

Near, but stopped... defining near miss as controls to support healthcare learning

Nick Woodier, Charlotte Burnett, Bryn Baxendale & Iain Moppett

University of Nottingham, United Kingdom

ABSTRACT

A near miss in healthcare represents a situation where a negative outcome for a patient was avoided, but it was a near thing. Healthcare has long struggled to embed reporting and learning from near misses, with limited clarity on what a near miss is. This study aimed to learn from industries beyond healthcare to identify the features of a near miss and clarify a definition for healthcare. A mixed methods study was undertaken with healthcare and industry safety experts providing their views on an example case study.

The study found that definitions may not be completely clear in industries beyond healthcare, but there is still opportunity to learn. The features of a near miss were found to be orientated around the role of controls in an event sequence, that almost resulted in events reaching and impacting on a patient. The authors advocate for a broad definition for healthcare, with value in identifying where humans are required to intervene to prevent incidents occurring. These situations may offer opportunities to develop more robust controls in healthcare systems to provide barriers to incidents.

KEYWORDS

Patient safety, barriers, near misses

Introduction

All who work in healthcare will recognise a situation where a patient almost came to harm, only to have 'gotten away with it.' These situations may be termed 'near misses'. 'Near miss' is an oft used but confusing term. It is an idiom, commonly used but does not make literal sense. The term has come to generally represent situations where negative outcomes were avoided, but it was close.

There is a belief that learning from near misses can support avoidance of catastrophic incidents (Donaldson, 2002; Kohn et al., 2000). However, healthcare has long struggled to embed reporting and learning from near misses (O'Dowd, 2006). The problems that contribute to this are many, but fundamentally it is unclear what a near miss is (Hewitt and Chreim, 2015; Marks et al., 2013; Yu et al., 2005). Without a clear definition healthcare will never be able to identify, support reporting of and learn from near misses.

Healthcare is often compared with other industries that maintain high degrees of safety, such as aviation and nuclear. Those industries use near misses to avoid catastrophic incidents and develop system resilience (Schulman, 2004). They commonly focus on building defences, using controls to prevent sequences of events propagating to become incidents. As a result of their successes, there is a belief that healthcare can learn from how those industries use near misses to prevent incidents (Donaldson, 2002; Kohn et al., 2009).

Industries other than healthcare have near miss systems to support identification, reporting and learning. In support there is an assumption that they have clarified definitions. The authors set out to

understand how the concept of a near miss is understood in other industries. The aim was to identify the features of a near miss to clarify a definition for healthcare.

Methods

A mixed methods study was undertaken following research and ethics approval. Firstly a literature review considered terminology and definitions of near misses in healthcare and other industries. A search strategy was developed, and relevant databases searched – healthcare (including Medline(OVID)), industry (including ErgoAbs and Proquest), and general (Web of Science). Grey literature was also identified. Included industries were healthcare, aviation, rail, maritime, space, nuclear, energy, fire and military (commonly identified as high-reliability organisations (The Health Foundation, 2011)). Maternity, obstetric and neonatal near misses were excluded because they are seen as different to ‘safety near misses’ with a focus on avoidance of death.

Secondly the authors approached healthcare and industry safety experts (participants) for their perceptions of an example case study (Table 1) inspired by the literature (Henneman and Gawlinski, 2004). Participants were asked to label each scenario as an (a) incident, (b) near miss, (c) non-event or (d) other. Fleiss Kappa was used to analyse agreement between participants.

