Understanding Complex Work Using the Resilience Mechanisms Framework: An Ethnographic Study

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ABSTRACT

Resilient Healthcare is an emerging theoretical field that has developed with influence from engineering, safety science, psychology, ergonomics, human factors, and aeronautics. Resilient Healthcare research has centred on understanding and improving the quality and safety of healthcare delivery. Theory is increasingly well-developed, but so far has only been applied in limited ways with select settings and activities. In order to improve the quality and safety of healthcare, it is essential to first understand the sources of complexity in clinical work. This ethnographic study of five hospital teams in a large, teaching hospital in central London aims to contribute to this growing evidence base by presenting data on specific challenges faced by healthcare workers and the adaptations they use to overcome them in everyday clinical work. This paper will present a new framework for recognising misalignments between demand and capacity and corresponding mechanisms for adaptation, which can be used to understand work-as-done in complex settings and to manage risk.

KEYWORDS

Resilient healthcare, complex systems, work analysis

Introduction

Human factors and ergonomic practitioners and researchers are increasingly focusing on improving the quality and safety of complex systems like healthcare. In order to improve healthcare technologies, systems, processes, and organisations, it is imperative that we first understand what healthcare professionals do so that ideas for improvement are grounded in the reality of what happens in practice. Theoretically informed methods for understanding complex systems, such as Cognitive Work Analysis, have been developed but require specialist expertise and have limited face validity with healthcare practitioners (Jenkins, 2009; Vicente, 1999). Resilient Healthcare (RHC) is an emerging field of research which focuses on healthcare safety by understanding how healthcare work is accomplished through adaptation to pressures and problems. It seeks to improve care by supporting adaptation to variable conditions (Braithwaite, Wears, & Hollnagel, 2017; Braithwaite, Wears, & Hollnagel, 2015). Framing complexity as a key feature of healthcare work in straightforward language has the advantage of increasing understanding and supporting adoption into practice.

One of the key insights of RHC is that flexibility is required in order to achieve safe, high quality care. This is contrary to traditional safety management practices, which focus on retrospectively identifying the causes of adverse incidents using investigation techniques, clinical audits, and process control charts to identify deviation from processes. The aim of these practices, which are used in hospitals worldwide, is to determine which parts of the system are not working and institute standardised procedures to prevent future occurrences of the same error (Hollnagel, Wears, & Braithwaite, 2014). The underlying assumption is that processes and protocols should be followed precisely to avoid errors and maximise safety. RHC argues that these practices are insufficient for improving systems as the same conditions are unlikely to occur more than once and rarely are there only two ways (right and wrong) of doing things (Hollnagel et al., 2014; Manser, 2009). RHC proposes that work-as-imagined (WAI) and work-as-done (WAD) are different because of the unanticipated variability of complex systems (Anderson et al., 2020; Braithwaite et al., 2015). The unpredictable, complex variability requires that workers resolve problems and prioritise resources to keep the system working, even if the resolution calls for deviation from protocols (Anderson et al., 2020). Additionally, even when the work environment is more stable, workers innovate new processes to decrease workload and improve efficiency, which also creates variability in work-as-done (Rasmussen, 1997). RHC recognises that complex environments like healthcare necessitate a degree of flexibility and adaptability (Anderson & Watt, 2020; Back et al., 2017; Iflaifel, Lim, Ryan, & Crowley, 2020). Understanding and analysing what factors necessitate flexibility and how flexibility is practiced by healthcare workers is therefore necessary to improve quality and safety.

