

**PAPER****GENERAL**

Mohammed A. Almazrouei <sup>1,2,3</sup> M.Sc.; Itiel E. Dror <sup>1,2</sup> Ph.D.; and Ruth M. Morgan <sup>1,2</sup> D.Phil.

## Organizational and Human Factors Affecting Forensic Decision-Making: Workplace Stress and Feedback

**ABSTRACT:** Although forensic examiners operate in a stressful environment, there is a lack of understanding about workplace stress and feedback. These organizational and human factors can potentially impact forensic science judgments. In this study, 150 practicing forensic examiners from one laboratory were surveyed about their experiences of workplace stress, and the explicit and implicit feedback they receive. Forensic examiners reported that their high stress levels originated more from workplace-related factors (management and/or supervision, backlogs, and the pressure to do many cases) than from personal related factors (family, medical, and/or financial). The findings showed that a few (8%) of the forensic examiners sometimes felt strong implicit feedback about what conclusions were expected from them and that some (14%) also strongly felt that they were more appreciated when they helped to solve a case (e.g., by reaching a “match” as opposed to an “inconclusive” conclusion). Differences were found when comparing workplace stress and feedback levels across three core forensic science fields (forensic biology, chemistry, and latent prints) and across career stages (early, mid, and late). Gaining insights into the stress factors within a workplace and explicit and implicit feedback has implications for developing policies to improve the well-being, motivation, and performance of forensic examiners.

**KEYWORDS:** forensic science, workplace stress, feedback, implicit feedback, forensic decision-making, well-being, human factors

Workplace stress has been shown to have an impact on the quality of decisions made by professionals in a variety of domains, such as medicine (e.g., [1]), policing (e.g., [2]), the military (e.g., [3]), management (e.g., [4]), and psychology (e.g., [5-7]). In the medical domain, for instance, a review of 22 empirical studies indicated that high levels of stress factors (such as bleeding, time pressure, and procedural complexity) can affect the performance of surgeons (1). However, research is still lacking with regard to the impact workplace stress may have on the well-being of forensic examiners (8) as well as the quality of their decisions (9).

Forensic examiners operate in a stressful environment (8,10,11). Some organizational stress factors are common in many workplace environments, such as workload volume and number of working hours (11). There are also stress factors that are specific and unique to the forensic science discipline (9), which further contributes to the “high stress occupation” of forensic examiners ([8], p. 34). One of these unique stress factors is the intensified scrutiny of forensic techniques and criticisms of their validity, as well as working within an adversarial

legal system (e.g., [12]). Moreover, there are often unreasonable expectations placed on the forensic examiners not to ever make any mistakes (13,14). In addition, forensic examiners can be directly exposed to emotionally distressing elements from crime scenes or disturbing case details (9,11).

Stress can have positive or negative impacts on human performance and decision-making (15-17). The Yerkes–Dodson law empirically shows an inverted U-shape relationship between stress and performance (17). Performance is lower at low stress; then with increased stress, performance is higher, but this elevation in performance continues only until the level of stress is moderate. As stress becomes high, performance and quality of decisions start to drop (17). In forensic science, quality of judgments includes accuracy, but also other issues, such as confidence levels, documentation of the decision-making process, reporting of the conclusions, ability to justify the decisions, and their presentation in court (18; see also [19] for Hierarchy of Expert Performance).

High levels of stress, or repeated exposure to stress, have been shown to impair the cognitive ability of individuals (20) and the well-being of forensic examiners (21). Workplace stress can result in negative workplace experiences. These occupational experiences can cause physical (e.g., stomach distress and heart disease), psychological (e.g., anger and job dissatisfaction), and behavioral reactions (e.g., substance use and absenteeism) (22,23). For example, Holt and Blevins (21) surveyed 56 digital forensic examiners and found that around 68% were working under a lot of pressure at work. Participates in this study reported a number coping mechanisms, such as drinking alcohol and smoking (21). It was also reported that in some law

<sup>1</sup>UCL Department of Security and Crime Science, University College London, 35 Tavistock Square, London, WC1H 9EZ, U.K.

<sup>2</sup>UCL Centre for the Forensic Sciences, University College London, 35 Tavistock Square, London, WC1H 9EZ, U.K.

<sup>3</sup>Forensic Evidence Department, Abu Dhabi Police General Headquarters, Abu Dhabi, 253, U.A.E.

Corresponding author: Mohammed A. Almazrouei, M.Sc. E-mail: mohammed.almazrouei@ucl.ac.uk

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enforcement agencies the attrition rates were about 50% within 3 years for staff members responding to critical crime scenes (about 20% of them reported long-term psychological problems) (11).

Feedback is a critical factor in its own right that can impact well-being and performance (24), as it can have implications for the motivation, expectations, and the decision-making of forensic examiners (e.g., questions 8 and 9 in [25]). Therefore, understanding the ways feedback given to forensic examiners and how it may affect the decision-making of forensic examiners is important for understanding the context in which decisions are made (18,26). This has the potential to impact the entire crime reconstruction process (27).

