Making Sure Investigators Get It Right - Human Factors Considerations for Investigators

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One of the key concerns for industrial incident investigation is the consideration of human factors and the decisions and behaviour that may have contributed to the event. However, less attention has been given to the fallibilities and vulnerabilities of the investigators themselves in relation to their task. Investigators, like the individuals involved in accidents, are also subject to organisational, task and individual factors that affect task performance. So how can we help ensure that investigators consistently get it right?

A workload study conducted in 2011-2012 revealed three workload peaks across 11 phases of accident investigation, and a steady drop in self-reported energy/capacity as the investigation progressed. A systematic review of cognitive biases performed by the Keil Centre in 2018 revealed that key cognitive biases are highly relevant at key stages of an investigation where workload is a relevant performance shaping factor. This includes the evidence gathering phase, where biases relating to team members' previous experience, technical expertise or expectation may affect the information sought, processed or retained. Later, during the analysis phase where the teams' understanding of the causal factors is refined, biases such as hindsight bias come into play. This is where the actions that contributed to the incident may be unfairly judged because of the knowledge of the outcome of the accident. The analysis phase is critical in the development of the recommendations that contribute to learning from the incident and help prevent recurrence.

Strategies for managing relevant performance shaping factors and cognitive bias in investigations are discussed in this paper. These strategies have been included in training courses for investigation-related interviewing and human factors analysis to encourage consideration of individual, job and organisational aspects that could affect investigator performance and investigation quality.

Introduction

Across many industry sectors, including healthcare, transport and defence, the role and importance of Human Factors in the investigation process is widely acknowledged. As part of a structured Human Factors approach, investigators will seek to identify key behaviour and/or decisions that contributed to the incident and are likely to use established analysis methods to help explain what influenced the behaviour in question. This process should, in turn, inform the process of formulating recommendations to help prevent recurrence of the incident. Investigation activities, including human factors analyses, may be carried out in parallel by internal investigators and investigators from the relevant regulatory authority.

Many organisations judge the findings of an investigation against their own Just and Fair Culture model (after Hudson et al, 2008) for determining whether sanctions should be applied to involved individuals. As such, the output of the investigation(s) of an incident can have significant consequences for both the affected organisation and individuals. This means that the accuracy and credibility of facts established by the investigation and the quality of the investigation work are critical. Since the investigation process is a highly human-dependant activity, there are human factors that will affect investigators' task performance. A hypothetical investigation-of-an-investigation would be likely to reveal behaviour and decisions influenced by a range of internal and external performance shaping factors and possibly evidence of cognitive biases.

Within the field of industrial accident investigation, the main focus of academics, regulators and industry associations that produce guidance on Human Factors has been in relation to examination of the incident itself. Studies such as Burggraf and Groeneweg (2016) have examined the quality of investigations from a management of Human Factors perspective. Specific guidance has been produced by The Assessment Capacities Project ACAPS (2016) and the Forensic Science Regulator (2015) that focuses on managing the risk of cognitive bias in crisis analysis and forensic science examinations respectively. The Institute of Occupational Safety and Health (IOSH) has also published guidance for internal investigations that identifies common human and organisational pitfalls to avoid and competence requirements.

This paper examines Human Factors aspects that affect investigators and presents the findings of analyses of investigator workload and cognitive biases relevant to investigations. Further, the paper describes some strategies for helping to manage the risk, and hence ensure that investigators are able to deliver consistent, high quality investigation work.

Investigation Workload

Organisational approaches to investigation differ, including between organisations from similar industry sectors and between private sector organisations and public sector organisations, of which the latter includes regulatory bodies. Key differences include the leadership and structure of the investigation team and the timescale allocated to the task. In many cases, investigations are led and carried out by personnel, often in supervisory or managerial roles, who are expected to divide their time between roles. This approach is also common for internal investigation of lower-severity incidents and near misses. Some organisations have a dedicated investigation unit, whose remit is typically to lead investigation of higher-severity incidents as their main role. Internal investigations may also be led by a more senior manager, a company lawyer or an external leader. In many of these scenarios, subject matter experts and other investigation team members will normally have a main role and will typically be expected to fulfil aspects of that role whilst working on the investigation.

