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Trauma and coping mechanisms exhibited by forensic science practitioners: A literature review

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ABSTRACT

Vicarious trauma (VT) has been studied in mental health experts for over 30 years due to their engagement with victims of trauma and exposure to details of events, crimes, and tragedies experienced by their patients. Recently, VT studies have been extended to first responders as they also engage with victims on a level which may affect their own wellbeing. First responders involved in the criminal justice system, such as law enforcement personnel, have benefited from these studies as the results have helped drive organizational change. However, other professionals throughout the criminal justice system, such as forensic scientists, have had far fewer studies published, and the awareness of VT they may be experiencing has only recently come to light. While this review is not exhaustive of all literature on VT, it showcases key studies and research gaps that could benefit the forensic science community and associated criminal justice system professionals.

1. Introduction

The subject of vicarious trauma (VT) has only recently been brought to light within the forensic science community as denoted by the requirement for research being mentioned as an operational need for the first time, in 2018, in the National Institute of Justice's Technology Working Group Operational Requirements report [1]. Most research on VT has been performed on mental health therapists and related professionals as they were the initial study population in the prominent and well-known McCann and Pearlman [2] study in which the VT term was first coined. However, law enforcement and first responders are now recognized as populations who are not only afflicted by VT, but also secondary traumatic stress (STS) symptoms as well. Baird and Kracen [3] sought to perform a comprehensive meta-analysis of the peer-reviewed literature on VT, but through their investigation determined that due to the disparity between VT and STS lexicon, a true meta-analysis could not be performed without a negative consequence to the validity of the study.

There are many discrepancies surrounding how VT is defined, and because of this, there are also challenges in determining the degree to which forensic scientists may or may not suffer from any amount of trauma. Therefore, this literature review seeks to define VT within the framework of how forensic scientists may be affected and seeks to describe recent relevant studies which have been performed on various professions throughout the criminal justice system. In these studies, some forensic practitioners are included, but it is clear from searches of all terminology related to VT, STS, and other variations of trauma, that forensic science practitioners may be a forgotten population in the body of research. Finally, this literature review will describe potential interventions in the form of coping strategies for trauma experienced by those in the criminal justice system, to include forensic science practitioners.

1.1. The lexicon of trauma

Vicarious traumatization, or VT was first defined by McCann and Pearlman [2] as a constructivist self-development theory which quantifies therapists' reactions to their clients' traumatic material. Raunick, Lindell [4] explain constructive self-development theory as being based on the principle that an individual's belief system, cognitive schemas, and personal reality shape how events are interpreted. With this specific construct in mind, VT can be defined as the unique, negative, and accumulative changes that can occur in those who engage in an empathetic relationship with clients, which

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can be developed through client disclosures of trauma, often detailed and graphic [5]. Baird and Kracen [3] expand upon this definition by explaining that experienced changes can affect the cognitive schema of oneself, others, and the world; and the effects are pervasive, cumulative and permanent. Furthermore, these changes can be physical, emotional, cognitive, sexual, and spiritual in nature [5]. It is imperative that the conceptual definition of VT be well-described before a literature analysis or research study is conducted, as one of the most notable gaps in this field of study is that there are several terms used to describe VT, which include but are not limited to secondary traumatic stress (STS), compassion fatigue (CF), burnout, and post-traumatic stress disorder (PTSD) [3,5]. While comorbidity may exist between one or more of these diagnoses, they are conceptually distinct afflictions.

The most co-mingled definitions in the literature which confound the body of research of VT are STS and CF [5]. Secondary traumatic stress, which was later coined CF by Figley [6], as the latter term was perceived to be less stigmatizing, results from professionals having sudden adverse reactions to survivor accounts and presents almost identically to first-hand PTSD [7]. The individual must have direct and close contact with the trauma survivor, but they do not usually develop an ongoing empathetic relationship with the victim of trauma. This is why STS will typically be most applicable as a diagnosis for first responders, medical personnel, and members of the legal/correctional communities [5,7]. The most notable difference between VT and STS is that STS closely mimics PTSD, thus contains a wider syndrome of experiences including exhaustion, hypervigilance, avoidance, and numbing, which can be short in duration. Vicarious trauma, on the other hand, is associated with disruptions to schema in theview of oneself, others, and the world in the areas of safety, trust, esteem, intimacy, and control; and these views are permanent. Additionally, STS is more likely to occur from a punctuated traumatic event, such as a mass disaster, whereas VT is exhibited from the prolonged and cumulative exposure to traumatic material [3].