During casework, forensic examiners communicate and receive feedback from a variety of sources, which can be categorized into five domains: forensic services, investigative, legal, public (26), and regulatory (18) domains (see Fig. 1). For example, forensic examiners communicate with top management and/or immediate supervisors (14,28), with police investigators (29-31), and they can be in contact with legal advocates during the preparation of evidence for presentation in court (32,33).

Human factors are not independent and often affect one another. For example, stress and emotions are closely related, as stress can generate negative emotions (34). Similarly, stress and feedback are related (e.g., pressures from feedback can cause stress). Importantly, such pressures can impact conclusions (35):

“Errors and disagreements among examiners may be due to in part ... [to] systemic pressures encouraging some decisions more than others. These pressures will vary by

agency or among cases, and examiners’ responses to these pressures will vary.” (p. 66)

The study reported here deals with these organizational and human factors of stress and feedback that can affect decision-making. A questionnaire was designed to contain questions about stress and feedback (see Appendix 1). For clarity in presenting the findings, this paper was divided into two parts. The first part focuses on stress experienced at the workplace, examining the existence of and sources of stress in forensic science laboratories. The second part addresses the feedback provided, examining how it is perceived by practicing forensic examiners.

**Part One: Workplace Stress**

Research addressing the decision-making in forensic science has mainly focused on some key human factors, such as contextual information (e.g., [36]) and emotional factors (e.g., [13,37]). However, other human and organizational factors, such as workplace stress have generally been neglected in the published literature. Only a few studies have paid attention to forensic examiners’ stress at the workplace, such as the stress experienced by forensic digital examiners exposed to internet crimes against children (e.g., [21,38]); crime scene examiners exposed to horrific crimes (e.g., [11]); and forensic odontologists exposed to mass casualties (e.g., [39]).

There is a lack of research addressing workplace stress of examiners working in forensic science in general, and specifically across core forensic science fields (such latent prints and forensic chemistry) and across different stages of their career. It

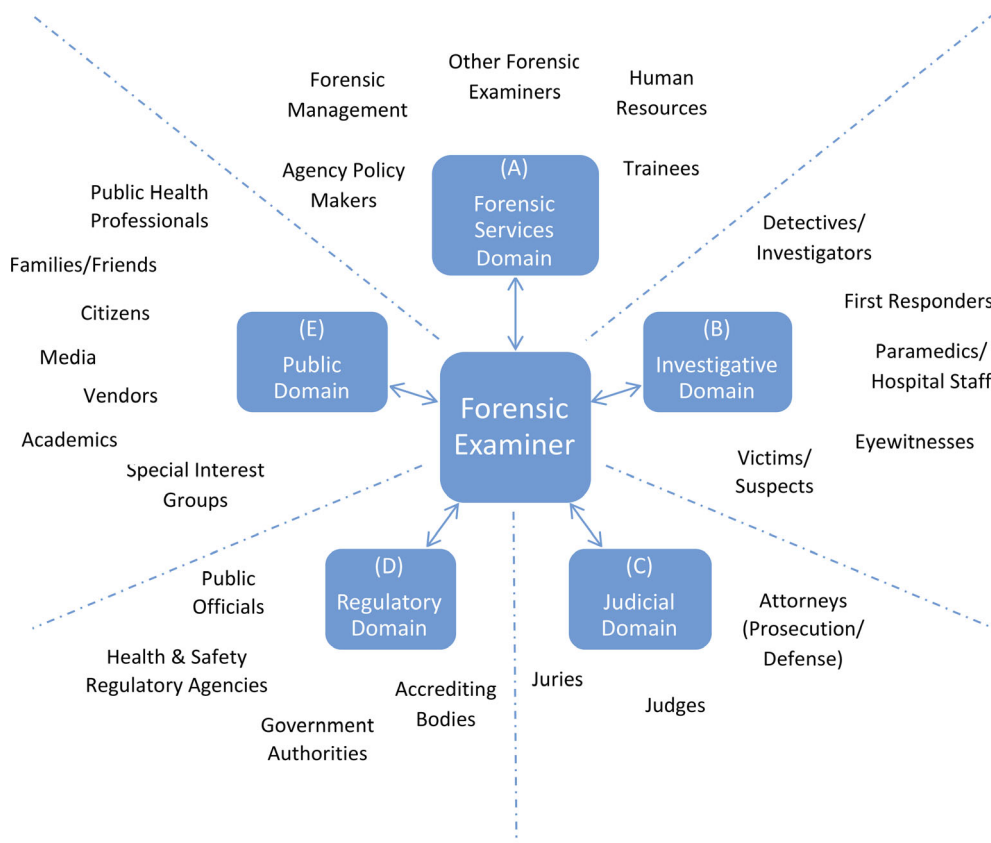


FIG. 1—Interactions and communications of forensic examiners with five stakeholders (taken from Dror and Pierce [18]).

