierarchy**

In most medical organizations there are clear-cut hierarchical structures, clearly demarcated by titles, duties and responsibilities. These lines of command and control are to be utilized for all decision-making processes. Decisions are to be escalated or delegated in hierarchy to the corresponding level of responsibility. All members of each hierarchical level are supposed to

take care of problems and decisions – and only those – that are assigned to them. As soon as their formal competence ends, they are expected to communicate the problem upwards for decision. We expected this hierarchical decision-making processes to be in place in the observed formally organized unit as well, given the fact that we were working in a university hospital which in general are said to be rather strict and drawn to titles and formal positions. However, we were surprised to learn that in situations of the unexpected, escalating decisions in the hierarchy is only one of a variety of means to tackle such incidents. Instead of automatically escalating extra-ordinary events in the hierarchy, additional coordination mechanisms were set into action. Furthermore, escalation always appeared to be a very conscious instead of automatic act with designated reasons and well-chosen points in time. Utilization of hierarchy was only one of many pieces in a complex puzzle of coordination mechanisms that was to be completed when unexpected situations occurred. However, a mere substitution of formal hierarchy by a hierarchy based on expertise, as postulated by Weick and Sutcliffe (2007), does not capture the organizational mechanisms being rolled out in such situations adequately, as hierarchy, based on whatever attribute, is only part of a more complex combinative process. Only the competent combination of a whole set of puzzle pieces that comprises formal and informal coordination mechanisms aided to accomplishing a sophisticated uncertainty management.

### *Uncertainty monitoring*

What we identified as the first piece of the puzzle is a complex relationship between the group of physicians and the nursing team that cannot simply be described in terms of command and control. First of all, nurses are not directly formally subordinated to the physicians' group but formally report to their head nurse who reports to a superordinated nursing director. The nurse-physician relationship is formally prescribed as a “functional authority” relation, meaning that the physician may order tasks in patient care but is not the formal supervisor of the nurse who is equipped with formal sanctional power. Furthermore, nurses in intensive care do not simply carry out tasks ordered by physicians but hold independent roles and responsibilities that they take as part of the caring profession. In terms of uncertainty management, nurses can be regarded as early “uncertainty monitors” that are supposed to detect upcoming crises at such an early state that they can be prevented and alert physicians when an acute crisis is happening. This comprises a variety of tasks that need to be carried out by the nurses independently.

First of all, all monitoring and alarm signals that are constantly ringing in an intensive care unit are primarily acknowledged by nurses. They watch all the vital parameters especially in cardiac and pulmonary functioning and try to correct parameters as soon as they are alerted by an alarm signal and find minimal deviations from an optimal status. Only if they cannot solve such an alarming situation, they physically yell for a physician for help, i.e. they buffer physicians from uncertainty. As the yell for a physician happens very seldomly (2-3 times a day normally), physicians become instantly alert when being yelled for and approach the critical situation immediately to support the nurse. This kind of uncertainty monitoring is possible as critical care nurses do normally only have to oversee 2 patients that they can examine in great detail and become very familiar with as it is tried to provide a certain continuity when assigning nurses to patients, i.e. a nurse is assigned to two certain patients some days in a row so that they can detect even smallest variations in patients' condition. This tight nurse-patient ratio as well as the continuity in patient care allow for the patient to be complexly captured in great detail as nurses do not only deal with vital parameters of the patients but are in close physical contact to the patient all the time. These details are essential input to further decisions on courses of actions for physicians, especially if patients' conditions or therapy paths are uncertain and cannot be covered by standards:

*During morning transmission session, the senior physicians orders for patient 11: "She needs to be mobilized. She needs to sit in the chair, out of bed." The nurse disagrees: "I think she is not ready. She is all swollen. We should wait some more." The senior physician agrees.*

The nurses' uncertainty monitoring function is sometimes even deliberately activated by physicians, especially in cases of experimentation, another practice that is frequently applied in situations of uncertainty: Whenever standard diagnostics and therapy cannot improve patients' situation, physicians engage in (reversible) experiments and try out different solutions such as different (doses of) medication. When everything else has proven to be insufficient and a patient remains in an unclear and highly critical condition, even highly unusual off-label solutions are being tried out. Whenever such an experiment is set into action, physicians equip nurses with a monitoring assignment, i.e. that nurses have to check for certain parameters in very high frequency and report slightest variations to the physician immediately. This also includes that other minimal differentiations that can be perceived by them, are instantly reported to the physician as they might be associated with the try-out which is not to be evaluated by the nurses.

