Working paper submitted for 'Ethnographies of diagnostic work' 17-18 April, Lancaster University, UK.

RESOURCES OF RESILIENCE:

AN ETHNOGRAPHIC STUDY OF HIDDEN COMPETENCE IN CRITICAL CARE PRACTICE

Jessica Mesman

University of Maastricht

Dept of Technology and Society Studies

PO Box 616

6200 MD Maastricht

Phone: 0031 - 43 - 3883339

Email: j.mesman@TSS.unimaas.nl

1. INTRODUCTION

Diagnostic abilities play a crucial role in patient safety. The competence of medical staff to notice complications and take proper remedial action is of utmost importance when it comes to preventing the occurrence of unwanted medical incidents. However, maintaining patient safety on the basis of sound practice is as important as taking preventive action. This requires the ability to recognize safe and sound practice. In other words, patient safety requires one to detect not only the gaps in the safety net, but also the structure of the net itself. This second ability, I will argue, can be considered as a form of diagnosis as well. It involves the ability to identify 'good practice' and act accordingly. In the staff's effort to secure patient safety, this second notion of diagnosis can be considered as complementary to the first one. Before elaborating these two diagnostic modes, I would like to introduce my research project on patient safety. Next I will present the two forms of diagnostic practice as part of patient safety, with special attention to the second diagnostic mode and its related processes of transduction, meta-stability and patterns of coupling and de-coupling.

2. INTRODUCING PATIENT SAFETY RESEARCH

Patient safety research

Safety issues are currently topping the agenda in health care. Recent studies show an unacceptably high level of adverse events and near-misses. Examples of adverse events are transfusion errors, adverse drug events, wrong-site surgery, restraint-related injuries or deaths, preventable suicides, burns, falls and treatment-related infections. Critical care units such as the intensive-care unit (ICU), the emergency room (ER) and the operation room (OR) can serve as exemplary contexts for studying patient safety. With their high level of interdependency and interrelations, many acute care practices are quite

vulnerable systems. The potential of catastrophic consequences and the interactively complex technology turn these practices into 'high-3 work environments': high-technology, high-intensity and high-reliability. High-3 practices are characterised by complex systems, tightly-knit infrastructures, a profusion of technologies, time as a major constraining factor and a high level of reliability. The intervention process in acute care situations has grown extremely complicated over the past two decades, and today it involves more decision moments, more options and their related risks, and more pronounced dilemmas and uncertainties for everyone involved. Errors may lead to unacceptable and irreversible consequences. This is why much of the current patient safety research focuses on the detection of causes of incidents and near-misses. Protocols and devices are adjusted or developed to eliminate the particular causes of adverse events.

Resources of Resilience

Defining patient safety as the absence of errors and incidents involves a too narrow focus. Patient safety, I would like to argue, is more than the absence of incidents. We also need to define patient safety on basis of what it is, instead of what it is not. In this perspective patient safety becomes the realization and preservation of maximal safety. This change of focus will bring other elements of patient safety to our attention and yield another set of questions. This is why patient safety research should not only focus on the causes of error, but should also include analysis of the resources of strength of a sound and reliable practice. The identification of the strength of critical care practices - their so-called resilience - is as important as the identification of these practices' vulnerability. After all, considering the high risk environment staff members work in and the innumerable complexities involved we can ask ourselves why things don't go wrong more often. A key question in patient safety research, then, is the following: What are the resources of resilience in a specific practice? In answering this question, one should not only focus on the explicit, intentional or formal safety measures, such as protocols and technological equipment designs, but one should also analyze the informal or implicit

elements of the safety structure. Patient safety is also achieved through an unplanned and perhaps unarticulated set of actions and initiatives that can still be effective. My research project, then, aims to explicate also the informal resources of resilience that enable staff members of a critical care practice to manage the unexpected and rise above decision-making dilemmas in order to maintain optimal patient safety.

