

## Methodological Issues in the Quest for Resilience Factors

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**Abstract.** The study considers the means to enhance resilience in acute situations in order to improve safety. A first objective is to identify the resources which are needed and the resilience know-how which is developed by expert operators through practice in order to cope with acute events. The issue we address is a methodological one: how to collect existing resilience factors? A critical incident methodology was used to elicit the resilience resources and know-how of experienced anaesthetists. Results show the central role of a specific decision –calling a colleague for help- in the management of unpredictable incident. It is suggested that the study of pivot decision-making is a fruitful tool for investigating resilience factors.

### 1 INTRODUCTION

In the field of patient safety, anesthesia is viewed as a pioneer. In France, the rate of mortality due to this medical act measured in 2003 is 1/145000, that means 10 times lower than in 1980(SFAR, 2003). If we refer to Amalberti's classification, anesthesia can be considered as a safe system (Amalberti, Auroy, Berwick, & Barach, 2005). Indeed, it is generally agreed that this medical specialty has become safer through major advances in pharmacology, improvements in monitoring techniques and professional commitment to practice standards. Nowadays, post – accident analyses identify *operator error* or *human factors* as the main cause of the majority of anesthesia accidents (Clergue, 2004; Sfez, 2002). As a consequence, models initially developed in large complex systems such as aviation or nuclear power are introduced in medicine in order to “look beyond the label error” (Cook & Woods, 1994) and to characterize the growing complexity of socio-technical system (Hollnagel, 2008a).

According to these alternative views, failures are an outcome of normal performance variability (Hollnagel, 2004) and a “resilient system” is one able to “adjust its functioning prior to, during, or following changes and disturbances, so that it can sustain required operations even after a major mishap or in the presence of continuous stress” (Hollnagel, 2008b). Then, a way to enhance safety is to develop the system' ability to detect hazards and cope with the variability and the uncertainty of the system (Cook,

Render, & Woods, 2000).

In this context, our empirical research, conducted in three pediatric anesthesiology services of French hospitals, addresses the means to enhance resilience in acute situations in order to improve safety. One method of improving resilience could be specific training methods, similar to those used in the aviation domain with simulators. The first objective is then to identify the resources which are needed and the resilience know-how which is developed by anesthesiologists through practice in order to cope with acute events. Consequently, the first step of our research raises a methodological question: how to collect these existing resilience factors?

## **2 HOW TO COLLECT RESILIENCE FACTORS ?**

### **2.1 What ? When ? How?**

The first issue is to define what we are after, what resilience factors we wish to unveil. Resilience is characterized as a constant characteristic of the system under consideration. However, this does not mean that the resilience factors at work in the system are constant. It may be argued (and it has been) that resilient factors at work in the normal, daily course of action differ from the ones that are triggered by exceptional situations (Westrum, 2006).

This has methodological consequences.

In the former case ("normal" resilience), a detailed analysis of everyday operations should be conducted. Video recordings, auto or allo-confrontations are needed to decipher the microstructure of resilience. Scenarios are to be collected in context, during the target activity. Observations of activities, which can take different forms (ethnographic approach, systematic observations) are commonly used in ergonomist analysis. They can be aided with audio or/and video recording for example. Most of the time, these in situ observations are insufficient to reveal cognitive processes, so they must be completed with verbal analysis like follow-up interviews, verbal protocol analysis, or auto and auto and alloconfrontations (Mollo & Falzon, 2004).

In the latter case ("exceptional" resilience), the focus should be on extra-ordinary, rare, memorable events, on which a detailed analysis has to be performed : the context, the collective aspects, the succession of actions, decisions, interrogations, all need to be described. Scenarios are then collected a posteriori, i.e. after the occurrence of the incident. In that case, the most cited techniques are the Critical Incident Technique (Flanagan, 1954) and its related methods, in particular the Critical Decision Method (Klein & Armstrong, 2005). In these techniques, operators are asked to recall and describe incidents in which they were involved. In order to obtain more details on cognitive processes, probes can be used, in semi-structured interviews. In the initial method proposed by Flanagan, the incidents are described retrospectively from memory by the participant. Later methods added that the analyst may have identified an incident, via for exempld an adverse-events reporting system. In all cases, the type of instructions given for verbalizations is a crucial point: a small change in the instruction may affect the nature of the collected incidents (Flanagan, 1954).