Regardless of the operational model chosen, investigation work is usually regarded as demanding and is characterised by a high workload. Key influencing factors on workload are the time and resources allocated (or available) to complete the investigation task and the expectations of the investigation. Timescales can vary from over a year (for example regulatory investigations of major incidents) to as little as 1 day for some internal investigations. Higher-severity incident investigations usually benefit from larger investigation teams, longer timescales and a greater capacity for engaging dedicated subject matter experts (SMEs).

Expectations, as defined by the investigation Terms of Reference (TOR), investigation mandate or similar scope of work can vary from an explanation of the incident timeline and assessment of causal factors to a wider scope that includes a detailed evaluation of the robustness of safety barriers and the effect of learning from previous incidents. To ensure that the investigation can be performed to a suitable level of quality, a reasonable balance has to be struck between organisational expectations and the resources allocated to fulfil these expectations. This is principally a management activity that requires a clear understanding of the resource requirements for the various task steps or phases of the investigation. Unless the initial conditions of the investigation are clearly defined and fixed, internal investigations may be prone to scope creep, whereby the commissioners of the investigation may request additional areas of interest or concern to be examined, yet without considering the impact on investigation workload and the timescale for the required output of the investigation.

Workload analysis

An examination of workload for full-time accident investigators from the internal investigation unit of an energy (oil & gas) company was undertaken during 2011-2012. This followed internal employee wellbeing survey results which had triggered a requirement for formal follow-up of aspects related to managing workload. Semi-structured interviews based around the topic of workload management were conducted with 12 full-time, experienced internal accident investigators. The interviews included asking the interviewees to rate workload and subjective stress level in each of 11 identified key phases of the investigation process as typically conducted over a 6-8 week timeframe, expressed as a percentage in relation to 'normal' workload for office-based tasks. Further, the interviews included asking the interviewees to rate their subjective energy level/capacity at each investigation phase. The results were aggregated to produce the illustrative graph shown in Figure 1.