Furthermore, they take care of constantly reminding physicians about critical problems that trouble patients (“Upward leading”). As physicians have to oversee more than 2 patients, they cannot turn their full awareness to only one patient problem at all times but need to prioritize and sequentialize. Therefore it is the nurses’ job to regularly approach physicians and call uncertainties into memory again.

Finally, nurses even correct physicians’ mistakes and therefore can also be understood as a human monitor that prevents self-induced unexpectedness to happen.

*After the morning transmission session has completed patient 2, resident F informs the nurse: “I have stopped medicine x and y with patient 2 because we want to exchange the tracheal cannula later on.” The nurse takes the resident back to the patient’s bed and tells her: “Very important: Stop the food and the heparine or do you want to get in trouble?”*

In total, we learned that the relationship between nurses and physicians with respect to uncertainty is not one of command and control but is marked by interdependency and reciprocity. During the ethnographic study, several physicians reported that they deliberately rely on (experienced) nurses that have not only acquired great expertise in patient perception and problem detection but that also, due to the patient-nurse ratio, have greater capacity to fully capture the patient and its problems. Vice versa, nurses need to rely on physicians to take care of the problems they have brought to awareness and to react immediately if they call for help.

#### *Involve others*

Another practice in the face of uncertain situations is the involvement of others outside one’s own unit, i.e. (1) representatives of other units inside one’s own department, (2) representatives from other medical disciplines outside one’s own department but in the same hospital and even (3) representatives from one’s own or other medical disciplines at other hospitals. What is especially remarkable about that is that the involvement of others can be triggered by every hierarchical level, i.e. if a resident during night shift senses that he or she needs a neurologist quickly for an emergency, he or she will directly address that discipline (horizontally or laterally) without previously asking for permission at a higher hierarchical level or following formally prescribed lines of communication.

With respect to uncertainty, the involvement of others broadens the ICU actors' perspective which has a twofold effect: On the one hand, uncertainty can be reduced as involved others possess expertise or experience that allows them to eliminate uncertainties from a once unclear case. On the other hand, others proved to be helpful in jointly clarifying an ambiguous situation. But during those dialogues new questions are also raised which induces new uncertainty as it opens up new options and alternatives on what is going on with a patient. This can mean that new diagnostics or therapeutic paths have to be explored to elaborate whether ideas by others are applicable to the unclear case at hand or not. Although this means new uncertainty added, the advantage of this uncertainty induction is that it prevents ICU physicians from adopting too narrow a perspective too early. Instead of becoming path-dependent (Sydow et al., 2009) in treatment because an early diagnosis is adopted and taken as given for a patient, the constant involvement of others ensures that other options remain in sight and treatment lock-ins are prevented or broken at a very early stage. A prerequisite for such an effect is that actors in ICU have to be clearly aware of and willing to admit the limits of the perimeter of their knowledge and expertise (on the culture of doubt see Kramer (2007)).

However, physicians in the ICU do not randomly approach colleagues from other disciplines that might be helpful to solve up uncertainty in a case, e.g. they do not randomly call the neurology department in their hospital if the patient is in an unclear neurological state. Instead they draw on personal contacts they have collected during their career as they believe to ensure a certain subjectively ascribed quality in the disciplinary expertise they add to the case. In other words they only approach outsiders if they know them and appreciate their expert knowledge. External involvement therefore is not only based upon formally ascribed expertise (e.g. "We call the leading senior physician of neurology.") but also upon familiarity, personal experience with and appreciation for the external actor to be involved. Therefore, every physician collects a portfolio of contacts during their career that they can immediately retrieve from in an unclear and unexpected cases (see also Kotter, 1999). As the resident physician T points out:

*"If you are faced with an emergency that has to be treated quickly and you do not have the personal knowhow and know the relevant people, that's a catastrophe."*

One very dense case of uncertainty management by involvement of others unfolded as follows:

*A patient went into reanimation without any obvious reason. The reanimation team was able to stabilize him and now he was a patient in ICU, being in a comatous state. Diagnostics had shown that the patient was having several thrombosis in his arms and legs so that during morning supervision the question was raised whether the patient could be mobilized. The senior physician suggests: "We could ask the physiotherapists this morning, maybe they know such a thing ad hoc. But if they do, this is not binding for us but just a recommendation. Or we could ask an angiologist, do we have one here?" Two residents reply: "What's an angiologist?" Senior physician: "That's an internist's sub specialization. I could call one at my home clinic in City X. I know who to call there."*

