Extemporaneous Adaptation to Evolving Complexity: A Case Study of Resilience in Healthcare

Shawna J Perry [1], Robert L Wears [1, 2], and Brandon Anderson [1]

[1] College of Medicine University of Florida, USA
sperry@ufl.edu; brandonanderson@jax.ufl.edu
[2]Clinical Safety Research Unit – Imperial College, London
wears@ufl.edu

Abstract. The work of healthcare is performed in a guild fashion with few instances of simultaneous cooperative work that crosses traditional boundaries of responsibility and authority. The following is a case of resilient performance during a medical crisis, in which several individuals from unrelated specialties who had never before worked together cooperatively, adapted quickly to shifting goals. Study of such successes and failures within healthcare may elucidate the conditions, features and characteristics necessary for sustained resilience in clinical care.

1 INTRODUCTION

Healthcare organizations are complex institutions composed of guilds of specialized workers (i.e. clinicians, allied health staff, administrative personnel) who work fairly independently to provide or support medical care. The degree of coupling between their work activities and patient care is highly variable and often opaque to not only patients but to the workers themselves. In order to minimize complexity of healthcare delivery, the work processes of each guild have evolved to minimize their interdependence, despite the high degree of interdependency within the system. (Rudolph, 1995)

In the hospital setting, physicians traditionally work within a hierarchical structure with fairly rigid boundaries for responsibility and authority in medical decision making and provision of care. Because of these boundaries, assessment and care is provided at a "cooperative distance", performed in a sequential fashion, with only one group "working" on the patient at any given time. Endorsement of these boundaries could be found in the nature of acute medical care, which involves working on an "individual" who cannot be easily dissembled with individual parts worked on in a piecemeal fashion and re-assembled when all problems have been solved. It is further supported by the growing sub-specialization of medical care, resulting in a more narrow view of the patient's care and impoverished understanding of other domains and opportunities for collective simultaneous clinical work. (Hashem, 2003, Swartztauber,2003) It had been demonstrated that specialists generate diagnostic hypotheses for a case that are biased toward their own specialty, list more hypotheses from their own domain than from others (indicating bias toward their specialty), and assigned a higher probability to those diagnoses within their domain than to those from other domains. (Hashem, 2003)

Rules for physician reimbursement in the United States further reinforces "cooperative" sequential care rather than collaborative care with stringent limits on remuneration (in some cases, no compensation) when several physicians are involved in a patients

care in a substantive way. Opportunities for crossing these boundaries of clinical work are not sought and are rarely crossed except when necessary. These few instances are stereotypically choreographed interactions deemed necessary for short periods, *e.g.* anesthesia and surgery must work simultaneously on the patient to perform an operation or an emergency physician will provide procedural sedation while an orthopedist reduces a fracture. In these situations, the silos between specialties are maintained and interaction is limited to communication on a "need to know" basis, *e.g.* anesthesia informing the surgeon that the patient's blood pressure is dropping after unexpected bleeding occurs but no discussion may occur of what the intervention for this finding should or will be.

This objective of this paper is to present a case study of an event in which these boundaries were crossed and resilience extemporaneously created by clinicians from different specialties (most of whom did not know each other) in the face of expanding complexity, growing unpredictability, and increasing risk.

2 CASE NARRATIVE

This event occurred in a 696 bed urban, teaching hospital United States and is part of an 8 hospital network. The facility has over 400,000 patient visits per year with 300 residents and fellows in training, 275 attending physicians and 330 support staff.

Sequence of events. A 33 year old female, who was 37 weeks pregnant, presented to the Emergency Department (ED) with a complaint of abdominal pain and chest pain for 24 hours. The patient was sent to the labor and delivery floor per hospital protocol for evaluation of pre-term labor and fetal monitoring. Initial assessment by the Obstetrics and Gynecology (OBGYN) resident found no significant problems but during the night the patient developed increasing chest and abdominal pain with unstable blood pressure. The OBGYN resident called his supervising Attending physician for assistance in the early evening, some 9 hours after presentation to the hospital.

Repeat assessment by the OBGYN Attending strongly suggested a heart attack as the cause of this patient's worsening condition and the patient was moved to the operating room for immediate Cesarean section (C-section) to reduce the stress of the pregnancy on the patient's condition and the risk of fetal demise. The Attending anesthesiologist expressed concern about sedating the patient, citing the high mortality rate associated with heart attacks in pregnancy should that be the problem. He felt that a more definitive diagnosis should be obtained before proceeding.

Several failed attempts were made to reach a cardiology resident and the increasingly anxious OBGYN Attending called the ED Attending on duty to ask for assistance. Upon hearing the story, the ED physician recommended treating the patient as if it were a heart attack, physically located the cardiology fellow and proceeded to the patient's bedside in the operating room. After a very brief review of the data collected so far, the Cardiology Attending on-call was contacted at home for guidance in managing a possible cardiac event in a pregnant woman and he voluntarily came from home to the hospital.

Three life threatening diagnoses were being supported by the data gathered to this point: a heart attack, aortic dissection, or a pulmonary embolism (blood clot in the lungs). Each specialty was advocating different action plans: the OBGYN Attending

wanted to deliver the baby immediately due to increasing fetal distress; the Anesthesia Attending remained reluctant to anesthetize the patient for C-section until the diagnosis for her chest pain became clearer; the ED Attending advocated to stabilize patient with intubation secondary to patient's increasing agitation and confusion and to support the patient during further more extensive evaluation; the Cardiology Attending wanting to take patient to cardiac catherization in order for definitive diagnosis and treatment is this was a heart attack. Definitive diagnosis could also be made with a CT scan, however, it was not clear the patient would tolerate being moved several times (Operating Room to CT scan to Intensive Care Unit-ICU) and there was concern about the high dose of radiation to the fetus.