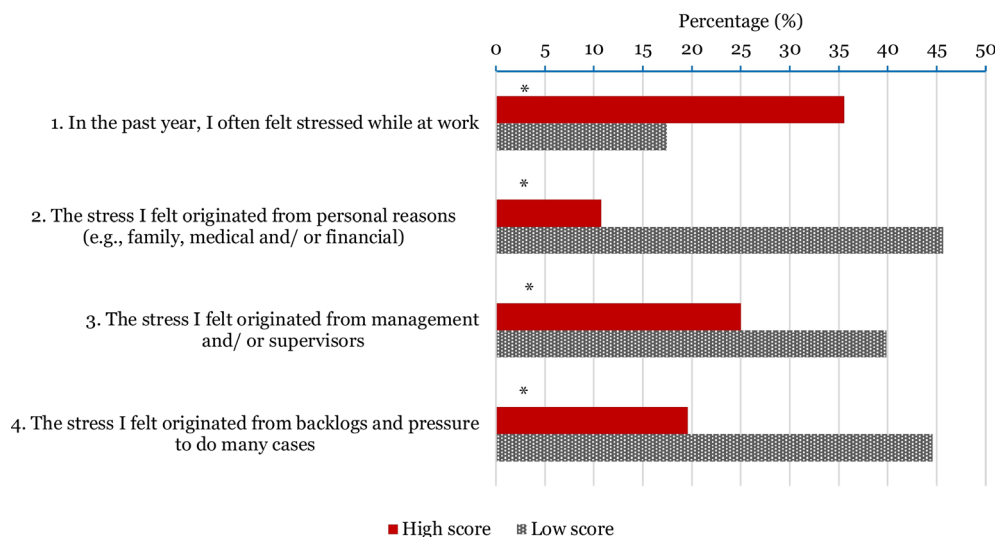


FIG. 2—Scores of stress levels ( $*p < .05$  for  $\chi^2$  of low vs. high scores).

is argued that research on the psychological consequences of stress experienced by forensic science professionals is lacking because of the general belief that professionals involved in emergency situations are expected to deal with stress and demands as part of their job (39).

Research on stress experienced by forensic examiners can help in understanding the factors that moderate stress, and how different factors play a role in creating, reducing, and managing stress (3,10). This may have implications for developing relevant evidence-based approaches to improve the well-being of experts as well as their decision-making performance. Therefore, this study explores the factors that may cause forensic science examiners to feel stress. It was of interest to examine the contribution of stresses attributed to the workplace as opposed to personal factors; whether there were differences in the stresses felt by examiners working in different forensic science fields; and whether the years of experience moderated the level of stress experienced.

## Method

### Questionnaire

Following established approaches in decision-making studies within the forensic science discipline (25,40,41), and studies addressing perceptions of workplace stress factors (e.g., [10,38]), a questionnaire was designed to examine workplace stress (Part One) and feedback (Part Two).

Part One contained questions to ascertain whether forensic examiners had felt stressed at work, and how much of the stress they attributed to personal reasons (e.g., family, medical, and/or financial matters) as opposed to relating the stress to the workplace (see Fig. 2). The participants were required to rank their responses on a seven-point Likert-type scale. The participants were also asked to provide demographic information on their primary forensic field and years of experience.

### Participants

A total of 150 forensic examiners from a major forensic laboratory in the United States took part in the study (71% response rate;  $N = 212$ ). All the participants were practicing forensic

examiners, and they were from the same forensic laboratory, so that it was possible to examine and compare variables (e.g., fields of expertise and years of experience) without introducing interlaboratory variations.

Forensic examiners identified their primary fields as: biology/DNA ( $n = 42$ ), latent prints ( $n = 40$ ), controlled substances ( $n = 24$ ), forensic alcohol ( $n = 7$ ), toxicology ( $n = 4$ ), firearms ( $n = 9$ ), and trace evidence ( $n = 5$ ). Nineteen (13%) did not report their primary field, and three latent print examiners stated that they also work as crime scene examiners as a secondary field. The fields were grouped together on the basis of the type of expertise deployed, giving three field categories: forensic biology ( $n = 42$ ; DNA and biology), latent prints ( $n = 40$ ), and forensic chemistry ( $n = 35$ ; controlled substances, toxicology, and forensic alcohol). The remaining fields (trace evidence, firearms, and crime scene investigation as a secondary field) were excluded from the analysis by field of expertise, because they contained low participant numbers and did not fit within any of the three main field categories.

The mean years of experience was 12 ( $SD = 9.7$  years, with a range from 1 to 47 years; did not respond:  $n = 12$ ). Four examiners provided a qualitative written response to the question about their years of experience (e.g., “many” or “lots”) or the number written was illegible and thus not included in the years of experience analysis (i.e., 16 participants (11%) were excluded from the analysis by experience, leaving 134 participants). Following the accepted approach in the published literature to categorize data, such as the years of experience (e.g., [10,42]), we grouped the years of experience into categories of comparable sample sizes: early career (0–5,  $n = 36$ ); mid-career (6–10,  $n = 28$ ) and (11–20,  $n = 40$ ); and late career (>20, with  $n = 30$ ).

