Situation Awareness and Risk Management
Understanding the Notification Issues

Plinio P. MORITA and Catherine M. BURNS

Abstract. Healthcare institutions are known to be risky environments that still lag behind other industries in the development and application of risk management tools. Awareness of risk is an important aspect of a risk management program. People depend on high awareness to take precautions to manage risk. The Situation Awareness framework describes how a person perceives elements of the environment, comprehends and projects its actions into the future, and analyzes the cognitive process used. Consequently, it allows the integration of the cognitive model and the risk assessment model into one single framework, provides a means of examining if the risk awareness is calibrated to the true risk levels of the institutions, and a better understanding of the issues with adverse events notification systems. In this paper we discuss how the situation awareness model can be used in the assessment of risk awareness, for understanding risk awareness and safety culture, and finally, for designing more effective risk management systems. For the purpose of this paper, we focus on the adverse event notification system.

Keywords. Situation awareness, adverse events, detection, healthcare

Introduction

Healthcare institutions are known to be risky environments that lag behind other industries in the development and application of risk management (RM) tools [1]. Awareness of risk, however, is a very positive thing. It is only with a good awareness of risk that people can take precautions to manage it [2][3]. Without appropriate awareness of risk, personnel are likely to inadvertently take inappropriate and dangerous actions [2]. The degree to which workers are properly aware of and calibrated to the risks in their environment is an important factor in having an effective safety culture in an organization, and vice versa.

While the terms “risk awareness” and “safety culture” are commonly used and tacitly understood, there is a need to integrate these concepts. In this paper we argue that the concept of “Situation Awareness,” developed by Endsley [4] may provide a unique way of understanding these ideas. Furthermore, with a situational awareness (SA) understanding we should be able to discuss whether an organization has developed an appropriate safety culture and whether its personnel hold appropriate awareness of the risks in their environments. Finally, we discuss how these concepts could lead to the design of more effective RM systems for healthcare. As a working example for this publication, we will discuss the improvements for an adverse event (AE) notification system.
1. The Situation Awareness Model

Endsley’s [5] definition of SA is one of the more widely adopted and is the one we will use in this paper. In particular, Endsley breaks down the human cognitive process of SA into three distinct levels, each one with different characteristics and effects on the overall awareness:

- Level 1 – Perception: this level describes how people perceive elements of the environment within the restrictions of a known space and period of time.
- Level 2 – Comprehension: this level describes how people process the information collected in Level 1 to gain an awareness of the current situation. With Level 2 situation awareness, people understand how the current situation will impact their goals and objectives.
- Level 3 – Projection: this level focuses on how people can predict future events and actions in their environment. To do this, people must already have appropriate Level 1 and 2 situation awareness and, through knowledge of the dynamics of their world, can extrapolate from this information to predict future states and future courses of action (COA).

When people have good and appropriate SA they operate effectively in their environments, properly interpreting information and taking necessary actions to prevent future problems. When people have inadequate SA they may misunderstand the state of the system or inappropriately predict future events [5].

While there is a wide body of research that examines risk perception [2] (similar to Level 1 SA) and risk comprehension [6][7] (similar to Level 2 SA), little can be found regarding risk prediction (similar to Level 3 SA). Therefore, the strength of Endsley’s model [5] is in three potential contributions. First, this model integrates other known concepts relating to the cognitive assessment of risk into a single model. Secondly, Endsley’s model can be used to examine whether the awareness of risk is properly calibrated to the true risk levels of the environment. Third, this model can be used to examine different awareness of risk at the institutional level and the level of personnel, allowing a better understanding of the issues found when using notification systems for detecting AE. Therefore, it is possible to say that the SA model provides a framework from which risk managers can better understand the environment of the institution, and the cognitive process of the staff, adjusting the RM tools to better fit them.

2. SA in Healthcare – Awareness of Risk and Safety Culture

Awareness of risk is deemed as one main factor for the success of RM programs [3]. A high level of risk awareness within the institution’s administrative structure will result in a more successful RM program [3]. Safety culture and risk awareness are directly connected, where a more developed safety culture will result in greater risk awareness due to investments in training, cultural change, and better support for the RM team [8]. The inverse is also valid: greater risk awareness will result in a quest for a better RM program. Many of the RM endeavors focus on raising awareness of risks – such as through training and campaigns – and efforts in creating a safety-focused culture.

The RM team is responsible for training the staff to be able to detect, briefly analyze, and decide if they should notify the RM team of risks and AE (Personnel SA) [9]. This training improves staff awareness both by facilitating the perception of occurrences and by giving a better understanding of AEs – focus on SA Level 1 and 2.
In the same perspective, changing the safety culture in institutions can benefit the notification process by changing the attention level and perception of occurrences, and by changing the staff’s mental model of the institution regarding the notification process, highlighting the benefits of successful notification.


The SA model allows a more in-depth analysis of the AE notification process in healthcare institutions, creating a better understanding of the reasons why notification systems sometimes fail in raising the RM team’s awareness of AEs, even while the personnel SA is high. Since notification systems are the mostly commonly used AE detection systems, it is necessary to understand them in order to design new systems that improve the institutional awareness of AEs.