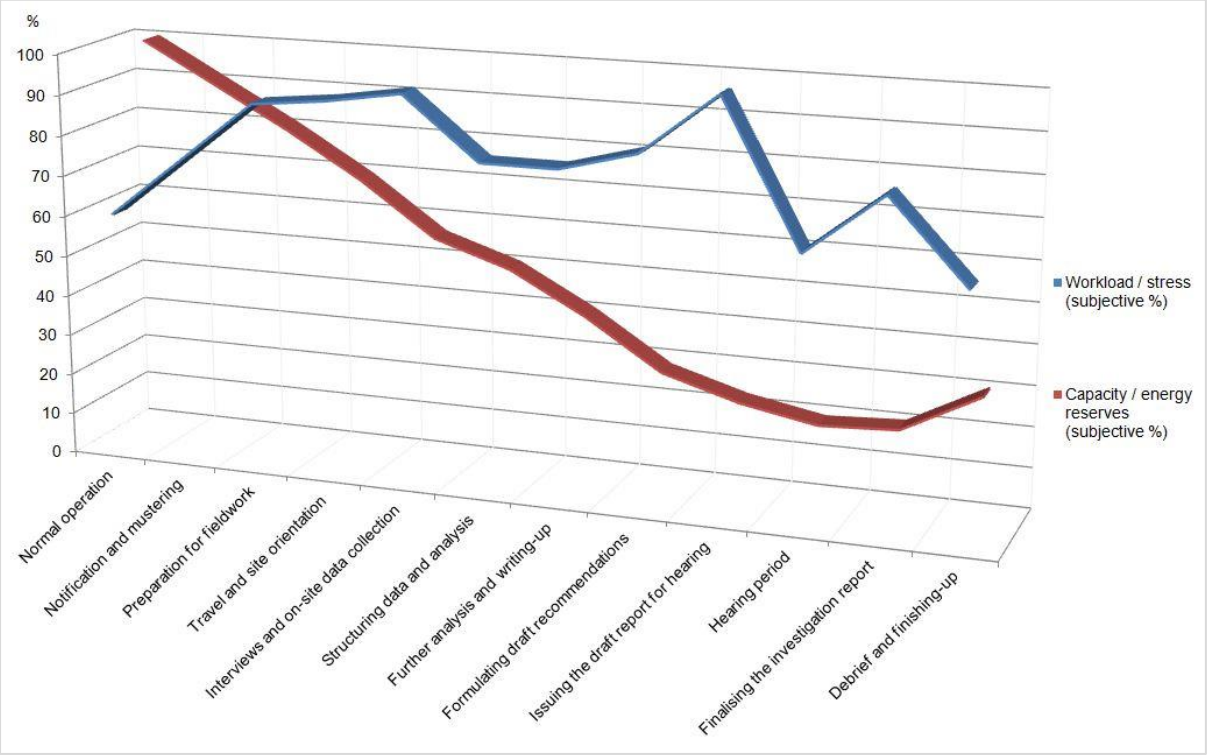

Figure 1. Subjective workload during the steps of a typical investigation with corresponding subjective rating of energy level/capacity

Figure 1 shows that for the sample of 11 investigators interviewed, their subjective assessment of workload and stress level followed a pattern characterised by a sharp rise in the initial preparatory and mustering phases of the investigation and a further rise in the site-based data collection and witness interviewing phases. This period, which typically took approximately1-2 weeks, was followed by a period of reduced (but still higher than normal) workload comprised of structuring the results of the preceding phase into a detailed indecent timeline and conducting analyses away from the incident site. After this, workload ramped up to its highest level as the recommendations were formulated and the first draft investigation was prepared to be issued for hearing. While the report was out for hearing the workload reduced to approximately normal level for a period of several days, which was commonly described as a welcome opportunity to recover from the exertion of the preceding period. This short lull was followed by a third period of elevated workload as the

feedback from the hearing round was evaluated and incorporated into the final report. The final evaluation and debrief phase of the investigation marked a return to normal workload. In contrast to the workload rating, the subjective ratings for energy reserves/capacity showed a gradual and relatively steady decline to a nadir in the hearing phase, and then a recovery period during the final report and evaluation/debrief phases.

The model that was developed in 2011-2012 was revisited in 2013 and 2014, and the feedback from the investigators involved was that the workload model in particular remained a good representation of the demands of the task. The subjective energy/capacity model was subject to greater individual differences, with some investigators reporting greater capacity as their experience and skill level had increased. This included feedback that their personal nadir point was not as low as previously reported, or that the slope of the energy/capacity model was less steep.

The key findings from this work in relation to managing investigation quality were that the phases of the investigation where critical analyses were being concluded and the key outputs were being formalised (the draft report with timeline, causal analyses and the recommendations) were accompanied by the highest workload and stress levels and the lowest energy levels/capacity. Taken together, the combined effects of elevated workload and diminished capacity introduce a quality risk including a risk of making poorer judgements that in turn may result in less accurate, effective or relevant recommendations. This situation also puts investigators at greater risk of being influenced by the effects of cognitive bias, which affects the objectivity of the investigator. The workload aspects discussed in this section are even more of a concern for the large number of investigators who have to divide their time with another, full-time role.