Table 1 the case study of a healthcare situation and four potential scenarios

Situation: John has known heart problems and has been admitted with chest pain. He is allergic to aspirin which is recorded in his medical notes. A nurse identifies that John may be having a heart attack and calls the doctor who cannot attend immediately. Four possible scenarios follow:	
1	Doctor tells the nurse to administer aspirin. The nurse retrieves the aspirin and administers it. No bedside checks are done to check John’s allergies and he has a life-threatening reaction.
2	Doctor tells the nurse to administer aspirin. The nurse retrieves the aspirin and administers it. No bedside checks are done to check John’s allergies, but he has no reaction to the aspirin.
3	Doctor tells the nurse to administer aspirin. The nurse retrieves the aspirin and checks with John whether he is allergic to anything, and he confirms Aspirin. Aspirin is not administered.
4	Doctor tells the nurse to administer aspirin and prescribes it via the electronic system. The system alerts that John is allergic to aspirin. The doctor therefore cancels the prescription.

Results

Healthcare near misses - literature findings

Near miss was the most common term across the articles. Several terms were seen as synonymous, for example, close call and good catch (for example, Hewitt and Chreim, 2015; Marks et al., 2013). In England, near miss was used by professional bodies such as the General Medical Council, but the term has been challenged by the National Patient Safety Agency (NPSA) as it was felt to be inappropriate. To improve reporting the NPSA chose to change terminology to ‘prevented patient safety incident’ (NPSA, 2006). However, the term near miss was still found in later NPSA and NHS England lexicon.

The term near miss was felt to be vague (Siegenthaler et al., 2005), confusing (ISMP, 2009), blame orientated (Ginsburg et al., 2009) and subjective (for example, Ginsburg et al., 2009; Clinton and Getachew, 2003). Several articles advocated for ‘good catch’ (for example, Wallace et al., 2017; Traynor, 2015). However, good catch definitions varied and were not always synonymous with near miss (Crandall et al., 2018).

There were a variety of definitions for near miss. The authors identified 63 broad healthcare definitions across the articles with variation in whether they: were incidents, could reach the patient; involved a barrier/intervention, or could still result in harm (for example, Champion et al., 2008). This variation was also found in other articles, specifically Yu et al (2005) who looked at 12 definitions and found three functionally different meanings.

Articles most often described broad definitions, not specific to a single specialty. Several articles did describe specific near misses, for example in pharmacy 'order and retract medicine order within 10 minutes' (Adelman et al., 2013). Wilson et al (2020) used a Delphi approach to identify categories of events that should be considered a near miss in liver surgery; this was hoped to help standardisation and comparison.

Industrial near misses - literature findings

In the industries, near miss was a less common term and used informally. Other terms included close call, low level and minor events. There was debate over whether close call is synonymous with near miss (Sheridan et al., 2004) or a causal condition of a near miss (Gnoni and Saleh, 2017). Precursor as a term was also used and represents situations where an event requires diagnosis and action to prevent progression (Smith and Borgonovo, 2007). Again some authors felt precursor was synonymous with a near miss, while others did not.

There was debate about the definition of a near miss and different definitions in operational and research settings (Bliss et al., 2014). Dillon et al (2014) described two types of near miss – harrowing close calls when you escape, and pernicious common, small failures that permeate everyday life. Near misses could be seen as vulnerabilities (something almost happened) or as resilience (got away with it); resilient perceptions may result in riskier decisions. The concept of barriers also came into definitions regularly, particularly in nuclear where definitions considered plant defence in depth (IAEA 2012).

Articles also debated the broadness of definitions. A broad definition may be useful as it supports a big data set (for example, Fabiano and Currò, 2012) and avoid blind spots (Gnoni and Saleh, 2017). However, specific definitions will support reporting and various industries use them such as chemical (CCPS, 2003) and nuclear (IAEA, 2012).

Case study

Fourteen healthcare and 22 industry participants provided their insights on the example situation and scenarios. Healthcare participants were from primary, secondary, mental health and ambulance care. Industry participants were from aviation, rail, maritime and nuclear. Fleiss Kappa was used to describe the agreement amongst participants in the same cohort (healthcare versus industry) for each scenario as poor, slight, fair, moderate, substantial or almost perfect/perfect.