The involvement of others as a practice does not only encompass to involve personally known experts from other disciplines intra- or extra-organizational. It also includes to involve a group that can be described as "uncertainty agents". Representatives of the highest hierarchical level of the clinic (i. e. members of the supervisory board) are such uncertainty agents that take over antagonistic tasks in uncertainty management. On the one hand, they involve themselves on the operational level ad hoc and focus their attention on certain cases they randomly choose. Often they spontaneously give a flying visit to the ICU to critically question the course of action that has been taken with a patient. Therefore they surprisingly appear at the ward, quickly oversee a case and approach the presently treating physician to question him or her about the case. During these "uncertainty sessions" the physician in question needs to be able to quickly resume the whole case and the reasons for the various steps that have been taken or denied to be taken and to defend medical decisions that have been made. This deliberate uncertainty induction is supposed to prevent that decisions are taken mechanically, automatically and without conscious consideration of its implications and indications. Additionally, during their flying visits members of higher hierarchical levels devote some of their time to certain cases to add more alternatives, ideas or options to a case, the treating physicians might not have thought of so far. Every physician in the unit is fully aware that these flying visits might come by every instant and that they need to be prepared to adequately report on a case and the taken courses of action. Speaking in terms of practice, higher hierarchical levels deliberately induce uncertainty in the unit in order to prevent a too routine and automatic patient treatment and ensure that every patient is regarded as an



individual case with its own peculiarities and distinctive features that have to be appraised accordingly. Therefore, members of the highest hierarchical level of the supervisory board involve themselves on the operative level in order to deliberately induce uncertainty to keep alertness and mindfulness up.

Vice versa, the “uncertainty agents” that belong to the supervisory board are being deliberately involved by lower hierarchical levels as well, that is to say that classical hierarchy is not useless in the organizational structure at hand. However, the involvement of higher hierarchical layers and the escalation of problems is not an automatic act, i.e. that there is no standard that formally prescribes that a certain problem needs be escalated in hierarchy. In fact, the escalation of an uncertain case is a means that is carefully considered and well-timed when being applied. Therefore, it is not an automatic act by lower hierarchical levels who simply follow formal protocol. Instead, escalation is a very conscious and deliberate act. High members of hierarchy are usually being involved when a case is unclear and turns really critical (i.e. a patient is in an acute near-death situation with unclear genesis) or when a case is critical but clear and now a radical decision has to be taken (e.g. a patient is irreversibly brain dead and an end of life decision has to be made with relatives) which are both situations of great uncertainty of different origin (in the first case, uncertainty stems from the unclear genesis of the criticality of the patient condition, in the second case, the reaction of relatives and their decision is uncertain). In such situations, hierarchy is actively involved for several reasons: (1) For legal protection of all physicians involved as it is formally documented that the highest hierarchical level was involved and supports the course of action, (2) to ensure that all opportunities, even exotic, rare and/or very costly ones, have been applied to the patient in critical condition, (3) to equip cases with more gravity,

*Patient 7 was supposed to be transferred to another unit's ward in order to release bed spot capacity in the ICU for more critically ill patients yesterday. Patient 7 was denied a bed spot on the chosen ward yesterday because – as they said – there was no spot available. The senior physician explains to a member of the supervisory board who visits the ICU momentarily, that later on another abdominal surgical patient got a bed on that ward. The supervisory board member comments: “He must have gone via supervisory level directly. I will call their supervisory level immediately if that is the only way. I thought this could be solved on the operational level, but ok.” The patient receives a bed spot on the other ward later on.*

and (4) to get rid of uncertain situations so that they can be solved on a higher hierarchical level:

*Patient 11 is supposed to receive a wound lavage today. After morning transmission session, a cardiac surgeon comes to the ward and discusses with a substitute ward physician whether the lavage should be done in the OR or bedside. According to the substitute ward physician, the leading senior physician wants the procedure to be done in the OR. According to the cardiac surgeon, the senior cardiac surgeon wants the procedure to be carried out bedside. The cardiac surgeon comments: "Now it's the question whether I stick to my boss or you to yours." The substitute ward physician replies: "It was our leading senior physician's order. Let the two of them solve this, that's none of our business."*

Summing up, members of the supervisory board as representatives of the highest clinical hierarchical level can be understood as uncertainty agents for two antagonistic reasons: (1) They deliberately induce uncertainty by involving themselves on the operational level (therefore temporarily suspending formal hierarchy and their ascribed role), questioning courses of action taken there and adding more options and interpretations to an existing case. (2) They fulfill their classical formally prescribed role by being recipient of escalated unclear cases in order to solve them. However, the utilization of the formally prescribed hierarchical channels is not, as indicated by a classical organizational structure, an automatic act, i.e. it does not follow a certain rule or standard. Instead, escalation is a conscious, carefully considered and well-timed decision that is taken case-based and individually.