### Statistical Analysis

Both descriptive and inferential statistics were applied, using SPSS (version 25), to measure the reported stress levels in general and to examine stress by field and years of experience. Following previous research (10), the seven-point Likert-type scale responses were converted to an ordinal, categorical scale of low, moderate, and high scores: scores 1–2 as low (i.e., low feelings of stress), scores 3–5 as medium, and scores 6–7 as high (i.e.,

strong feelings of stress). Equal categories of low and high scores were made as per previously published research (10). However, it should be emphasized that some of the neighboring scores (e.g., scores 2 and 3) are grouped in different categories (i.e., low and medium) and this is reflected in the interpretation. Likert scales can be categorized (e.g., [25]) and can be statistically treated at an ordinal level (43). This categorization helps to examine the variability of stress experienced by the examiners.

A chi-square test (goodness of fit) was used to determine whether the categorical responses for each question differed significantly (i.e., low vs. high stress scores; see Figure 2). An alpha significance level of 0.05 was used for all the statistical tests. In addition to the significance testing, the means and standard deviations are reported.

One-way ANOVA and post hoc (Bonferroni) were used to compare the mean workplace stress levels across the categories of forensic fields and years of experience. In case that the homogeneity of variance assumption was not met, as assessed by Levene's test, then a one-way Welch ANOVA and post hoc (Games–Howell) were used instead. In addition to comparing the means, a chi-square test was used to test whether the responses of the high scores for the three categories of forensic fields differed significantly from one another. The stress scores were particularly important at the high levels where the influence of stress on the well-being and performance of forensic examiners can be most critical (17,20,23).

## Results

### Workplace Stress

One in three forensic examiners (36%,  $n = 53$ ) strongly felt that they often experience stress while at the workplace (low vs. high stress scores,  $\chi^2(1, N = 79) = 9.23, p = 0.002; M = 4.61, SD = 1.90$ ; see Fig. 2). For the high stress levels felt by the examiners, stress was attributed more from the workplace (i.e., 25%,  $n = 37$ , from management and/or supervisors ( $\chi^2(1, N = 96) = 5.04, p = 0.025; M = 3.62, SD = 2.16$ ), and 20%,  $n = 29$ , from backlog pressure ( $\chi^2(1, N = 95) = 14.41, p < 0.001; M = 3.30, SD = 2.05$ )) than from the personal life (11%,  $n = 16; \chi^2(1, N = 84) = 32.19, p < 0.001; M = 3.14, SD = 1.85$ ).

### Stress by Field and Experience

On average, moderate workplace stress (question 1) was felt by all forensic field categories: biologists ( $M = 5.02, SD = 1.94$ ), latent print examiners ( $M = 4.75, SD = 1.77$ ), and forensic chemists ( $M = 4.09, SD = 1.92$ ). While the mean stress levels did not vary across the three field categories (questions 1–4,  $p > 0.05$ ), the level of high stress differed from backlog pressure only,  $\chi^2(2, N = 24) = 7.75, p = 0.021$ . The percentage of

forensic biologists (34%,  $n = 14$ ) who strongly felt that their stress originated from backlog pressure was higher than the other fields, that is, latent print examiners (18%,  $n = 7$ ) and forensic chemists (9%,  $n = 3$ ).

The mean stress levels varied across experience groups, but only due to stress from management and/or supervisors (question 3, *Welch's F* (3, 67.7) = 6.01,  $p = 0.001$ ) and backlog stress (question 4, *Welch's F* (3, 67.7) = 8.15,  $p < 0.001$ ; see Table 1). There were no interactions between the forensic field and years of experience on the reported stress levels (univariate ANOVA for questions 1–4,  $p > 0.05$ ).

## Discussion

### Workplace Stress

On average, forensic examiners in this study reported a moderate frequency in feeling stressed at the workplace (question 1,  $M = 4.61, SD = 1.90$ ). However, there was variability in the data as reflected by the standard deviations and by the low and high stress scores (see Fig. 2). Variability is expected given individual differences in responding to stress factors (44,45). Also worth noting is that although question 1 asked examiners on the frequency of their stress at work (i.e., “often”), the responses to this question can also reflect their level of stress. It is generally reasonable to assume that people who feel stressed more frequently also feel higher levels of stress (e.g., see transdisciplinary model of stress that describes “stress” as a set of integrated processes, including the history of stressors in the life of an individual [44]).

In this study, 36% of the forensic examiners strongly felt that they are often stressed at work. Published research from other domains has shown that repeated exposure to stress or when stress levels are high, the well-being (23), and decision-making performance drops (17,20). For example, LeBlanc et al. (46) asked 30 paramedics to calculate drug dosage after working in a highly stressful scenario and found that intense stress increased medical errors.

The data from the study reported here concerns the feelings experienced by forensic examiners. It does not include objective measures of the performance and quality of decisions of the participants. Hence, the data reported do not show the nature of the causal relationship, if any, between high stress and performance. Higher levels of stress can impact performance in a number of ways. These data cannot ascertain the impact, but clearly show that stress is felt by forensic examiners, and hence warrant further research.

