Unpacking Safety-II in action: Weak Signals of Potential Error in Patient Handling Tasks

Eva-Maria BURFORD, Mike FRAY and Patrick WATERSON

Human Factors in Complex Systems Research Group, Loughborough Design School, Loughborough University, Loughborough, UK

Abstract. As a result of a new definition of safety, whereby the focus on the ability to succeed under varying conditions is emphasised, new opportunities for assessing and improving safety are being developed. This study investigated both Safety-I and Safety-II elements using a focus group method with two expert groups in patient handling. The Safety-I and Safety-II elements investigated included potential errors, weak signals and learning opportunities arising from these situations. The weak signals that were identified were classified as originating from either an external or internal source. Potential learning opportunities to improve signal recognition were identified.

Keywords. Errors, weak signals, patient handling

1. Introduction- Safety-II and close calls

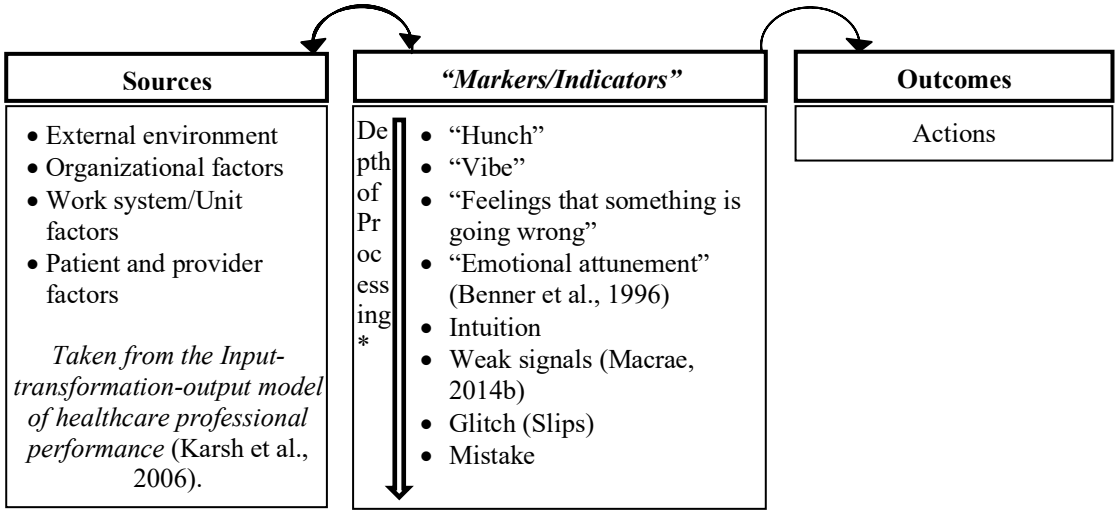
Preventable adverse medical events, despite large amounts of research available (Vincent, 2011), are still a current topic (Dhillon, 2012). In recent years a new definition of safety has emerged, resulting in new opportunities for assessing and improving safety. The traditional definition of safety (Safety-I) focuses on the occurrence or identification of potential or actual adverse outcomes, whereby Safety-II reports the ability to succeed under varying conditions so that the number of intended and acceptable outcomes is as high as possible (Hollnagel, 2014). As yet, there is a lack of data, literature and methods for studying human and organizational performance success as defined by Safety-II (Hollnagel, 2014).

One element of Safety-II is the ability to adjust performance to ensure success of the task and this requires anticipating, identifying and responding to signals indicating changes in the system (Hollnagel, 2014). The signals are often weak and ambiguous, and as a result need to be actively sought out (Macrae, 2014a). These weak signals can be defined as information, vague in nature, regarding imminent events (Ansoff and McDonnell, 1990), which require interpretation and sense-making (Weick, 1995) and in order to be meaningful, need to be placed within a frame of reference by processing interrelated current events, prior knowledge and future expectations. (Macrae, 2014a, 2014b). Failure to notice the warning signs and addressing risks promptly can result in the risks being normalised, and remaining dormant until an adverse event occurs (Macrae, 2014a). This highlights the role that the weak signals can play in safety behaviours, but research exploring weak signals and the role it may play in safety, especially in health care, is limited. The motivations for this enquiry were to better understand weak signals within a health care context and develop a preliminary framework for the initial investigation of weak signals in relation to safety behaviour, which is presented Figure 1.

1.1 Framework

The proposed framework includes the nested structure of the Input-transformation-output model of health care professional performance (Karsh et al., 2006). In order to

analyse and understand the work, actions and events in this work system, a systems approach needs to be adopted (Karsh et al., 2014). This model was incorporated as a general multi-level model of a work system for the framework, in addition to it having considered open systems theory and being based on other sociotechnical models, such as that proposed by Carayon et al. (2006). During the work process, the worker receives signals of different strengths requiring different levels of processing. The processing and influence the signs or signals may have on performance of tasks can be explained by the skill-rule-knowledge model of behaviour (Rasmussen, 1983). These signs or signals can be considered as markers or indicators and can be interpreted as information regarding the status of the system and may indicate areas of risk (Macrae, 2014b).