With this approach I deliberately move away from 'deficit' models, which are based on error analysis. In other words, rather than addressing the gaps in the safety net, I focus on the structure of the safety net. Moreover, I would like to emphasize the need for a better understanding of patient safety by analyzing the resources of resilience of a critical care practice. Exclusive analysis of errors and breakdowns cannot illuminate the strength of a practice. Moreover, prevention of errors can interfere with practices of resilience. Instead of making things safer, it might destroy perfectly well functioning practices of resilience.

In sum, the aim of my project is to elucidate the hidden competence and the informal built-in structures that are part of systems of safety. As such this study has to be considered as critical towards, yet complementary to, studies on patient safety with a focus on the detection and elimination of causes of error.

Exnovation

This project, however, should not be viewed as 'just another case study'. Instead, its analytical scope and effort can be understood as an act of exnovation: that which is already present in practice is foregrounded and the implicit is made explicit. Importantly, more than innovation, exnovation does justice to the creativity and experience of the actors involved, as they assert themselves in the particular dynamic of medical practice. It offers a new perspective on their competence and the structure that comes with specific styles of ordering day-to-day practices. Moreover, analyses of hidden competence reveal not only the complexity of treatment trajectories and the inventiveness of those involved,

but also the limited power of medical technology and formal protocols and regulations to solve medical problems and sustain patient safety. If theoretical development and practical insights rely on error analysis only, these kinds of accomplishments will always remain a hidden feature of the everyday medical practice involved.

Data collection

To excavate the locus of strength of critical care practices I am doing fieldwork in a neonatal intensive care unit (NICU). As an outpost of today's health care system where the pioneering sprit of medicine reigns supreme, the NICU can serve as an exemplary case for studying patient safety as one of the concrete vulnerabilities in the health system triggered by a permanent dynamic of change and the growing complexity of health care systems. NICU's are specialized in the care and treatment of newborns. Very young babies end up in a NICU because their lives are seriously at risk on account of their prematurity, complications at birth, congenital diseases or potentially lethal infections.

3. DIAGNOSIS AS THE ABILITY TO NOTICE TROUBLE AND TAKE REMEDIAL ACTION

The ability to notice trouble and see scope for remedial action is crucial for the preservation of patient safety. It provides the basis for prevention of incidents. It is due to this diagnostic act that incidents can be avoided.

To notice trouble staff members are supported by all kinds of technical devices, such as monitors and alarm bells. However, this is all but sufficient to cover the range of areas comprising potential problems. Most measures focus only on the bodily functions of the baby, while trouble may be hiding in every corner of the treatment trajectory. Therefore, staff members have to take into consideration all the possible configurations that have the potential to create problems. In a critical care environment such as a NICU, with an exceedingly vulnerable patient population, this applies to almost every act and decision. After all, in this delicate environment all that is happening, being done and decided (or, for that matter, *not* done or decided) has the potential of turning into a problem. The multitude of possible causes of trouble made me wonder how staff members actually prevent themselves from not becoming overwhelmed by this avalanche of possible mistakes and unforeseeable incidents. How do they avoid drowning in an ocean of errors which may or may not be committed but which, surely, someone is bound to commit at one point?

Listening to their discussions and reading their notes I became aware that they do not consider each and every moment or intervention a potential disturbance. They arrange the complex medical reality in which they work into a manageable reality by *simplifying* it. In order to identify trouble staff members simplify the overall socio-technical configuration of the treatment into a spatial entity. They reconfigure the treatment at hand as a protective area with multiple entrances and exit points between multiple boundaries on various levels. In this specific order, staff members act as gatekeepers and focus on gateways. They check *what* goes in and out (substances, information); *how much* goes in and out (fluid balance, medication dosage); and whether elements are *miscible or not* (medication, machine and body). The protective area includes more than just the baby's

body. It involves the entire socio-technical configuration of treatment. As such gateways can be found at many locations and moments, for example, inside the body of the child (gastro-enteral track, lungs, blood system etc), on the body (skin, mouth, etc), during the changing of shifts, in and outside the incubator, in IV-lines, the patient record, the neonatology ward, the disciplines involved and the stream of information for the parents involved.

