How Not to Run an Incident Investigation

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"If you don't inquire in a way that respects the intelligence of the other person, you probably won't find many insights."

—Gary Klein, Seeing What Others Don't, 2013

Don't Let the Investigation Get in the Way of Learning from People

Incident investigation is an integral feature of perioperative surgical safety programs and is likely to be fundamental in directing future initiatives. Advances in clinical practice and biomedical technology make the challenge of doing effective incident investigation more complex and nuanced. There is a palpable distance between the stable incident investigation activities of quality and safety departments and the continually evolving scope of surgical practice necessitating increasingly risky and complex procedures, requiring clear communication across clinical disciplines, and ongoing adjustment to the subtle changes in workplace conditions.

Incident investigation should not be a remote activity of senior management disconnected

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from everyday practice in the perioperative setting but a functional tool for discovering fresh insights about the challenging aspects of the local clinical workplace in context [1]. Local experience and expertise are important factors in shaping a culture of good clinical judgment and decision-making [2]. However, clinicians remain ambivalent about incident investigation processes and tend to find more value in the informal debriefing conversations that start up after an adverse event across the organization. Perhaps the establishment of local review meetings and departmental debriefings is the most vital aspect of any incident investigation process. A good and timely debrief shifts the conversation from a retrospective search for isolated causes to a prospective exploration of patterns and cues in the local clinical workplace that emerge from everyday activity over time [3–6].

Nonetheless, it is commonplace for hospitals and health service providers to use structured methods for the analysis of adverse events, the determination of contributing factors, and the implementation of corrective actions to improve the safety and performance of clinical systems (e.g., root cause analysis in combination with human factors engineering). Incident investigation typically involves a broad range of techniques for gathering and arranging the facts that relate to adverse events into a report that categorizes areas of breakdown and vulnerability in the interactions within a clinical micro-system [7, 8]. Investigation methods have become systematized

and organized over time around a predetermined set of procedures to produce the required data [9]. However, it does not follow that incidents need to be investigated according to a fixed scheme. Above all, clinicians need to have the authority and inclination to shape the investigation process to achieve the ends that they most value in their particular workplace [10, 11].

A Surgical Trauma Case

The insights drawn from the experience of facilitating nearly 200 incident investigations in a medium sized health service in the outer suburbs of a large urban center in Australia underpin the observations presented in this chapter [10, 11]. One particularly illuminating investigation demonstrates how the ideas and setting for an incident investigation evolved from a top-down to a bottom-up process.

The case concerned a 25 year-old male brought into the emergency department by ambulance following a high speed motorbike accident. The patient was assessed by the trauma team on arrival to be in profoundly shock with a bleeding wound to the left upper thigh and chest. Chest tubes were inserted and intravenous fluids commenced. The patient was transferred to the operating room for surgical management of internal injuries and pelvic vascular injuries. During surgery the patient deteriorated and required resuscitation, which was unsuccessful, and the patient expired. The case involved clinicians across disciplines and departments from various specialties. The initial response, preparation for surgery, and overall management were discussed at a multi-department Trauma Meeting. The case was referred for a root cause analysis (RCA) investigation. The investigation team included a trauma surgeon, general surgeon, intensive care specialist, orthopedic surgeon, a perioperative nurse, and trauma nurse. The trauma physician led the team and the patient safety manager facilitated the investigation. What makes the case interesting is the broad representation of clinicians from the perioperative setting, and the leadership from the trauma physician who used the opportunity to get clinicians around the table to talk about the

lessons *they* learned from the case and will apply going forward. Notably, the trauma physician was more interested in improving the quality of insights generated from the local conversations between respected clinicians about the case than the investigation process and its detailed methods and regulatory requirements.

In retrospect, the measure of each investigation at the facility was the personal qualities and approach of the investigation team and the collective wisdom of the local clinicians. Over the last two decades various techniques and methods for incident investigation have been tested in the acute clinical settings of surgical departments (e.g., root cause analysis, common cause analysis, cognitive human factors, failure modes and effect analysis, critical incident review, risk analysis, and review of morbidity data). None should be viewed as a prescription or a system, but a set of tools to be adapted, updated and revised with each new adverse event by well-informed clinicians. Perhaps the best advice to a prospective investigation team is not to see the adverse event in isolation but a group of clinicians busily going about their work as they would on *any given day*. This is the art of incident investigation, no matter the method selected to analyze the event [12].

The experience of working with different incident investigation teams highlights the importance of good governance, transparency and authentic leadership within the surgical department and hospital. This will enable a department to move away from the zealous insistence on a particular system for investigation and direct attention to the thoughtful and timely triage of events, the selection of an appropriate team, and combination of methods, according to the goals and needs determined by the local conditions and context. Validation of the incident investigation will be demonstrated by the relevance of the findings to local clinicians and managers (What Weick refers to as their "clinical sensemaking" [13, 14]). For the investigation of an adverse event to be rendered meaningful the findings need to relate to a concrete situation where patterns of action are recognizable [1]. This is crucial for the construction of a legitimate explanation that has integrity in the local workplace.

An investigation report that makes sense to people in context is more likely to stimulate further conversation and action over time [1].

The dynamic conditions of the surgical environment and the human factors related to the performance of surgical teams warrant specific attention. Incident investigation tools and methods need to be assessed and constantly adjusted for their fit and applicability to local conditions. The skill of commissioning an investigation is a matter of clear perception of the character of the people selected for the investigation team, and an appreciation of the available resources given the organizational climate. It requires a developed capacity for understanding the human predicament of clinical work, and an ability to assess an unexpected event on a continuum, as a set of circumstances in the ongoing flow of activity in the clinical workplace [15]. Even though the situation was not personally encountered, a senior clinician who knows their department and staff will seek to understand the challenges the situation presented to the people involved, when tasked with commissioning an investigation team. He will first and foremost work to establish trust in the process and create a sense of safe space that allows open and uninhibited conversations about how best to learn from the adverse event [16].

Define Your Purpose

The investigation of adverse events should be organized around the surgical workplace culture, the organization of surgical space and schedules, the impact of perioperative work on human performance, and the potential for learning from the adaptations that surgical teams and perioperative staff make in order to recover from unexpected events [15, 17]. The extent to which local adaptation and the fitness of the selected investigation method impact on the meaningfulness of the inquiry for making sense of surgical adverse events should not be under-estimated [10, 11, 14]. Living with uncertainty and ambiguity contrasts the demand from administrators to account for the facts related to an adverse event with a plausible explanation [15]. The misguided bureau-

cratic search for *the* root causes or a single explanation has the tendency to give investigation teams and health care administrators the impression that a description of specific causative factors must and can reliably be applied to the health system as a whole (e.g., the establishment of classification systems and taxonomies of serious adverse events; [18]). The contrasting reality is that the safety and performance of a perioperative environment is the product of the continuous flow of small everyday adaptations and course corrections from multiple people within the surgical workplace in response to the ongoing technological pressures, transformations and system level developments, such as introduction of new electronic medical record systems, that shape the level of complexity and inherent patient risks [6, 19].