Recommendations for managing investigation workload

- To help ensure the quality of the investigation, investigation team leaders/members and subject matter experts should, as far as possible, be allocated to investigation work on a full-time basis for the lifecycle of the investigation or a specific TOR/phase of the investigation. A stand-in for their day-to-day role should be arranged while the individual is allocated to the investigation.
- In the workload study described earlier, one of the main recommendations for managing workload was the creation of a co-investigator role to support the investigation leader. This differed from a pure SME role, and was intended to provide operational and administrative support to the nominated investigation leader during the investigation. The role was considered to be mandatory for the initial phases of the investigation (the first workload ‘peak’ shown in Figure 1) and was strongly recommended up to issue of the draft report for hearing (the second peak). The co-investigator served a second purpose of providing a more familiar colleague from the same organisational unit with a similar level of investigation competence. This was intended to help maintain the required internal quality standard in evidence gathering, analysis work and reporting, and to support the development of cohesion in the investigation team.
- To develop resilience to the demands of investigation workload, opportunities should be provided for investigators to build and maintain experience through a managed process of involvement in regular investigation work. This is more feasible in organisations that investigate near misses with the same approach as investigation of actual incidents, and which are more likely more frequent investigable events to work with.
- Investigations should be established against terms of reference that provide realistic and sufficient time and resources for the scope of work to be completed, and which provide the facility for additional time to be allocated if required. Additional work should not be included during the course of the investigation without an accompanying timeframe extension. Determining realistic timescales for investigation types and work phases should be assisted by task analysis, with input from experienced investigators and managers of investigation-related functions. Feedback on operational challenges should also be sought following the completion of an investigation, for example via a formal debriefing process, and the results should be recorded and fed back to the investigation process ‘owner’ in the organisation. Periodic reviews of this feedback should be conducted, and an action list should be maintained that provides the basis for process changes, for example when allocating resources, setting terms of reference and considering delivery deadlines.
- For investigators working in a dedicated investigation leader role, providing a recovery period between investigation tasks is critical. This may be administered through a duty roster, or through use of backup personnel who can be freed up from their normal role to provide extra cover for investigators from the dedicated unit. The recovery period should be maintained as far as possible, but in busier periods it may be acceptable to allocate an investigator in a more supporting role, for example as co-investigator, coach or investigation subject matter expert.

Cognitive Bias

Cognitive biases are common human tendencies in information processing that aid decision making (Forensic Science Regulator, 2015) and save energy (Kahneman 2011). Kahneman (2011) outlines two types of thinking – conscious objective, fact-based and rational decision making (“slow” thinking) and more subconscious, emotion and experience-driven decision making (“fast” thinking). Of these two types of thinking, the more bias-prone fast thinking is less desirable in an investigation context, where the quality and credibility of established facts is crucial. Instead, conclusions should be reached via the slow thinking process, and ideally through discussion with team members. Factors that influence the propensity for fast thinking include stress, cognitive workload, and (over) confidence. Over the last two decades cognitive bias has become more commonly discussed in the context of safety management and increasingly in the context of investigation, including accident investigation (Groeneweg, 2002, Burggraf and Groeneweg, 2016) and corporate fraud investigation, Sundaraparipurnan, 2015). Limited guidance aimed at controlling the risk of these biases has also been produced (ACAPS

2016, Forensic Science Regulator, 2015). However, the operationalisation of managing cognitive bias in investigations in industry requires further development.

Cognitive Bias Analysis

An analysis of cognitive biases was conducted during 2018 to provide a more accurate picture of the relative relevance of cognitive biases to investigation work, and the type or phase of investigation work that each bias applied to. The aim was to provide a structured baseline for further discussion of cognitive bias in training courses for analysing human factors in investigations and when discussing performance management for investigators.

A list of cognitive biases was derived from the "Cognitive Bias Codex" published on Wikipedia. This consisted of 188 cognitive biases, divided into three main types: decision making, belief and behavioural biases, social biases (typically used for evaluating other people's behaviour), and memory-related biases. Initial analysis revealed that two biases in the list were essentially the same (double-counting), so these were removed, and the subsequent analysis was performed on a list of 186 biases.

The biases in the list were screened for their degree of relevance to investigation work, as seen from the perspective of the investigator/investigation team (rather than an interviewed eyewitness perspective). For the resulting biases, the phase of the investigation or investigation work type where the bias was considered to be most relevant was then selected. The list with rated relevance and relevant phase/work type was then reviewed by 4 experienced investigators from the Keil Centre and adjustments were made as required. The screening process resulted in a list of 123 cognitive biases with either high, medium or low relevance to investigation work. A summary of the results is shown in Table 1, and as a bar chart in Figure 2.