One RHC framework that illustrates these principles is the Concepts for Applying Resilience (CARE) Model. The CARE model introduces the concepts of 'alignment' and 'misalignment' to capture the disparities between work-as-imagined and work-as-done (Anderson et al., 2016). In the model (see figure 1), WAI is conceptualised as alignment between demand and capacity, where organisations institute protocols and procedures based on past experiences and in anticipation of future *demands* (such as patient acuity, hospital census, quality standards). The organisation plans to provide *capacity* to meet these demands by providing the resources perceived to be needed, such as sufficient equipment, staffing, expertise, and support. However, the model suggests that work is never done as imagined, because there are always unforeseeable circumstances, variances, and demands in a complex system that create misalignments between demand and capacity. Thus, WAD captures workers' adaptations in response to misalignments between demand and capacity. This includes innovating workarounds and making adjustments to processes and procedures as necessary to continue operations despite the misalignments. A strength of the model is its recognition of the distinction between WAI and WAD (Anderson et al., 2016).
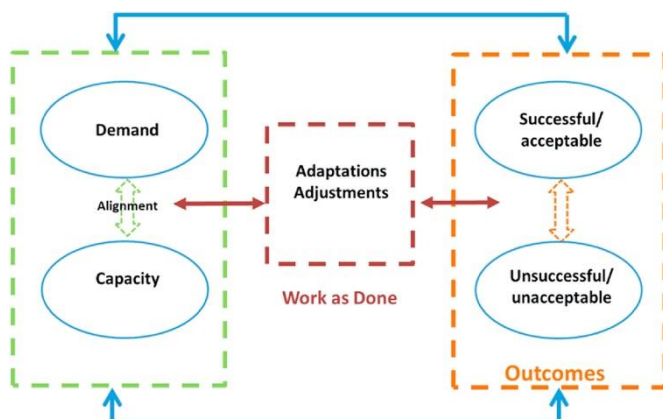

Figure 1: The Resilience CARE Model

However, while providing a clear conceptualisation of misalignments and adaptations as key to producing outcomes, the model does not specify what types of misalignments occur or capture what types of adaptations are used. Furthermore, it only captures adaptations that take place due to misalignments, when other motivating factors, such as innovation, efficiency, personal preference, and workload may also inspire such adjustments (Rasmussen, 1997).

Watt, Jun, and Waterson (2019) built on this work using interviews with blood transfusion staff to specifically identify types of misalignments and adaptations. In the study, the researchers interviewed staff about difficulties during blood transfusion and asked how they responded to these difficulties. Watt, Jun, and Waterson (2019) identified five primary categories of 'triggers' (misalignments) and adaptations to triggers: person(s), tools/technology, task/process, internal environment, and organisation/management. The researchers conclude by suggesting an extension of Anderson et al.'s (2016) CARE model that incorporates categories of mechanisms for adapting to triggers. Although this is a significant advance in understanding complexity, the study examined a specific task and setting and so the extent to which the findings generalise to other settings is unknown.

The aim of this study was to identify types of misalignments and adaptations in healthcare work using ethnographic observations of complex clinical work in five teams within multiple settings in a large, teaching hospital in central London. We present a new framework for understanding work-as-done in complex settings such as healthcare to help manage risk.

Objectives

1. To identify and classify types of misalignments between demand and capacity experienced by healthcare ward teams

2. To identify and classify types of adaptations that are made in response to misalignments

Methods

Setting

This study involved non-participant ethnographic observations in a large, teaching hospital in central London. Purposive sampling was used to select five diverse ward areas to represent multiple in-patient settings. The wards included in the study were: two surgical wards, an older adult ward, a critical care unit, and the Acute Assessment Unit (AAU), a temporary extension unit created to expedite patient flow out of the Emergency Department. The study had ethical approval (REC REF:18/WA/0218) and formal approval from Trust leads. Clinical and nursing leads on each ward provided written informed consent, consenting both for ethnographic observations to take place on the ward and for researchers to shadow the lead's own routine clinical work.

Methods

Data Collection and Analysis

Non-participant ethnographic observations were conducted over a six-month period between Oct 2018 and March 2019 by two trained researchers. 80 hours of observations were completed across the participating ward sites. Activities observed included both routine clinical work such as ward rounds and medication rounds as well as coordinating events like board rounds, bed meetings, and flow meetings.

Ethnographic field notes were transcribed and uploaded into NVivo 12 for storage, organisation, and analysis on a password-protected computer. Identifying information was removed. A combined deductive-inductive approach to thematic analysis was used. Analysis was carried out in two

phases. In phase one, the initial coding framework was based on the resilience CARE model (Anderson et al., 2016) and was adapted as new themes emerged. Thematic analysis of the data began with the assignment of codes to misalignments between demand and capacity and adaptations to misalignments. After initial coding into these two categories, the research team collaboratively created a hierarchical coding framework based on the themes identified in the text. The framework was amended iteratively during the coding process to accommodate new emergent themes. Once the themes had been finalised, 25% of the transcripts were independently coded by a second researcher to determine agreement. Double coding a sample of the data is commonly used in qualitative research to determine reliability and rigour. Disagreements were discussed and theme descriptions were clarified. Final agreement between coders for misalignments was 92.60% and for adaptations was 95.23%, indicating that the coding framework was highly reliable.