Another group of "uncertainty agents" is made up of physicians working in on-call services who cover late, night and weekend shifts when the senior and the ward physician are not at the ward. This is a group of physicians who have a special formal degree in their discipline ("Facharzt") that is awarded after a certain number of years of service in that discipline and an accompanying number of cases of different sort being treated, completed by an examination. These on-call physicians cover 3-4 units (ICU's, intermediate care unit and PACU) and are designated to being called whenever unexpected, non-routine situations occur, i. e. that their function is to cover for unexpected situations of different kind (this can be a high amount of workload by a greater number of really critically ill patients that cannot be treated by the ward servicing physician alone, it can also be rapid unexpected deteriorations in patients'

conditions etc.). During night and weekend shifts, every unit is being serviced by a resident physician who normally is – due to his/her professional rank and experience – able to perform all routine tasks of an ICU ward. Whenever a critical or unexpected situation comes up that they feel they cannot handle, residents are formally requested to call the on-call physician for help. However, it is up to the resident physician in service to evaluate whether support by the on-call physician is needed. There is no formal trigger that automatically leads to the involvement of the on-call physician. With respect to uncertainty, the on-call physician does also provide a twofold effect: On the one hand, the involvement of the on-call physician as a formal specialist provides legal security and protection for the resident in service as well as the hospital as it is legally prescribed that a “Facharzt” is involved in critical situations. On the other hand, the on-call physician might also, similar to the members of higher hierarchical levels in their flying visits, question courses of action taken by the resident and include new options and alternatives in diagnostics and treatment to broaden perspective which induces additional uncertainty again. The perimeter of medical courses of actions is widened by that. Therefore, on-call physicians, similar to representatives of the supervisory board, can prevent a too narrow perspective in patient care, preventing path dependency in diagnosis and treatment by deliberately inducing uncertainty. However, although a formal rule prescribes to involve the on-call physician in an uncertain situation, it remains up to the resident’s evaluation of the situation when to involve this uncertainty agent. Therefore, the utilization of hierarchy here again is not an automatic or routine act but a conscious and deliberate decision (which also includes that this decision might be taken too late).

In sum, the involvement of others, be it intra- or extra-unit or even outside the hospital, always disseminates a twofold effect with respect to uncertainty: On the one hand, involved others might be able to release uncertain situations, therefore reducing uncertainty. On the other hand, involved others might add new uncertainty to a case as they cannot come up with clear-cut solutions for an unclear case but can only provide it with new suggestions or options that then need to be further explored. By this institutionalized uncertainty induction, path-dependency in patient treatment is prevented. Which of these two effects actually does unfold if others are involved cannot be anticipated beforehand. Therefore, the practice itself contains uncertainty for those practicing as they cannot predict the results of the inclusion of others.

### *Obsession with permanent doubt*

Another coping practice figures prominently, it is intimately intertwined with the two other practices: uncertainty monitoring and the involvement of others. We call it: obsession with permanently doubting the current course of action and contradicting present assumptions about a case. This permanent doubting and questioning is carried out during intra- and extra-unit contact sessions which contain a twofold function: Superficially, they serve an update function especially the information transmission sessions between shifts and between ICU and other units. Of course, this permanent updating serves the formal function of providing everybody involved with current information so that they can be responsive when an emergency occurs. However on a more deep routed level, these permanent updates, be they intra- or extra-unit, are systematically marked by permanent dissonance, contradiction and constructive conflict. Updates and update sessions are not simply carried out to provide everybody involved with recent news and changes in patients' condition. In fact, all those contact opportunities serve to infuse cases with doubt and conflict to prevent too early closure, too simple conclusions and too narrow resulting actions. Additionally, they are supposed to retain vigilance and a look for the extra-ordinary.