	Relevance to investigations		
Investigation work phase/type	High (n=25)	Medium (n=51)	Low (n=47)
All (non-phase or work type-specific)	12%	8%	15%
Planning and Investigation Leadership	0%	2%	0%
Evidence Collection	8%	6%	9%
Conducting Investigation Interviews	24%	31%	17%
Evidence Analysis	56%	45%	45%
Reporting and Dissemination of Findings	0%	8%	15%

Table 1. Analysis of 123 cognitive biases organised by relevance to investigations and investigation work phase/type

Table 1 shows that 25 biases were rated as highly relevant to investigation work, from the perspective of the investigator. Of these biases, the majority (n=17) were related to decision making, belief and behaviour. Further examination confirmed that these biases were the same as examples of investigation-related bias described in other studies and guidance (Sundaraparipurnan 2015, ACAPS 2016). Key investigator biases in the highly relevant category included:

- Hindsight bias - The tendency to judge past events as being more predictable than they actually were, otherwise known as "the benefit of hindsight".
- Outcome bias - The tendency to judge a decision by its eventual outcome (typically a negative outcome in the case of investigations) rather than on the quality of the decision at the time it was made.
- Confirmation bias - The tendency to search for, interpret, focus on and remember information in a way that confirms preconceptions, to the detriment of other potentially relevant information

The remaining 8 high-relevance biases were in the social category, which related to evaluating the behaviour and characteristics of others. Key high-relevance biases in this category included:

- Authority bias - The tendency to attribute greater accuracy to information provided by an authority figure and be more influenced by that information. This is relevant when considering interview information provided by operational personnel against interview information provided by more senior professional and managerial personnel.
- Actor-observer bias (related to Fundamental attribution error) - The tendency to under-emphasise the influence of the situation and over-emphasise the influence of personality when seeking to explain the behaviour of others.

Table 1 also shows the breakdown of biases in relation to the most relevant investigation phase/work type. The results show that a small number of biases were relevant to investigators throughout the investigation lifecycle. An important example of one of these biases is the "Bias Blind Spot', which is a tendency to perceive oneself as less biased (and hence more objective) than others. This increases the risk of establishing facts and drawing conclusions on the basis of perceived judgement ability as an investigator and placing less focus on facts derived from objective data.

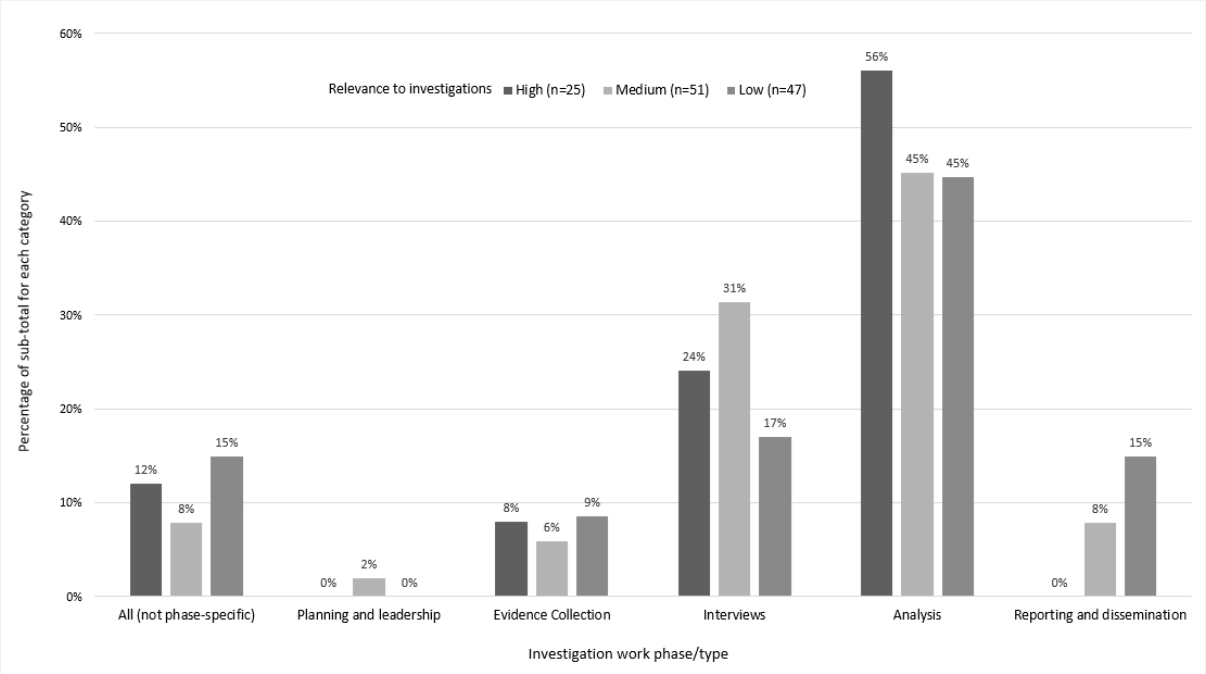

Figure 2. Analysis of 123 cognitive biases organised by to relevance to investigations and investigation work phase/type