**Depth of processing can be described by the Skill-rule-knowledge model (Rasmussen, 1983)*

Figure 1: A proposed framework for the investigation of weak signals in relation to safety behaviour.

The purpose of this study was to identify key elements, behaviours and process which contribute to the task being completed successfully and safely. Through a focus group format and by discussing specific types of tasks and the possible outcomes, it was aimed to explore the strategies individuals use to detect, interpret or respond to variations in the work environment.

2. Case Study: Patient Handling

The study adopted an explorative qualitative method aimed at investigating weak signals in the patient handling field using a focus group methodology. The study investigated some of the elements from the proposed framework in Figure 1.

A 60 minute focus group was conducted by two investigators (EB, MF) with two different expert groups in patient handling. Once an introduction to the research topic had been provided, participants were asked to complete a consent form. Following this, basic demographic information comprising of the participant's age, educational degree, number of years involved in patient care, the current position held, the current responsibilities in this position and number of years in this current position was collected using a demographic information form.

The second investigator (MF) presented a scenario where a hospital unit, the staff present, the necessary patient handling information (such as the patient's capabilities) and finally the task, which was a patient transfer task, was described. Following the

description of the task to be considered the second investigator (MF) guided the discussion through the following series of questions:

1. What could go wrong with this task? (Error)
2. What external factors would influence this task? (External Factors)
3. How do you know the task is going wrong? (Signals)
4. Do you use this knowledge next time you do this task? (Learning)

The discussions of the focus group were recorded using two audio recorders and the first investigator (EB) recorded field notes. During the discussion the second investigator compiled a summary of the key points raised by the group in the discussion on a white board or flip chart, which at the end of the session was photographed. The audio data was transcribed (EB) and analysed together with the field notes and photographs of the summary points made during the discussion.

3. Findings

3.1 Participant Characteristics

Two focus groups were conducted, one with the Loughborough Alumni Research Forum (LARF) in patient handling and one with a group of manual handling advisors at the Western General Hospital in Edinburgh. The first group conducted at Loughborough Design School at Loughborough University consisted of 10 participants with a mean age of 54 years old (±7.69 years), with a mean total of 30 years (±12.14 years) involvement in patient care and 10 years (±3.19 years) involvement in the current position. The current positions held in the Loughborough group were four manual handling advisors or coordinators, five back care advisors or managers and one director manual handling consultant.

The second group conducted at Edinburgh Hospital consisted of 7 participants with a mean age of 45 years old (±7.17 years), with a mean total of 25 years (±7.95 years) involvement in patient care and 11 years (±5.63 years) involvement in the current position. The current positions held in the Edinburgh group were two manual handling advisors or coordinators, four manual handling area leads and one head of manual handling.

3.2 Focus Group Results

Commonalities between the results for each of the questions investigated within the two focus groups could be identified and are presented in this paper. The results for the four questions investigated in the focus group sessions are depicted in**Error! Reference s ource not found.** Figure 2.