There is an acute need to move away from the Newtonian assumption that the investigation of a past event will arrive at a stable explanation, or that the perioperative environment operates in a stable state according to an automated set of rules [8]. Commonly used investigation techniques such as root cause analysis may create an appearance of order, but the findings of a single investigation are rarely, if ever, indicative of safety and performance at a systems level [8]. This is due to the properties of system complexity and the difficulty of reconstructing events post hoc in the clinical setting using the standardized language of incident investigation models. Organizational life is continually being shaped by unintended, unexpected and unknown factors that result in *both* positive and negative outcomes [14]. A comparison of the common assumptions behind the US Veterans Affairs National Centre for Patient Safety (NCPS) RCA process [20, 21] and the human factors approach described by Dekker [8] highlights the impact that contrasting mental models can have on event perception (see Table 41.1).

Developing insight into the way complex human systems interact and making connections within perioperative environments requires a shift in mindset about the knowledge generated from incident investigations [19]. Techniques like root cause analysis originate from industrial

Table 41.1 The level of event reconstruction possible in the local work context can vary somewhat from the assumptions made in formal incident investigation models

Common assumptions in RCA	The local reality
The investigation team displays a thorough understanding of the event through the rational presentation of information	The information gathered by the investigation team is partial and incomplete
The purpose of an investigation is to establish a reliable account of what happened and why it happened	There is no single authoritative account of an event as the analysis of what happened is influenced by the emerging mental models of the people involved and interpreted through the collective wisdom of the investigation team
The investigation team's task is to demonstrate cause and effect relationships and develop corrective actions that address each root cause or contributing factor	The findings of an investigation team are tentative and recommendations need to be confirmed in the local setting because it is not possible to capture all possible consequences of an event or anticipate all future possible situations where a similar event may occur
The incident investigation system takes into consideration the concerns of frontline personnel and is a tool for learning through the dissemination of positive actions that reduce or eliminate vulnerabilities identified	The consequences of an event are related to subjective factors that operate deep within the workplace independent of rational statements in incident investigation reports. Therefore, all conclusions remain open to review and require ongoing dialogue in the workplace

settings where, typically, the contributory factors to a defect in a stable system can be attributed to a limited number of physical causes. The nature of clinical adverse events is such that it is near impossible or exceedingly rare to frame an investigation around a single procedure or device. Human error is even more problematic as it is hard to link individual actions to discrete properties of a broken system [6, 8]. Rather than argue for a best method of incident investigation, the chapter presents a number of related propositions that can be used to make decisions about the most appropriate combination of tools that will help make sense of an adverse event. In contrast to the assumptions of Newtonian rationality about the universal application of methods, the guiding premise is that an investigation team needs to understand an event *within the context* of the operating environment and adapt the selection of tools and techniques accordingly [22]. The approach represents a shift away from assuming that there are broken properties to fix, to shaping a perspective of the event that best fits the nature of the problematic situation, and directs sparse organizational attention and resources towards the methods of inquiry that will provide a useful explanation.

A Cautionary Word About Methods of Inquiry

Most of the frustration with adverse event data and the slow progress with making changes in response to incident investigations can be related to either relying too heavily on a particular investigation technique to draw conclusions, or to making incorrect assumptions about the purpose of an inquiry. The trajectory of a serious adverse event is unique and unlikely to occur again in exactly the same pattern. Meta-analyses of RCA report data make the assumption that common factors can be categorized and aggregated across multiple (often high risk) clinical adverse events without due regard for the contextual factors that were particular to individual cases on a given day in a specific perioperative setting with a particular surgical team [23]. Aggregated RCA data, consequently, has little predictive value for future adverse events. This is challenging for regulators, risk managers, and the public to appreciate. Separated from the original context of action, system level aggregations of event data become a "cumulative mess" through the multiplication of known causes and effects [18].

When external governing bodies make these assumptions they tend to work from a basic set of definitions for the purpose of systematically organizing the consequences of multiple adverse events into categories within a measurable body of knowledge (e.g., incident management and reporting systems). At a universal level, the questions posed by regulators relate to what can be *known* generally about adverse events and clinician's performance.

In contrast, clinicians deal with everyday interactions in context and relate knowledge construction to the dynamic of particular situations [5]. In order to address what is *known* or *unknown* about the risks and vulnerabilities in the perioperative setting methods are needed that enable the discovery of previously unrecognized problems (e.g., failure modes effect analysis, fault tree analysis, and probabilistic risk assessment) [24]. Questions at a contextual level relate to gaining a better understanding of operational matters across a department. When making sense of an adverse event it is important to find out what was *known* about the particular problematic situation *by the people involved*. An incident investigation draws on the experience of people working on the frontline in the clinical setting in order to reconstruct the event.

In summary, the three different ways of knowing represent three basic approaches to constructing knowledge about adverse events:

1. *Knowledge as transferring data*. Policy makers and regulators look for what is known generally, from aggregated reports,
2. *Knowledge as learning about systems*. Perioperative suite quality and safety programs seek to discover what is unknown or better understand known risks, and
3. *Knowledge as an ongoing dynamic*. Local incident investigation teams work with what is knowable about an event from the circulating information about everyday clinical actions.

The points of intersection in the diagram (Fig. 41.1) represent the current state of knowledge about actual or potential problems. In practice, knowledge varies from situation to situ-
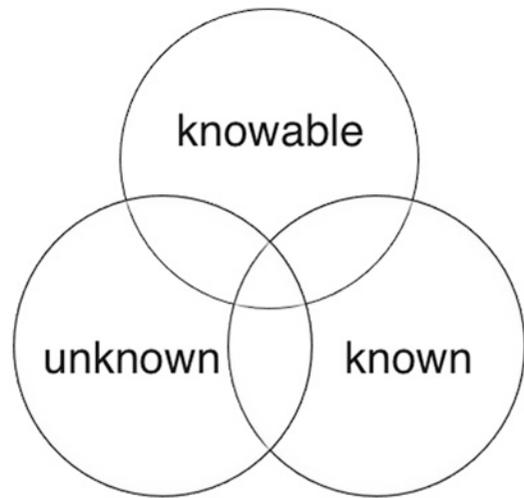

Fig. 41.1 Different inquiry methods produce different types of knowledge

ation, is highly context dependent, and mediated through a process of translation by multiple people at different levels across the organization (For a thorough analysis of knowledge transfer, see [25]. Cook and Woods [19], discuss the impact of resources and constraints on knowledge at the point of care delivery in complex systems).