All healthcare and industry participants agreed that scenario one represented an incident; there was perfect agreement. There was fair agreement in both cohorts for scenarios two and three. Scenario four saw slight agreement amongst healthcare participants, but substantial agreement amongst industry participants. A full summary of choices and Fleiss Kappa results are available in table 2.

Table 2 participant choices of label for each scenario and agreement

Scenario	Option	Healthcare participants (n=14)		Industry participants (n=22)	
		Choice	Fleiss Kappa	Choice	Fleiss Kappa
1	Incident	100% (n=14)	Perfect $\kappa=1.00$ (95% CI, .88 to 1.12), $p<0.001$	100% (n=22)	Perfect $\kappa=1.00$ (95% CI, .93 to 1.07), $p<0.001$
	Near miss	-		-	
	Non event	-		-	
	Other	-		-	
2	Incident	64.3% (n=9)	Fair $\kappa=.26$ (95% CI, .14 to .38), $p<0.001$	63.6% (n=14)	Fair $\kappa=.27$ (95% CI, .20 to .35), $p<0.001$
	Near miss	35.7% (n=5)		36.4% (n=8)	
	Non event	-		-	
	Other	-		-	
3	Incident	7.1% (n=1)	Fair $\kappa=.29$ (95% CI, .17 to .41), $p<0.001$	4.5% (n=1)	Fair $\kappa=.23$ (95% CI, .15 to .31), $p<0.001$
	Near miss	71.4% (n=10)		63.6% (n=14)	
	Non event	21.4% (n=3)		27.3% (n=6)	
	Missing	-		4.5% (n=1)	
	Other	-		-	
4	Incident	7.1% (n=1)	Slight $\kappa=.09$ (95% CI, -.03 to .21), $p=.12$	-	Substantial $\kappa=.86$ (95% CI, .78 to .94), $p<0.001$
	Near miss	50% (n=7)		4.5% (n=1)	
	Non event	42.9% (n=6)		96.5% (n=21)	
	Other	-		-	

Discussion

There is perceived value in identifying and learning from near misses to improve safety in healthcare without first having to have a catastrophic or significant harm event (Donaldson, 2002; Kohn et al., 2000). However, without clear agreement of what a near miss is, identification and reporting will always be limited. Healthcare can take advantage of learning from other industries to help develop processes for learning from near misses; this starts with clarifying a usable definition.

The authors assumed that, because of the regular advocacy for learning from other industries, those industries would have clear definitions. This was not found in the literature or when meeting with the industry participants. While individual organisations may have agreed terminology and clarified definitions, they are not necessarily industry wide and vary across the industries. However, the learning from how those industries have defined 'near misses' still adds value in support of this study's aim.

The literature and case study allowed the authors to start to define the features of a near miss to support of development of a healthcare definition. Firstly, for a near miss to have occurred, an intervention within a sequence of events was found to be required. Many authors across healthcare and the industries described the role of interventions such as barriers and controls. Formally, controls are measures put in place to prevent incidents from occurring, but their effectiveness may vary (CIEHF, 2016). A barrier is a control that has been assessed to be sufficiently robust and reliable and can therefore be relied on as the primary control to prevent incidents; a safeguard is a control but cannot be expected to prevent incidents consistently (CIEHF, 2016).

In the case study the controls included the nurse following a procedure for undertaking bedside checks prior to administering the medicine, and the functionality of prescribing system to alert and potentially block the prescription of a medicine to an allergic patient. The nurse intervention is a control, but arguably only a safeguard, because of the recognition that interventions that rely on humans 'doing the right thing' will sometimes fail; it cannot be assessed as being robust and

reliable. However, the functionality of the prescribing system might be considered a barrier, depending on the extent of its influence on events.

Considering the case study, most industry participants did not describe scenario four as a near miss, rather they felt it a 'non-event.' They described it in a positive nature as the system doing as designed and intended, accounting for human fallibility. A barrier had been developed that reliably prevented an incident occurring. In contrast, healthcare staff perceived scenario four as a negative safety event in that it was a near miss. This may provide insight into the differences in system understanding and safety culture in healthcare compared to the industries. During the study, one participant described the conscious or subconscious tendency of those in healthcare to want to 'find someone to blame.' There is limited acceptance of human fallibility and therefore whenever someone or something has intervened, a safety issue is perceived to have arisen.