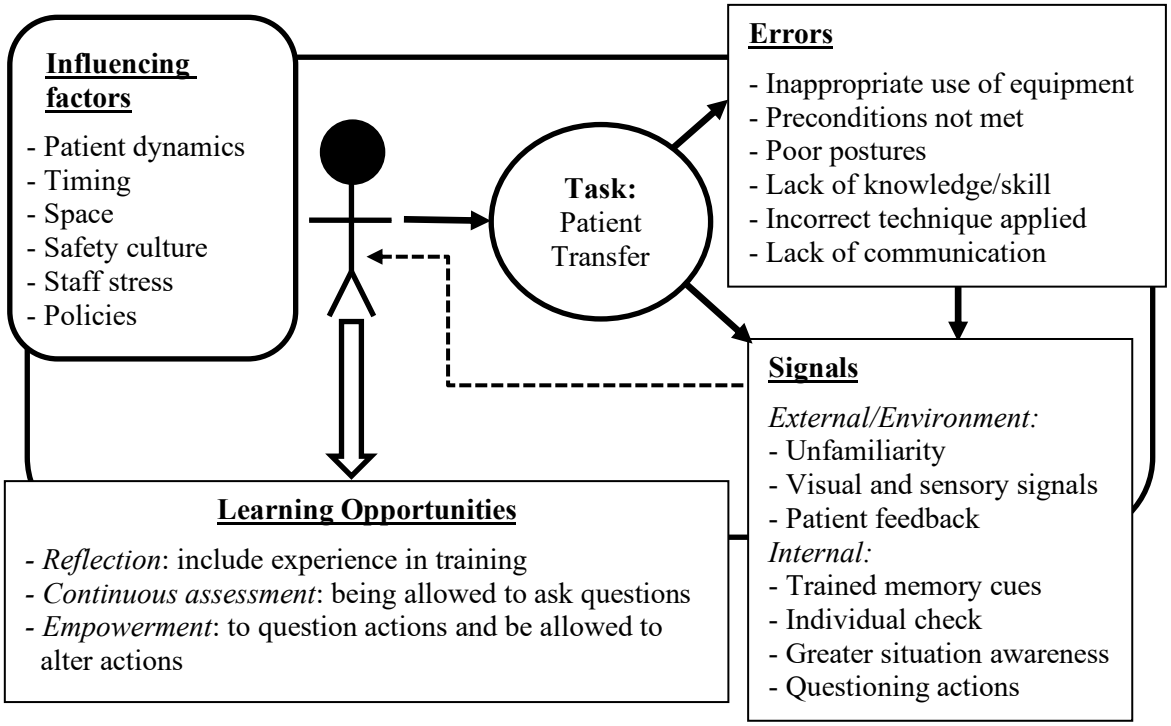


Figure 2: The combined results from the field notes and the discussion-created summary for both groups with regards to the five investigated questions from the focus groups.

Common errors were identified for several examples of patient transfer tasks including a lateral bed transfer or an assisted transfer from a seated position to a standing position. The common errors identified for the task examples included errors relating to inappropriate equipment use, lack of teamwork and communication with team members or the patient, poor postures, the task preconditions not being met, a lack of knowledge or skill and incorrect techniques being applied. The examples of where preconditions were not met included brakes on the bed being not applied and attempting the transfer at an appropriate bed height.

Potential factors that would influence the task and the task-related behaviour identified by both groups included patient dynamics, time and space-related factors, poor safety culture as well as staff stress. The one group also included policies as a negative external factor from the perspective that policies could lead to a lack of situation awareness and risks being normalised and explained away. The same group mentioned later then policies needed to be influenced by the learning opportunities described by the group. Patient dynamics referred to current health state of the patient as well as the level of cooperation they would provide.

The signals that assisted in detecting that an error may occur were identified by both groups as either originating externally (from the environment) or internally. The signals identified as being internal consisted of trained memory cues, for example a rhyme to ensure all safety aspects of the task were completed, individual checks such as those develop through personal experience, being less task orientated and more situation aware, and questioning actions. By being less task orientated and more situation aware, an individual may be more receptive to signals and be more aware of how the task is progressing. Furthermore by questioning actions one would hopefully negate the negative effects of habituation such as risks being normalised and explained away.

Signals that could be considered as originating from the environment include awareness that was heighten due to an unfamiliar aspect or element of the task, visual or sensory signals such as seeing or feeling that the brakes on the bed were not activated prior to starting the transfer and feedback from the patient.

The learning opportunities identified in the focus groups included the need for reflection, continuous assessment and for empowerment. By incorporating reflection into the work environment, the rest of the team, co-workers or the individual themselves would benefit from the experience of learning to recognise signals more readily. Continuous assessment may provide the opportunity to identify any signals that may originate from the patient or the environment. The need for empowerment would provide the opportunity for staff to question actions and potential change the course of action based on a signal received.

4. Discussion and Conclusion

Traditional Safety-I element, namely errors and influencing factors were selected to initiate the discussion as errors and adverse events are more memorable elements as opposed to the tasks that are successfully completed which occurs usually the majority of the time. The errors identified were very similar for both focus groups and were related to skill, knowledge, equipment misuse, lack of communication, incorrect technique, poor postures and preconditions not being full filled. Most of the influencing factors identified by the two groups were organizational and managerial in nature such as available resources and safety culture. These organizational and managerial factors may not only influence the worker, task but also may affect the identification, interpretation and response to signals identified.

Two different sources of signals emerged from the discussions and these were external, originating from the environment, or internal. These signals may be considered as an element of Safety-II in that if resulting action is taken and performance is adjusted the task may still be completed successfully. As the triggers or signals are often weak and need to be actively sought out and created by processing various forms of information (Macrae, 2014a), a key aspect to enhance this would be identifying potential learning opportunities so that one could more readily identify these signals. The learning opportunities identified in the focus groups included the need for reflection, continuous assessment and for empowerment. These suggested learning opportunities mirror the proposed means of improving safety with regards to signals by actively producing and amplifying signals, as described by Macrae (2014a). For these learning opportunities to be realised one would need ensure that learning and adaptation occurred on numerous levels as the organization would need to assist in ensuring that the work environment allows for reflection, continuous assessment and empowerment at individual, unit and potentially on other levels. Here the organization's safety culture could have an influencing role in providing the potential means of training and ensuring the environment is available for identifying these signals.

The method above investigated both Safety-I and Safety-II elements. The Safety-I element addressed in this study included potential errors that may result in adverse outcomes whereas the Safety-II elements investigated in this study included signals and learning opportunities. These Safety-II elements would assist in improving the ability to succeed under varying conditions so that the number of intended and acceptable outcomes was as high as possible (Hollnagel, 2014). The proposed framework and method provide a preliminary basis for the investigation of weak signals and assists in highlighting the role that the weak signals can play in safety behaviour.

Further investigations are required in order to further identify what type of signals are present in tasks as well as identify which influencing factors promote or inhibit signal identification.

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