Building a Body of Knowledge About Adverse Events

Although root cause analysis was introduced into health care for the investigation of serious clinical adverse events, it uses causal reasoning from stable categories to deduce what happened (i.e., root cause analysis works from categories of what is generally *known* to break an event into *knowable* parts). The view of the system is drawn from a process of deduction from known factors. Curiously, the root cause analysis checklist of questions used by the US Veteran's Administration (and adopted by other countries such as Australia) is labeled as a set of human factors questions, but the method is unlike most human factors investigations due to a focus on identifying specific causation and applying fixed categories in relation to multiple aggregated events [23, 26]. Without knowing the consequences for the local clinical workplace, and

how the people involved defined the situation, there can be no meaningful understanding of the event and the depth of analysis is limited [18, 19].

In terms of the way knowledge is produced, most adverse event investigations fit between two antithetical positions: either there is a specific "root" cause to find and sort into causal statements for corrective action according to a standardized hierarchy imported from other industries [9], or they opt for the alternative, that a clinical adverse event is the outcome of multiple contributory factors that are open to explanation from different perspectives particular to the complexity and context of the situation [15]. The separation of human factors in an event from system issues, under the label of "human error" is arbitrary, reflecting a misguided commitment to investigation methods adopted from engineering without regard for the interplay between expertise and situational constraints in complex clinical environments [4, 6, 9, 19]. The selection of method often says more about the purposes and philosophy of the investigation team and the sponsor of the investigation than the event itself [26]. The choice of response to an adverse event will to a large extent determine whether the investigation team seeks to replace broken components of a system, identify a barrier to prevent recurrence, consider the redesign of particular tasks, or to optimize workplace systems by developing a better understanding of what people do at the local level [27].

An Overreliance on Rational Analysis Paralyzes Local Knowledge

Top-down quality and safety processes have been implemented in all major health care systems for the management of adverse events. The situation in health care a decade ago was that decision makers needed to be mobilized to turn the idea of the patient safety movement into an organizational reality [28]. There is a growing body of literature that documents the implementation of the resultant processes such as root cause analysis (RCA) for the investigation of serious adverse events [5]. However, the assumptions about using retrospective approaches to locate patterns of

error within health care systems need to be challenged due to an over reliance on rational analysis as a basis for understanding breakdowns in care delivery [29]. The initial implementation of safety improvement programs introduced structured processes for thinking about the causes and contributing factors to adverse events. As health departments and jurisdictions accumulated data about findings from RCAs assumptions were made about the transferability of what was known about past events from generalized data aggregated from multiple RCA reports [23]. Informal corridor conversations about care lack the apparent rigor of rational management sanctioned incident investigations. The inherent risk in the pursuit of more reliable adverse event data is the paralysis of knowledge transfer at the local level which is the most important level for developing an understanding of how people manage constraints and regain control of unexpected events [6, 30]. A philosophical commitment to the prevention of adverse events feeds into a belief that systems are generally consistent and reliable. The reality is rather different in complex clinical systems. Accepting that good people sometimes make poor judgments and decisions is more likely to lead to an understanding of the inconsistencies that are common in everyday human interaction with complex clinical and organizational systems [30].

In order to manage this dilemma it is necessary to consciously reflect on the models that the perioperative department selects to guide incident investigation [26]. If the department is primarily concerned with external reporting there is likely to be a focus on identifying the organizational factors related to adverse events. A limitation of this risk averse approach is that perioperative care directly depends on what humans do each day in the operating room environment where only the indirect impact of organizational decisions are seen. Health care is quite different to other industries and trying to identify a rational explanation for interaction in human systems can be problematic and over reaching. Clinical work involves a level of complexity not encountered in stable closed systems where incident investigation heuristics such as the "Swiss

cheese model" originate [26, 31]. It is a constant challenge to resist the management imperative to produce normative incident investigation data about what happens in the operating room. A contrasting focus on the original concerns that guided local clinicians to initiate an inquiry into an adverse event will enable the development of measures that are the most meaningful and most likely to gain the trust of clinicians in the findings [26]. Incident investigation models that aim to develop insights about an adverse event that inform the local clinical operating system look at all aspects of human and technological interaction with the perioperative suite. Asking how local systems fit together and the nature of local constraints on perioperative care will provide a more dynamic and contextually sensitive approach to guiding incident investigation [26]. A systemic model of investigation shifts attention from what is already generally *known* to identifying what is *knowable* within the organization at the time of the event [27]. This is a hugely important distinction that is often lost on regulators.

The selection of an incident investigation model will inform how the organization chooses the types of incidents to be investigated, makes decisions about the process for engaging staff and providing feedback, and how to support the clinicians involved in the adverse event. It will also shape the type of information gathered from investigation reports. These factors are important in shaping the debriefing session format with local perioperative staff following the adverse event and its investigation. Questions should relate to a specific context where particular cues and patterns make sense and are recognizable [2, 26]. This approach will help guide future decision-making and judgments when faced with similar situations and also engender trust in present and future deliberations by management.

How to Run a Local Investigation

The decisions about the process and techniques for analyzing adverse events are best made at the local level where investigation teams reflect the workplace culture of the surgical center, its human resources, and the mix of perioperative activities [32]. Many health facilities and their surgical centers will have established structures for clinical governance and processes for the

Table 41.2 Triage questions and key decision points to consider when setting up an investigation that will facilitate and support the team process within the facility

Triage questions	Key decision making points
What is the political landscape for inquiry?	Evaluate the existing process for the investigation of adverse events, and the track record at the facility
Is the inquiry within the scope of your facility?	Select techniques from the available toolkit at the facility and for which there is local expertise and experience
Who will commission a team?	Establish a core group of experienced investigators/senior clinicians to appoint a team leader and the advise team
Who will lead the team?	Identify a senior clinician with clinical currency in the facility who is not involved in the event under review
Who needs to be on the team?	Appoint an investigation team with the requisite knowledge of the clinical area, balancing representation across disciplines and clinical specialties, from staff not involved in the event under review
Who is responsible and accountable for which actions during the investigation?	Determine the number of investigation team meetings required and the available time for each meeting Define the internal and external team reporting requirements, including who signs off on the final report Identify who will endorse the investigation team findings, allocate resources and support the implementation of the team recommendations across the organization Set a timeframe to evaluate the effectiveness and impact of any proposed changes to practice Organize debriefing sessions with different groups of staff at regular intervals to provide timely feedback

investigation of clinical adverse events. A particular method of inquiry (e.g., root cause analysis) is not prescribed here. Table 41.2 describes a commonplace approach (based on ref. [26]) that could be adapted as a triage tool for use in a range of settings to investigate different events:

Risk Assessment and Triage

Standard incident risk matrices rate an event in terms of the severity of injury to the patient and the likelihood of recurrence of the event type. There is a need for some level of triage beyond the risk assessment stage where experienced local senior clinicians not involved in the event determine what aspects of the situation warrant the most attention. The emphasis when making the decision is the knowledge of previous and current relevant challenges in the perioperative environment. In the trauma case above this was particularly relevant. The trauma physician at the facility had the foresight to convene an investigation team with the necessary senior expertise and experience to evaluate the trauma call system, the escalation process for medical review, the roles and responsibilities of the trauma team once the patient arrived in the operating room, and highlighted the importance of the trauma team leader in setting care priorities [33].

Framing the Investigation Process

The investigation needs to be flexible with the amount of time allocated tailored to the complexity of the event, recognizing if similar events have been investigated in the past. This may shorten the current inquiry. Key tasks include establishing a timeline or chronology, analyzing contributing factors to the event, and taking existing and related care delivery problems in the facility into account. It is not always possible to identify specific causal factors. The team needs to consider where the greatest benefit might be obtained in making recommendations. This was evident in the trauma case, where the trauma physician leading the investigation team had the foresight to recognize that there would be considerable benefit in having the senior clinicians on the investigation team interviewing local staff and reflecting with their peers on recent practices.

Asking Questions and Gathering Information

Beyond establishing a basic chronology of an event it is useful to identify what activities people were engaged in at the time of the event (see Table 41.3). It is essential to gather information directly from people involved in the event close to

Table 41.3 Asking key questions that help to analyze the constraints on normal operations at the time of the event helps to situate the actions of people in a specific and naturalistic context

Constraint	Questions to unfold everyday thinking
Expectations	What was the expected outcome of the clinical intervention or activity for the patient in the perioperative environment?
Professional standards	What were the normal parameters or standards that clinicians were expected to follow?
Expertise and experience	What were the reasonable limits on human performance at the time? Were people working outside of their usual roles?
Work environment	How did the people who were involved in the event identify cues and make sense of their work environment?
Protocols and procedures	Were there any obvious adaptations of the normative care protocols that were deemed necessary at the time?
Teamwork	Were people working independently or did the activity require some level of teamwork and cooperation?
Attention	Where did people focus their attention and what was pointedly ignored by people in the situation? What competing demands did people need to negotiate in order to participate in the activity?
Perception	What perception did people have of evolving changes in the immediate physical setting as the event unfolded?

the time of the event as this will increase the opportunity to capture the immediate perceptions of what happened and what operational constraints needed to be negotiated [26]. The delivery of perioperative care is increasingly complex and contingent on the interaction between multiple team members and departments that make many adjustments to routine everyday activity and continually adapt to less than optimal conditions in order to provide safe and quality care.

A more nuanced and tacit understanding of what the people involved were thinking at time can be obtained by asking them to retrace their actions while speaking out loud their assumptions and their perceptions of the situation as it developed [34]. This "think aloud" approach enables people to talk about things they usually would not verbalize (e.g., thoughts, feelings, reasoning, and expectations) [35]. Thinking out loud can provide useful information about how people interpret their environment and the constraints operating in the workplace at a specific point in time. Moreover, it situates events back into the messy flow of workplace activity [6].

Facilitating Team Meetings

The investigation team will need to consider how information will be shared in face-to-face meetings as well as online in a secure manner. Clinician demands need to be weighed carefully when determining where and how often the teams need to meet and for how long. The team meeting ideally will have a facilitator of the investigation process and a senior clinical team leader to guide the clinical conversation. The individual team members each bring their own set of experiences and levels of expertise to the investigation. Rather than the team engage in a retrospective flow charting process that is prone to hindsight bias due to knowledge of the outcome of the event, it is more productive for the investigation team to put the available information from people involved in the adverse event back into the context of the unfolding situation as it was experienced [6, 8, 26]. This approach directs the inquiry toward capturing the complexities and

uncertainties of why actions made sense at the time of an event. Making assumptions based on a standardized checklist of trigger questions [9, 21] runs the risk of not allowing the team to capture the nuanced perceptions of people and the variety of valid perspectives that can be derived directly from contextual information about the unfolding unexpected situation [14].

Notably, during the trauma case, the senior clinicians on the team considered that the task of categorizing the relevant factors was the remit of the patient safety manager facilitating the process. The majority of the team conversation was dedicated to a detailed analysis of local systems and the development of insights based on comparison with the team's broad experience with similar problematic trauma presentations.

Identifying Contributing Factors

Consulting senior management at the facility early and often in the investigation process and developing a formative picture of what type of practical recommendations could realistically be implemented as an outcome of the investigation increases the likelihood that recommended changes will be taken seriously and implemented. Talking with management also reduces the risk that an adverse event might be investigated in isolation from other safety improvement activity in the department or across the hospital. If controls and corrective actions were put in place for a similar event, this is vital information for the investigation team. Arbitrary systems for deciding whether a risk is to be mitigated or removed are too disconnected from the complex and continually changing nature of the perioperative clinical setting. It is a false and dangerous assumption that risks in health care can be removed or errors completely prevented [29]. The nature of working in human systems is such that this level of predictability does not exist in a reliable form.

Recommendations that result from an incident investigation must be tested and trialed in the clinical setting [36]. This can be via formative feedback from the frontline clinicians or through simulation prior to implementation, depending

on the level of complexity of the activity [37]. Simulation is an incredibly useful and visual form of event analysis. Whether using desktop, task trainer or a high fidelity surgery simulator, it can highlight the breakdowns in human performance and errors in the use of technology during the event [38, 39]. The simulation helps ensure all members of the investigation team as well as management understands what actually occurred during the event and how the team performed [40].