Future research needs to experimentally examine the impact of stress on the decision-making performance in the forensic science context, as has been studied in other specialized domains (see, for example, Arora et al. (1) for a review of studies that

TABLE 1—Mean responses (and standard deviations in brackets) for questions 3, 4, and 7 where significant findings were found among the experience groups.

Question	Experience Group (Years)			
	0–5	6–10	11–20	>20
3. Management/ supervision stress	2.53 (1.63) <sup>a,b,c,d,e,f</sup>	4.21 (2.83) <sup>a,b,c,d,e,f</sup>	3.70 (2.12) <sup>a,b,c,d,e,f</sup>	4.20 (2.28) <sup>a,b,c,d,e,f</sup>
4. Backlog stress	2.06 (1.51) <sup>a,b,c,d,e,f</sup>	3.37 (1.98) <sup>a,b,c,d,e,f</sup>	3.98 (2.19) <sup>a,b,c,d,e,f</sup>	3.50 (1.94) <sup>a,b,c,d,e,f</sup>
7. Feedback on expected conclusions	2.18 (1.62) <sup>g</sup>	2.89 (1.85)	2.76 (1.48)	3.33 (1.94) <sup>g</sup>

<sup>a,b,c,d,e,f</sup> $p < 0.05$ , post hoc (Games–Howell)

<sup>g</sup> $p < 0.05$ , post hoc (Bonferroni).

investigated the impact of stress in the medical domain). Such experimental research is important given the critical nature of forensic science decisions within the criminal justice system (27,29).

In the current study, 17% of forensic examiners reported feelings stressed at work relatively infrequently (if they felt stressed at all). It has been observed in some contexts that low levels of stress can lead to underload, boredom, and lower performance (47). Conversely, moderate stress can improve performance (17), as it can, among other things, push individuals to meet deadlines (9). Hence, the published literature addressing stress suggests that there could be benefits in maintaining moderate stress levels at the workplace of forensic examiners (by, for example, providing new, interesting tasks to motivate underloaded, low stressed individuals [47]).

The findings of this study suggest that the forensic laboratory management and/or supervision contribute to the stress levels felt by the forensic examiners (the way the question was framed in the survey does not allow us to determine if it was the laboratory management or the supervisor that created the stress, or both—it is only possible to identify that there was stress felt and it was attributed to either or both of these factors). Published research addressing stress suggests that relationships in the workplace are a common organizational-level stress factor, and that they can be one of the primary causes of stress among criminal justice employees in general (10,48). Hence, it would appear that forensic management and/or supervisors may play a key role in optimizing the stress levels and well-being of forensic examiners.

Similarly, the findings of the current study reveal that backlogs and pressure to complete many cases can contribute to the stress felt by the forensic examiners (see Fig. 2). It has been suggested in the published literature that pressure from case backlog is intensified by the increase of requests from prosecutors and law enforcement agencies for rapid forensic analysis and reports, in addition to increasing forensic service requests for nonviolent crimes in an under-resourced and overtaxed forensic science environment (9,12). However, it is acknowledged that backlog pressure is a complex measure and can vary from one forensic organization to another (8).

The findings show that more examiners strongly felt that their stress originated from the workplace than arising due to personal reasons. It is, however, important to note that the questions posed in this study did not directly relate personal and workplace causes of stress in one question so as to offer the opportunity for examiners to rate one type of stress factor directly against the other. Further research on personal life stress is needed, as it has been suggested in the published literature that stress from the personal life can affect the work–life balance, increase work–life conflict, reduce job satisfaction, and lower performance in the workplace (49,50).

#### Stress by Field and Experience

On average, forensic biologists, forensic chemists, and latent print examiners reported moderate frequencies or levels of stress at the workplace (again, it is important to note that there were individual differences even within the same forensic science field). Previous research targeting specific forensic fields yielded inconsistent findings. For instance, forensic odontologists reported low stress levels when attending mass casualty incidents, for reasons such as having sense of achievement and obtaining invaluable professional experience (39), whereas digital forensic examiners reported moderate levels of stress in

undertaking their roles (e.g., examining child pornography [21]). These previous studies were conducted across laboratories; hence, it is not possible to attribute the different findings to the forensic fields, because these differences may arise from other confounding factors, such as the general workplace culture and environment in the laboratory.

The results from this study, within a single laboratory, allow for a better comparison across forensic fields. These data indicate that high levels of stress from backlog pressure vary among the three fields; specifically, more forensic biologists strongly felt stress from backlog pressure in comparison with forensic chemists and latent print examiners. However, as previously mentioned, backlog is a complex measure and has been shown to vary across forensic organizations—even within the same field of expertise—and can change with time (8). The dynamic and complex nature of backlog pressure suggests that each forensic organization may be well advised to evaluate the way they communicate their own backlogs among the different forensic fields, and how it can influence the well-being and performance of their forensic examiners.