The reconfiguration of the child's treatment as a protective area with multiple gateways enables them *to focus* their attention. They focus on input and output, such as numbers, words, fluids, substances, ideas, treatment policies and protocols. They enter or leave the treatment zone in the form of test results, medication orders, doctors, information, emotions, opinions, food and blood, gasses, plastics and equipment. It is of utmost importance to be sure that the correct things go in and out: that the right information is entered, that the doctor uses the right protocol, that the correct kind of blood is drawn for blood tests, that the nurse notes the right heart rate on the flow sheet, and so on and so forth. Although a lot of attention and concentration is still required, this approach provides staff members an '*adequate tunnel vision'*. Instead of trying to look everywhere and cover everything in every possible way at any moment, they simplify their world into a manageable reality. In other words, the diagnostic competence that involves the identification of problems timely requires an additional ability: the skill to manage the huge number of potential causes of errors and incidents. This is accomplished through the act of simplification, which allows the actors to focus their attention. Instead of a multitude of moments, locations and kinds of possible errors, staff members regard the situation as a protective area with gateways. As well-trained gatekeepers they now focus on substance, quantities and the miscibility of everything that enters the treatment area. The act of simplification is crucial in this matter. As is true of many professional practices, medical practice is in fact rife with processes of simplification. For example, narrative simplification is inevitable when patients are transferred from one unit to another, or their identity is simplified when they are hooked up to a machine.[i] Similarly, I would like to

conclude, simplification proves essential for being able to notice trouble and take remedial action.

4. LOGICS OF PRACTICE

The first form of diagnosis is related to prevention of incidents. Its strength lies in the combination of simplification, the identification of problems and taking remedial action. In this way doctors and nurses can take care of the gaps in the safety net before problems can turn into unsafe situations. However, preservation of a maximal level of patient safety can also be achieved by strengthening the safety net itself. In this case it is not about trouble, mistakes, imperfection, flaws, and inadequacies, but about things going well, about how they are supposed to be – it is about safe and sound practice. Therefore, not just the gaps in the safety net but the safety net itself should to be taken into consideration when we aim to preserve and optimise patient safety.

However, do we actually know which elements constitute sound practice? Do we actually grasp the composition of the safety net? We may think so, but do we really? Do we really know what and why things are going well and how they secure patient safety? Are we able to recognize unplanned or unarticulated yet effective sets of action? Are we able to identify the informal initiatives which contribute to an optimal level of patient safety? Do we know enough of what it is that turns practice into sound practice? To gain insight into these matters we need to account for the formal and informal resources of resilience in specific practices.

A focus on sound practices involves more than a focus on 'an error-free' form of action and reasoning. Instead of being the error-free counterpart of unsound practices, sound practices should be defined on the basis of their own modalities. From this perspective good practices can be regarded as specific arrangements of processes which constitute the fabric of practice. These arrangements of processes are socio-technical

configurations that include elements of a different kind, such as technical and social devices, people, norms, formal and informal knowledge, customs, and temporal-spatial and social orders. Also specific styles of reasoning and acting can be considered as constitutive parts of the fabric of practices. We may consider them, alternatively, as the basic logics. I will try to identify the basic logics which have significance for patient safety. In this way I hope to gain a better insight into the resources of resilience.