*During transmission session the leading senior physician becomes a little impatient and tries to hurry the resident who is reporting on the patient. He states: "Now let's talk about the relevant questions: Can we extubate him? If you really want to annoy me, you tell me parameters from the PICCO or the PAC [instruments who serve for extended monitoring; participating observer]. The PICCO may never seduce you to mechanically run after certain parameters. What's more important is: What is his clinical situation like? His gas exchange is really bad. If somebody goes through a bad gas exchange and you raise and raise and raise the PEEP [lung pressure parameter; participant observer] , maybe CPAP ASB is not the coolest ventilation mode."*

Summing up, the information transmission fulfills a twofold function: Formally, information transmission is carried out to keep everybody involved in a case up to date so they can be responsive in emergency situations. Informally, those transmission sessions are always arenas of systematic conflict and doubt. Whenever information is transferred and cases are being reported on, this is associated with questioning the current course of action and suggesting alternative courses. So informally in these sessions new uncertainty is induced again.

However, the informal function cannot exist without the formal frame of official transmission sessions.

This practice comprises sub practices that are assembled in a certain order. First part of this practice, to allow for a contradictory session, is that prime treaters (i.e. the ICU physicians) permanently update themselves about their patients' state and smallest deviations (by utilizing the monitoring practices described above). Physicians are meant to update their knowledge about patients during their shift by writing a patient state for the shift, i.e. that they examine the patient physically as well as on the computer, where a variety of parameters and values about the patient are available, and evaluate the patient's condition accordingly. The patient state is categorized from "top to bottom" meaning that the physician needs to evaluate all relevant vital functions such as neurology, cardio-pulmonary or abdominal function. The patient state is not only descriptive but it is physician's task to evaluate the results of his or her examination, i.e. if parameters have improved, deteriorated or remained stable and if there are new developments that point into a certain direction and might show early warning signs of a crisis. Producing the patient state then gives them the capacity to report during transmission sessions. There are formal transmission sessions three times a day between shifts (i.e. from early to late shift, late to night shift and night to early shift). During these transmission sessions when neighboring shifts meet, the shift that is leaving reports on every patient in detail on his or her leading problems, critical incidents during hospital stay, momentary problems and recommendations for further diagnosis and treatment. This leads to a detailed update for those taking over the patients and directs their attention to the problems needing to be approached. But especially from night to early and early to late shift, senior and ward physician participate in the transmission sessions and check on courses of action taken by residents, raise new questions and articulate doubt about present diagnosis or treatment procedures the patient momentarily undergoes. So this formal procedure of information transmission from shift to shift turns into a session of doubt and disagreement when senior and/or ward physician are involved, taking a position similar to those of the uncertainty agents described above. Furthermore, every participating physician (i.e. also residents) as well as the nurses who attend the transmission sessions as well have the opportunity to speak up in these sessions and articulate their opinion about the patient, i.e. everybody involved is asked to and actually does act as an uncertainty inducer. Permanent contradiction and disagreement characterize these sessions.

But updating sessions are not restricted to formal inner-unit transmission sessions between shifts. A second form of update takes place between the ICU ward and outside actors who are involved in a case. These update sessions, although they are not formally prescribed as the transmission sessions in the ward, fulfill the above described formal and informal functions as well, however the informal function is broader. Of course, these updating sessions that are normally carried out within the framework of temporal organizational arrangements formally give involved units the opportunity (1) to react to emergencies that involve their discipline and (2) to detect problems that are not intensive care nature early on. This serves to sense early warning signals to prevent an uncontrollable situation of unexpectedness on the one hand, and to provide a certain level of preparedness for unexpectedness on the other. Especially the cardiac surgeons who primarily place their patients in this ICU post surgery regularly visit the unit to be updated about their patients' conditions and to check them for post-surgery cardiac problems. With other (surgical) departments who do not place patients as regularly on the ICU as cardiac surgeons, temporal organizational arrangements are being set into place to keep these departments updated about their patients. Very often, the department names one representative who visits the unit in a fixed interval and is to be called when their patient's condition changes. Those also name a substitute who gets second-order updates and who is to be approached whenever the first-order representative is not available. The other way round, extra-unit representatives examine the patient from their disciplinary point of view and lay down their results in the patient data management system so that the ICU physicians know about particularities in the treatment and condition from this perspective and can integrate that in their course of action. This also includes that the extra-unit representatives articulate recommendations on how to proceed with the patient with respect to the problem they are treating.

