Stopping incidents in their tracks: identifying weak signals for error prevention in healthcare

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Stopping incidents in their tracks: Identifying weak signals for error prevention in healthcare

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Abstract:
In order to adjust performance to ensure the success of a task and prevent error, it is necessary to anticipate, identify and respond to signals indicating changes in the system. The objectives of this study were to investigate weak signals within two different healthcare case studies by identifying key elements and behaviours of these tasks. This study investigated both Safety-I and Safety-II elements with four expert groups, two from the field of patient handling and two from the field of patient discharge. The Safety-I and Safety-II elements explored included potential errors, influencing factors, weak signals and learning opportunities arising from the investigated situations. The errors identified by the focus groups were related to skill, knowledge, inappropriate equipment, equipment misuse, lack of communication, missing or incomplete information, incorrect technique, and preconditions not being fulfilled. The influencing factors identified by the two case studies included patient-related factors, time and space-related factors as well as organizational and managerial factors such as available resources and safety culture. The weak signals identified in both case studies were analysed using the SEIPS 2.0 model. The sources of the signals were identified as originating from the work system elements “person”, “tasks”, “organization” and “internal environment”. The manifestation forms of the weak signals included the different sensory signals as well as the experience of intuition or “hunches”. Potential learning opportunities to improve signal recognition were identified and included the need for reflection and empowerment, continuous assessment and the sharing of information between the involved systems. 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.

