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Improving Healthcare-System Safety through Near Misses: Learning from Transport Industries

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ABSTRACT

The aim of this study was to understand how the transport industries of aviation, rail and maritime have implemented near-miss management systems, and the impact of their learning from near misses. Grounded Theory, augmented by a scoping review, was used to generate the theory and principles behind how the industries manage near misses. The paper summarises the key findings from the scoping review and the themes identified through interviews with safety/human factors leads across various transport organisations. The findings provide insights into how healthcare might better manage near misses. However, the findings also challenge healthcare perceptions that other industries have perfected safety, and the specific value of near misses if used in isolation. The paper finishes by recommending safety management systems in healthcare.

Keywords: Near misses, Safety management systems, Patient safety, Healthcare

INTRODUCTION

Patients may come to unintended harm through the care processes that are meant to help them (for example, Balen, 2004). Healthcare is regularly challenged that it fails to learn from significant harm incidents, meaning those incidents reoccur (for example, Peerally et al. 2017). In attempts to address gaps in safety management, healthcare often turns to other industries to gather insights (for example, Gordon et al. 2013). The literature refers to the safety advances of Safety-Critical Industries (SCIs). SCIs have complex sociotechnical systems and risks of significant harm from failure (Wears, 2012). Examples include aviation, rail and nuclear energy.

The healthcare literature has long described how SCIs have embraced and learnt from near misses to make their industries safer; there are calls for healthcare to learn and do the same (Barach and Small, 2000). A near miss in English healthcare is thought to have occurred where an incident was prevented (NPSA, 2004). However, there are several different definitions for near misses in healthcare, many with different functional meanings (Marks et al. 2013).

It is believed that effective reporting, investigation and learning from near misses will prevent harmful incidents (Aspden et al. 2004). The literature regularly cites Heinrich's 'safety pyramid' to describe how near-miss rates relate to incident rates (Heinrich et al. 1980). The 'pyramid' has led to a hypothesis that by addressing near misses, incidents may be prevented due to the same underlying causes (Manuele, 2011). Therefore, there is believed to be value in healthcare developing near-miss management systems to improve patient safety. The question is how?

This research aimed to understand how transport SCIs (aviation, rail and maritime) have implemented near-miss management systems and their value. Findings were used to develop principles for healthcare to improve the management of near misses.

METHODS

A Grounded Theory (GT) methodology, augmented by a scoping review, was used. Data collection included interviews, field notes and the literature. The review protocol is accessible online (Woodier, 2022) and included all SCIs (Saunders, 2015).

The GT aimed to develop theories about how SCIs manage near misses, their maturity in that management and the value of learning from them. It was not realistic to engage with all SCIs and achieve theoretical saturation, so transport industries were selected (aviation, rail and maritime). Organisations were approached for interviews with safety and/or human factors leads. Sampling was purposive and then theoretical.

All data were anonymised and collated using NVivo. Analysis used open, axial and selective coding, and the constant comparative method (Glaser, 1965). Analysis was undertaken independently by two of the authors. To ensure rigor, data was triangulated and verified with participants. Memos were written as research progressed, acknowledging the authors' roles in the research (reflexivity).

RESULTS

The scoping review findings were incorporated into the GT. 83 papers (and further grey articles) were included. Literature was published between 2000 and 2018, most commonly in North America (n = 40). Chemical (n = 24) was the commonest industry, with others including rail (n = 13), maritime (n = 12), and aviation (n = 7). SCIs rarely used the term 'near miss.' Other terms included close call and precursor, but there was debate over whether these were synonymous with a near miss (Gnoni and Saleh, 2017; Sheridan et al. 2004; Smith and Borgonovo, 2007). There was debate about the definition of a near miss with variation between operational and research settings (Bliss et al. 2014). Dillon et al (2014) described two types of near miss where they could be seen as vulnerabilities (something almost happened) or resilience (got away with it). 'Barriers' often came into definitions, particularly in nuclear (IAEA, 2020).

For management of near misses, industries had different reporting systems. Some included automated detection, such as aircraft proximity detection (Brooker, 2005). To support reporting the need for the following was described: usable reporting systems, right safety culture, feedback, commitment, and training. Anonymity was contentious with some advocating for it (for example in maritime, Köhler, 2010), while others found it challenged learning (for example, Multer et al. 2013).

SCIs used various, but no consistent method for analysis (examples included HFACS, TRACEr and barrier analysis). Most prioritised high-risk near misses for investigation (for example, Gnoni and Lettera, 2012). It was impractical to analyse all near misses and so aggregation was used (Hughes et al. 2015). Various coding frameworks existed, some including 'recovery codes' to aggregate learning around how incidents were avoided (for example, Wright and van der Schaaf, 2004).

There were examples of changes made following investigation of near misses. However, detail was limited and rarely considered impact. Perceived improvements in safety were described, but only a few showed evidential impact (for example, Saks et al. 2004; Wincek, 2016) More commonly reductions in incidents were assumed (for example, Hodges and Sanders, 2014), generalising from Heinrich's pyramid.