But besides these formal functions, the updates have an informal impact as well. First, the permanent update of extra-unit actors is designed to raise or retain excitement about a case. Often, cases are being "sold" as highly interesting and extra-ordinary to outside actors that are to be involved in order to draw them to the case and create a certain obligation towards it. The idea is that those who are excited about a case consider and reconsider it permanently and voluntarily add new ideas to it without being called for. Additionally, this ensures their prime availability in emergency situations. Second, those informative or transmission sessions are again sessions of doubt, critical questioning and raising of new ideas. Often, when extra-unit actors are being updated about their patient's condition and the courses of action that have

been taken with them, this leads to constructive conflict whether the current course is adequate. This conflict often is a result from the different disciplinary backgrounds and consequential different perspectives on a patient (e.g. the cardiac surgeon primarily cares about the cardiac parameters like blood pressure or heart beat frequency as well as the cardiac wounds, the nephrologist primarily looks at the kidney parameters, the ICU physician claims to capture a complete picture of the patient). As there is no formal authoritative or hierarchical superordinate-subordinate relationship between those actors, those conflicts have to be settled by compromise and professional argumentation. None of the actors involved can simply order a certain course of action to be taken. The infusion of doubt, as could be observed, can even be that far reaching that representatives of other disciplines spontaneously prepare a small educational session for those who are being present on the ward during that shift.

*A pregnant patient who then gave birth to twins came to the ward because she was going to an unusual liver and kidney problem which made it necessary that the babies were delivered early on. As the ICU physicians were not sure about the cause for the kidney and liver problems and the resulting course of action, they involved, among others, a well-known senior physician from the nephrology department. He came to the ward in the morning, examined the patient and announced that he was going to give a short presentation on the most likely diseases the patient is suffering from in the afternoon. In the afternoon, all ward's physicians at service were called to the physicians' lounge and the nephrologist gave a brief presentation on the case, the potential diseases the patient was suffering from and a detailed analysis which of the potential diseases was the most likely one. As this was convincing and well thought through, the ICU physicians treated the patient accordingly. Her liver and kidney parameters quickly normalized and she could leave the ward.*

As demonstrated, by permanently involving and updating others in cases that are tangent to their specialty or sub discipline, uncertainty and doubt is carried into a case at hand. Constructive conflict arises as every other discipline involved understands itself as a systematic doubter that actually is involved to question the ICU course of action and to expand the perimeter of assumptions by suggesting new alternatives. Thus, the formal practice of updating other disciplines who are formally involved in a case due to their expertise and speciality contains an informal component as well. This informal practice not only attaches other disciplines more tightly to a case by arising their interest and excitement in a case, it primarily leads to a permanent systematic questioning and doubting of diagnosis and

treatment. Thus, we see another uncertainty induction practice which again prevents path-dependency.

Apart from extra-unit updating, the on-call physicians who belong to the unit but care for more than one ward during their services are being updated about the most critical cases as well with similar implications with respect to uncertainty. As the on-call physicians change every day, they try to participate in all transmission sessions between early and late shift and learn about their units' patients. They also approach the ward or senior physician to be quickly updated about the most critical or problematic patients in the ward they will need to direct their attention to. Again formally, by this permanent updating it is ensured that patient problems that might lead to unexpected catastrophic situations can be detected early. If situations quickly change and crisis could not be detected before, on-call physicians involved have a basic idea about the patient and its condition and do not have to start from scratch to become familiar with the patient when quick action is needed. This allows for rapid situationally appropriate reactions in unexpected situations as the leading problems and peculiarities of the patient are known and therefore the causes of a rapid deterioration can be uncovered faster, more easily and more sophisticated than in a situation when a patient is unknown (like in emergency units, where patients and their history normally are unknown to the physicians). But besides their formal jobs of assisting residents in late and night shift during non-routine situations, they also fluctuate between the wards they have to service and critically question the routine task performance of residents, i.e. they examine cases quickly and critically comment on them. Therefore, the assistance of an on-call physicians always goes in line with the potential of disagreement, doubt and consequential changes in a prescribed course of action. As one resident stated:

*“It is exhausting. If you call an on-call physician for help, they normally unsettle you. But it forces you to stay alert, especially during night shifts.”*

Summing up, intra- and extra-unit update sessions form another building block of a sophisticated uncertainty management that consists of a formal *raison d'être* complemented by an informal practice: First on the formal side, permanent updating of one's own and other discipline's representatives in close time intervals gives a great opportunity to detect early warning signals of rising crises very early so that catastrophic unexpectedness can be prevented. Furthermore, many “unknowns unknowns” are not early detectable. The



permanent update to all relevant actors leads to an informational advantage when the unexpected occurs. But second, on the informal layer the information transmission sessions are occurrences of systematic and institutionalized doubt. In those sessions, irrespective if they are intra- or extra-unit, those who are being updated regularly take over the role of the critical questioner and doubter, therefore infusing new uncertainty in an already defined course of treatment. Consequentially, treatment plans need to be permanently reconsidered, reevaluated and adjusted or even knocked over. However, this obsession with doubt that is associated with continuous uncertainty induction prevents too early closure and a resulting path-dependent treatment of patient cases.