Keywords: Weak signals, Errors, Patient Handling, Patient Discharge

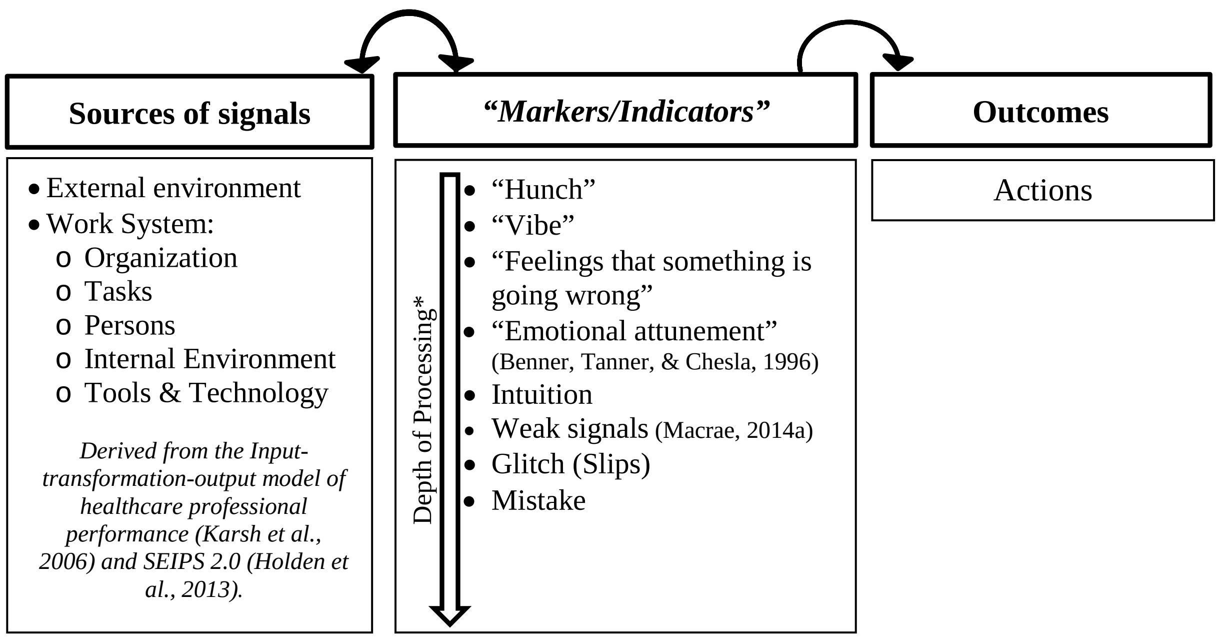
1. Introduction

Traditionally, safety has been defined as the absence of harm, whereby the number of adverse events is as low as acceptably possible (Hollnagel, 2014). Resultantly safety is measured indirectly based on the state when safety is absent and the focus is placed on incidents and adverse events, which then has practical consequences and limits the possibility of learning to events that only occur infrequently (Hollnagel, 2014). As a result of the limitations caused by the traditional definition of safety, in recent years a new definition of safety has emerged, resulting in new opportunities for assessing and improving safety (Hollnagel et al., 2013). The new definition of safety, Safety-II, focuses on the ability to succeed so that the number of planned outcomes is as high as possible under varying conditions (Hollnagel, 2014). Performance variability within a system is both normal and a necessity for the functioning of the system (Hollnagel, 2014), and Safety-II aims to provide insight into how individuals, departments and organizations within the system continually achieve planned outcomes despite adversity (Vogus & Sutcliffe, 2007). As yet, there is only very limited 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). By anticipating potentially events, monitoring the current state, responding effectively when something occurs and learning from past experiences, a system has the potential to become more resilient to adverse events (Hollnagel, 2009). The strength of the signals of risk that can lead to anticipation are often weak and ambiguous. These weak signals can be defined as information, vague in nature, regarding imminent events (Ansoff & Mcdonnell, 1990), which require interpretation and sense-making (Weick, 1995). Often these weak signals need to be actively sought out and created by processing interrelated existing events, prior knowledge and future expectations in order to understand the information they provide (Macrae, 2014a). Through the early detection of unexpected events, they may be addressed in a more cost-effective and timely manner (Vogus & Sutcliffe, 2007), but failure to notice the warning signs may result in the risks being normalised, and remaining dormant until an adverse event occurs (Macrae, 2014a, 2014b).
Weak signals may provide an opportunity to achieve proactiveness through the required awareness, monitoring and constant vigilance needed for the identification of these signals and the up-to-date information regarding ongoing operations they provide (Vogus & Sutcliffe, 2007). Effective risk management requires continuous identification and addressing the problems that threaten safety (Macrae, 2014b) and identifying weak signals may offer means of reducing risk and responding early to hazards. This highlights the role that weak signals can play in safety behaviour. Increasingly accident reports include indicators or signals prior to an event that, had they been acted upon, would have altered the course of the event. Despite this, research exploring weak signals and the role they may play in safety, especially in healthcare, is limited.

2. State of the art

This work draws on strategic management theory, specifically that of Ansoff and colleagues (1990), as well as traditional human factors models, while considering both Safety-I and Safety-II definitions. A framework for the investigation of weak signals was developed in order to analyse and understand weak signals in the context of the work, actions and events in the system in which they occur. This preliminary framework is depicted in Figure 1.



**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.

This framework has been based on the Input-transformation-output model of healthcare professional performance (Karsh et al., 2006) as it provides a general multi-level model of a work system, as well as having considered open systems theory. The model was then further expanded to incorporate more specific elements from the second version of the Systems Engineering Initiative for Patient Safety (SEIPS) model (Holden et al., 2013). The SEIPS 2.0 model was selected as it provides a framework for the analysis of processes and the relationship of various elements that occur in healthcare (Carayon et al., 2006). The signal source element in Figure 1 was expanded and structured to incorporate the work system elements from the SEIPS 2.0 model. The processing and influence the signals may have on performance can be explained by the skill-rule-knowledge model of behaviour (Rasmussen, 1983). By considering the source and type of information these signals provide, insight regarding the status of the system and areas of risk may be revealed (Macrae, 2014a).

3. Objectives and Methods

The objectives of this study were to investigate weak signals within a healthcare context. Two different case studies were selected with the aim to explore the strategies individuals use to detect, interpret or respond to variations in the work environment. The case studies selected included patient handling as well as patient handover and discharge from a hospital setting into the community. Both case studies adopted an explorative method using focus groups and aimed to explore elements of potential errors, influencing factors, signals regarding task failure, behaviour related to failure prevention and learning opportunities.

In each case study, two focus groups were held with expert staff and were 45 minutes in length. Once an introduction to the research topic had been provided wherein the aims of the research and the pertinent information for participants had been explained, participants were asked to complete a consent form. Following this, basic demographic information comprising of the participant's age, current position, and number of years involved in patient care was collected. Subsequently the focus group commenced, whereby discussion was lead and directed through a series of questions by the lead researcher. The discussion points addressed during the focus group were generated using the following questions:

1. What can go wrong with this task? (Error)
2. What external factors will influence this task? (External Factors)
3. How do you know the task is going wrong? (Trigger)
4. When you know it is going wrong, how do you correct yourself? Can you pre-empt the task? (Reaction)
5. Do you use this knowledge next time you do this task? (Learning)

The discussions from the focus groups were recorded using two audio recorders and one researcher recording field notes. During the discussions, the lead researcher compiled a summary of the key points raised by the groups on a white board or flip chart. The audio data was transcribed by the researcher E. Burford and analysed together with the field notes and summary points made during the discussion. The weak signals were then analysed using the Input-transformation-output model of healthcare professional performance (Karsh et al., 2006), as well as the SEIPS 2.0 model (Holden et al., 2013).

