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Avoiding Burnout at the Digital Forensics Coalface: Targeted strategies for forensic agencies in the management of job-related stress

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ABSTRACT

Recent evidence shows digital forensics experts are at risk of burnout and job-related stress. This may be related to the increase in digital evidence and/or repetitive exposure to challenging material, either face to face or via digital imagery in real time or post-event. This exposure includes footage and/or sound recording of extreme violence, child exploitation, suicide, and death scenes. This increase in the risk of stress also aligns with the changing nature of policing with rates of serious crime, especially robbery and homicide decreasing, while digital crime in many countries increases. This increase changes workload demands and requires new skillsets in addition to traditional investigation methods. Workplace stress has high financial and personal costs, impacting organisations, teams, family, friends, and the individual. For organisations and teams, occupational stress is associated with increases in workplace accidents, absenteeism, early retirement, higher intention to quit, lower motivation and disillusionment with work, all of which impacts the cohesion of forensic teams. The aim of this paper is to present a set of key evidence-based, targeted strategies that forensic science and policing agencies can roll-out in order to manage workplace stress, thereby managing the risk of higher turnover, absenteeism and lower workplace innovation.

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1. Introduction: Increases in distressing material viewing and occupational stress

The landscape of digital forensics is shifting. The nature of serious crime is changing creating sharp rises in digital/cybercrime offences compared to reduced rates of face-to-face violent crime, especially assault, robbery, homicide (Bryant and Bricknell, 2017; Caneppele and Aebi, 2017). The rise in digital crime has changed the volume and types of distressing material viewing by digital/police investigators (Davis et al., 2013), with repetitive exposure to images, sound, CCTV, and mobile/video footage of harrowing and disturbing events in real-time, or post-event, capture of child exploitation, sexual assault, torture, gang violence, graphic suicide, accident, and unlawful death scenes.

This increase in distressing material viewing also aligns with increasing risk of experiencing job-related occupational stress, burnout and secondary traumatic stress (Lamontagne et al., 2016; Burruss et al., 2018).

Approximately 30% of digital forensics and forensic science practitioners are at risk of developing psychological injury and/or occupational stress and burnout from their occupation (Kelty and Gordon, 2015). Forensic science is not alone in this, with estimates of one-fifth of emergency management and first-responder personnel will develop, or are at high risk of, occupational stress. This covers occupations including such as policing, crime scene examiners, critical care and forensic medical practitioners, coronial staff, mortuary technicians, correctional officers, and military forensic and medical staff (Kelty and Gordon, 2015; Lauvrud et al., 2009; Orchard, 2012; Patterson et al., 2014; Paton et al., 2009; Sherwood et al., 2019).

2. Aims of the current project

In this paper we present part 1 of an ongoing project with The Australian Federal Police Digital Forensics to develop organisational strategies to manage stress in their teams. Project part 1 is to use current rigorous empirical evidence that has been subjected to systematic or meta-analytical review in the field of stress management in digital forensics and forensic science to develop key

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strategic stress management practices.

As will be discussed in detail in section 4 below, most research on stress in forensic science and law enforcement more generally has examined the experience and treatment of stress at the individual level. This has resulted in a lack of research around organisational stress factors, or how agencies can develop and trial targeted stress management interventions for their digital teams. The lack of research examining how organisations can lower the risk of job-related stress for their employees and consultants is highly problematic as the World Health Organization (Leka et al., 2004) classifies stress relating to organisational factors as a primary hazard requiring a focused approach to stress management.

After an extensive search of the literature there appears to be a lack of evidence based organisational strategies to manage stress risk in digital forensics teams. Part 1 of this project had two aims; both specifically devised to fill this knowledge gap. These aims are as follows:

2.1. Aim 1

To carry out an in-depth critical review to synthesise current knowledge surrounding the organisational factors associated with job-stain, burnout and secondary traumatic stress (STS).

2.2. Aim 2

To use the results from the critical review to develop a set of robust evidence-based strategies that law enforcement and forensic agencies can utilise to manage the risk of organisational stress risk for their digital forensics teams.

3. Why we should be concerned about occupational stress in digital forensic teams

Neurological research shows that cognitive innovation and creativity reduce as cortisol levels rise due to stress (Echouffo-Tcheugui et al., 2018). The natural physiological response to stress means that people are not able to engage in high level problem-solving or be highly creative in their thinking. Furthermore, stress can reduce the motivation to strive at the workplace as people can be cognitively overloaded (McCarty et al., 2009). For digital forensic experts, this can mean they may have lowered problem-solving in analysing evidence or less capacity for innovation when faced with how to access or analyse new forms of data.