The Investigation Report

The team report describes the process and outcomes of the event, contributing factors, recommendations, and strategies for implementation, with timeframes for review and evaluation. It should be acknowledged that the team's view is a limited perspective based on the *available* information at the time of the investigation [41]. A meeting to debrief and discuss the team's findings with local staff across discipline and department boundaries is the single most important step. In the example of the trauma case above, there was significant email conversation between clinicians about drafting recommendations outside of the scheduled team meetings. The investigation reporting process became a vehicle for the articulation of patterns and the identification of potential solutions to the issues raised by the discussion of the case. Constructing the investigation report provided the team with a medium for inter-professional dialogue and debate that did not previously exist in the perioperative culture of the facility.

Staff Debriefings

Translating investigation reports into meaningful actions is a challenging task. In fact, in our 35 years of combined experience in being part of over 400 adverse event investigations, the investigation process is largely disconnected from everyday clinical practice and thus imposes a huge administrative burden on individuals who have ongoing operational responsibility as well

as investigating the process failures that led to the adverse event. Feedback following an investigation and the implementation of strategies to implement change is not well managed [5]. Providing ongoing feedback to staff in a completely transparent manner with an interest in the event at strategic points during the investigation and debriefing after the completion of the investigation is essential if the analysis is to penetrate the local clinical workplace culture and lead to entrusting future communications [15, 17, 42]. It is additionally important to evaluate the process followed by the investigation team and to measure how effective the recommendations made by the investigation team were in addressing the challenges related to the original situation. The debriefing needs to focus on the aspects of the problematic situation that warrant the most attention in order to reduce the interference of competing agendas. An adverse event will involve many potential problems that could potentially consume large amounts of time and resource. It is useful for debriefing sessions to look beyond the event and consider the patterns and trends from similar events within the context of the facility.

In the trauma case above, after the investigation was completed, members of the investigation team participated in an open interdepartmental Trauma Meeting where people involved in the adverse event and their clinical peers were able to make sense of the investigation team's findings through the debriefing process. The debriefing brought together in one room key people who were loosely connected with the case. If the larger feedback meeting had not been held, there was a risk that opinion and rumor would impede the impact of the investigation. The Trauma Meeting proved an effective forum to produce insight, synthesize bits of information, and conceptualize improvements in perioperative care delivery. Intelligently, the trauma physician had recognized that routine organizational networks were not able to resolve the workplace tensions related to the case due to the impact of a death in the operating room. A different mode of thinking was required that would be a "springboard into action" for the local clinicians [14]. The coordi-

nated response to the case piqued the interest of staff and helped to embed the Trauma Meeting as a respected clinical forum. Attention to how staff conceived the adverse event in the perioperative setting in retrospect was a key feature of the coordinated response to the case.

Reflection on the outcomes of incident investigation requires careful handling and this applies directly to the way the investigation report and its recommendations are disseminated and shared in the local clinical environment. The report needs to be seen as part of an ongoing process of making sense of clinical work and not a fixed definitive statement. Socializing the report (and the ongoing place of the adverse event in the local workplace culture) is a collective thinking task that requires a coordinated response, with due regard for differing standpoints, acknowledgement of hindsight biases, recognition of familiar cues, an emphasis on plausible explanation rather than root causes, and provision for people to adjust to the impact and changes that result from the investigation [6, 14].

How to Interpret an Investigation Report

The nature of an investigation report will depend to a large extent on the selection of methods and techniques for the investigation of an adverse event and the leadership style of the person in charge of the investigation [41]. Regardless of the particular method of inquiry chosen, the investigation report should contain deductions from the known facts about the event and a set of proposed recommendations or corrective actions that address the problematic situation surrounding the adverse event in a particular time and place. It is important to note how the experience and expertise of the investigation team is positioned relative to the perioperative workplace. The stance adopted by the investigation team, its demeanor and credibility, and the selection of methods of inquiry directly shape the strength of the statements made in the report and the range of possible conclusions that readers of the report can make as they interpret the report.

The analysis conducted by the investigation team usually consists of a combination of propositions about characteristics of the event based on standardized language contained in checklists of human factors categories [9]. Interpretation is drawn from what is knowable about the event and the report should provide a reader with a clear picture of what was happening at the time of the adverse event. The investigation team report goes beyond the experience of people involved in the event and includes statements drawn from the collective knowledge of the team, use of electronic medical records about similar events in the perioperative setting, as well as global experience with similar events. This is the process of understanding at work. Investigation teams are not able to present an objective interpretation, as both authors and readers of an investigation report, bring with them subjective perspectives based on their own experiences and understanding of the clinical workplace [30]. However, if the characteristics of the event described in the report are not recognizable the readers are likely to dismiss the report as unrepresentative of the event as experienced or a simple white wash of the events by management [43].

What Is in a Name?

It is appropriate to mention the role of the word "event" at this point in understanding the investigation report process. A word like "event" is an approximation of something that has happened in the clinical setting for the purpose of making it knowable [6, 18]. The adverse event described by the investigation team is not the same as the experience of that event by the people involved. While this may seem self-evident it is an important distinction about the process of interpretation. Clinical operations in the perioperative environment are a dynamic ongoing activity. When an investigation report speaks of an event it represents a moment in time when something changed [6]. An event does not come packaged as an organic whole. The beginning and end of the event described in the investigation report chronology is a convenience. Put simply, the

investigation team sets up the conditions for interpretation. If it is not made clear to the readers of the report that the event is an approximation of what happened, the risk is run that people will feel that what they personally know has been left out of the picture or erroneously modified.

The reporting process, therefore, is concerned with making the adverse event knowable. There is considerable potential for the investigation report to be interfered with by distracting factors and the final version may be altered due to the introduction of different perspectives to those captured by the investigation team [41]. Unwittingly, clinical leaders, senior management and health facility administrators may impede the interpretation of the event due to their concerns about the wider implications within the organization and beyond if and when the report is shared with external stakeholders. The investigation report is not intended to cover all related clinical situations and possibilities. The investigation team report deals with a specific problematic situation in a particular perioperative workplace setting such as an operating room at the time of the event. It is important to clarify that the investigation report must be understood within these parameters.

The testing of what is recommended in the investigation report will follow. It is important that senior management can make decisions about what changes to implement based on a clear picture of what was knowable from the event based on the characteristics of what was happening at the time of the adverse event [26]. The description of the event in the investigation report provides a structure or framework for interpretation by different audiences. The report needs to contain information that will enable readers to construct a meaningful picture of the event that relates to the reality of everyday experience [14].