4. Results & Discussion

4.1 Participant Characteristics

Both case studies had two focus groups with experts who had at least 5 years of experience in patient care. The groups in the patient handling case study consisted of a group of 10 participants from the Loughborough Alumni Research Forum (LARF) in patient handling and a group of 7 manual handling advisors from Western General Hospital in Edinburgh. The group from Loughborough had a mean age of 54 years (±7.69 years) and had a mean total of 30 years (±12.14

years) involvement in patient care. The group from Edinburgh had a mean age of 45 years (±7.17 years) and had a mean total of 25 years (±7.95 years) involvement in patient care. The positions held by the participants included manual handling advisors or coordinators, manual handling area leads, back care advisors or managers, a head of manual handling and a director manual handling consultant. The groups in the patient discharge case study consisted of two groups of expert community staff with various qualifications and roles, involved in the discharge process, from two different directorates in Nottinghamshire county. The first group consisted of 7 participants with a mean age of 45 years old (±8.91 years) and had a mean total of 20 years (±10.06 years) involvement in patient care. The second group consisted of 7 participants with a mean age of 40 years old (±9.91 years) and had a mean total of 18 years (±11.28 years) involvement in patient care. These groups were comprised of registered community nurses, physiotherapists, an occupational therapist, a community matron, a team leader of a care home team, an admissions and discharge facilitator and a locality team lead.

4.2 Safety-I

Traditional Safety-I elements, namely errors and influencing factors were selected to initiate the discussion as adverse events and the influencing factors are usually highly memorable elements. The patient handling groups focused on two specific tasks namely a lateral bed transfer and an assisted transfer from a seated position to a standing position. The common errors identified 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. Potential factors that would influence the task and task-related behaviour identified by the 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. The common errors identified in the patient discharge case study included errors relating to inappropriate or missing equipment, lack of communication between the different services involved in the process, missing or incomplete information or documentation as well as missing medication or inadequate packages of care. Potential factors that would influence the task and task-related behaviour identified by the groups included patient-related factors, time-related factors, other service providers as well as hospital organizational factors. These organizational and managerial factors may not only influence the worker and task but also may affect the identification, interpretation and response to signals identified.

4.3. Safety-II

In both case studies, participants were asked to consider and discuss how they knew the task was going wrong and signals or cues that indicated this. These signals may be considered as an element of Safety-II as they have the potential to change the course of the task if they are acted upon and may aid in ensuring that the task is completed successfully. The signals identified in the patient handling case study consisted of heightened awareness 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 the patient being transferred, feedback from the patient, trained memory cues, for example a rhyme to ensure all safety aspects of the task were completed, individual checks such as those developed 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. These behaviours may assist in making the system with regards to this task more resilient as it allows the system to function despite potential disturbances or variations (Hollnagel, Braithwaite, & Wears, 2013).

The signals identified in the patient discharge case study that assisted in detecting if a discharge may fail included signals such as seeing the patient's physical state and the state of their home, the experience of the interaction with the patient's family, for example if family is continuously contacting health services for support, as well as the behaviour of the families such as becoming intense and disengaged during interactions with community staff. Signals were also derived from patient documentation and included key elements of the patient history as well the history regarding readmissions. The staff mention in the focus groups that they felt that the identification of these signals were a key component of the work they do, in order to adapt the patient treatment plan so that the patient would not be readmitted.

From the combined results of both case studies, the information pertaining to signals could be classified according to SEIPS 2.0 model whereby the sources of signals corresponded to the work system elements and the manifestation form of the signals corresponded predominantly to the work process elements of the model. The sources of the signals could be categorized as the following elements from the work system: “person”, “tasks”, “organization” and “internal environment”. Examples of signals originating from “person(s)” in the system included trained memory cues, individual checks, the patient’s physical state and feedback from the patient and their family. Signals originating from the “internal environment” included the state of the patient’s home. The forms or manifestations of the signals included the different sensory signals as well as feelings that could not be describe in more detail other than the experience of intuition and can be associated with the elements of the work processes described in the model. These forms included heightened awareness due to an unfamiliar aspect or element of the task, and visual or sensory signals.

An additional aspect of Safety-II discussed during the focus groups included the learning opportunities needed from the identification of weak signals. These included the need for reflection, continuous assessment, the need for empowerment, and the sharing of information between the various systems involved. 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. 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 to ensure that learning and adaptation occurred throughout the organization as the organization as a whole would need to assist in ensuring that the work environment allows for reflection, continuous assessment and empowerment at individual, at unit and potentially at 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.

5. Conclusion & perspectives

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 included signals and learning opportunities. These Safety-II elements may assist in improving the ability to succeed under varying conditions (Hollnagel, 2014) and therefore make the system more resilient. Additionally, weak signals may also provide a means for effective risk management in that through the continuous identification and addressing the problems that threaten safety (Macrae, 2014a), one may identify means of being more proactive, reducing risk and responding to hazards early. The proposed framework and method provide a preliminary basis for the investigation of weak signals and assist in highlighting the role that weak signals can play in safety behaviour. Further investigations are required in order to identify the types of signals that are present in tasks as well as identify which influencing factors promote or inhibit signal identification.

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