Occupational stress results in high costs for the organisation and the individual at the financial and personal level, with flow-on effects impacting the productivity of work teams, family and social life (Chae and Boyle, 2013; Kelty and Gordon, 2015). At a financial level for Australian organisations, each claim made by an employee for psychological injury relating to job-related stress is estimated at AUD\$1.3 million.

For organisations and teams, occupational stress is associated with increases in workplace accidents, absenteeism, early retirement, high intentions to quit, disillusionment with work tasks, which negatively impacts the cohesion of forensic teams (Brown and Campbell, 1990; Kelty, 2012). Research shows gender differences in job stress, which impact work performance and social support networks. In households where females carry greater responsibility for children, occupational stress has been shown to increase out-of-work demands, which creates or inflates strain for women, especially in inflexible workplaces (McCarty et al., 2007; Jeanguenat and Dror, 2018).

At the personal level, stress is associated with intentions to quit, early retirement, and in some cases, premature death through physiological impacts of ongoing stress leading to chronic disease

(Brown and Campbell, 1990; Paton et al., 2009). It is estimated that over 25% of personnel in the forensic sciences and law enforcement are alcohol dependent, or show signs of alcohol dependency, as a result of stress. These estimates are suggested to be lower than the actual rate due to inaccurate self-reporting (Dempsey et al., 2019). High levels of job stress are linked to higher family conflict, higher distress/depression/anxiety, lower life satisfaction and higher intimate partner violence (Burke et al., 1984; Chae and Boyle, 2013). For law enforcement and criminal justice agencies, high staff attrition has ripple effects due to the high level of organisational and job-specific knowledge that is lost. Research in 2008 examined the rate and trends of turnover in policing agencies across all Australian and New Zealand jurisdictions (Lynch and Tuckey, 2008). Voluntary (resignation) and involuntary (instigated by the organisation or external factors) attrition data for four financial years were collected (1999–2000 and 2002–2003). Voluntary resignations of sworn police officers comprised 59% of the total number of sworn separations over four financial periods, indicating that voluntary resignations were a major source of turnover in Australasian police jurisdictions (Lynch and Tuckey, 2008).

In some Australian law enforcement agencies, attrition rates approaching 50% over three years have been reported. Included in these rates were crime scene examiners, who reported crime scene exposure led to extended stress leave and high levels of intention to quit (Kelty and Gordon, 2015). As voluntary turnover is largely avoidable, it is reasonable to recommend that forensic agencies attempt to investigate causes of voluntary resignation to inform retention strategies and strategic workforce planning.

4. Theories of occupational stress: job strain, burnout and secondary traumatic stress

Stress is defined as the body's reaction to internal or external stimuli that results in psychological or biological changes (Violanti, 2010). *Occupational stress* refers to the responses an employee develops when they are exposed to demands and expectations that are outside the sphere of their average daily life and/or that exceed their abilities or coping mechanisms (Brough and Barbour, 2010; Fink, 2016).

In essence, *occupational stress* can develop following exposure to a range of work stressors and arises when people attempt to manage/juggle their responsibilities, tasks or other forms of pressure related to their jobs, life, external responsibilities, and encounter difficulty, anxiety or worry in this attempt. Common job-related stressors found in many occupations are: long hours, heavy workload, job insecurity, conflicts with co-workers, exposure to highly-charged and/or emotional incidents, discrimination, and workplace bullying (Spector, 2012). A recent review found a similar range of job-related stressors *specifically related to forensic personnel* (Jeanguenat and Dror, 2018). These included: workload volume, tight deadlines, lack of advancement, number of working hours, low salary, technology distractions, fluctuating priorities, exposure to case details, low tolerance for mistakes and the adversarial nature of the legal system.

3.1. Job strain

The concept of job strain was developed by Karasek (1979), who concluded that the impact on physical and mental health caused by work stress did not occur from a single aspect of the work environment. Rather, it arose due to the joint effects of the work situation and/or task demands, and the employee's freedom and ability to decide how to face and meet work demands. Job strain occurs when the job demands placed on an employee are higher (such as excessive amount of work and work pressure) and job decision

freedom is lower (including a limited ability to learn new things, or develop skills, and lack of decision-making ability (Karasek, 1989; Spector 2012). More recently, it has been suggested that supervisor support be considered a means of reducing the effect of job strain (Sargent and Terry, 2000).