What basic logics of practice can be identified as being relevant to patient safety? On the basis of my field notes I have identified a provisional set of logics that constitute the fabric of a safe and sound NICU practice:

1. The act of simplification
2. The geography of patient safety
3. Spaces of experience and horizons of expectations
4. The priming effect as mindset and mindfulness
5. Processes of coupling and de-coupling

These logics act as constituents of the safety net. As explained in the previous section, the act of simplification can be considered a prerequisite for noticing trouble. The geography of patient safety is a formative dimension of the spatial order. Spaces of experience and horizons of expectation are the locus of anticipation and improvisation. The priming effect adjusts mindset and mindfulness. Coupling and de-coupling can be considered as a specific form of collaboration. Collaboration, simplification, location, anticipation and awareness: all are crucial for the preservation of patient safety. In the next section I will discuss the last logic: coupling and de-coupling as specific form of collaboration. To gain insight in collaborative practices I will offer a brief description of one specific complex medical procedure: the intubation of a trachea-tube. Rather than seeking to provide a detailed description of a collaborative act, my basic discussion

merely serves to explain the process of coupling and de-coupling in the context of a critical care practice.

5. TRACHEAL INTUBATION

Tracheal intubation is the positioning of a tube of a ventilator for artificial respiration into the windpipe (trachea). Artificial air supply is indicated in case of respiratory insufficiency due to underdevelopment of lung tissue in case of severe premature birth, airway obstruction, infections etc. To provide the baby with oxygen the tube of the respiratory machine needs to be inserted into the nose (or mouth), passing the glottis (the space between the vocal cords in the voice box) and into the windpipe. This procedure is not without risks. It is possible, for example, that one ruptures the windpipe, intubates the oesophagus instead of the windpipe, inserts the tube too high or too deep, or damages the vocal cords.

This invasive procedure requires a lot of clinical experience. In teaching hospitals residents need to learn how to intubate a baby in a correct way in a short time span, sometimes under difficult circumstances. Most of the times four persons are involved: a resident who will perform the procedure, a neonatologist who supervises the resident and two nurses. One nurse will assist the doctors, while the other nurse assists the neonatologist and/or the nurse. As such, the procedure requires close collaboration of a number of people and a set of special socio-technical and cognitive devices.

During the preparation nurses check the respiratory machine and collect everything that is needed for the intubation: the laryngoscope (handle, blade and light source); McGill forceps, suction equipment, mask and balloon, tube, tube fixation, stethoscope, suction catheter, pair of scissors and medication. The neonatologist decides on the size of the tube and laryngoscope to be used and communicates his decision to one of the nurses.

The nurses check whether everything works properly. Meanwhile the neonatologist and the resident go over the whole procedure to anticipate the sequence of actions.

Before the doctors start, they too check whether the instruments work correctly. To avoid a non-stop alarm from sounding and ensure a tranquil environment for the nervous resident, the neonatologist has switched off the alarm of the monitor. When everything is ready, one of the nurses sedates the baby. This nurse indicates the exact moment of the infusion of the sedation medication. For the resident, this is the green light to go-ahead. While the resident opens the mouth with the laryngoscope and pushes the tube through the nose, one nurse keeps an eye on the saturation level (oxygen percentage in the blood) and heart rate on the monitor and informs the neonatologist non-stop about these figures. If the saturation level is too low, the neonatologist orders the resident to stop the intubation so the neonatologists can supply some extra oxygen by ballooning with a bag until the monitor shows a sufficient oxygen level. At this point, the resident is allowed to continue. The laryngoscope helps him/her to see the windpipe. When he/she has the windpipe a-vue, he/she will use the McGill pincers to position the tube between the vocal cords.

During the whole procedure one nurse holds the baby's head or arms and the neonatologist informs the resident what to look for and when to do what, while he/she listens to the information of the nurse about the saturation level. Once the tube is in the windpipe, the tube is fixed to the balloon, while the neonatologist listens with a stethoscope if the tube is in the right position. He/she checks the thorax motion, sees whether there is any improvement of the skin colour (was blue) and looks at the display of the monitor to check heart rate and saturation level. The resident will do the same.
When the neonatologist is convinced the tube is in the right place, the nurse connects the tube to the ventilator. The resident calls the radiology department for an x-ray to confirm the correctness of the location. In the meantime the two nurses will fix the tube with tape, fix the hands of the baby and connect the tube to the ventilator.