## **2.2 What was done?**

The study was conducted in a University hospital in France, focusing on the pediatric anesthesiology department. After several weeks of “open-observations”, we chose to deploy an “*a posteriori* methodology”, based on the technique of critical incidents. Indeed, observations conducted have shown that (thankfully) few incidents occur in daily practice. And although resilience is an essential quality for any type of disturbance, it is recognized that “the determining characteristics are often easier to note in the case of events of an unusual scale or severity” (Hollnagel & Sundström, 2006). Indeed, the analysis of these incidents shows how the system behaves at the performance boundaries, ie simultaneously how it adapts and adjusts to cope with the disturbances and what are the limits of this adaptation (Woods, 2006).

Contrary to the Flanagan’s method, our collection of scenarios focused exclusively on cases of near accidents, where adaptation was successful. Our main hypothesis was that critical scenarios, during which anesthetists have been close to a serious event for the patient and were able to cope, may have left a profound imprint in the practitioner’s memory (Marchand-Sibra & Falzon, 2006). In that case, retrieved past scenarios of “resilient behaviour” could be used to identify specific resilience factors.

6 trained anesthetists were interviewed (4 with many years of experience). They were asked to recall near-accident situations, in which they were close to a severe problem for the patient, but where they managed to cope and get back to a stable condition. Each interview lasted for about 1 hour. Interviews were transcribed. A content analysis was performed, in order to describe what subjects considered as a critical situation and identify the resources that allowed them to cope with the situation.

## **3 IS THERE A PRACTITIONER’S MEMORY OF “RESILIENT BEHAVIOUR”?**

### **3.1 Salient episodes in practitioners’ memory**

22 situations of near accidents, dating from “a few days’ ages” to “20 years ago”, were recalled by anesthetists during interviews. They allow, as a first step, to draw up some characteristics of near accidents marking the memory of anesthetists. The first characteristic of these scenarios concerns the severity of the situation. All the situations reported are situations where the patient’s life was at stake, for which the anesthetist said he narrowly avoided the death of the patient. The second characteristic refers to the temporal dimension of scenarios remembered: most situations are “acute” situation where “time passes very quickly”, where monitored parameters are changing “brutally” and where anesthetist must “act in urgency.” A third feature concerns the emotional content of narrated episodes: in half the cases, interviewed practitioners spontaneously evoke memories of “fear”, “stress”, “concern” or “anguish”. There are also several references to feelings of guilt. For example:

*“But clearly we therefore felt... finally I mean, it was an accident - the cannula was*

*blocked - but we were not perfect, I had the feeling ... telling me "Damn, I should have found the hole in the tracheo. It is because I have not found that he had a cardiac arrest."*

One last point relates to the unexpected nature of the situation: all recollected situations were characterized by practitioners as “unexpected” events. But a more detailed analysis of scenarii shows that the concept of “unforeseen” is vast and includes many different situations. It is also mentioned by some practitioners that “there are levels of unpredictability” that some episodes are “more or less predictable than others”. Indeed, unexpectedness can arise in different ways. An unforeseen situation may be a situation that is already listed, well known and codified in the profession: it can only be a situation the occurrence of which remains uncertain. In this case, the “unexpected” is not directly related to the event but to the time of occurrence of this event, that could not have been anticipated by the anesthetist. At the opposite, a situation may be unexpected in its very nature: the event itself has not been foreseen by the anesthetist. The situation does not surprise by its "unexpected" occurrence but by its very nature, which has not been considered.

### **3.2 Episodes’ categorization and factors “to cope”**

According to these distinction between types of “unexpected” events, we categorized the 22 episodes of near accidents retrieved by anesthetists into two classes:

- Coping with known-events occurring at random,
- Coping with unpredictable events.

**Coping with known-events occurring at random** Nine situations have been categorized as critical situations where "the unexpected" refers to the time of occurrence of the event. These situations are described as relatively frequent situations: the anesthetist "expects it at each intervention." In this case, similar situations are told several times by different anesthetists. The diagnosis is almost immediate and the means employed to “cope with” cited by practitioners are systematically algorithms.