The relationship between conditions of job strain, and employee physical and mental health outcomes has been well established across a range of employment types (Stansfeld and Candy, 2006; Butterworth et al., 2011; Harvey et al., 2018). In particular, adverse work conditions, including high job demands, low decision control, and job strain, are associated with increased psychological distress and diagnosis of common mental health disorders such as depression and anxiety (Martin et al., 2009), as well as burnout (Lindblom et al., 2006). In France, Sultan-Taïeb and colleagues found 8.8% of mental disorders and 10.2% of coronary heart disease were attributable to job strain. The total costs associated with the associated heart disease and mental disorders attributable to job strain ranged 1.8 to 3 billion euros in 2003 (Sultan-Taïeb et al., 2013).

Although work-related stress is common and unavoidable in law enforcement/forensic occupations (Kelty et al., 2017; Jeanguenat and Dror, 2018), when experiencing on-going stressors, some staff are at risk of, or do develop, job strain. Job strain has three possible reactions which can lead to a set of negative coping behaviours, outlined in Table 1 below.

Where job strain becomes prolonged, recent longitudinal research with front line military, social work and health practitioners showed that employees can develop the syndrome of burnout, followed by secondary traumatic stress (STS). An alternative pathway is that employees can move from strain directly to STS (Shoji et al., 2015). This research found that employees working in high demand jobs where the role exposed them vicariously to traumatic events/images (e.g., digital forensics) were at higher risk of burnout developing into STS.

3.2. Burnout

Burnout is a syndrome consisting of three phases: exhaustion, depersonalisation (including cynicism and job detachment), and reduced efficacy (Burke et al., 1984; Maslach 1998; Maslach et al.,

2001). The exhaustion phase occurs in response to unrelenting demands or combined pressure from the workplace, colleagues, external agencies, or clients. This depletes an employee's personal emotional resources and coping ability. The next phase is where depersonalisation of the work or workplace begins. This includes the employee becoming cynical, detached and distant and the development of a lack of empathy towards clients or co-workers. Reduced efficacy is the final stage, where employees lose a sense of achievement from their work, and levels of job satisfaction and ability to produce results drop. At this final stage, time management becomes an issue. The theory of burnout was first developed to explain symptoms in medical environments (Figley, 1983). It has now been found to occur in a range of workplaces including 'high-risk' occupations such as law enforcement (Maslach and Schaufeli, 1993; Bakker and Heuven, 2006). One of the most significant risk factors for job burnout is job strain. Further risk factors for burnout at the organisational level include longer hours, lack of organisational support and continual high demand for results (Mor Barak et al., 2001). The symptoms of burnout can be seen in Table 1.

3.3. Secondary traumatic stress (STS)

Secondary traumatic stress (STS) is the emotional response when an individual is exposed to the traumatic experiences of another person. Its symptoms mimic those of post-traumatic stress disorder (PTSD). The experience of STS is suggested to be the natural behavioural and emotional response to knowledge about trauma experienced by others. It is a form of stress that can result from helping or wanting to assist a person suffering (Ludick and Figley, 2017; Murphy, 2016). Although burnout and STS appear similar, they have been shown to be distinct syndromes (Newell and MacNeil, 2010). STS emerged from the field of human services (Figley, 1983), but research findings indicate that it can be developed by any person exposed to the suffering of others on a prolonged basis (Murphy, 2016). Examples beyond the field of human services include the immediate family of trauma survivors (Lambert et al., 2012), and digital forensic investigators from police departments (Holt et al., 2012; Burruss et al., 2018). The symptoms of STS can be seen in Table 1, below.

Table 1
Categories and signs of Job Strain, Burnout and Secondary Traumatic Stress.