The findings also reveal that mid- and late career examiners—that is, over 5 years of experience—felt more stress originating from management and/or supervision and from backlogs in comparison with early career examiners—that is, under 5 years of experience (there were no interactions between field of expertise and years-of-experience categories in all the stress questions). A previous study suggested that examiners with more experience have more workload responsibilities, such as having a supervisory role (21), which may go some way toward offering insight to this trend that was observed in this study.

There are differences in the levels of workplace stress across occupations (51). There are insufficient understanding and data about stress in forensic science to enable a meaningful comparison to other occupations. This study is one of the first to address workplace stress from various forensic science fields (with statistical comparisons of examiners working in core fields, such as forensic biology and chemistry). In addition, since data were collected from one laboratory, the data do not necessarily generalize to other forensic laboratories. However, there are good reasons to believe that forensic science is a high stress occupation in comparison with typical working environments (8,9). Working environment and organizational culture are human factors that impact forensic decision-making (see fifth source of bias in [52]).

#### Part Two: Workplace Feedback

Feedback is a key component of the conceptual model of communication in forensic science presented by Howes (53). Additionally, feedback received by forensic examiners who perform casework analysis and interpretation is an important component of monitoring and improving performance, and motivating and rewarding examiners for hard work (e.g., [24]). Feedback can be explicit (messages that can be directly codified and articulated) (30,54), such as an immediate supervisor saying “well-done” to the examiner. Feedback can also be implicit, meaning that messages are not direct and less codified (30,54). An example of implicit feedback would be the supervisor “smiling” to the examiner, which can cause subjective interpretation and experiences of emotions (55).

Stress and pressure resulting from explicit and/or implicit feedback can influence forensic science judgments. In an earlier

study, some fingerprint examiners reported that they were not allowed or were discouraged from making inconclusive decisions when the latent mark and known prints were of value and included a large area for comparison (56). Moreover, Kassir et al. (57) discussed that a contributing factor of the misidentification in the 2004 Madrid train bombings was the increased “need for closure” (i.e., the desire to provide clear-cut judgments [58]), which resulted in a subsequently established erroneous identification of Mayfield. It is salient that an independent investigation report on this case stated that the criteria for reaching an inconclusive result could lead to implicit pressures on an examiner to reach an identification when making a difficult comparison of marks, particularly when the case was very serious (59).

Previously published research has started to look into the possible relationships between perceived feedback and forensic expert decision-making (e.g., questions 8 and 9 in [25]). Yet its impact and scope are still largely unexplored. This current study assessed the explicit and implicit feedback, as felt by the forensic examiners with the following key actors (see Fig. 1): forensic management and/or supervisors (the forensic services domain), police investigators (the investigative domain), and legal advocates (the legal domain). These have been identified as actors that can impact decisions made during crime scene work, laboratory analysis, and/or judicial procedures (12,33,60,61).

Therefore, the second part of this current study sought to identify the level of explicit and implicit feedback as felt by the forensic examiners, and whether the feedback varied by forensic science field of expertise or years of experience.

### Method

The same methodology was followed as outlined in Part One, with the only difference being the inclusion of three questions on feedback. Specifically, the feedback questions addressed whether forensic examiners received feedback about their work from stakeholders, such as from management, supervisors, police investigators, and/or legal advocates (i.e., explicit feedback; see question 5 in Fig. 3). In addition, questions 6 and 7 asked whether the forensic examiners felt that the stakeholders appreciated them more when they help to solve a case (such as when finding a “match”

rather than “inconclusive”) and whether the examiners sometimes felt they know what the stakeholders expect or want their conclusions to be (i.e., implicit feedback; Fig. 3).

### Results

#### Workplace Feedback

About half (49%,  $n = 71$ ;  $M = 3.06$ ,  $SD = 1.93$ ) of forensic examiners reported low scores for feeling that management, supervisors, police investigators, and/or legal advocates appreciated it more when they were helping to solve cases, and that sometimes they felt they knew what these stakeholders wanted or expected their conclusions to be (53%,  $n = 77$ ;  $M = 2.75$ ,  $SD = 1.77$ ). Nevertheless, some examiners, albeit a small minority, reported high scores for feeling such feedback and expectations, 14%,  $n = 20$ ,  $\chi^2(1, N = 91) = 28.58$ ,  $p < 0.001$  and 8%,  $n = 11$ ,  $\chi^2(1, N = 88) = 49.50$ ,  $p < 0.001$ , respectively. Examiners were equally divided (27%,  $n = 40$ , high scores vs. 28%,  $n = 42$ , low scores;  $p > 0.05$ ) on whether they receive explicit feedback ( $M = 3.95$ ,  $SD = 2.00$ ; see Fig. 3).