Figure 2 provides a visual representation of the results in Table 1. The pattern of results indicates that biases that were more specific to an investigation phase/work type showed increased relative frequency higher relevance during evidence gathering and evidence analysis. In relation to the frequency of biases at each level of relevance, analysis-related biases were generally predominant, and represented the majority (56%) of the high-relevance biases. The start-up and reporting phases of investigations showed fewer relevant biases. This can be explained in terms of these phases involving fewer critical decisions and a need for belief forming. In contrast, the data collection and analysis phases are where hypotheses and beliefs are more likely to be developed and confirmed, and hence where biased thinking poses more of a risk.

When considered together, the bias analysis results and workload analysis results indicate an increased risk. The results show that the evidence analysis phase of an investigation is more vulnerable to biases in general, and this phase corresponds with a period in the investigation where the investigator's workload has been high and where their energy levels and capacity have diminished. This situation provides strong preconditions for bias-prone thinking. The formulation of recommendations relies on the output of the analysis phase yet corresponds with the period of peak workload and further reduction in capacity. This reduces the likelihood of detecting or recovering from errors arising from biased thinking in the preceding phases.

Recommendations for managing cognitive bias

- Incorporate a quality assurance process in the investigation process with checkpoints at key investigation stages. The audit profession incorporates a quality assurance process with periodic checks at key stages of topic-based audits (IIA 2017, HM Treasury 2013). With additional reference to the workload analysis in Figure 1 and the bias analysis in Figure 2, recommended checkpoints should include:
    - The initial notification and mustering stage, to help check that the investigator is suited to the task be not be too inexperienced or overly familiar with the site/subject matter;
    - After initial fieldwork has been conducted, to check the depth and quality of the evidence collected and to help check that the investigator will not attempt to proceed with the analysis with insufficient supporting evidence;
    - After key analyses have been conducted, including any Human Factors and causal analyses
    - A review of the draft report with the recommendations derived from the analysis phase
    - A review of any comments received during a hearing round and how these have been addressed by the investigation team, to ensure that feedback from stakeholders has been suitably considered and to highlight any concerns relating to the quality of the investigation findings
- Ensure that investigations are conducted by a team of nominated people. This sounds obvious, but in some circumstances, investigation may be carried out by one or two people at most, or an investigation team may dwindle to one person following the initial data gathering period as other members are pulled back into their main jobs. This recommendation helps to ensure that the vulnerable analysis phase is safeguarded against potential bias effects through group working and peer checking.

- Use recognised analysis methodologies to provide structure to the analysis phase and provide a basis for quality review. This helps to avoid a free-form approach to analysing evidence and forming conclusions that could be more susceptible to bias. Some analysis methods challenge the investigator to refer to supporting evidence in the analysis process, which may indicate areas where conclusions have been drawn with insufficient evidence.
- Use an interview planning guide to help structure and prepare for interviews, allocate sufficient time for interviews and use the option of a follow-up interview rather than allowing an interview to take excessive time (and hence affect the ability to maintain concentration and active listening). Avoid scheduling too many interviews per day, since successful interviewing can be more tiring than people anticipate. Ensure that interviews are carried out by at least two people and agree beforehand that the other interviewer can step in if required (for example if the lead interviewer is aware that they can no longer lead the interview effectively due to fatigue, confusion etc).

Providing education about cognitive biases and their effects on investigation quality to investigators is important for raising awareness and prompting introspection. However, this should not be overly relied upon as a control measure. This is because it is likely that investigators will tend to judge themselves to be less biased in their work, as supported by the concept of the "Bias Blind Spot". Instead, this type of education and awareness-raising should be used to supplement stronger organisational control methods.