Over a short period of time (less than one hour), the group decided to prioritize the treatment of the mother over the child and to perform ultrasound evaluation for aortic dissection (the condition with the highest mortality), which would avoid moving the patient to CT scan. The ED Attending persuaded the group to intubate prior to the procedure and to make one move to the ICU where all of her needs could be met.

Once moved, a bedside ultrasound demonstrated a massive aortic dissection *and* large heart attack. Following discussion with Cardio-thoracic surgery and the family, it was decided to perform an emergent C-section, during which it was found that the patient had developed extensive dead bowel which would be ultimately fatal to the patient. The baby was delivered and the patient subsequently expired once removed from life support.

ANALYSIS

This case is a remarkable demonstration of the emergence of resilience. Methods for adapting to the changing clinical course of the patient were unplanned, very informal (i.e., the OBGYN attending calling the ED for help when unable to find Cardiology fellow), and novel to the individuals involved. The involvement of some of the individuals was necessary (OBGYN required Anesthesia support to perform delivery) yet others were voluntary (ED Attending physically locating cardiology fellow and coming to the bedside; Cardiology Attending coming in from home). The simultaneous cooperative work of multiple clinical specialties (OBGYN, Emergency Medicine, Anesthesia, and Cardiology) is a deviation from the normally bounded work environment within a hospital. The primary actors recognized that their individual expertise was necessary but not sufficient for managing this evolving clinical and ethically complex case (whether to prioritize mother or child). The final action plan was arrived at by referencing a higher level abstraction within medicine of "mother first, baby second" which was brought to the fore by the Cardiology Attending. Once consensus was reached on this high level goal, the group was able to construct an action plan of how to meet it.

This group was also able to avoid over-control by one individual as the situation became more critical. [Brehmer, 1987] Formality, in the form of medical-legal responsibility, seniority, and organizational hierarchy were supplanted by the reality of the complexity of the case and the dire consequences for both patients. The result was

shared decision-making and negotiated solutions rather than action being taken along the traditional lines of responsibility and authority.

The four specialties involved formed a distributed cognitive system, and exhibited important adaptive properties in this case (Woods & Hollnagel 2006). Specifically, by mutual deference to expertise they supported the requirement of *directability* wherein strategic directions were changed based on current events, past history, and anticipated future directions. Similarly, they supported the facility of *shifting perspectives*, in which each could articulate important, but local goals which served to point out alternatives for action and kept the team from being trapped in a narrow view of the problem.

4 DISCUSSION

The presence of conflicting goals between each of the specialties in this case is an example of Rasmussen's goals-means hierarchy (Rasmussen, 1997). The challenges of the patients worsening conditions (mother and fetus) required the rapid working out of various conflicts at lower levels of the hierarchy in order to cope with the challenge before them. (Cook, Nemeth 2006). The actors created new strategies for coping and made sacrifices in the face of a greater threat or hazard. (eg. the EM attending left his patients in the ED to go to the operating room; the Cardiology attending came in from home during the night) The shifting of goals also necessitated recurrent re-defining of what "success" in this situation meant, alternating between saving both or either patient.

This case is also demonstrates "frequent shifts among various relevant formal [diagnostic] strategies in order to resolve local demand-resource conflicts", a unique characteristic of diagnostic reasoning in action described by Rasmussen (1993). The group shifts between strategies due to changing priorities and objectives, ranging from concern about potential consequences to the mother and baby to concern about stabilizing the patient in the OR (the operator's perspective) to concern about correcting the current problem by delivering the baby once dissection was diagnosed (the repairman's perspective). The shifting between strategies can also be seen in the decision to abandon the traditional protocol for diagnosing aortic dissection, which would have required moving the patient several times, in favor of a single move to the ICU and the use of ultrasound to assess the patient, something rarely done at night. These shifts in strategies highlight the intimate connection between diagnosis and action. (Rasmussen, 1993)

Exactly what elements or conditions are necessary to support impromptu collaborative work within the domain of healthcare (which does not seek or foster it) are not clear. There are, however, a number of intriguing features of this case that bear consideration on how resilience was created. First, the unusualness of this case and its rarity in the clinical practice of all involved may have contributed to lowering barriers as the attention was focused on attempting to understand the scope of the issues and on diagnosing the problem. Additionally, the fact the patient was a pregnant woman in distress may have allowed the interactions to focus more on *her* as a universally protected individual and less on the imbedded formalities of clinical work. This may have been further supported by the focusing effect of the patients deteriorating conditions before them, leaving little time to address lower level abstractions of general functions and activities. Finally, although this may seem a cliché, the personal make-up of the individuals involved may also be significant contributors. All involved in this case worked from

a sense of shared responsibility and were open to acting collaboratively and in concert to provide care, increasing their efforts to work together as the complexity and criticality deepend. The behaviors demonstrated here are not cultivated within medicine and often the opposing behaviors of narrow focus, silo thinking, and heirarchical behaviors are those that are rewarded.

Although the resilient cooperation went well in this case, it is by no means the standard. We are currently investigating an almost identical case of another critically ill woman following delivery involving the similar specialties represented here (but not the same individuals) which was characterized by failures to interact across traditional hierarchical barriers, silo thinking and multiple individuals competing for control as the case became more critical.

CONCLUSION

The unplanned and informal nature of the resilient performance recounted here highlights the latent nature of resilience within healthcare. What elements or conditions support impromptu collaborative work in this domain are unclear, however characteristics of the patient, her condition and the individuals involved may be factors. Study of such successes and failures within healthcare may elucidate the conditions, features and characteristics necessary for sustained resilience in clinical care.

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