#### Feedback by Field and Experience

On average, most forensic biologists ( $M = 4.49$ ,  $SD = 2.06$ ), forensic chemists ( $M = 3.77$ ,  $SD = 2.00$ ), and latent print examiners ( $M = 3.62$ ,  $SD = 1.96$ ) felt they received moderate explicit feedback from their management, supervisors, police investigators, and/or legal advocates. Both the explicit and implicit mean feedback levels did not significantly differ by field of expertise (questions 5–7,  $p > 0.05$ ). However, for the high scores of the explicit feedback question, more forensic biologists (41%,  $n = 17$ ) reported receiving feedback than latent print examiners (21%,  $n = 8$ ) and forensic chemists (20%,  $n = 7$ ; approaching statistical significance,  $\chi^2(2, N = 32) = 5.69$ ,  $p = 0.058$ ).

Question 7 on expected conclusions was the only feedback question that varied by experience (approaching significance,  $F(3, 126) = 2.54$ ,  $p = 0.060$ ; see Table 1). There were no interactions between the forensic science field and years of experience on the reported feedback levels (univariate ANOVA for questions 5–7,  $p > 0.05$ ).

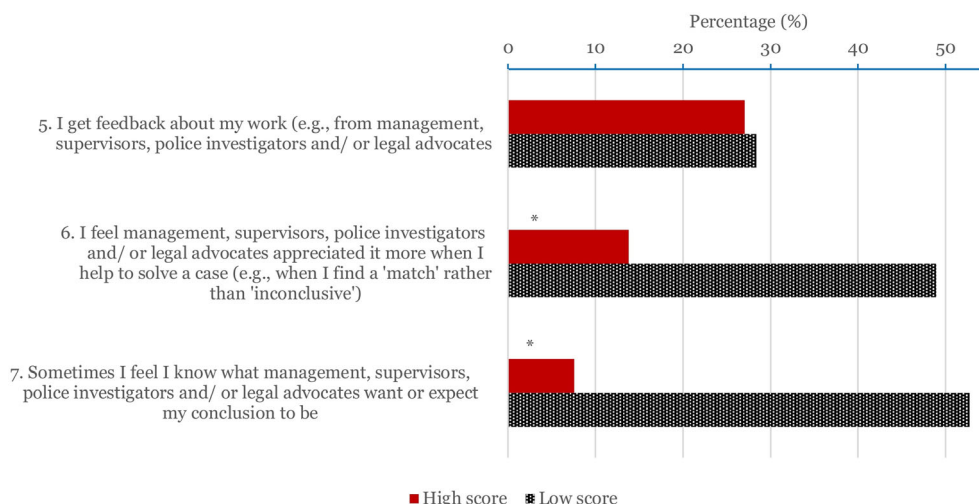


FIG. 3—Scores of explicit and implicit feedback (\* $p < 0.05$  for  $\chi^2$  of low vs. high scores).

## Discussion

### Explicit Feedback

Forensic examiners were divided on whether they receive low or high amounts of explicit feedback about their work from the stakeholders they interact with. Additionally, on average, forensic examiners reported receiving similar levels of explicit feedback across the investigated forensic science fields and experience groups. However, more forensic biologists reported receiving high levels of explicit feedback than the latent print examiners and forensic chemists did, while at the same time, more forensic biologists reported experiencing high levels of stress from backlog pressure than the other two fields of expertise (see Part One). The data, however, do not include measures to inform an understanding of how such feedback impacts the well-being and the performance of the forensic examiners. Therefore, in order to consider the explicit feedback within the crime reconstruction process further, it will be important for future research to identify what type and level of feedback is warranted (18,26,62).

### Implicit Feedback

A few forensic examiners strongly felt that sometimes they knew what stakeholders wanted their conclusions to be (question 7, 8%; see Fig. 3). Despite being a low proportion, this finding on implicit feedback is concerning because each forensic examiner is involved in casework analysis and interpretation (32). The findings also show that a higher level of implicit feedback was felt by late career (>20 groups) in comparison with early career examiners (0–5 group), in terms of what stakeholders wanted or expected their conclusions to be (see Table 1). This finding is consistent with previous research, which found that 63.6% of forensic examiners agreed (i.e., slightly agreed, agreed, and strongly agreed) that on occasions they know what conclusions they are expected to find (25) and that forensic examiners can be pressured to extend opinions beyond their scientific findings (63).

To be clear, the aforementioned findings do not demonstrate that the examiners are in fact being pressured by the stakeholders to reach expected conclusions. Rather, the data illustrate what the examiners perceive and feel as implicit pressure. It is the perception and feeling of stress that makes a situation stressful rather than there being an actual stress factor (44,45). It is important to consider the context within which decisions are being made to ensure there is transparency in this process to mitigate conditions that exert pressure on examiners to make “expected” decisions.

The findings from this study demonstrate that some (question 6, 14%) forensic examiners strongly felt that stakeholders in the forensic services, investigative, and legal domains appreciated it more when they reported conclusions of high certainty (e.g., a clear-cut, match conclusion as opposed to inconclusive). While this is a low percentage of the sample, this high implicit feedback score is also concerning. It shows that some active casework scientists may feel an implicit pressure to reach certain conclusions. As stated earlier, it is the “cognitive appraisal” of the individual to the situation that makes it pressurizing (44,45), even in the absence of such pressures. It is of course important to note that these data cannot indicate whether conclusions are being influenced by such implicit pressures.