The study described by Jenkins and Baird [7] was designed based on the understanding that VT and STS are different diagnoses but could be convergent with each other. To evaluate this potential association, the researchers studied the discriminant and the construct validity of two trauma-related measures, the Trauma Stress Institute Belief Scale (TSI-BSL) for VT and the Compassion Fatigue Self-Test (CFST) for STS. The study also measured burnout as they hypothesized that the two measures which evaluated trauma would be correlated with each other more highly than either would be by itself with burnout. Burnout is usually more indicative of job structure and occurs when the workplace in which one works does not offer enough social support for coping mechanisms that are more positive in nature, which may lead to detachment, and feeling rigid and cynical. Burnout was measured in this study using the Maslach Burnout Inventory (MBI) which measures emotional exhaustion, depersonalization, and reduced personal accomplishment. It should be noted that burnout is specifically related to the feeling of monotony, and neither STS nor VT have been linked to conditions experienced in the workplace. This study examined the subscales of the CFST and the TS-BSL to evaluate their construct validity; and burnout was examined to measure general distress and fatigue as the CFST includes indicators of CF. The study demonstrated good concurrent validity for the CFST and TSI-BSL without being redundant, associations of distress in the CFST, TSI-BSL, and MBI, and demonstrated inadequate concurrent validity between the burnout portion of the CFST and the MBI.

Jenkins and Baird [7] compared the MBI with two trauma-related constructs to demonstrate the lack of consistency and validated methods in existence to tease apart burnout from compassion fatigue. Similarly [5], indicated that there is a general lack of validated surveys used to quantifiably measure VT through additional dimensions beyond “yes” and “no” questions, and that perhaps a continuum measure should be employed. The author also states that even the quantitative research on the topic suffers from variations in study populations, making it challenging to compare and contrast constructs reliably. This lack of consistent lexicon and survey instruments make it difficult to find statistical evidence for VT outside of STS in any study population.

While VT may fit for the larger population of forensic science practitioners, there are disciplines that may be most prone to burnout. For example, sexual assault nurse examiners (SANEs) are trained health providers who specialize in the collection of evidence from a sexual assault victim. They are knowledgeable in how to collect a sexual assault kit from a victim-centered approach. As a discipline, SANEs are categorized as performing crime scene investigations acknowledging that the “crime scene” is the human body from which forensic evidence is collected [8]. SANEs have direct interaction with victims, often spending hours collecting evidence from a victim and obtaining accounts of violent acts. Maier [9] performed a qualitative study on SANEs to understand their own perception of personal trauma as a result of their profession and their propensity for burnout. Burnout could lead to depression and lack of empathy for victims and is more likely to occur in individuals who perform shift work. This study indicated that not only were the SANEs mindful of their own perceptions of VT from their professions, but that 46% of the SANEs interviewed were acutely aware that they felt the symptoms of burnout.

One’s susceptibility to traumatization is not solely dependent on the profession. It is a product of both the job and personality type. In a study conducted by Măirean and Turliuc [10], medical staff were measured for their level of vicarious trauma and were also assessed on the “big 5” personality test using the Five Factor Model of personality (FFM). The FFM traits measured in this test are neuroticism, extraversion, openness, agreeableness, and conscientiousness. The researchers found that personality traits account for 36% of the presentation of VT, with extraversion and conscientiousness as predictors of lower VT, and neuroticism as the highest predictor of VT. These results indicate that VT, STS, PTSD, and burnout are complex and nuanced conditions which are dependent on several mediating variables beyond job function such as shift schedules, gender, personality type, and previous history of personal trauma.