**Institutional SA** - An institution’s RM team needs to gain awareness about AE before investigating them and creating RM projects. Even though an institution is not a person, we have adapted the SA framework to understand the process used to detect AEs. The diagram shown in Figure 1 shows how the SA model can be expanded to an institutional perspective. The perception mechanisms used by the institution to gain awareness of AEs range from passive notification systems to active registry scouting systems [10]. Related personnel SA is also described in the diagram. Some parallels can be drawn between the RM processes and the SA model [5]: the AE detection systems correspond to institution’s perception mechanisms, the AE investigations correspond to the comprehension mechanisms, and the RM projects based on investigations correspond to the projection of those findings into measures that would reduce the risks in the future. By understanding the SA framework [5], a mapping of the links between each SA phase would highlight possibilities for improvement. Focusing on the perception mechanisms, the notification link provides most of the perception regarding AEs. If the safety culture of the organization does not support notification, the perception of AEs is severely hindered [11]. Since the later stages of SA (comprehension and projection) rely on perception, this further hinders the institution SA of AE.

![Figure 1. Graphical visualization of the institutional SA gap.](image-url)
**Personnel SA** – Most AEs are detected by one or more staff members (SA Level 1) as they participate directly in the situations where AEs take place. The COA taken from this point – notify the institution of the AE or not – depends on an individual’s goals, training, and motivation towards safety. Some examples of factors that can prevent hospital staff from submitting an AE notification are: lack of comprehension of the risk to patients and peers (Level 2 SA) and fear of reprisal, a negative projected COA, which could be considered Level 3 SA. In contrast, personnel with a strong understanding of the risk of the AE (Level 2 SA), who can accurately estimate the future risk of the AE to patients and are optimistic about that the institution will take effective action (Level 3 SA), are more likely to submit an AE notification. This model clearly identifies two key issues – first, that personnel must have a strong comprehension of what AEs mean in terms of patient risk. Secondly, the safety culture of the institution is critically influential in a person’s assessment of the future events that will follow their AE notification. In this way, the decision to submit an AE notification can be directly related to the staff member’s SA regarding a particular event. To influence this SA, personnel must have adequate knowledge to comprehend the event and the institution must have a healthy safety culture so that the person is confident the AE will be handled effectively.

**Institutional SA Gap** – Since the only link between personnel SA and institutional SA is the notification system and given the fact that most of the perception of AEs by the institution comes from the notification system, whenever a staff member decides not to submit a notification for an AE, the chances of the RM team gaining awareness about that event are drastically reduced. Since the SA process is guided by goals, without the solid depiction of safety as a main goal inside the institution, it is difficult to promote notification. As discussed by other authors [12][13], safety culture is one of the most challenging, yet simultaneously most rewarding aspects of change in an organization. Implementation of a healthy safety culture would result in the alignment of the institutions safety goals and the needs of a successful AE detection system, improving the likelihood of proper AE notification.

One critical issue that can be identified by the SA model [5] is that in all cases, the goals and objectives of the staff and those of the institution may not be properly aligned. When institutions are driven towards safety programs, the objective can often be to increase the quality of care, but also to reduce the costs associated with AEs. In contrast, personnel may be driven by pressures to maintain tight schedules, manage high workloads, and maintain good relationships within their team and their managers. In some situations, depending on how much the institution is perceived to value safety, personnel goals and institutional goals may be misaligned.

The model shown in Figure 1 describes this institutional SA gap. The notification link is shown as the most used, but least robust, as poor personnel SA can weaken this link. This link can be improved with better designed AE notification systems that contribute to better personnel SA by promoting comprehension and ensuring effective COAs. In contrast, active detection systems are shown as a robust but less common link. This link is more robust, as it does not rely on personnel SA to same degree as the notification link; it is less common, because active AE detection systems are still not commonly deployed. Due to the challenges that can occur with personnel SA, however, active detection systems should be considered as an opportunity to bridge the institutional SA gap, by making institutional SA more resilient.
4. Conclusion – Bridging the Gap

To improve the detection of AEs it is necessary to bridge the institutional SA gap between personnel SA and institutional SA. Some solutions to this problem include:

**Improve the notification systems in place** – improving the current notification system towards a more automated, easier to notify system may increase the number of notifications. These changes should occur in concert with general improvements to personnel risk comprehension (Level 2 SA) and a healthy safety culture [11] (Level 3 SA). Ways to improve these systems include simple usability changes so that notifications are straightforward and less time consuming, protecting anonymity so that personnel are confident that the COA will not negatively impact them, and giving feedback on how the AE has resulted in positive changes in the organization.

**Develop a safety culture** – this technique is the most effective approach, although it is a long-term endeavor and requires effort, patience, and resources [11]. An example of successful safety culture development is the Veterans Association [12], which consists basically of changing the culture to one that encourages notification, investigation, and modifications that improve safety in all processes in the institution.

**Use active detection systems that are not based on peer notification** – these systems can improve the detection of AEs without using personnel notification systems by actively scouting through the institution records, video detection systems, registry scouting systems, and RM brokers [10]. These systems are more effective than personnel notification systems because they are less reliant on personnel SA.

Overall, in order to increase the number of AEs detected, the institutional SA gap must be avoided. The described alternatives focus both on reducing or avoiding the gap, always with the intent of increasing institutional SA.

References