Care must be taken when reducing an event to essential or abstract terms in an investigation report (e.g., human factors categories, incident classification systems, and risk management controls). The selection of investigation methods directly impacts the way a report is written and interpreted [18]. The guiding principle when reading a report should be determining local operational utility more than satisfying the demands of external administrative control [44]. The investigation report is a vital part of the process by which local staff in the perioperative suite deal with the experiences and outcomes of an adverse event. A report needs to be written in an accessible form in order for different readers to find ways to discriminate what they know from the knowledge gathered by the investigation team. It may be helpful to consider three types of report formats: a one page executive summary, a three page summary, and a more detailed report with all the key investigation findings. The report is not a final statement but a transition document that identifies the problems that require ongoing attention in the perioperative setting. Report findings are more likely to be made known when they relate to how the perioperative workplace is experienced.

New knowledge about an event takes on meaning when it is considered in the context of the familiar circumstances and conditions in the local environment where problems are experienced and managed. Finding points of identification with the report will enable resolution of the issues raised by the adverse event. People with local knowledge need to come together and talk often several times about the report in order to make progress beyond the approximations of the investigation team. This is rather different from essential explanations that reduce an adverse event to an allocation of root causes. What moves an event forward is when a cogent narrative is conceived in terms of a specific perioperative setting where new knowledge about the operational problems can be differentiated from existing knowledge and corrective steps can be implemented [41].

Engaging Staff in Learning Through Feedback and Debriefing

Studies of investigation reports and the implementation of investigation team findings following surgical adverse events commonly report that the team has "no power to enforce any recommendation or ensure compliance" and that learning is limited to the clinical unit involved in the event

[45, 46]. Publishing aggregated RCA data may improve the dissemination of knowledge, but it does not follow that this is an effective strategy to engage staff in meaningful learning at the level of the perioperative suite in individual facilities [47]. Despite a sustained response in the literature to the category of "wrong surgery" and the implementation of checklists and time-out protocols by surgical teams, meta-analyses of RCA reports are limited to confirming that incorrect surgeries continue to occur at a rate not much dissimilar to before checklists were required [48]. Aggregating data from multiple RCA reports does not make the clinical workplace environment more predictable; rather it creates a false impression of an ordered world waiting for its causal links to be identified [6]. The reality is that adverse events take place within a flow of dynamic activity not isolated in discrete and context-free repeatable actions. The meta-analysis of wrong surgery events suggests that "errors upstream and downstream" to the implementation of universal checking protocols in the perioperative suite require attention [48, 49]. However, what might be happening upstream in one perioperative setting may well be rather different to other surgical departments. Activity downstream today in a given facility may be due to rather contrary factors tomorrow.

The metaphor of the stream of activity is a step in the right direction [6]. However, to effectively engage staff in making sense of adverse events in the continuous flow of clinical experience, a strategy for workplace learning is required that can be tailored to the dynamic conditions of local clinical culture [15]. This process is important for making sense of investigation team findings in everyday operations [10, 11].

Building an Adaptive Workplace Culture

There are activities that can augment or even replace the need for an incident investigation by focusing attention on the analysis of the clinical workplace. Considerable attention has been given to near miss reporting and clinical risk assessment in health care over the last decade [50]. Incident management systems and adverse event investigations work hand-in-hand. However, despite improvements in reporting and data collection, progress with changes in the reliability of clinical operations as an outcome of adverse event investigations has been less convincing in the literature [51]. This is because reliability is a local dynamic property within clinical microsystems (i.e., in this case, the perioperative setting) and not a stable property of the health system [52]. Tools and techniques that test the reliability of local clinical systems and the efficacy of local system design provide a useful adjunct to incident investigation. Indeed, they may be integral to the testing and evaluation of recommendations arising from adverse event investigation reports.

Applying Probabilistic Risk Assessment (PRA)

The national and international professional standards for the regulation of perioperative environments provide a useful guide to the boundaries of safe operation in the operation room. In contrast to perioperative risk assessment with a clear focus on the patient and procedural risk for different patient groups, PRA is concerned with assessing and evaluating the safety of the operating room environment [53]. Adverse event investigation identifies problems in the current system and regulatory standards indicate optimal operating room practices. In anesthesiology in particular there are checking procedures for multiple items of equipment and the related processes. It is routine to run safety drills and simulations to identify how best to recover from conditions that threaten patient safety in the operating room. Individual investigations of adverse events include some level of commentary on the chronology of actions, or sequence of events that were precursors to the event. Identifying these factors can help inform where redundancies need to be built into clinical practices to promote surgical safety [54]. In the root cause analysis methodology, for example, this is referred to as

barriers and controls. In order to determine which interventions are critical for perioperative safety, a process such as probabilistic risk assessment (PRA) can be applied to measure specific thresholds of safe operating practice within the boundaries of the relevant professional standards [45]. Considerable attention to safety in the surgical environment has identified a need to balance effective utilization of perioperative resources and operating room time with strategies and techniques to reduce risk and promote patient safety. An adverse event investigation can highlight areas needing attention in the current design of operational systems, the configuration of equipment, or the physical layout of the perioperative space. In determining priorities, a PRA will provide an estimation (based on current operations) of the safety measures that reduce the frequency and likelihood of future adverse events at different levels of utilization for the particular operation, operating room and the dedicated surgical procedures within a perioperative facility.

The limitation of PRA is that it is less able to predict future risks that may produce unexpected events and the uncertainties that a change in procedures may introduce [55]. Maintaining real time activity within the perioperative setting within the boundaries of safe practice is mostly dependent on clinician expertise and experience in observation and interpretation of the available information on a given day. Local adverse event data, however, can be used to inform ongoing risk assessment. PRA when used in combination with and adverse event investigation report provides information about problem identification and resolution within the boundaries of safe operation [24]. Clinicians and managers must make the decisions about how the investment in resources, changes to operating room schedules, and introduction of new procedures will impact current levels of system safety in the perioperative suite. One method available to determine the duration of a cases or how changes already under way might impact current safety is through Bayesian analysis. Bayesian analysis refers to the use of previous observations and current information to help determine future events [56].

Applying Failure Modes and Effects Analysis (FMEA)

FMEA is a useful tool to analyze workflows through the perioperative suite following an adverse event. An investigation may identify that an aspect of operations within the perioperative suite is not performing as intended. Investigation teams can also use FMEA to develop and evaluate recommendations for corrective action in a final report. The analysis of the failure modes and effects involves identifying the elements and their sequence in the procedure under review, the conditions that could result in failure at each step, the effects of each failure on the performance of the procedure, the likelihood that the failure could occur under local conditions, the impact of the failure on patient safety, and, what remedial action could reduce the risk of failure [27, 57].