1.2. Trauma in forensic science practitioners

There has been extensive research published on the STS experienced by police officers and first responders, but studies investigating potential VT experienced by forensic science practitioners are not as numerous [11]. Merriem-Webster Online [12] defines forensic science as “the application of scientific principles and techniques to matters of criminal justice especially as relating to the collection, examination, and analysis of physical evidence.” Trained individuals who apply these principles and techniques are typically defined as forensic scientists and the areas of expertise they encompass include physics, biology, chemistry, and the computer sciences [13]. The overarching disciplines which are generally recognized as embodying the forensic sciences include biology/deoxyribose nucleic acid (DNA), chemistry/instrumental analysis, physics/pattern interpretation, crime scene/death investigation, and digital multimedia, with each of these being comprised of 25 distinct sub-areas [8].

Whether directly at the crime scene, at the bench, or at a computer, forensic scientists are frequently exposed to graphic content in the form of victim accounts (either directly or through investigation notes), disturbing crime scene photographs, graphic

digital material, bloody or otherwise sullied physical evidence, details of assault, torture, or murder (from case notes or through direct analysis of decedents), and information on demographics (most notably age and gender). As this population fits the Branson [5] VT criteria of those who are frequently exposed to client (in this case victim) disclosures (or details) of trauma, which are often graphic, and their exposure is cumulative and diverse in nature (one scientist may have up to hundreds of cases they process per year of varying degrees of violent crime), they are likely afflicted with any variation of PTSD, STS, or VT, depending on the degree of involvement in their cases.

VT and STS have primarily been used to describe symptoms experienced by therapists treating victims of trauma, and there are very few evidence-based recommendations for treatment for first responders. In a study of the literature, out of 845 peer-reviewed articles available in the literature specific to first-responders, only two provided effective treatment options which were determined through randomized controlled trials [14]. One study randomly assigned Amsterdam police officers to psychotherapy or to a wait list for therapy, and the second study randomly assigned disaster workers exposed to the World Trade Center rescue efforts to cognitive behavioral therapy or treatment as usual. The majority of the participants were middle-aged, married, white males. In both studies, the treatment groups receiving psychotherapy or cognitive behavioral therapy presented statistically significant improvements to levels of trauma as compared to the non-treatment or wait-listed groups. While first responders are not licensed therapists, they are often deeply ingrained within therapeutic activities involving victims and families of victims. For example, New York Police Department (NYPD) police officers from the Community Affairs Division (CAD) who were dispatched to assist the families of victims from the September 11th terrorist attack on the World Trade Center were assessed for VT six months after the event. These individuals worked long shifts and likely maintained a lengthened hyperarousal due to their continual involvement with the families, seeing a case through to completion. One in five of these officers exhibited symptoms of post-traumatic stress and very few of those sought treatment [15]. Similar findings have been shown for clinicians (physicians, SANEs, and non-SANE nurses) who must develop a relationship with a sexual assault victim to establish trust, which may seem similar in nature to the relationship a therapist develops with their patient [16].

Raunick, Lindell [4] performed a study on the occurrence of VT among SANEs and compared this with nurses who did not serve in a SANE capacity. Raunick, Lindell [4] chose to use the Trauma Attachment Belief Scale (TABS), which is an updated version of the TSI-BSL, both of which are widely accepted instruments designed to explore concepts of VT. The TABS instrument measures the disruptions in one's cognitive schema noted by McCann and Pearlman [2], and it has been strongly associated with the aftereffects of direct trauma or VT. Molnar, Sprang [17] describes the TABS instrument as a measure based upon constructivist self-development theory which uses a survey to assess the impact of trauma on beliefs about self, others, and relationships. The Raunick, Lindell [4] study surveyed 144 SANEs and 196 traditional women's health nurses, and like Baird and Kracen [3], found that nurses who experienced a history of trauma first-hand showed statistical significance on the TABS scale, regardless of if they were a SANE or not. The higher TABS scores indicated that these nurses experienced greater levels of disruption in cognition and world view, whichreflects that the nurses in this study were experiencing tangible levels of VT. However, when results were compared through an independent *t*-test, the TABS scores indicated that overall, SANEs experienced more VT than their women's health nurse counterparts. This study suggests that the cognitive disruption experienced by the SANEs was similar to having experienced trauma first-hand. This study was comprised of 99% women, of which 46% indicated that they had "personally experienced rape, attempted rape, incest, child sexual abuse, or otherwise been made to engage in a sexual act to which they did not willingly consent".