*Categories of Job Strain	**Burnout	**Secondary Traumatic Stress (STS)
Psychological reactions	SIGNS	SIGNS
Anger	Fatigue	Sadness and grief
Anxiety	Anger	Avoidance of working with people
Frustration	Frustration	Reduced ability to feel empathy
Job dissatisfaction	Negative reactions towards others	Somantic complaints
	Cynicism around work	Addictions
	Withdrawal	Nightmares
		Changes in beliefs
Physical reactions	SYMPTOMS	Frequent use of sick days
Dizziness and headache	Physical	SYMPTOMS
Heart pounding	Psychological	Headaches
Cancer	Anger	Digestive problems
Heart disease	Cognitive	Muscle tension
		Fatigue
		Psychological distress
		Poor concentration and focus
		Poor judgement
Behavioural reactions	TRIGGERS	TRIGGERS
Workplace accidents	Personal characteristics	Previous exposure to trauma
Smoking	Work related attitudes	Empathy and emotional energy
Substance use	Work organisational characteristics	Prolonged exposure to materials
Turnover and absenteeism	Work environment	Personal response to stressor
Lengthened sick leave		Work environment

Table adapted for this paper using *Spector (2012), pp. 278, and **B.H. (Stamm, 2009–2012) on the Professional Quality of Life: Compassion Satisfaction and Fatigue Version 5 (ProQOL) questionnaire.

3.4. Risk and protective factors in occupational stress

The development and maintenance of occupational stress, whether it be job strain, burnout or STS, occurs through the interaction of two primary factors, where personal and social factors interact with the workplace factors of job context and job content (Leka et al., 2004; Peñalba et al., 2008; Chae and Boyle, 2013; Ruotsalainen et al., 2015). How these interactions evolve provides a person with either increased risk of stress or can buffer/protect against risk of stress.

These risk and protective factors include:

- **individual risk** and protective factors, which include two categories:
 - **personal factors** include levels of trait stress and anxiety, personality type, adaptive or maladaptive coping strategies, strategies and knowledge of the self-management of their own physical and mental health, diet and exercise; and
 - **social factors** including strength of relationships with family/partners/friends, degree of harmonious/stable home environment, work/life balance involving down time and recreational activities.
- **organisational risk** and protective factors, which include two categories:
 - **job context** factors include job security, unclear performance practices, supportive collegiate teams, supportive supervisors, bullying/harassment, isolated work, workplace culture with poor communication, lack of leadership, poorly managed organisational change, poor promotion/provision of staff work-life balance; and
 - **job content** factors include meaningfulness of tasks, achievable workload, shift work impacting family/social relationships, involvement in team decision-making, control over work processes, the work environment, access to appropriate debriefing spaces.

5. Review procedure for developing key stress management strategies

We conducted a 3-step mixed studies critical and thematic review to critically examine the robustness of current empirical in this area. This evidence base was then used to develop industry strategies and policy directions that law enforcement/forensic agencies could take.

First, a systematic search of the literature using electronic databases including PsycINFO, CINCH, Global Policing Database, Cochrane Library, JSTOR, PubMed, Web of Science, Google Scholar, ResearchGate and a search of online Masters/PhD thesis. The search inclusion keywords were ‘, STS’, ‘job-related stress’, ‘digital investigations’, ‘digital forensic’, ‘mental health’, ‘resilience’, ‘trauma’, ‘retention’, ‘forensic management’, ‘job-content/context forensics’.

Second, to ensure robustness, we analysed abstracts and full-text content of studies that satisfied inclusion. All appropriate studies were analysed with a critical analysis method. This method appraised research design, sample selection and methods/materials, data analysis and results. Studies used were peer-reviewed exploring organisational factors related to stress in digital forensic teams, or police investigators who routinely analysed digital evidence.

Third, results were subjected to a thematic analysis following the method outlined by Miles et al. (2019) to identify key themes that provide the foundation for developing targeted risk management strategies for digital forensics teams.

This thematic review was essential to achieving the project aims, because the identified literature analysed only provided

general suggestions at the end of their papers; none had provided clear and concrete strategies for managing occupational stress risk.

6. Results and discussion: key organisational stress management strategies in digital forensic teams

The results from the review identified three key job content and context factors. The key aspects, in no specific order, are: (i) supportive supervisors/team leaders; (ii) effective workplace environments; and (iii) exposure direction and risk trend analysis.

6.1. Supportive and resilient supervisor/team leaders

The evidence has provided robust findings that supportive supervisor practices buffer against occupational stress in policing, including digital forensics (Randall and Buys, 2013; Wößner and Graf, 2016; Kula, 2017; Foley and Massey, 2019). Research in 2004 found that proactive supervisors who monitored trainees and staff were associated with reduced turnover, absenteeism and enhanced staff job satisfaction (Brough and Frame, 2004). Later research indicated that supervisor support was a significant predictor of (lowered) intentions to quit in police employees (Barbour et al., 2009).