6 PROCESSES OF COUPLING AND DE-COUPLING

Witnessing an intubation procedure makes you aware of the importance of skills and senses. First of all intubation requires careful observation: looking inside the throat (resident); looking at the skin colour of the baby (neonatologist); looking at the monitor for the frequency of the heart rate and saturation level (nurse); looking at the pressure gauge on the balloon (neonatologist): looking at the length of the tube once it is positioned in the windpipe (neonatologist): looking at the thorax to check breathing while ballooning (neonatologist).

Second, intubation requires careful listening: the nurse listens to the resident while assisting him/her; the neonatologist listens to the nurse while she informs him about the figures on the monitor; the resident listens to the neonatologist while he/she instructs him; the neonatologist listens to the lungs after the baby has been intubated.

Third, intubation requires skilful hands: to hold the baby's head and hands (nurse); to use the laryngoscope and McGill tong (resident); to bag the balloon in such a way that the baby receives enough oxygen again (the neonatologist); to position the stethoscope to listen to the effect of the intubation (neonatologist and resident).

My brief description of this intubation procedure underscores that medical interventions may require multiple eyes, ears and hands, and that this entails a high degree of close collaboration. This form of collaboration seems to transcend a normal disciplinary distribution of tasks. The actors involved have to act as one entity.[ii] They have to become 'one intubating body', so to speak, with multiple eyes, ears, mouths and hands. This form of collaboration differs from, for instance, a sequential form of collaboration in which actors take action one after another, instead of at the same time. In the case of intubations the key activities have to be carried out at the same moment. This is not a matter of alternating roles, but of becoming one acting body.

Tight coupling

To intubate requires a collaborative mode that has to be so well-timed and accurate that it can be defined as a form of tight coupling. Tight coupling refers to a situation in which what happens in part A directly affects what is happening in part B.[iii] In the case of tight coupling there is no buffer or slack between two or more components of the system. In the case of intubation, tight coupling provides a solid base for a successful and safe procedure. But what, exactly, do I mean with 'tight' in this case? Is it that the actions are carefully coordinated, while still leaving room for corrective measures if necessary? Or is it that the boundaries of the actors' roles are rigidly defined?[iv] In the case of intubation I use the first notion of 'tight'. This form of close collaboration does not deny the division of labour and responsibilities, but instead focuses on the overlap of knowledge and skill necessary in order for a number of staff to act as one entity. If a neonatologist for whatever reason is unable to watch the saturation monitor (e.g. the heating system of the incubator blocks his view), safety is not necessarily compromised because the nurse is still able to watch the monitor and inform the neonatologist. Tight coupling leaves room for such compensation.

This raises the question of how doctors and nurses manage to become such close-knit team? In other words, I am less interested in what this collective of people, devices, and machines *is* (its being or ontology) than in how it became a socio-technical ensemble (its becoming or ontogenesis). This concern warrants taking a closer look at the genesis of this tight and stable ensemble. The genesis of a collectivity as a stable entity can be regarded as *a process of transduction*.[v] A transductive process is a process which occurs when an entity individuates. It is the encounter between chains of different operations in which realities of heterogeneous domains are linked. What existed prior to the transduction as separate (doctor and nurse, medical knowledge and nursing knowledge, and so on) emerges as a coherent ensemble. How is it possible that different constituents of the ensemble can act as one entity? How do they manage to become one acting body of knowledge and skills?