### **3. Discussion**

As we have demonstrated by the first analysis of our data, one can find a variety of uncertainty practices in an intensive care unit that – by definition – is uncertainty ridden due to the critical cases that need to be admitted and treated there as characterized by literature and the uncertainty factors derived from our exploratory study. In particular, a multitude of coordinative mechanisms form a complex puzzle that allows for a sophisticated uncertainty management have been uncovered, of which the involvement of hierarchy by escalation of uncertain situations is only one among other options. Spontaneous teaming up, ad hoc coordination or the establishment of temporal organizational arrangements are further building blocks of this kind of organizational form.

As we have demonstrated, these practices do not only simple aid to mastering uncertainty by reducing it. In contrast, we could find first evidence for a set of practices that actually is designed to systematically induce uncertainty into cases by the involvement of a variety of outside actors that primarily take the function of critical questioners and doubters of courses of action in order to prevent cases to be diagnosed and treated too unilaterally. By systematically expanding the perimeter of actors to a pluralism of opinions and expertise, path dependency in patient care, especially in cases that are uncertain and unclear themselves, is prevented. In sum, formally prescribed courses of action or practices do also contain an informal layer that aids to a sophisticated uncertainty management, that combines uncertainty reduction and induction at the same time.

First, a complex interplay of coordinative mechanisms is used for early detection of warning signs of rising crises leading to unexpected situations. The combination of uncertainty monitoring by the nursing team, the continuous self-update of the ICU physicians' team and the regular information and integration of actors outside the unit by temporal organizational arrangements are designed to make sure that unexpectedness is detected before it can lead to catastrophic or fatal outcomes. For every case, due to its complexity and duration of ICU stay, a web of intra- and extra-organizational actors is knit that permanently monitors the patient according to the mechanisms described above to detect early warning signs of upcoming crisis. However, this network does not only perform the monitoring task but is also activated if warning signs could not be detected and unexpectedness is showing up. As pointed out, not all uncertainty can be detected early on, there are things that are simply unknowable and therefore undetectable. In terms of the ICU, this can for instance be rapid deteriorations in patient conditions e.g. by new infections whose germs can only be detected if the infection is unfolding already (as those germs need a certain time to grow and be detected in microbiological examination). In these situations of unexpectedness all "knots" of the network are immediately activated to provide their support on the uncertain situations, i.e. that they are either able to clear it up or to add options and ideas to the situation. Therefore, the network knit around a patient case takes an important role pre-unexpectedness (monitoring), whilst unexpectedness (solution generation) and even post unexpectedness (What have we learned from that situation? Where does it lead us for further patient treatment in this case?).

Second, understanding the ICU as an uncertainty management unit, we can state that such a unit – embedded in a larger organization (i.e. the university hospital) – contains organizational arrangements and integration mechanisms to handle the unexpected that so far have not been described in classical or more modern organization theory. For instance, we already pointed out that the unit, in contrast to Weick and Sutcliffe's (2007) claim, does not only rely on a hidden hierarchy based on expertise when facing the unexpected. Of course, experts are included when an unexpected events turn up but we did not encounter a shadow hierarchy which replaces the formal hierarchy. Things unfold differently. Practitioners oscillate intuitively and virtuously between the two worlds (Luhmann, 1995). They know when the formal side is unavoidable and they know when and how to act in the informal world. Often they do both simultaneously, they ask a formal supervisor and consult their personal network parallel. And even more, the formal supervisor often does not hesitate to ask subordinates to activate their network for getting advice. The perimeter of actors that are being involved in

reaction to unexpected situations is also shaped by availability (who is there and might give a hand?), experience and tenure (Salas et al., 2010) (who might have seen such a case before?), proximity to the patient (who knows most about the patient and can tell us about changes in patient's conditions/slightest deviations; this can also be relatives who report on patients pre-hospital), formal decision power and personal contact.

The organizational structure of the unit and the hospital does also not resemble modern organizational forms like the "heterarchy" (Neff & Stark, 2003; Powell, 1996; Stark, 1999) with flat structures and where accountability is shared and dispersed. What we found was a more complex interplay of hierarchical, heterarchical and spontaneous coordination like bricolage (Bechky & Okhuysen, 2011) or improvisation (Weick, 1998) principles.