For the GT, 28 interviews were undertaken across aviation (n = 12), rail (n = 9) and maritime (n = 7). These were supplemented by the scoping review, field notes and research memos. Table 1 provides a summary of the themes from selective coding.

Table 1. Selective coding findings from the grounded theory.

1	SCIs have organisation and industry-wide structured and regulated safety management systems. These include near misses.
2	SCIs strive to prioritise safety, but reporting, learning and levels of safety vary across organisations and industries.
3	SCIs recognise the importance of and strive for the right safety culture, with a preference for 'just.' Cultures vary across organisations and industries.
4	There is no standard term or definition for a near miss. SCIs refer to near misses in relation to interceptions where something almost happened.
5	Underreporting of near misses exists across all SCIs.
6	Reporting systems for near misses vary, but often include multiple and simple routes for reporting. Confidential and anonymous systems exist.
7	It is impossible to analyse all near misses and so prioritisation of high-risk near misses for analysis is undertaken. The rest are aggregated.
8	There are no standard or near-miss specific analysis tools, but barrier-based tools are common.
9	SCIs make changes following learning from near misses but have limited evidence of impact on safety; impact is often assumed.
10	Significant harm events lead to a greater impetus to improve. However, they are rare in SCIs, allowing a focus on other events, such as near misses.

DISCUSSION

The findings provided insights into the management and value of near misses in the transport SCIs from perspectives of operational, policy, research and investigation providers. The authors felt that they had reached theoretical saturation. The GT therefore sought to identify the theory, the principles behind, how SCIs improve safety using near misses. Key principles found are described in turn.

Near Misses Contribute to Safety Improvements Through Embedded Safety Management Systems (SMS)

SCIs had organisational and industry-wide SMSs. An SMS is an organised approach to safety through processes that identify safety hazards and manage safety risks (HSIB, 2021). Near misses were one form of intelligence informing these SMSs, contributing to safety improvements. It was not evident that near misses alone had led to improvements in safety, rather they contributed. SMSs are not widely used in healthcare and are not regulated for, unlike in SCIs (Dixon-Woods et al. 2014).

Safety Culture Must be Developed and Protected to Support Learning and Improvement; a Just Culture is Preferential

SCIs described the importance of developing and nurturing a safety culture. Reason (1997) suggested that a safety culture has five elements including being 'just.' Organisations agreed that 'just' was needed to encourage reporting, but without absolving individuals of their responsibilities (Macrae, 2014).

It was evident that the maturity of safety, and of safety cultures, varied across industries, within industries and within organisations. Safety was not homogenous and describing a single industry as 'safe' was felt to be inaccurate. For example, differences were heard about across passenger, freight, military and general aviation.

A Near Miss is Characterised by the Intervention of Human Controls Leading to a Safety Event That Almost Happened

SCIs suggested that near misses should be thought of in terms of controls. Controls are measures expected to prevent incidents. Barriers are controls that are robust and reliable to prevent an incident; safeguards are controls that support barriers, but are not robust (CIEHF, 2016). SCIs suggested that a near miss has occurred when a human safeguard has intervened, and where no barriers exist. Barriers acting as intended are not near misses as they represent the system working as designed.

Reporting Routes are Designed With the User in Mind Supported by Simplicity

SCIs demonstrated examples of reporting routes that accounted for the way in which workforces functioned. This included multiple avenues for reporting, internal to and external to organisations. Whether anonymous or confidential systems were most beneficial was unclear. Maritime felt that

they required anonymity because of their safety cultures, but others felt confidential allowed follow-up for further information.

Not all Near Misses can be Investigated, With Prioritisation of Those for in Depth Analysis Based on Risk, and the Rest Aggregated for Trend Tracking

SCIs reviewed each near miss and, in certain cases, investigated them to the same depth as harmful incidents. Near misses were prioritised using risk matrices (for example, Gnoni and Lettera, 2012). Where there was felt to be significant risk, learning or limited barriers, in-depth investigations occurred. All near misses were coded for aggregation, using frameworks that included causal and recovery codes.

Significantly Harmful Events Lead to Greater Attention and Change, They Therefore Currently Have Greater Value for Learning

SCIs described the challenges of gaining momentum with safety improvements resulting from near misses. Rather, more attention was paid to where significant damage or harm had occurred. Harm led to emotive responses and more resources allocated. There was felt to be value in investigating significant harm incidents.

CONCLUSION

SCIs use near misses as intelligence for their SMSs. Due to the low occurrence of harmful incidents in these industries, they can spend time and resource managing near misses. However, the value of managing near misses is unclear with no clear evidence of positive safety impact from solely focusing on near misses; rather it is the inclusion of near misses in a comprehensive SMS that is more likely to support improvements. Healthcare may therefore benefit from developing SMSs to which near misses contribute through the principles identified in this study.

The study also found assumptions that by addressing near misses, incidents can be prevented (Manuele, 2011). However, no evidence was found to support this hypothesis, rather the assumptions were based on historical data that has since been challenged. There is a need for further research to test the hypothesis across various industries; some have already commenced this (Wright and van der Schaaf, 2004).

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