In a Australian study, interviews and surveys were conducted assessing mental health and stress in police investigators of internet child exploitation (ICE) from across all Australian law enforcement jurisdictions (Australian Capital Territory Policing, Australian Federal Police, New South Wales Police Force, Northern Territory Police Fire and Emergency Services, Queensland Police Service, South Australia Police, Tasmania Police, Victoria Police and Western Australia Police Service; Powell et al., 2014). 32 investigators with ICE experience were interviewed, and 294 investigators completed the survey (188 with ICE experience, 106 without). A second survey 12 months later was completed by 37 participants. The finding showed that supervisors acted as a job support or a job demand, depending on their attitudes and behaviour (Powell et al., 2015).

6.1.1. Supervisors who **increased** levels of occupational stress for their staff were: inflexible micro-managers; primarily concerned with budgets and their own career; out of touch with the emotional, technical and time demands of digital forensic and ICE investigations; did not know workers well enough to identify when their staff were not coping; and failed to organise and follow up on mandatory mental health appointments for staff (Wortley et al., 2014). These results confirmed the earlier work of Holt et al. (2012), who found that supervisors who contributed to work stress were less aware of differences between computer crime examiners and traditional policing roles, especially the time and technological needs of their role (Holt et al., 2012). This indicated that supervisors ideally must have a working knowledge of the tasks conducted by their team, be an effective and flexible leader, and support/promote access to regular mental health check-ups.

6.1.2. Practices and knowledge of supervisors who **buffer against** stress acted as an integral part of their team; were knowledgeable of specific work demands on their staff; acted to promote mutual trust; used their administrative role to support investigators to focus on their own roles; worked strategically to lessen role overload; took a ‘hands off’ approach by not micromanaging staff and allowing autonomous working; provided case-related feedback; and enforced mandatory psychological appointments (Powell et al., 2014).

Supervisors' responses were mixed in terms of their in-depth knowledge of mental health support. In Bonnar's (2000) qualitative study with six police superintendents, five indicated a need for increased mental health education to assist them to support their

staff, while one indicated that sensitivity should be an innate characteristic of a supervisor. Most studies with digital forensics staff and/or police indicated that training to enhance supervisor practices, and foster attitudes supportive of mental health and resilience/coping strategies was necessary (Bonnar, 2000; Chapin et al., 2008; Burruss et al., 2018).

Lamontagne (2016, 2017) carried out an intervention with Victoria Police, aiming to improve mental health literacy with supervisors as a core component. Of the eligible police stations available, 12 stations participated in the intervention, with 12 additional stations allocated as controls. The supervisors at the 12 experimental stations undertook training in coaching staff, to assist them to develop competency in noticing and discussing mental health concerns with staff. Data collected from staff of all levels indicated that the effects of the intervention were mixed, with staff being more positive, but no differences in mental health literacy observed between supervisors who took the training and those who did not. Challenges existed at the organisational (mobility of staff) and station (limited availability due to demands) levels, which may have impacted results. Lamontagne suggested that the follow-up window was insufficient to observe positive outcomes (Lamontagne et al., 2016; Lamontagne, 2017). A second study by Chapin and colleagues worked with supervisors in a US police department to improve their abilities in observing operational stress and strategies to deal with staff under stress. While this paper described the training, the efficacy of the program's stress reduction strategies was not evaluated (Chapin et al., 2008).

6.2. Effective work environments for digital forensic teams

Studies of occupational stress for digital forensic personnel (and police officers involved in ICE) have primarily considered psychosocial aspects of the work environment (social support, bullying, work-load demands, shift work), rather than the physical environment in which digital teams work.

6.2.1. The physical workspace. Australia-wide studies into the occupational health and safety of ICE investigators identified that workspaces posed significant concerns (Wortley et al., 2014; Kelty and Gordon, 2015; Powell et al., 2015). Primary concerns included the general lack of space, and lack of private, quiet space in relatively open-plan offices, when their role may require them to view particularly sensitive material, have quiet impromptu conversations supervisors, or conduct covert conversations with suspected perpetrators in the course of an investigation. Other issues identified included: poor ventilation, excessive heat emanating from computers, cramped and overcrowded spaces, inadequate natural light, and furniture unsuited for long hours of sedentary work (Powell et al., 2014). A smaller study in Canada found that for digital investigators, having control over their work environment, including how and when they viewed material and took breaks, access to a private environment suitable for viewing material, and access to colleagues, were factors considered to facilitate coping amongst ICE investigators (Burns et al., 2008).