The statistic obtained from the quantitative analysis performed by Raunick, Lindell [4] showing 46% of the study participants experiencing both previous first-hand trauma and VT seems staggering, but Jenkins and Baird [7] found similar results from a validation study they performed on 99 sexual assault and domestic violence counselors. For this study, 95 of the survey participants were women and four were men; 35% were sexual assault agency counselors, 17% were domestic violence counselors, and 48% worked in an agency that served both populations; 52% were married; 47% held a master's degree; and they ranged in age from 21 to 65. This quantitative study measured VT using the TSI-BSL instrument, which contained the full 80-item 6-point Likert scale survey, and the TSI life events checklist, which measured 19 potentially traumatic events that have been survived and/or witnessed. Of this study population, 55% reported a previous personal trauma history of either sexual assault or domestic violence. These rates of experienced assault are consistent with national rates as reported through sexual violence surveys of women in the United States [4].

It is important to note that actual exposure to a victim or a victim's family may exasperate symptoms of trauma, and may even lead directly to PTSD. Oftentimes, crime scene investigators (CSIs) will be in the room with a victim of non-violent crimes, such as burglaries and vandalizations, which can lead to increased stress to perform the job welland help find a resolution in the case. Other times CSIs may be processing a case, and are exposed to tragic emotions exhibited by bereaved family members. In a qualitative study performed by Sollie, Kop [18], a CSI recalls a case in which the body of a stabbing victim was still at the scene while the team was examining and collecting evidence. The parents and the brothers of the victim arrived at the scene and refused to leave during the investigation. This event left an impression on the CSI being interviewed, who remembers feeling extreme discomfort at hearing the emotions of the family members. This likely explains why many of the CSIs interviewed in this study preferred to emotionally distance themselves from their cases, even going as far as not seeing victims as human beings, but instead carriers of forensic evidence.

Not only have there been few quantitative studies performed on CSIs to determine the level of PTSD, STS, or VT they may exhibit, but the ones that have been performed do not use consistent terminology or study instruments. For example, Waugh [11] performed a study on the exposure of CSIs to traumatic death events and the prevalence of event-related stress. The researcher's representative population was well recruited from the crime scene section of the Florida Division of the International Association for Identification and the criminalistics section of the American Academy of Forensic Sciences, and included 183 CSI professionals. The instrument chosen was the original Impact of Event-Scale Revised (IES-R) developed in 1979 by Horowitz, Wilner, and Alverez. This instrument measures avoidance, intrusion, and hyperarousal. Based on the content domains defined by Figley [6] and described by Jenkins and Baird [7], STS symptoms include avoidance and persistent arousal, which is not the same symptomology of VT. Baird and Kracen [3] clearly explain that the changes which are experienced when an individual suffers from VT affect the cognitive schema of oneself, others, and the world; and the effects are pervasive, cumulative and permanent. Waugh [11] notes that a limitation of her study, beyond the fact that her survey constituted a convenience sampling strategy, was that it was designed to assess the impact of a single event

as opposed to the cumulative effect of exposure to multiple traumatic events. While CSIs might suffer from STS from events such as the processing of mass disasters or terrorist attacks, if they have never been directly involved in such an event, then the results would indicate that they do not suffer from any form of trauma, based on this survey instrument. As such, the results from the Waugh [11] study indicated that there was no statistical correlation between perceived stress in CSIs and their exposure to traumatic death events.