## General Discussion

Taking the stress and feedback findings together, many of the forensic examiners in this study perceived that they operate

under pressure, and that the level of pressure varies by field and experience, during casework and reporting conclusions. The findings emphasize that one must consider the operating environment that forensic examiners work in, and the importance of managing the levels of workplace stress and feedback.

The insights from the data provide a valuable but limited insight into the possible relationships between feedback, stress, and forensic decision-making. This study clearly cannot identify and characterize the relationships but indicates that this could be a fruitful avenue for future studies. Additionally, as detailed earlier, organizational and human factors (such as stress and feedback) are interrelated and affect one another (34). Hence, it is possible that the questions addressing the feelings of examiners regarding implicit feedback (i.e., questions 6 and 7) can be related to stress and/or other factors.

The current study further contributes to the forensic science literature by synthesizing relevant stress and feedback literature from other domains. It offers a focused theoretical discussion, along with empirical data, on how workplace stress and feedback can affect forensic science judgments (whereas most of the previous research mainly focused on the relationship between stress and well-being of forensic examiners (e.g., [10,38])). In addition, the current paper unpacks the notion of feedback, an under-researched but important organizational factor in forensic science. It is hoped that this study will drive further research directed toward workplace feedback and its potential effects on expert decision-making.

The published literature suggests that there can be individual differences in perceiving and coping with stress (44,45). This means that forensic examiners can perceive and cope with stress and feedback differently, even among those examiners who work in the same laboratory and forensic field, and have the same years of experience. The current data account for interlaboratory variations, as it has been collected from a single laboratory. However, differences in individual stress perceptions and coping styles were not investigated, and so should to be considered in future research and also in practice.

It is important to note that self-reporting from a participant of how they feel about stress or feedback can offer valuable and informative insights. However, individuals cannot accurately describe the rationale of their decision-making and judgments, as this often involves unpacking complex cognitive processes (40,64). It is possible, for example, that the workplace stress felt by the forensic examiners is originating from personal reasons (50) and it could have been difficult for participants to separate the workplace from personal causes of stress. In addition, the responses of forensic examiners may have been affected by social desirability bias (65), in particular for the implicit feedback questions. Although the current study included a large sample size of 150 practicing forensic examiners from the same laboratory, it may not be representative to forensic laboratories worldwide. The reported levels of stress and feedback may vary in other jurisdictions that have different working environments and cultures.

## Conclusion

This study surveyed active forensic examiners with different fields of expertise and years of experience working within one laboratory. The examiners reported feeling varying levels of workplace stress and levels of explicit and implicit feedback. More high levels of stress were reported to originate from the workplace (specifically, stress from backlogs and pressure to do

many cases, and management and/or supervisors) than from stress derived from personal reasons outside the workplace. More forensic biologists perceived high levels of backlog pressure than latent print examiners and forensic chemists. Mid- and late career examiners (i.e., over 5 years of experience) reported higher stress levels originating from management and/or supervision, as well as backlog pressure in comparison with early career examiners (i.e., less than 5 years of experience).

It was concerning that a few forensic examiners sometimes felt strongly that they knew what the stakeholders in the forensic services, investigative, and/or legal domains expected or wanted their conclusions to be and that some forensic examiners also strongly felt that the same stakeholders appreciated it more when they helped to solve a case (e.g., by finding a match as opposed to inconclusive).

In a broader context, the creation of working environments that can address the negative impacts of the types of stress examiners are exposed to will be valuable. It is also important to be aware of the impact of both explicit and implicit feedback and to develop practices that ensure the positive assistance and timely explicit feedback. This may include preventive risk management measures (18), such as the evaluation of the how backlogs are measured and communicated to forensic examiners across different fields of expertise. It is also important to consider the context within which decisions are being made to ensure there is transparency in this process to mitigate conditions that exert pressure on examiners to make “expected” decisions.

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**Appendix 1 Anonymous Questionnaire**

Please rate the following statements. It is totally anonymous, so please be honest.

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	1 (Low)	2	3	4	5	6	7 (High)
1. In the past year, I often felt stressed while at work.							
2. The stress I felt originated from personal reasons (e.g., family, medical and/ or financial).							
3. The stress I felt originated from management and/or supervisors.							
4. The stress I felt originated from backlogs and pressure to do many cases.							
5. I get feedback about my work (e.g., from management, supervisors, police investigators and/or legal advocates).							
6. I feel management, supervisors, police investigators and/ or legal advocates appreciated it more when I help to solve a case (e.g., when I find a "match" rather than "inconclusive").							
7. Sometimes I feel I know what management, supervisors, police investigators and/ or legal advocates want or expect my conclusion to be.							

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Which section do you work at (e.g., DNA, firearms, latent prints, etc)?\_\_\_\_\_Years of experience:\_\_\_\_\_