Third and most remarkable, as pointed out, another distinctive feature of this kind of organizational form is that, in contrast to all other forms, this combination of formal organizational structure and informal practices is not only designed to reduce uncertainty. Several of the above described mechanism provide a twofold effect of uncertainty reduction as well as induction (see also Michel, 2007; Michel & Wortham, 2009) in that they not only resolve uncertain cases by reliance on organizational structure and hierarchy but add new uncertainty to a case by broadening perspective, raising new questions and doubting what has already been done. We found special mechanisms to induce uncertainty: The self involvement of representatives of the highest hierarchical level on operational level, the deliberate involvement of uncertainty agents by low hierarchical levels (supervisory board members, on-call physicians), the involvement of personal contacts intra- and extra-organizational equipped with special expertise and the associated obsession with doubt, leading to a permanent questioning and challenging the current course of action. The threat that ICU physicians stick to only one diagnosis with associated treatment path that has been verbalized early on a case can be understood as relatively low, as new uncertainty is infused permanently. This leads to an ongoing reconsideration and reevaluation of a case so that diagnosis and associated causes of disease are always regarded as temporary. The resulting treatment is also understood as a temporal solution until proven wrong. The underlying rationale is that all diagnosis is permanently precarious and can be substituted by newer ideas at any time. Therefore, associated treatment paths are also only working foundations until they are replaced by a different or more fine grained diagnosis and treatment plan. In extremely unclear cases, treatment is being carried out without any diagnosis at all. Instead, physicians operate upon a working definition of a patient state that might prove right, might prove wrong and will

therefore be replaced or might not prove to be neither definitely right nor wrong after all. In the latter case, the underlying rationale that is verbalized by physicians all over again is “Who cures is right”. In such cases, try-outs are set into place and physicians are primarily result-drawn, i.e. that they look for slightest effects of their treatment and reevaluate the case as soon as effects unfold. Due to this rationale of diagnosis being always precarious, which is ensured by the various uncertainty inducing practices described above, lock-ins are highly unlikely to occur.

In total, the organizational arrangement detected in the ICU and its integration into the larger organization of a university hospital hold certain features of Schreyögg’s and Sydow’s (2010) “balanced organization”, which – in contrast to more modern organizational concepts like the “ambidextrous organization” (Benner & Tushman, 2003; Duncan, 1976) claims that modern organizations need to balance flexible and adaptive functions with stabilizing and boundary maintaining functions at the same time in the same units. In a way the empirical explorations in the ICU provided some rough indicators for such balancing. However, without doubt further analysis is urgently required here.

Summing up, our first analysis uncovered an organizational unit that can be understood as an uncertainty management unit that has developed and is integrated into a complex web of organizational structures which comprises formal as well as informal coordination mechanisms to adequately and situationally appropriately treat critical problems. This involves early detection of as well as flexible and quick response to uncertainty which is provided by a sophisticated utilization of a complex web of intra- and extra-organizational actors and units. Additionally, uncertainty is not only mastered by flexibility, speed and the ability to adequately respond, more counter-intuitive, uncertainty is deliberately induced and created in patient cases in order to prevent too early closure, unanimity in patient care and consequential path dependency. The observed organizational unit seems to have some elements of the balancing model (Schreyögg & Sydow, 2010).

#### **4. Limitations and implications**

Admittedly, our first analysis is still raw and not yet detailed enough to allow for well-defined conclusions. The paper is designed to report on first results and the frame of reference underlying the empirical research. And goes without saying, no generalizations are allowed on the basis of these first insights of one case.

Next steps of the analysis must necessarily be a completion of the data set analyzed, a more detailed formation and description of analytic categories and a clearer theoretical demarcation of our organizational forms and coordination practices facing the unexpected that differ from those known in modern organizations theory. This means in particular that we need to unveil in detail why the unit being examined can be understood as a prime example of a “balanced organization” and how exactly this fluid organization works and unfolds: What are its mechanisms, organizational features and generalizable characteristics?

Furthermore, not all practices fit with all situations, effective tactics or practices reflect the context (‘contingent coping’). Hence, the question of generalizability of such practices needs to be addressed when studying them. Therefore, we need to demonstrate why those results derived from an extreme setting as the ICU of a university hospital can be generalized into universally relevant organizational concepts and why they hold relevant implications for modern organizations outside the health care sector.

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