In phase two of data analysis, the relationship between misalignments and adaptations was examined to determine how misalignments were linked to adaptive actions. A paired, matrix coding query was run in NVivo 12 to identify segments of text which were coded for both a misalignment and an adaptation. This data was synthesised to identify occurrences of misalignments paired with a corresponding adaptation. Because a key objective of the study was to identify mechanisms of adaptation, the analysis focused only on those misalignments for which a corresponding adaptation was identified.

Results

A total of 351 misalignments were identified across the five wards. Of these, 212 had at least one observed corresponding adaptation. Misalignments and adaptations were seen in each team, regardless of structure, design, function, and leadership. Six types of misalignments and three types of adaptations were identified in the study and were subsequently compiled into a framework (see Table 1). Two of the adaptations, *process* and *resource redistribution*, were broken into the subcategories of: *who, how,* and *when,* to distinguish between different ways a process could be adapted, and *equipment* and *staff redistribution* to differentiate between the observed resources that were redistributed, respectively.

Table 1 provides an overview of the Resilience Mechanisms framework, which identifies and describes each misalignment and adaptation type.

Table 1: Resilience Mechanisms Framework

Misalignment Type	Description	Observed Example
Equipment	There is an equipment shortage and/or equipment is broken, not fit for purpose, or faulty	There are not enough computers on the ward
Staffing	Unexpected shortage of staff and/or staff skills mix does not fit needs	A staff member calls in sick, leaving the ward short-staffed
Communication	Message is not accurate, clear, and/or consistent	The medical team is not informed that the consultant has been reassigned to a different team
Space	Space is poorly designed for purpose	The team meeting takes place in a hallway, lacking privacy and blocking traffic flow through ward
Process	Process is not efficient, reliable, easy, coordinated, and/or achievable	The patient is medically ready for hospital discharge. It is unsafe for them to discharge home independently, but they do not qualify for an increased package of care
Workflow	Staff are taken away from the task they are working on to tend to another task	A nurse providing patient care is interrupted with a question from another team member
Adaptation Type	**Description**	**Observed Example**
Extra-role Performance	An individual spontaneously assisting with work that is not their direct responsibility	The ward manager delivers meal trays to help out when the ward is busy
Resource Redistribution	Redistributing *equipment* or *staff* to areas of greater need	*Equipment* The nurse borrows a glucometer from a neighbouring ward *Staff* The ward borrows an additional nurse from a neighbouring ward when they are short staffed
Process	*Who* Changing who does a process by reshuffling tasks among team members *How* Changing how a process is done *When* Changing when a process is done	*Who* The consultant leaves to attend to an urgent situation on another ward. The junior doctor and nurse practitioner divide up and complete the outstanding tasks while she is away *How* The computer is not working, so the doctor writes paper notes instead *When* The patient is not available when the nurse tries to give them their medications, so the medications are given later

Examples of misalignments and adaptations observed in the study are populated in the third column of Table 1. Each misalignment and adaptation had implications for the quality and safety of patient care and resulted in both positive and negative impacts. For example, for extra-role performance, the ward manager delivered patient trays when the ward was overwhelmed. This meant that patients received their meals more quickly and the other staff members were free to tend to their more pressing tasks. However, extra-role performance also had negative impacts, like the ward manager

temporarily disregarding managerial tasks, skipping lunch to step in to help, and staying late to catch up, which could contribute to role blurring, staff turnover, and stress and burnout.

Some misalignments had natural pairings with certain adaptations- for instance, staffing misalignments were often linked with staff redistribution (see Table 2). Equally, when equipment was broken, faulty, or missing, equipment was redistributed to compensate. However, process misalignments and extra-role performance were also used to overcome these misalignments. The selection of the adaptation was largely dependent on access to outside resources, preference, team structure, team design, and team function; we found that two different teams might employ different adaptations to the same misalignment with differing outcomes and varying degrees of success.

Table 2 shows a heat map of the misalignments with a paired adaptation, capturing which adaptations were used in response to each misalignment across all five settings. The data illustrates that across all misalignments, process adaptations were the most frequently used adaptations. Of the three process adaptations, hospital workers most often adapted by changing *how* the process was done. The exception to this was for staffing shortages, which were most frequently responded to with extra-role performance.