The learning from industries therefore suggests that a near miss should be considered as where an intervention has occurred to prevent an incident, but that the intervention is of limited robustness and reliability to not always be successful. These could be seen as interventions that rely on human safeguards or luck, like in scenario three. The human plays an active part in terminating the event cascade and this highlights where true barriers are needed (Kaplan, 2005). These are the situations that potentially offer value to healthcare organisations to mitigate hazards effectively through more physical or engineered barriers.

Secondly, with regards to the features of a near miss, the literature and case study identified the relevance of when events were stopped. In scenario two the patient received the medicine they were allergic to but did not have a reaction. The articles sometimes identified these types of scenarios as a type of near miss (for example, Shekhataheri, 2014), because by fortune the situation did not result in a harmful outcome; several participants thought the same. Similarly some articles also identified scenarios where harm had occurred but had been reduced or mitigated as near misses. Fair agreement amongst healthcare and industry participants showed that there was uncertainty about whether scenario two, that reached the patient with no harm, was a near miss or incident.

Returning to the consideration of barriers, barrier analysis recognises that incidents will sometimes occur and therefore controls can be put in place to prevent those incidents resulting in harmful or more harmful outcomes. In the case study this could have been the administration of medicines to prevent or reduce the allergic reaction. However, participants also advocated for systems that avoided incidents because a no harm incident this time may be catastrophic the next. Many definitions do separate no harm incidents from near misses, and the authors of this study agree that this is beneficial. There is value, again, in identifying those controls to prevent incidents from occurring. This also discounts scenarios where harm occurred, but was mitigated, as near misses.

Thirdly, with regards to features, articles described how a near miss can be seen from the perspective of vulnerability or resilience. Dillon et al (2014) described a near miss bias in that, if one is aware of a near miss before and avoided a negative outcome, they are more likely to choose risky options in the future. To address this risk, the suggestion is that near misses should be seen as system vulnerabilities and situations that almost led to a significant outcome.

What therefore is the most appropriate definition or definitions for a near miss in healthcare? Some literature advocates for multiple definitions, formal and informal (Tamuz et al., 2004), and academic and operational (Bliss et al., 2014). The authors of this study feel that there is enough challenge already in identifying near misses in healthcare, therefore a single definition would be appropriate. Whatever the definition, it needs to avoid defining away a near miss (Tamuz et al., 2004).

Based on the findings in this study the definition needs to consider events that almost led to a significant outcome, but where the events were intervened by a human before they reached the patient and there was no physical or engineered barrier. This definition would support identification of situations for improvement where either by luck or through human controls has potential harm been avoided. The authors therefore suggest that a healthcare, patient safety near miss has occurred where by luck and/or human intervention, unintended events almost impacted on a patient.

The definition proposed is generic and could be applied to any healthcare specialty. However, it is broad, and articles have highlighted the potential benefit of specific definitions; examples were seen in specialties such as pharmacy and surgery. Specific definitions allow focus on specific event types and areas of suspected risk, but need to be specialty centric (Pfoh et al., 2021). The work by Wilson et al (2020) using a Delphi approach offers a potential method to identify specific definitions, but national agreement would be required to allow consistency. It may be that, if healthcare organisations are struggling to support staff to identify and report near misses with a broad definition, specific definitions may be an alternative to support some learning.

Finally it is important to consider terminology. Near miss is the most common term in healthcare, but other terms, such as close call and good catch exist. There may be benefits in considering the term 'good catch' as they focus a positive lens on near misses for learning. However, the variation in terms and their matching definitions is evident in the literature. Near miss is the embedded term in healthcare, it will be hard to move away from this. Nationally the suggestion of 'prevented patient safety incident' has been made (NPSA, 2006). It may be appropriate an appropriate term as it is descriptive and represents the features of a near miss. However, further national work is required to embed this term consistently and with a clear, usable matching definition as proposed in this study.

