

## TECHNICAL NOTE

### GENERAL

Amy M. Jeanguenat,<sup>1</sup> M.F.S.; and Itiel E. Dror,<sup>2</sup> Ph.D.

# Human Factors Effecting Forensic Decision Making: Workplace Stress and Well-being

**ABSTRACT:** Over the past decade, there has been a growing openness about the importance of human factors in forensic work. However, most of it focused on cognitive bias, and neglected issues of workplace wellness and stress. Forensic scientists work in a dynamic environment that includes common workplace pressures such as workload volume, tight deadlines, lack of advancement, number of working hours, low salary, technology distractions, and fluctuating priorities. However, in addition, forensic scientists also encounter a number of industry-specific pressures, such as technique criticism, repeated exposure to crime scenes or horrific case details, access to funding, working in an adversarial legal system, and zero tolerance for “errors”. Thus, stress is an important human factor to mitigate for overall error management, productivity and decision quality (not to mention the well-being of the examiners themselves). Techniques such as mindfulness can become powerful tools to enhance work and decision quality.

**KEYWORDS:** forensic science, human factors, mindfulness, forensic decision making, expert performance, well-being, workplace stress, forensic error, cognitive forensics, resilience

The examination of human factors in forensic science is relatively new compared to the age of the forensic field. Only this past decade, it has emerged that human factors are relevant and important to forensic work and this area has just started to be explored (1–3). Following this revelation, official bodies have recently taken on these issues (e.g., the United Kingdom Forensic Science Regulator (4), the US National Commission of Forensic Science (5), the Organization of Scientific Area Committees at the US National Institute of Standards and Technology (6)). These hives of activity have officially recognized and placed human factors as having a key role in the forensic field.

However, the research and recognition that human elements can affect the quality of work and/or the outcome of forensic examinations has mostly focused on bias and other cognitive issues (7,8). Other important human factor areas that are also fundamental to performance and work of forensic examiners have been overlooked. One such area is the environment in which forensic work is carried out, specifically issues of stress, anxiety, and well-being. These areas have been well researched in other domains, and there is much attention to these issues in a variety of commercial and governmental workplaces. This paper is the first step in raising these issues and providing a suggestion to mitigate its effects within the forensic science domain.

Issues relating to the workplace and its role in forensic work are situated between more general factors that affect forensic work (such as training and motivation) and more specific factors (such as the casework at hand). This is well illustrated in Fig. 1 (below) that explicates different elements that can affect forensic

expert performance (taken from Dror, 2017 (7)). It clearly shows that forensic examiners trying to do their job are subject to many pressures from different directions. These originate from case-specific information; environment, culture, and experience; and human nature.

The organizational factors level includes sources that originate from the organization, culture, and environment that the forensic scientists work within to include interactions with law enforcement, the legal system, politicians, administrators, and other stakeholders. Also included within this category are human factor issues that relate to the well-being of people in the workplace, which may include pressure, stress, and anxiety. These factors have clear implications to performance, focused attention, and decision making within the workplace. Workplace stress and wellness has been studied heavily across multiple disciplines, including law enforcement (9–17). Techniques, such as mindfulness, can be an effective mechanism to mitigate negative effects

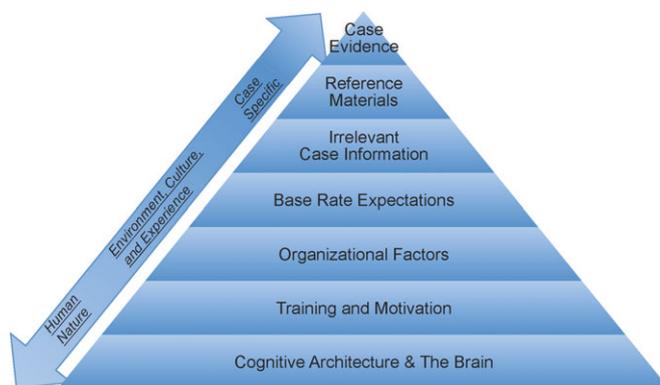


FIG. 1—A taxonomy of different sources that may effect forensic observations and conclusions (7).

<sup>1</sup>Mindgen, LLC 8605 Kenilworth Drive, Springfield, VA, 22151.

<sup>2</sup>University College London & Cognitive Consultants International (CCI-HQ), London, UK.

Received 12 Feb. 2017; and in revised form 4 April 2017; accepted 5 April 2017.

of workplace pressures and act as a pattern interrupt in the forensic process (discussed below).