One crucial element in the coupling process is the *coherency of thinking* of the human actors involved. The coherency of action is mirrored by a coherency of thinking. Both doctors and nurses have their own responsibilities and, as such, their own protocols. However, the nursing protocol for intubation is developed along the same line of thinking as the medical one. The overlap with the medical protocol is striking indeed, as it refers to medical indications, contra-indications and medical complications. Strictly speaking, it is not a nursing protocol.[vi] After all, nurses have to deal with objectives, indications and complications tied to their own specific role. Not in this case, however. In the case of intubation the nursing protocol was designed within the medical frame of thinking. According to one of the nurses, the protocols should overlap as much as possible because no one involved can afford staying one step behind: 'There is no time to do one more step if immediate action is called for.' The coherency of the protocols results in analogous anticipation, thus facilitating tight coupling. It is not so much that the nurse's actions are merely a response to the doctor's indications. On the contrary, there is a coherency of anticipation which is crucial for a coherency of action.

De-coupling

However, procedures such as intubation also involve moments in which doctors and nurses do not act as one entity. In the preparatory stage or after the actual intubation, the actors may focus on their own activities. For instance, after the intubation, the doctors take care of the paperwork, while the nurses check the fixation of the tube. These separate actions have to be done simultaneously and initiate a de-coupling process. These alternating moments of coupling and de-coupling can be understood as a *regime of meta-stability*.[vii] Meta-stability is a provisional form of stability. This implies that the actors have to be coupled tightly enough in order for them to act as one entity, while preserving the ability to de-couple and act as separate but interrelated sub-systems. Complex procedures like trachea intubation require a form of collaboration that can deal with this need for meta-stability, this ability to couple and de-couple.

7 CONCLUSION: ANOTHER FORM OF DIAGNOSIS

Patient safety, as I have argued, can be sustained on the basis of preventing incidents and preserving the accomplished adequate level of performance. Prevention requires the diagnostic ability to notice trouble and take remedial action. The preservation of an optimal level of patient safety can be achieved by strengthening the safety net itself as well. To strengthen what is already strong involves active involvement, changes, shifts and adaptations. This, I would argue, requires another diagnostic ability. It is the ability to recognize good practice and act accordingly. Moreover, this ability is also relevant for the prevention of incidents. After all, to recognize the gaps in the safety net presupposes the ability to identify the safety structure itself. Hence, this form of diagnosis has its focal point in the basic logics that constitutes the fabric of practices and secures a safe and sound practice. In this paper I have briefly touched on two of these logics, forms of simplification and collaboration.

However, if staff members are trained to identify problems, they are not explicitly trained to identify the basic logics of their practice. Most of the times, they will hardly realize that they are using simplification as a tactics. Also, collaboration is considered as just a matter of 'working together'. A closer look at their daily activities, though, reveals a rich repertoire of collaboration and simplification, of using space and time as well as different styles of reasoning. Exnovation of these hidden competences can improve actors' diagnostic ability and allow them to recognize these resources of resilience. Having the diagnostic ability to identify the presence of, for example, processes of coupling and de-coupling while performing certain interventions such as intubation will contribute to patient safety. These and other logics deserve as much attention as the troubles, errors and incidents. Put differently, reliable and adequate processes deserve as much attention as disturbing ones and therefore need to be recognized as such.

Acknowledgement:

I would like to thank Dawn Goodwin and Monika Buscher for organizing this workshop and the participants for the inspiring discussion after my presentation.

[i] These examples are based on the work of Maggie Mort, Dawn Goodwin, Andrew Smith and Catherine Pope in the field of anesthesia.
[ii] I am aware that in this situation also the respiratory machine, the monitor, the balloon, the baby, and more elements are part of the collaborative act. However, in this presentation I will only focus on the staff members involved.
[iii] In the area of safety studies - more particular in the work of Charles Perrow, 'Normal Accidents' (1984) - 'tight coupled systems' are considered as vulnerable.
[iv] I want to thank Dawn Goodwin for pointing out this difference to me.
[v] The use of this concept is based on the work of Adrian Mackenzie (2002).
[vi] One of the nurses was not yet trained as a neonatology nurse. It was her amazement that made me aware of this overlap.
[vii] MacKenzie, 2002