This study is limited by its narrow focus on definitions and terminology. It is recognised that many other factors limit learning from near misses. Reporting will only be as good as the reporting culture and the ability of staff to identify events as near misses; this can be challenging and needs a degree of training, clarity and system maturity. Articles, while advocating for a focus on intervention, also identify that those interventions can be difficult to conceptualise as they are often routine behaviours and often there is no way in telling if the intervention led to a near miss (Clinton and Getachew, 2003).

Conclusions

This study has identified the features of a near miss for healthcare. The authors believe that this is the first time that the literature, with user-input across healthcare and industry, has been collated and combined to reach a firm conclusion.

To support reporting of near misses in healthcare, a near miss or prevented patient safety incident should be seen as 'a situation, where by luck and/or human intervention, unintended events almost impacted on a patient.' These situations offer opportunities to develop more robust controls in systems to provide barriers to incidents occurring. Future work should seek to evaluate this definition and whether it supports reporting and safety improvement in healthcare.

References

- Adelman, J. S., Kalkut, G. E., Schechter, C. B., et al. (2013). Understanding and preventing wrong-patient electronic orders: a randomized controlled trial, *Journal of the American Medical Informatics Association*, vol. 20, no. 2, pp. 305–310.
- Bliss, J. P., Rice, S., Hunt, G. & Geels, K. (2014). What are close calls? A proposed taxonomy to inform risk communication research, *Safety Science*, vol. 61, pp. 21–28.

- CCPS/ Centre for Chemical Process Safety. (2003). *Guidelines for investigating chemical process incidents*, 2nd edn, New York, American Institute of Chemical Engineers.
- Champion, H. R., Meglan, D. A. & Shair, E. K. (2008). Minimizing surgical error by incorporating objective assessment into surgical education, *Journal of the American College of Surgeons*, vol. 207, no. 2, pp. 284–291.
- CIEHF/ Chartered Institute of Ergonomics & Human Factors. (2016). *Barrier Management - Chartered Institute of Ergonomics & Human Factors* [Online], Chartered Institute of Ergonomics & Human Factors. Available at <https://archived.ciehf.org/learn/barrier-management/> (Accessed 22 October 2021).
- Clinton, C. & Getachew, H. (2003). Learning from near-misses', *Practice Development in Health Care*, vol. 2, no. 3, pp. 156–165.
- Crandall KM, Almuhanha A, Cady R, et al. (2018). 10,000 Good Catches: Increasing Safety Event Reporting In A Pediatric Health Care System. *Pediatric Quality and Safety*, vol. 3, e072.
- Dillon, R. L., Tinsley, C. H. & Burns, W. J. (2014). Near-misses and future disaster preparedness. *Risk Analysis*, vol. 34, no. 10, pp. 1907–1922.
- Donaldson, L. (2002). An organisation with a memory. *Clinical medicine*, vol. 2, no. 5, pp. 452–457.
- Fabiano, B. and Currò, F. (2012). From a survey on accidents in the downstream oil industry to the development of a detailed near-miss reporting system. *Process Safety and Environmental Protection*, vol. 90, no. 5, pp. 357–367.
- Ginsburg, L. R., Chuang, Y.-T., Richardson, J., et al. (2009). Categorizing errors and adverse events for learning: a provider perspective. *Healthcare quarterly*, vol. 12, pp. 154–160.
- Gnoni, M. G. & Saleh, J. H. (2017). Near-miss management systems and observability-in-depth: Handling safety incidents and accident precursors in light of safety principles. *Safety Science*, vol. 91, pp. 154–167.
- Henneman, E. A. & Gawlinski, A. (2004). A “near-miss” model for describing the nurse’s role in the recovery of medical errors, *Journal of professional nursing*, vol. 20, no. 3, pp. 196–201.
- Hewitt, T. A., & Chreim, S. (2015). Fix and forget or fix and report: a qualitative study of tensions at the front line of incident reporting. *BMJ Quality and Safety*, vol. 24, pp. 303–310.
- IAEA/ International Atomic Energy Agency. (2012). *Low level event and near miss process for nuclear power plants: best practices*, International Atomic Energy Agency, Safety report series Np.73 [Online]. Available at https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1545_web.pdf (Accessed 11 July 2020).
- Kaplan, H. S. (2005). Getting the right blood to the right patient: the contribution of near-miss event reporting and barrier analysis. *Transfusion clinique et biologique*, vol. 12, no. 5, pp. 380–384.
- Kohn, L. T., Corrigan, J. & Donaldson, M. S. (eds). (2000). *To err is human: Building a safer health system*, 8th edn. Washington, National Academy Press.
- Marks, C. M., Kasda, E., Paine, L. & Wu, A. W. (2013). “That Was a Close Call”: Endorsing a Broad Definition of Near Misses in Health Care. *Joint Commission journal on quality and patient safety*, vol. 39, no. 10, pp. 475–479.
- NPSA/ National Patient Safety Agency. (2006). *Seven steps to patient safety for primary care: The full reference guide*. National Patient Safety Agency.