The human brain sets off a reaction when it feels under stress. This reaction is commonly referred to as a “fight or flight” response or acute stress response. When a need is unmet, the brain reacts by preparing one to fight or flee the issue. The reaction is accompanied by changes in hormones such as spiking of adrenaline and cortisol, the heart beats faster, platelets in the bloodstream plump and clot, muscles tighten, the stomach and intestines cease operation, and the immune system suppresses (18).

A “fight or flight” reaction is extremely useful when faced with life-threatening situations such as avoiding a car accident or exiting a building on fire. However, in the modern age the majority of daily stressors are mostly non-life-threatening, such as being stuck in traffic, misplacing car keys, spilling coffee, or running late for a meeting. However, the brain sometimes still responds to stress in an extreme way (i.e., as if it is a life-threatening situation).

Stress can also be beneficial; in small spurts (often called eustress), stress can help increase performance and productivity, providing an extra edge to meet demands and deadlines (19). However, when stress factors are repeated or constant, performance and productivity tend to decrease due to physical and psychological phenomena accompanied by responding to chronic stress (20). Chronic stress can lead to mental and physical exhaustion, illness, depression, and anxiety. Across workplaces there are many shared triggers of stress: workload volume, tight deadlines, lack of advancement, number of working hours, low salary, technology distractions, and fluctuating priorities (21).

The forensic scientist is subject to many of these common triggers, as well as forensic-specific pressures. With technology advancements and forensic science being used in new ways especially on “lesser crimes,” workload volume has increased in many laboratories. This is accompanied by pressure from law enforcement and prosecutors to return results quickly, often requesting rush services. Agencies that have successfully focused on increasing efficiency often find that as they meet demand, more samples are submitted. Thus, the culture is under continuous pressures to do more, regardless of how efficient they are.

There is also not a lot of room for advancement in a forensic science laboratory. Many analysts that succeed in securing higher-level positions of a supervisor and technical leader often stay in those positions for the majority of their career. In some higher-level positions, the competition increases as civilian and noncivilian staff may compete for positions such as director.

Due to workload demands, many forensic scientists may experience long workdays and longer workweeks. Being a service field, forensic science is often low paid despite the desire for higher-level education needed to understand, train, and convey results. The mean annual wage for a forensic scientist in the United States is \$60,090 (22). The forensic scientist has the same technology distractions as other fields. Smartphones and email mean it is hard to ever turn off work. Priority fluctuations also change and may be triggered by validation of new technology, training, meetings, pressures from stakeholders, violent crimes demands, and trial and testimony dates. Thus, forensic scientists continuously exposed to a variety of chronic stressors.

Women specifically are also more likely to feel the effects of stress and report a higher level of day-to-day stress. Women are generally under more pressure in life as those who work outside the home are often still the primary caretaker for children and elderly parents (23), and their coping styles (24) and

evolutionary differences in neurobiology and hormones between men and women (25,26) further contribute to the problem. As the forensic science field becomes more predominantly women, noted by an average 78% female participation in forensic science graduate programs (27), wellness factors affecting women become an important cultural factor to consider in catering to women’s health and workplace performance.

There are also unique industry-specific pressures that are placed on forensic scientists and managers such as technique criticism, repeated exposure to crime scenes or horrific case details, access to funding, working in an adversarial legal system, and zero tolerance for “errors”.

- **Technique Criticism:** The field of forensic science has recently found itself highly criticized by committees aiming to improve the science. The issuing of reports such as the NAS (28) and PCAST (29) critically examines the forensic field. These reports have raised questions about the very foundation of many forensic domains, as well as specific criticisms about how they are practiced (other issues relate to the need for additional funding, more scientific research to include contribution from independent sources, standardization, independent laboratories, and issues with interpretation, subjectivity and bias—most notably with patterned evidence). These reports have created an environment of feeling threatened and an adverse atmosphere.
- **Exposure to Case Details:** In some jurisdictions, forensic scientists may act or assist crime scene investigators by working to recover items viable for forensic testing from a crime scene. Even if not exposed directly to a crime scene, many forensic scientists and managers are involved in case details with law enforcement in order to triage a testing strategy to assist the investigation. Many cases involve homicides, sexual assaults, motor vehicle deaths, and violent crimes against children. While certain mechanisms are employed in an attempt to stay detached and dispassionate to disturbing and distressing case details, these mechanisms have limited effectiveness overtime (14). Crimes of this nature can be especially stressing when the forensic testing is not able to help the investigation.
- **Funding:** Many forensic laboratories are under substantial funding pressures (e.g., some public laboratory budgets are significantly or wholly secured by government grant funding, meaning all employee positions, supplies, and equipment need to be secured through obtaining government grants (28,30)). This can lead to employees with uncertain job security, feeling unsupported by the jurisdiction being served, and the inability to properly serve stakeholders.
- **Adversarial Legal System:** Many forensic examiners work within the adversarial legal system, which brings about a number of problems. First, often they are pawns in legal litigation where they are used to make arguments rather than actually help uncover the truth and fulfill their role as scientist. Second, the forensic scientist and their work is attacked by attorneys and opposing experts working within the adversarial legal system.
- **Tolerance for Errors:** Forensic practitioners are humans performing procedures, often involved with analysis, subjective interpretation, and comparisons, and therefore, mistakes do happen. Knowing this along with the understanding that the outcome of a forensic examination can have a significant impact on human lives can cause pressure and stress in conducting work. Furthermore, forensic practitioners are often held to unreasonable standards where “honest” mistakes are