Example: *A patient who never underwent general anesthesia must be operated urgently. The assessment of risk criteria, particularly intubation, usually made during the pre-anesthetic visit has not been made. The intubation is very difficult and anaesthetist cannot put in place the breathing tube. To face the anaesthetist "follows the protocol to the letter : several attempts at intubation, chuck, then fast track. "*

**Coping with unpredictable events** Thirteen cases were classified as surprising situations by the nature of the event and the course of the situation itself. In these cases, anesthetists had not envisaged such a situation and were in difficulty

- either for identifying and understanding the situation: the diagnosis is not immediat and since the problem is not identified, it is impossible to bring the situation in stable condition,

- either for implementing ways to cope: protocols cannot be applied, provided technical gestures do not work or surgical team does not meet the demands of the anesthetist.

In all these situations, the main factor that allowed the anesthetist to cope with the challenging reported event is the call to a colleague as reinforcements. The other cited elements are personal characteristics as "instinct", "reflex", the ability to "improvisation".

Example: *At the end of an intervention, when being transferred in the recovery room, the child becomes black, cyanotic, bradycard. The anesthetist calls the rescue. Two colleagues arrive and take turns to perform cardiac massage. In parallel, the three anesthetists think together in order to understand the event : checking equipment, clinical diagnostics, radiological examination ... After ¾ hours, the diagnosis is made (pneumopericardium), one of them performs the technical gesture that will bring the child back to a stable state.*

### 3.3 Conclusion

The salient episodes in the memory of anesthetists are not necessarily exceptional or rare episodes during which specific ways to cope had to be made: among remarkable situations, almost half situations are identified and protocolised. These procedures provide the ability "to react and recover from disturbances at an early stage" (Hollnagel, 2006 p.16), in similar and frequent situations. But they are insufficient to enable the system "to handle unanticipated disruptions" (Woods, 2006, p.22). And when anesthetists recall unpredictable situations, it is difficult for them to determine what has enabled them to cope. The "instinct", "reflex", and "improvisation" are vague concepts that do not allow us to specify the "factors of resilience": It is inconceivable to ask someone to "better improvise" or to "improve his reflexes". Only the "call for colleagues" appears as a "key point" in the analysis of these two types of scenarii. In most unpredictable situations, the anesthetist in charge of the patient took the decision to call for help, while in "random" situations, although there are serious, distressing, urgent and unforeseen situations, he/she remained alone to cope (with the team already in place). The call for additional resources appears as a key variable to enable the system to adjust its functioning to change of situation.

## 4 THE CALL TO A COLLEAGUE: A KEY ADJUSTMENT VARIABLE

"Calling for aid" is part of several algorithms referenced in anesthesia. But the decision criteria ("when the situation is serious" or "unforeseen") leave a wide margin of interpretation for the practitioner. *"We must call ... but, the most important thing is to think about the question: Do I call for help or not ? And immediately or do I take one or two minutes to assess things? ". Calling depend on the seriousness of what is happening and there is no absolute rule about calling for help or not. "* Especially because the decision to call has a cost: *" If it occurs in the operating room, in the morning, there is someone in the room next door and in these cases, presumably, one hesitates much less to*

call [...] but waking up a colleague at 3:00 in the morning... " This cost is variable, depending on the time of day and place, as in the example above, but also in terms of the team and collective work. In some services, "practitioners quickly call for help, they remain not alone, they know each other. " "But this is not the case everywhere." Then the decision to call is not only based on the assessment of the situation by the anesthetist but is rather a trade-off between the assessment of the situation and the cost of mobilizing additional people. This decision is individual: Several stories show a disagreement between the senior anesthetist and the resident:

- "I have not sought to call a colleague. I acted, I intubated... but the resident wanted to call"
- "And there, in fact, the resident did not like that I call one of my senior colleagues "

This decision is constructed with experience. After having narrated an incident, an anesthetist says: " I thought about that, and what I reflect is, in the future [...], as soon as I ask myself whether I should call someone , I'll do it., to avoid as much as possible to find myself in a situation where I regret not having done so. "

Finally, this adjustment variable is only possible if colleagues are present and available to meet the demand. The planning service is set up by a senior anesthetist who, beyond legal obligations, "is careful to who composes the day," taking care "as long as possible to put a senior in the team". "Because even if it is always a doctor and a nurse, this is not the same thing if it is a young doctor and a nurse who has just arrived or if it is a doctor with a younger former nurse etc. ".Moreover, on top of that "official" planning, an "informal" planning is introduced: "we have unofficial "being on call", it has been a code between us for a very long time; we say: "I'm home if you need.." Well, there's always some body in (the city of the hospital). It seems nothing but it is very important to know who is where and who does what and how it is organized ".

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