Measurable activities in the perioperative setting include standardized processes with multiple steps performed in sequence. As an adjunct to an adverse event investigation it useful to break a procedure or protocol into separate steps using a process mapping methodology, and consider the stages where something unexpected happened or there is potential for the sequence to break down. Rather than look at the prevailing conditions in the perioperative suite, the FMEA looks specifically at human interaction with technology or equipment and the potential for procedural failure at a systems level [27].

An example of an adverse event where the consequences of a procedural failure needed to be mapped out involved a patient who had a spinal fusion performed at the incorrect level [58]. The local neurosurgical practice for sighting and marking of spinal levels was a contributing factor to the adverse event. FMEA identified that the timing of access to radiological images was critical as was the ability of the members of the surgical team to visualize and confirm the spinal level with the radiology team. A key finding was that the position of the surgeon relative to the patient and the position of the assisting surgeon on the opposite side of the operating table could give the perception of different spinal levels depending

on the viewing angle. Visualization of the radio-logical image was not always completed at the same time by each surgeon due to movement within the operating room relative to the position of the viewing box. In the adverse event, this was compounded by the fact that the two surgeons did not provide clear verbal confirmation to each other or to others on the team in the room about the spinal level. An experienced neurosurgeon not involved in the adverse event used the information available to the investigation team to analyze the practice for spinal marking at the facility and developed specific insights to reduce the chances of similar events. The high probability of recurrence suggested by the FMEA led to a change in the local procedure whereby both surgeons had to provide clear verbal confirmation citing specific anatomical markers and read-back their interpretation of the radiology image to the entire OR team. The agreed position was recorded by a third person prior to the marking of the spinal level for the surgery. Before the investigation, the neurosurgeons at the facility had varying individual practice for sighting and marking spinal levels. The FMEA provided an opportunity to develop a consistent and reliable practice.

Looking Beyond the Investigation Phase

Following the incident investigation there is the interpretation phase. Different groups will interpret the findings of an investigation team, and therefore, there is a need to create opportunities for making sense of the event back in the clinical setting of the perioperative workplace [6, 14]. Adverse events have a context around which various arguments are constructed and perceptions are shaped by different groups of people. The discussion of a particular event must become sensitive to operations in the local clinical setting, taking into account the impact of the relative distance of the event in time and space. The treatment of individual adverse events in terms of how they are experienced by different groups facilitates discrimination of what is relevant from a range of possible explanations (that might apply to other

perioperative settings). The retrospectively constructed chronology of an adverse event needs to make sense in terms of everyday operations, as they are currently experienced, not at some imagined point in the past. When it comes to interpretation, it is important to acknowledge that all arguments about adverse events cannot be separated from the current experience of the clinicians doing the interpreting. The determination of the beginning and end of an adverse event is constructed through the process of an adverse event investigation, as it is easier for the investigation team to deal with a finite bounded set of circumstances. How an event is then put back into the continuous flow of perioperative activity is a separate but crucial task to the actual investigation [6].

An adverse event is but one moment in the continuous flow of activity in the perioperative setting. This flow of action is essentially local, making it necessary that the event be examined and interpreted via a range of thinking processes that enable the construction of a composite picture that can be translated by local clinicians and managers into everyday operations where there are ongoing interrelated problems in motion that relate to and continue to inform the interpretation of the adverse event and the resolution of problems raised at different levels of operations within the perioperative clinical micro-system [7]. The various processes recommended that might help to manage what might be distorted or limited in defining and discussing the event from the particular preferred perspectives of dominant clinicians in the clinical workplace culture.

Translate Insights into Everyday Operations

Translating knowledge involves more than the formal feedback of the findings by the investigation team in the form of a report. What is involved, in *knowing* even what the investigation team discovered, is more than what is now known about the adverse event, there is also the *knowledge* that each discipline and practitioners of differing levels of expertise seek and how various people

make sense of the event according to their particular set of relations within the perioperative setting [25]. It is important to acknowledge *who wants to know* about an adverse event, how it has impacted different people psychologically, and what variations on the story have accumulated in the workplace about the event. Translation, in contrast to unilateral forms of feedback following an adverse event, seeks to integrate and take into consideration these various perspectives [25]. The everyday operations at the local perioperative workplace are the basic setting for translating event analysis into different levels of organizational knowledge. It is the place where the explanation for an adverse event is grounded and the process of sense making is translated into genuine insights.

This does not mean that inquiry is reduced to the level of opinion. Rather, in selecting appropriate methods, the subjective is viewed as guiding the human factors analysis. The selection of an appropriate means whereby an investigation team's findings can be translated into the functioning of the local workplace should be supplied. The process of translation involves activities such as simulating and testing knowledge and skills, analyzing the components of a task, reviewing communication channels, and evaluating resource constraints and utilization [25]. Suitable methods for the translation of the investigation team findings include but are not limited to process mapping [7], common cause analysis [59], implementation mapping [60], probabilistic risk assessment (PRA) and failure modes effect analysis (FMEA) as discussed previously. These devices need not be applied in isolation from everyday activity, but facilitate ongoing discussion and meaning construction. The analysis of any adverse event should not be viewed in isolation from the particular nuances of the workplace environment and the people who do the perioperative work. The findings of the investigation team are basic working hypotheses or approximations that require testing in real situations where they can be made meaningful to the people who use the workplace.

Actively Explore the Problematic Situation with the People Involved

Formal feedback following an adverse event investigation is often limited to summary statements of the investigative team's findings and recommendations. This is not adequate for frontline clinicians and risks undermining the credibility of the investigative team on this and future investigations. The outcome of the team's event analysis and the proposed solutions to the original problematic situation need to make sense in relation to what is already *known* about the perioperative setting, for the different groups of people who *want to know* about the adverse event, incorporating the current state of *knowledge* about the variety of actions and human factors the investigation team identified as pertinent to the adverse event under review (outlined in Table 41.4).

Safe practice and adverse events exist on a continuum and learning comes from seeing the tension between interruptions to normal perioperative activity and routine activity in the same organizational space [18]. In order to extract the most value from the investigation of an adverse event the local managers and clinicians need to step back and look at the event in the wider context of the continuous flow of perioperative activity while constantly evaluating the impact of the proposed policy or service interventions [61].