not tolerated. The process of investigating an error through a corrective action report (or “conflict resolution”) can also be a very negative process in laboratory cultures that do not have open communication or practice a continuous cycle of improvement but are accusatory or attuned to placing blame.

Reaction to stress often first causes communication and decision making to suffer. As the brain enters “stress-reaction” mode based on changes in hormones, a person tends to enter fearful decision making becoming defensive and disorganized (19). Continued stress reactions can cause fatigue, mistakes, and injuries all based on physical and psychological responses (18).

When the stress factor(s) continue to exist, absenteeism and presenteeism avail. Absenteeism is easy to track, as the scientist will start to come to work later, leave earlier, or call in sick more. Presenteeism involves the scientist still being present for work; however, their performance levels are low due to illness or mental fog; this can be more difficult to understand and measure (31). People in positions with high levels of pressure and stress are more likely to have poor work performance, be less productive, and suffer from emotional and physical negativity bias (32).

It is not practical nor the point of this article to eliminate all workplace pressures; some pressures are extremely valuable in affecting change and others are simply a byproduct of the current scope of work. However, forensic scientists and managers need effective tools to cope with common workplace- and industry-specific pressures. To do that, first, one must recognize the role of stress and well-being as an important human factor issue in forensic science. Individuals can take an active role in their lives using techniques such as exercise, healthy eating, meditation, vacations, and hobbies to help manage workplace stress.

Due to the clear connection between wellness and effects on decision making, productivity, and performance, there should also be an industry wide effort to improve forensic science by taking this issue on board and improving the resilience and wellness of the practitioners. Workplaces may try flexible work schedules, exercise initiatives, and provide healthy nutrition sources at work. Wellness programs can become great benefits, increase workplace enjoyment, and help employees establish a work/life balance.

To counteract the “fight or flight” stress response, methods to train the brain and body are needed. With practice, training in techniques such as mindfulness can retrain the brain by reducing cortisol levels and altering the brain in areas such as learning, emotional regulation, and perspective (33–35). Mindfulness training provides necessary techniques needed to effectively respond to challenges instead of reacting on auto-pilot (36). It also generates awareness to stress triggers both psychologically and physically and brings the mind back to the present moment for focused attention.

Many organizations, such as Google, Target, Accenture, Salesforce, General Mills, and Aetna, have recognized the advantages of such training (37). When Google introduced mindfulness training to employees, the sessions would get booked immediately with employees in search of ways to increase resilience to stress, become more creative, have mental clarity, and increase focus. The popularity of the program in turn spun off books and permanent workshops (38). However, service-related industries such as forensic science, where decision making can affect human lives, have not yet reaped the benefits of such training.

As being mindful is a psychological state, people can learn how to cultivate a mindfulness practice (39). Learning

mindfulness techniques and practicing them improves cognitive functions and job satisfaction, and nurtures creativity (40). This leads to improvements in communication, innovative thinking, and handling workplace conflicts. These effects all help enhance quality of life while increasing focus and efficiency (33). Physically a person who practices mindfulness may experience lower blood pressure, increased immune system responses, improved emotional stability, and the quality of sleep (41). This leads to a decrease in depression, anxiety, and even pain (42).

The tools learned through mindfulness training can be applied throughout the workday, in the moment a stress response is cued and in common functions such as eating, walking, and meetings. Mindfulness programs may explore exercises in breath functions, mental body scans, conscious communication, focused attention, compassion, and physical movements to provide various tools to employ during stressful moments (43). Workplace programs can outline how to use techniques in emails, meetings, goal planning, setting priorities, and communication to effectively encourage a culture of mindfulness (44).