Table 2: Paired Misalignments and Adaptations Heat Map

		Adaptations					
		Process			Resource Redistribution		Extra-role Performance
		How	*When*	*Who*	*Equipment*	*Staff*	
Misalignments	Communication	19	14	3	0	0	9
	Equipment	54	12	3	17	1	7
	Process	38	18	8	3	1	27
	Space	27	4	0	0	0	4
	Staffing	9	4	8	2	17	25
	Workflow	7	11	4	0	1	8

Interestingly, individuals spontaneously assisted with work that was not their direct responsibility (extra-role performance) more often than teams responded by reshuffling tasks among themselves (*who* process adaptation). Although process adaptations were used to adapt to process misalignments, hospital teams also managed ineffective and inefficient processes by taking on additional responsibilities that were normally outside their role responsibilities (extra-role performance).

Resources were rarely redistributed or provided spontaneously when demand was greater than capacity. If there was a process that was inefficient that required adaptation and extra time, staff accommodated this demand as well as their normal clinical work without additional help. In the instances when capacity was particularly low, ward leaders had to take the initiative to advocate for additional resources, for instance, visiting a neighbouring ward to plead for an extra staff member. Many times, extra staff and equipment were required and requested, but the request was not

fulfilled. This necessitated that staff adapt in other ways, most often with extra-role performance and adapting processes.

Discussion

Misalignments are a ubiquitous feature of healthcare work and workers are adept at devising adaptations to ensure the system keeps working. Understanding how misalignments correspond to adaptations and the implications for the functioning of the system are important for designing effective improvement efforts. Previous work by Anderson et al. (2016), Braithwaite et al. (2015), Braithwaite et al. (2017), and Watt et al. (2019) has provided the foundation for understanding work-as-done and identifying variability, misalignments, and adaptations. This study adds to this by examining these concepts in ward settings and by further categorising misalignments and adaptations to better understand their mechanisms.

The Mechanisms of Resilience framework is centred on the concepts of misalignments and adaptations with a focus on improving understanding of work-as-done to the best of our ability. The aim of the framework is to provide an analytic lens for categorising and interpreting resilience mechanisms to guide research efforts and to enable better support of existing adaptations to enhance safety and resilience. The methods and categories described here provide a means to make sense of the complexity of healthcare work in multiple organisational levels in a theoretically informed way. Because work-as-done is not mechanistic and linear, it is not possible to completely specify complex clinical work. However, identifying and pairing misalignments and adaptations allows us to consider the trajectory of actions required for successful patient care and consider the positive and negative impacts of misalignments and adaptations. This affords insight into the complexity of the system and how it might be improved through reducing misalignments (work system redesign) or by enhancing adaptive capacity, which could be useful in improving healthcare quality and safety.

There are several possible limitations of this study and the resulting framework. The first is that it does not account for the instances when a misalignment did not have an observed corresponding adaptation. Because the aim of the study was to categorise mechanisms for adaptation, these are not included in the results presented here. Additionally, there may be mechanisms for adaptation that were not immediately observable and have not been accounted for. The data reported here also does not capture adaptations that were employed to innovate, improve efficiency, and suit personal preference, but it will be important to identify these in future analyses. Additional research is needed to look at other factors, besides misalignments, that could precipitate adaptation and the outcomes of these adaptations.

Conclusions

This ethnographic study of five hospital teams set out to contribute to the growing RHC evidence base by specifying the challenges faced by healthcare workers and the adaptations they use to overcome them in everyday clinical work. The major finding is that healthcare workers respond to varied misalignments by adapting how processes are done in the absence of additional support and resources. Additionally, healthcare workers are frequently challenged with supporting one another by stepping in to perform extra-role responsibilities when other adaptations are not available. These findings were consistent no matter which demands were present and across multiple teams and settings. Additional research is needed to understand the impacts, both positive and negative, of these adaptations and how they might contribute to patient care, healthcare quality and safety, burnout, and staff retention. Based on the insights gained from the observations of clinical work, a

new framework for categorising resilience mechanisms and analysing resilience based on the CARE model was proposed to guide future research.

This study has demonstrated that further categorising misalignments and adaptations from the resilience CARE model and understanding mechanisms for adaptation can provide in-depth insight into work-as-done in healthcare. This understanding can help ground quality improvement efforts and contribute to system redesign on multiple organisational levels.

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