Test Alternative Actions and Hypotheses in the Perioperative Setting

How do the various recommendations made by the investigation team fit together? The dynamic nature of activity in the perioperative setting needs to be taken into consideration when evaluating the applicability of the investigation team's recommendations. The formalized standard language of investigation techniques such as RCA (e.g., mitigating actions and quantifiable outcome measures) can give an impression that the recommended actions that result from the investigation

Table 41.4 The problems that investigation teams identify bring the (human) factors related to different types of knowledge together around a variety of human actions

Types of knowledge	Variety of human actions
The experiences of individual people involved in the adverse event	What is pertinent to the perioperative setting that was not evident prior to the interpretation of the adverse event? And conversely, what aspects of the event are relevant to prior experience in the local workplace? What do people pay attention to and what do they ignore?
The habits and routines of the organization	In some accident models these problems are referred to as "latent" or "system" level issues. Activity in the clinical workplace is determined by local systems as defined by the particular perspectives of people working at the time
User perspectives on technology and work	Techniques such as PRA and FMEA can assist in identifying local definitions and perceptions of human–machine interfaces in particular situations and practices. Simulation and thinking aloud can be very useful here in stepping through the use of technology by the people involved in the event, and any proposed changes to the application of technology following the investigation
The varying bodies of knowledge among the clinical disciplines	A clinical workplace problem concerns not only interdisciplinary and intradisciplinary communication about clinical work but the beliefs and practices at different levels of expertise within each clinical discipline

are stable and reliable and ready to be implemented [9]. This could not be further from the truth. The recommendations presented in an investigation team report are vulnerable to many distortions and intrusions and as such require careful interpretation before being considered for implementation [41]. It is well reported that recommendations from RCA investigations have an uneven record of effective implementation [5, 46, 62, 63]. This may in part be due to a lack of processes to test the viability and feasibility of proposed changes to action in the clinical workplace. The different groups that constitute the perioperative workforce have varied levels and awareness of knowing about surgical work and its processes, and differing experiences of working in the perioperative setting (e.g., the perspective of the surgeon will vary to that of the circulating nurse on the team in the same operating theater on a given day).

The recommendations made in the investigation report need to be tested with surgical teams at different levels engaged in everyday workplace activity, or simulations of that activity where real time testing would either be unethical or not feasible [37]. The perspectives of all perioperative team members on the surgical processes are needed in order to facilitate practical testing. Well-designed team based simulations enable the necessary actions that underpin any surgical situation to be better understood and

respected. Knowing how normal work is done will make the interventions of the investigation team less arbitrary and more trustworthy.

Develop Effective Strategies for Insight into Local Systems

The investigation team's stable recommendations need to be distinguished from the ambiguity of everyday operations in the perioperative setting. The distinction involves identifying the differing frames of reference that are an integral part of working relations and the arguments people express in support of certain recommendations over other changes proposed by the investigation team. There is no objective stance apart from the world of experience. Experiences bring together those who want to know and what is known about an adverse event. The insights that are produced as a result of an investigation process make sense to people as the new knowledge enters into circulation within the workplace [25].

Statements about zero tolerance for error in health care and preventing harm are at best wishful thinking and at worst create cynicism, anger, distrust and contribute to clinician burnout (Compare [29] with [64]). Turning error management into a bureaucratic activity stifles local attempts to take risks and develop insights [16]. For example, it is common to label the causes of adverse events as
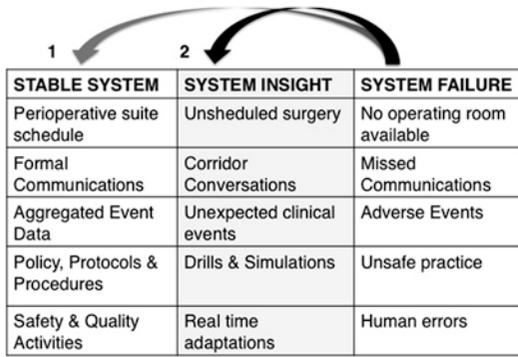
STABLE SYSTEM	SYSTEM INSIGHT	SYSTEM FAILURE
Perioperative suite schedule	Unsheduled surgery	No operating room available
Formal Communications	Corridor Conversations	Missed Communications
Aggregated Event Data	Unexpected clinical events	Adverse Events
Policy, Protocols & Procedures	Drills & Simulations	Unsafe practice
Safety & Quality Activities	Real time adaptations	Human errors

Fig. 41.2 The desire to pursue system stability is compelling in health care organizations (*arrow* #1). What can be known about the perioperative suite exists on a continuum between stable predictions about the system on the left and significant breakdowns in the system on the right

"communication failure," but this practice simply generates another cycle of event classification rather than exploring the systemic vulnerabilities in the local clinical context [19, 65]. Likewise, and importantly for the present discussion, adverse event investigations are a quality and safety activity and *a product of system stability* that often constitute the immediate response to *system failures* (Fig. 41.2). In contrast to the stable activities produced by the left hand side of the diagram, rich information about perioperative communication pathways generated through everyday clinical work provides an opportunity for robust local discussion and interpretation (middle column of the diagram). Real insight comes from exploring ambiguous and novel situations (arrow #2). Unlocking *system insight* involves building a local workplace culture for learning from experiences in a supportive environment where clinicians and managers feel safe to experiment with new ways of doing things [3, 15, 66]. Developing system insight is an ongoing process of negotiation. Articulating what needs to be done in the aftermath of an adverse event in organizations with a healthy workplace culture is recognizable by the level of participation in negotiation, discussion and learning about the work [67].

Progress in perioperative system safety will largely come from strategies to better understand how people and processes operate when they are in the middle zone of the diagram. Paradoxically, this involves turning attention away from formal

quality and safety activities (e.g., retrospective investigations that produce hypothetical recommendations to reduce errors) and looking at what people *actually do* to recover from a breakdown in care delivery (by strengthening informal opportunities for local conversations about perioperative team experiences using qualitative methods such as interviews, focus groups, observations and more) [68]. Both systems are necessary but they require different approaches, in order to continue general strategies that reduce errors and to also develop strategies that enable local system insights to be brought to light [3]. These systems help to create resilience that allows people to conduct hundreds of operations a week with few to no adverse events.

The evaluations of incident investigation processes such as RCA consistently identify that health care organizations need to prioritize time and offer some productivity slack for clinicians and managers to reflect on their learning, share information and insights about everyday care delivery problems [5, 31, 46, 63]. Existing review meetings within the perioperative workplace environment could profitably be redesigned to meet regularly to explore and discuss the lessons learned and patterns identified from incident investigations. A single incident investigation is simply not adequate to capture the insights that a complex problematic situation entails. Shifting the emphasis from stable system processes to thinking about the ambiguous and unexpected opens the team up to a variety of responses and sets up the conditions for mindfulness in the local perioperative workplace culture [15].

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