6.2.2. The technological infrastructure has been highlighted as a barrier contributing to digital forensic practitioners' workplace stress. In a recent international survey of digital forensic practitioners, participants identified that software and hardware required regular updates to match the complexity of offenders' capabilities, the increasing volume of digital and cloud storage, and computer processing speed required (Franqueira et al., 2018). These findings were echoed in Australian studies (Powell et al., 2014; Wortley et al., 2014), and in a recent needs assessment conducted in the UK (Schreuders et al., 2018).

Recommendations included providing units with up-to-date computer hardware, software, large computer storage, and

improved processing speed. Furthermore, that software that can automatically scan image libraries to identify previously graded images be obtained, thereby reducing the time and exposure of ICE investigators (Franqueira et al., 2018; Schreuders et al., 2018). While Australian ICE workers were aware of this software, it was noted that predominantly they did not have access to it (Wortley et al., 2014). Research by Franqueira et al. (2018) and Schreuders et al. (2018), mirror the findings by Kelty and Gordon (2015) who had interviewed field forensic scientists. One widely experienced specific technological stressor was noted: Regardless of jurisdiction, poorly managed upgrades of digital technology (upgrades scheduled without a reasonable lead time) and without any reduction in usual workload allocation to allow for upskilling or training were considered challenging. These challenges increased the work pressure of an already time-pressured and stressful role. Providing forensic teams with advance notice of upgrades or changes in the workspaces or work environment could reduce this stressor.

6.2.2. The use of black humour within law enforcement has long been acknowledged as a coping mechanism to reduce stress, albeit potentially considered politically incorrect or insensitive to people outside of serious crime squads and forensic operations (Roth and Vivona, 2010; Vivona, 2014). Humour is regarded as a form of communication, and when used in workplaces it can become a mechanism for building cohesiveness, a means for teams to socialise and develop working relationships, and a mechanism to turn difficult situations into less aversive experiences (Gayadeen and Phillips, 2016). It is argued black humour can reduce the experience of unpleasant emotions, thereby reducing psychological distress (Doosje et al., 2010). In the Australian forensic context, it has been observed that CSEs, DVI and ballistics experts often use dark black humour to reduce the unpleasantness of certain stimuli, for example: dealing with deceased persons at disaster scenes, mass shootings and suicide scenes (Kelty, 2012). Sewell noted that police investigators use humour as the way to desensitise themselves from the reality of the crime scene and control their emotional responses (Sewell, 1994).

6.3. Exposure duration and case file analysis of stress leave and turnover

One facet of the role for digital forensics personnel is the repetitive exposure, on a daily or weekly basis, to images or materials related to child abuse and exploitation, terrorism, death, trauma and suicide related materials. Furthermore, forensic investigative roles can be filled with frustration, disappointment and empathic fatigue due to lengthy prosecutions, or investigations that do not proceed due to a lack of sufficient evidence, especially during intensive investigations (Jeanguenat and Dror, 2018). Anecdotal evidence specific to digital forensics suggests that criminal offence categories have not evolved at the same rate that digitally committed crimes are carried out, thus even if digital evidence is found, it can be difficult to charge a person for a specific act.

A recent study by Burruss (2018) explored rates of STS in 360 police employees, both sworn and unsworn investigators, who had digital evidence analysis roles. They found that the longer a person worked in roles exposed to digital evidence, the higher their STS symptoms. No differences in the results were found between sworn and unsworn investigators in risk of STS (Burruss et al., 2018). Similar results were found in earlier studies (Brady, 2017; Bourke and Craun, 2014; Perez et al., 2010).

Although these findings have shown a correlation between increased exposure and STS symptoms, it cannot be inferred from this evidence whether reported stress rates peak at certain stages of training, after a certain amount of viewing hours, from viewing specific types of materials, or whether there is no pattern at all in

when and how occupational stress develops. The absence of this information negatively impacts workforce planning.