Performance Shaping Factors

There are a number of other performance shaping factors (PSFs, otherwise known as Performance Influencing Factors) that are relevant to investigators. These are summarised, together with some recommendations, in the following sub sections.

Task Related factors

Time pressure - Aside from the workload aspects discussed previously, actual time pressure in terms of limited opportunity to collect data and tight deadlines for delivery of findings characterise many investigations. This increases the risk of collecting an insufficient amount of evidence in the available time, and then lacking time to conduct thorough analyses. In this situation, cognitive biases are more likely to come into play since they help to make easier sense of information in the available time. As with workload, time pressure should be managed through establishing a reasonable timeframe for the investigation up-front, with an opportunity to extend the timeframe if the investigation requires it (for example where a key witness is unavailable due to hospitalisation, or if additional evidence or analysis work is required from a third party). Managing stakeholder expectations is also critical, which must include an understanding that reliable "facts" are likely to require time to determine. This means that status reporting to senior manager, head office or other key stakeholders should avoid expectations of a detailed explanation of causal factors in the early stages of an investigation, for example.

Task familiarity – An otherwise experienced investigator may be required to investigate an incident in a novel or unfamiliar subject matter area, an unfamiliar location, or in an unfamiliar context such as an incident with a high level of media coverage, a complicated stakeholder situation, police involvement or impact on the general public. This may require a re-evaluation of the structure of the investigation team, or the inclusion of additional resources such as liaison functions to help manage communications between the investigation team and identified stakeholders.

Procedures and documentation

Although investigations may differ considerably in terms of the incident that occurred, the investigation process is highly suited to being described in a procedure, or similar formalised description of the work process. The intention should be to provide the investigator with sufficient structure to reasonably carry out a wide variety of investigations to the required performance standard. In addition to a procedure, quality checklists for each step of the investigation can help the investigators to check their work against established requirements and provide a context for discussing investigation quality at regular milestones during the investigation.

Training and experience

Alongside other technical and analysis methodology training, Investigator training must include high-quality training on interview technique with periodic refresher training. The importance of refresher training is often overlooked, but interview technique, particularly in terms of maintaining an active listening and open questioning approach can degrade over time. This can be an issue for more experienced investigators, for whom overconfidence in their abilities and perceived seniority can lead to diminished interview skills and lack of honest feedback from other members of the investigation team. Interview training should also incorporate guidance on conducting interviews in more challenging situations, such as when an interpreter may be required, with an emotional or aggressive interviewee, or if an interview is required to be conducted via telephone or video calling due to travel restrictions.

Personal Factors

Investigators may, in the course of their work, encounter potentially traumatic situations due to the nature of the incident, the evidence reviewed, the reaction of a witness, or other stressful situations. Incident investigations are also typically negative events that can have longer term emotional impact. Many organisations do not have a recognisable structure for ensuring the wellbeing of investigators and may either assume or expect that investigators are more robust than others. Access to support through an occupational health function is important for helping to manage these effects, but it is equally important to ensure that managers provide the opportunity for debriefing and feedback both during and after the investigation to identify potential problems in a timely manner.

Social and team factors

Investigations are typically carried out by teams who may not have worked together before, yet for whom the ability to quickly establish themselves as an effective team is critical. For investigators, leadership skills are as relevant as technical skills for ensuring that the investigation functions effectively, yet investigator training may often lack sufficient leadership-related content. Project management is a similarly important skill for investigators and should also be included in the competency requirements for selecting investigators.

Conclusions

The structured analysis of investigation workload and cognitive biases relevant to investigators provides further reinforcement for some existing best practice in the investigation and audit disciplines. The findings indicate that critical phases of investigation work are potentially more vulnerable to quality deficiencies than may have previously been considered. This indicates that additional mitigations may be required for organisations to improve the preconditions for high-quality decision making during investigations, and hence improve the quality of the resulting conclusions and recommendations.

These findings and the recommendations included in the preceding sections of this paper have been incorporated into investigation-related educational and training material developed by the Keil Centre. This helps to ensure that training and education in investigative interviewing and human factors analysis considers the wider individual, job and organisational aspects that could affect investigator reliability and investigation quality.

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