- O'Dowd, A. (2006) 'Adverse incidents in NHS are still under-reported', *BMJ (Clinical research ed.)*, vol. 333, no. 7558, p. 59.
- Pfoh, E. R., Engineer, L., Singh, H., et al. (2021). Informing the Design of a New Pragmatic Registry to Stimulate Near Miss Reporting in Ambulatory Care. *Journal of Patient Safety*, vol. 17, no. 3, e121-e127.
- Schulman, P. R. (2004). General attributes of safe organisations. *Quality and Safety in Health Care*, vol. 13, suppl_2, pp. ii39-ii44.
- Sheikhtaheri, A. (2014). Near Misses and Their Importance for Improving Patient Safety. *Iranian Journal of Public Health*, vol. 43, no. 6, pp. 853–854.
- Sheridan, T. B. (2014). Evaluating models in systems ergonomics with a taxonomy of model attributes. *Appl Ergon*, vol. 45, no. 1, pp. 78-84.
- Smith, C. L. & Borgonovo, E. (2007). Decision making during nuclear power plant incidents: a new approach to the evaluation of precursor events. *Risk analysis*, vol. 27, no. 4, pp. 1027–1042.
- Tamuz, M. (2004). Understanding Accident Precursors. In National Academy of Engineering (ed) *Accident Precursor Analysis and Management: Reducing Technological Risk Through Diligence*, Washington, D.C., The National Academies Press, pp. 63–78.
- The Health Foundation. (2011) Evidence scan: High reliability organisations, The Health Foundation. Available at <https://www.health.org.uk/sites/default/files/HighReliabilityOrganisations.pdf> (Accessed 23 October 2021).
- Traynor, K. (2015). Safety culture includes "good catches." *American Journal of Health-system Pharmacy*, vol. 72, no. 19, pp. 1597–1599.
- Wallace, S. C., Mamrol, C. & Finley, E. (2017). Promote a Culture of Safety with Good Catch Reports. *Pennsylvania Patient Safety Advisory*, vol. 14, no. 3.
- Wilson, S., Barkun, J., Bertens, K., et al. (2020). A Canadian consensus definition of near-miss events in liver surgery for the real-time quality benchmarking of laparoscopic liver surgery. *HPB*, vol. 22, suppl_1, s88,
- Yu, K. H., Nation, R. L. & Dooley, M. J. (2005). Multiplicity of medication safety terms, definitions and functional meanings: when is enough enough? *Quality & Safety in Health Care*, vol. 14, no. 5, pp. 358–363.