7. Recommendations and strategic directions

After an extensive search using a range of digital databases, we identified a developing but small body of robust evidence-based literature exploring organisational risk factors for stress in digital forensic teams. Although the research used in this review had robust methodology, with many of the findings being replicated in different countries, the discussion of the findings provided by the research teams were generalised and did not provide clear directions for what steps or strategies forensic agencies and police departments could take.

The following recommendations and future directions were developed from each of the key themes presented above in section 6. Directions are presented in no specific order of importance. Each direction can be undertaken independently or combined into a single comprehensive project. This provides that agencies can undertake research as and when their budgets or operational plans permit.

7.1. Future direction 1: Supportive and resilient supervisor/team leaders

Overall, the evidence suggests that supervisor practices and knowledge are important for reducing stress risk in the digital forensics teams they manage. There are two aspects to this research direction.

First, supportive management styles in supervisors/team leaders can act as a buffer against occupational stress. Although research has identified what this effective skill set looks like, further research is required within agencies and department to ascertain how effective managers gained their skills. As we do not know, we cannot confirm the best manner to enhance and teach these skills. Organisations could carry out internal surveys after identifying who their effective managers are. The surveys will need to identify the range of learning that effective managers used: for instance, were skills learnt by observation, reading, informal courses, podcasts or formal management/leadership courses. This knowledge will then be able to guide career development in effective management.

Second, of the limited research existing in forensic science in this area, there appears to be a complete gap of evidence into what resources supervisors and team leaders require to manage their own mental wellbeing while they champion the mental wellbeing of their team. This direction requires a separate project with supervisors to understand how they manage their mental health and stressors, after which findings should be used to implement useful workplace policies that reduce the risk of supervisor burnout.

7.2. Future direction 2: Effective work environments

The evidence indicated that physical space is an important factor in facilitating productivity and camaraderie within digital forensic teams. However, the layout of forensic spaces is changing, with a move from closed offices to open plan spaces with tea stations replacing tearooms. A future direction will be to carry out workplace assessments that explore the environment in which digital forensic personnel work and whether that environment is 'fit for purpose'. This direction would inform agencies and departments whether staff have the types of space they need to work safely and effectively. This might include a work space that provides digital investigators with the knowledge that non-digital forensic staff will not pass their open-plan desk space and view

investigation images and material, and that they have the designated space within the workplace to mix with their colleagues, build cohesive teams, and to debrief.

Further, tightened budgets in many countries have restricted the technology that organisations have purchased, and/or limited the training courses to which staff have had access. Given the rapid increase in digital crime, an issue for agencies to explore is whether digital forensic staff have the technology that they need to work effectively, and whether they have the capacity built into their workloads for regular upskilling, as digital crime becomes more sophisticated.

Allocation of appropriate 'fit for purpose' spaces to debrief and work, and to have the expertise and equipment to work well, can present forensic organisations with one way to potentially reduce an environmental stressor for digital forensic teams.

7.3. Future direction 3: Exposure duration and case file analysis of stress leave and turnover

The final direction from this review would be to assess whether the risk of occupational stress is related to duration of exposure in general, or to specific materials over time. This direction would involve a risk assessment and analysis using two different, but complimentary methods. This form of analysis is what WHO advocates as the 'gold standard' for identifying and responding to job content hazards.

First, would be to carry out a longitudinal study with digital forensic team members. Data collected would include exposure over time to a range of different materials, stress levels and measurements of other organisational stressors.

Second, would be to carry out case file analysis of the work circumstances that led to personnel reporting psychological injury, followed by placement on temporary sick leave, transfer or exiting. The data would be analysed without the need for personal details to be retained, as the aim is to determine patterns, spikes, and troughs in stress, absenteeism, intentions to quit or psychological injury.

If patterns in stress are identified, agencies and departments are in a better placed position to develop targeted risk hazard management. For example, possible patterns in stress leave, or reductions in workplace performance may hypothetically occur in the third year of training, or after a new team leader commences, or spike during a complex investigation when workplace hours increase.

CRedit author statement

Sally Kelty.: Conceptualization, Methodology, Formal Analysis, Supervision, Writing - Original Draft Preparation, Project Administration. Emma McQueen.: Investigation, Formal Analysis, Writing - Review & Editing. Carly Pymont.: Conceptualization, Investigation, Writing - Review & Editing. Nathan Green.: Conceptualization, Funding Acquisition, Writing- Review and Editing, Avoiding Burnout at the Digital Forensics Coalface:

Disclosure statement

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