Forensic science is evolving to understand the outcomes of human factors in forensic examinations, quality of work, and error management. Understanding and managing human factors can enhance quality and technical procedures of a laboratory as well as improve decision-making ability. Workplace wellness and especially stress has been studied heavily across multiple industries to better understand employee retention, job satisfaction, health, and absenteeism.

As forensic scientists work in a dynamic environment not immune to common workplace pressures and subject to industry-specific pressures, stress becomes an important human factor to mitigate for overall error management and productivity. Techniques such as mindfulness become a powerful tool for a forensic scientist to employ to enhance decision making and focus attention.

## References

1. Dror IE, Rosenthal R. Meta-analytically quantifying the reliability and biasability of forensic experts. *J Forensic Sci* 2008;53(4):900–3.
2. Dror IE. A hierarchy of expert performance. *J Appl Res Mem Cogn* 2016;5(2):121–7.
3. Dror IE. Cognitive neuroscience in forensic science: understanding and utilising the human element. *Philos Trans R Soc* 2015;370(1674):20140255.
4. Forensic Science Regulator. Guidance: cognitive bias effects relevant to forensic science examinations, 2015;FSR-G-217; [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/510147/217\\_FSR-G-217\\_Cognitive\\_bias\\_appendix.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510147/217_FSR-G-217_Cognitive_bias_appendix.pdf) (accessed April 4, 2017).
5. National Commission on Forensic Science. Ensuring that forensic analysis is based upon task relevant information, 2015; <https://www.justice.gov/ncfs/file/818196/download> (accessed April 4, 2017).
6. Organization of Scientific Area Committees at and the US National Institute of Standards and Technology, 2014; <https://www.nist.gov/forensics/organization-scientific-area-committees-forensic-science> (accessed April 4, 2017).
7. Dror IE. Human expert performance in forensic decision making: seven different sources of bias. *Aust J Forensic Sci*. Published online 2017; 49(5).
8. Found B. Deciphering the human condition: the rise of cognitive forensics. *Aust J Forensic Sci* 2015;47(4):386–401.
9. Patterson BL. Job experience and perceived job stress among police, correctional, and probation/parole officers. *Crim Justice Behav* 1992;19(3):260–85.
10. Burke RJ. Stressful events, work-family conflict, coping, psychological burnout, and well-being among police officers. *Psychol Rep* 1994;75(2):787–800.
11. Anshel MH. A conceptual model and implications for coping with stressful events in police work. *Crim Justice Behav* 2000;27(3):375–400.

12. Toch H. *Stress in policing*. Washington, DC: American Psychological Association (APA Books), 2002.
13. Brough P. Comparing the Influence of traumatic and organizational stressors on the psychological health of police, fire, and ambulance officers. *Int J Stress Manag* 2004;11(3):227–44.
14. Robyn G, Barocas B, Canton AN, Li X, Vlahov D. Mental, physical, and behavioral outcomes associated with perceived work stress in police officers. *Crim Justice Behav* 2009;36(3):275–89.
15. ABengt BA, Arble E, Backman L, Lynch A, Lublin A. Assessment of a prevention program for work-related stress among urban police officers. *Int Arch Occup Environ Health* 2013;86(1):79–88.
16. Jerome NR, Heesch KC, Washington TL. Wellness programs at firefighter and police workplaces: a systematic review. *Health Behavior Policy Rev* 2014;1(4):302–13.
17. Joseph BK, Maguire ER, Leach NR. Health, safety, and wellness program case studies in law enforcement. Washington, DC: Office of Community Oriented Policing Services, 2015; [https://www.valorforblue.org/Documents/Publications/Public/Health\\_Safety\\_and\\_Wellness\\_Program\\_Case\\_Studies\\_in\\_Law\\_Enforcement.pdf](https://www.valorforblue.org/Documents/Publications/Public/Health_Safety_and_Wellness_Program_Case_Studies_in_Law_Enforcement.pdf) (accessed April 4, 2017).
18. Herbert B, Aggie C. *Stress management: approaches for preventing and reducing stress*. Boston, MA: Harvard Medical School, 2011.
19. Davidji. *Destressifying: the real world guide to personal empowerment, lasting fulfillment, and peace of mind*. London, U.K.: Hay House, Inc, 2015.
20. Yerkes RM, Dodson JD. The relation of strength of stimulus to rapidity of habit-formation. *J Comp Neurol Psychol* 1908;18:459–82.
21. Health Advocate, Inc. *Stress in the workplace: meeting the challenge*. Plymouth Meeting, PA.: Health Advocate, Inc Publication, 2009; <http://healthadvocate.com/downloads/webinars/stress-workplace.pdf> (accessed April 4, 2017).
22. U.S. Bureau of Labor Statistics. Occupational employment wages: 19-4092 forensic science technicians, 2015; <https://data.bls.gov/cgi-bin/print.pl/OES/current/oes194092.htm> (accessed January 19, 2017).
23. Nidhi S, Subho C, Sandeep G. Gender difference in caregiving among family-caregivers of people with mental illness. *World J Psychiatry* 2016;6(1):7–17.
24. Matud MP. Gender difference in stress and coping styles. *Personality Individ Differ* 2004;37:1401–15.
25. Verma R, Balhara YP, Gupta CS. Gender difference in stress response: role of developmental and biological determinants. *Ind Psychiatry J* 2011;20(1):4–10.
26. Kajantie E, Phillips DI. The effects of sex and hormonal status on the physiological response to acute psychosocial stress. *Psychoneuroendocrinology* 2006;31:151–78.
27. Houck M. Is forensic science a gateway for women in science? *Forensic Sci Policy Manag* 2009;1(1):56–9.
28. National Research Council (U.S.). *Strengthening forensic science in the United States: a path forward*. Washington DC: The National Academies Press, 2009; <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf> (accessed April 4, 2017).
29. Executive Office of the President, President's Council of Advisors on Science and Technology (U.S.). *Report to the President – Forensic science in criminal courts: ensuring validity of feature-comparison methods*. Washington DC: Office of Science and Technology Policy, 2016; [https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_forensic\\_science\\_report\\_final.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf) (accessed April 4, 2017).
30. Manger JT, Beary R, Sloan RC, Youngblood D, Ramsey CH. Letter to Congress: FY16 support and assistance for state and local forensic service providers; <http://www.iacp.org/Portals/0/documents/pdfs/FY16%20Coverdell%20Request%20Letter.pdf> (accessed January 19, 2017).
31. Hemp P. Presenteeism: at work—but out of it. *Harvard Business Review*, 2004; <https://hbr.org/2004/10/presenteeism-at-work-but-out-of-it> (accessed April 4, 2017).
32. Williams LM. 'Negativity bias' in risk for depression and anxiety: brain-body fear circuitry correlates, 5-HTT-LPR and early life stress. *NeuroImage* 2009;47(3):804–14.
33. Davidson RJ, Kabat-Zinn J, Schumacher J, Rosenkranz M, Muller D, Santorelli SF, et al. Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Med* 2003;65:564–70.
34. Hölzel BK, Carmody J, Vangel M, Congleton C, Yerramsetti SM, Gard T, et al. Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Res: Neuroimaging* 2011;191:36–43.
35. Modinos G, Ormel J, Aleman A. Individual differences in dispositional mindfulness and brain activity involved in reappraisal of emotion. *Soc Cogn Affect Neurosci* 2010;5:369–77.
36. Glomb TM, Duffy MK, Bono JE, Yang T. Mindfulness at work. *Res Personnel Human Resour Manag* 2012;30:115–57.
37. Schaufenbue K. Why Google, Target, and General Mills are investing in mindfulness. *Harvard Business Review*, 28 December 2015; <https://hbr.org/2015/12/why-google-target-and-general-mills-are-investing-in-mindfulness> (accessed April 4, 2017).
38. Tan CM. *Search inside yourself: the unexpected path to achieving success, happiness (and world peace)*. New York, NY: HarperOne, 2012.
39. Dane E. Paying attention to mindfulness and its effects on task performance in the workplace. *J Manage* 2011;37:997–1018.
40. Chaskalson M. *The mindful workplace: developing resilient individuals and resonant organizations with MBSR*. Oxford, U.K.: Wiley, 2011.
41. Halliwell E. *Mindfulness report*. Commissioned by Mental Health Foundation, 2010; [https://www.mentalhealth.org.uk/sites/default/files/Mindfulness\\_report\\_2010.pdf](https://www.mentalhealth.org.uk/sites/default/files/Mindfulness_report_2010.pdf) (accessed April 4, 2017).
42. Baer RA. Mindfulness training as a clinical intervention: a conceptual and empirical review. *Clin Psych: Sci Pract* 2003;10:125–43.
43. Kabat-Zinn J. *Full catastrophe living: using the wisdom of your body and mind to face stress, pain, and illness*. New York, NY: Bantam Books, 2013.
44. Hougaard R, Carter J, Coutts G. *One second ahead: enhance your performance at work with mindfulness*. New York, NY: Palgrave Macmillan, 2015.

Additional information and reprint requests:

Itiel E. Dror, Ph.D.

University College London & Cognitive Consultants International (CCI-HQ)

London

UK

E-mail: i.dror@ucl.ac.uk