In another study, Rosansky, Cook [19] sought to measure the level of PTSD experienced by CSIs recruited through the newsletter associated with the International Association for Identification, CSIs recruited through the Federal Bureau of Investigation's National Academy Associates Blog, CSIs directly contacted across 14 states, and CSIs recruited through the Tennessee National Forensic Academy Alumni Association's Facebook page. The study population was comprised almost equally of males and females (45% and 54%, respectively), 68% were between 30 and 49 years old, and 89% identified as White/European Americans. The researchers evaluated this group using the PTSD Checklist for the DSM-5 (PCL-5). Using this instrument, the researchers found that only 9.3% of CSIs exhibit scores high enough to be considered at risk for PTSD. As previously noted, PTSD is often a symptom exhibited after an individual has experienced a trauma first-hand. However, the most frequent experiences that were noted included negative beliefs about oneself, others, and the world (experienced by 48% of the participants), and a feeling of hypervigilance (experienced by 44% of the participants). These experiences are typically denoted as symptoms of VT as they are indicative of a change in views of oneself and the world.

Another notable quantitative study for CSIs includes one performed by Adderley, Smith [20] which measured the psychological impact of traumatic events using the IES instrument, in addition to the physiological symptoms of 12 participants over a 7-day period (demographics of the 12 participants were not noted in this study). The latter indicator was measured using heart rate variability collected through a physiological monitoring device worn by CSIs and an activity log to correlate the activity to the differences noted in heart rate. The activities of CSIs were categorized as either administrative (writing reports, office work, etc.), driving (to and from a scene), physical activity (preparing their van), breaks, and/or scene activity. Results indicated that heart rate increased above a resting pace during scene processing, which suggests CSIs experience stress reactivity during their routine job functions. The authors hypothesized that other extenuating circumstances may lead to changes in variable heart rate for CSIs, as well, which may include but are not limited to being in the presence of a victim (living or deceased), working in social isolation, and working a scene that would be considered very untidy, as ascertaining what may or may not be evidence becomes challenging in these situations.

One forensic practitioner group who is receiving attention in the current discussions of VT research includes the digital forensic examiners responsible for investigating internet crimes against children (ICAC) and other similar cases of exploitation. Burruss, Holt [21] examined the prevalence of VT in digital evidence analysts who investigate ICAC using the Secondary Traumatic Stress Scale (STSS) as their instrument. A total of 360 samples were obtained from surveys given to law enforcement personnel who were present at an advanced cybercrime investigation training course hosted by the National White-Collar Crime Center across 23 states. The results indicated exposure to ICAC evidence was positively and statistically correlated to trauma. The nature of the effect was independent of gender, but presentation of trauma increased in investigators who had children, though not to a statistically significant level. Seigfried-Spellar [22] explains that individuals in this profession may be police investigators, digital forensic examiners, or individuals who perform both duties. In her study, she measured the level of STS exhibited by individuals serving in all three variations of this position using the PCL-5 instrument. Results indicated that individuals serving in the dual role exhibited more STS, had more statistically significant feelings of worthlessness, lacked concentration, and had lower job satisfaction than those serving in only one role. Interestingly, this may be most pronounced in the United States, and not as prevalent in other first-world countries such as the United Kingdom. Bourke and Craun [23] performed a comparative study on the prevalence and severity of STS in child exploitation investigators within the United States and the United Kingdom. The bivariate results indicated that individuals from the United Kingdom exhibited far less STS as compared to their American counterparts. The authors did not measure the amount of exposure to ICAC in this study, and out of 965 study participants, a total of 677 worked in the United States. These study limitations may have led to the STS disparity, but these results could also be indicative of other factors, such as different coping mechanisms performed by individuals in each country.

Medical examiners and coroners are another population who have been examined for PTSD and were found to have significant levels of trauma. Flannery and Greenhalgh [24] performed a comprehensive literature review spanning from 1990 to 2017, and noted that only three research articles were published on the prevalence of PTSD in this group. The authors performed a search on PubMed and PsychINFO with keywords including, "coroners", "first responders", "medical examiners", psychological trauma", and "PTSD". Combined from these three studies, a total of 935 coroners and/or medical examiners were studied and determined to suffer not only from PTSD, but also anxiety and depression. In this instance, it is quite possible that coroners and medical examiners do indeed experience first-hand PTSD as they are frequently tasked with recovering corpses, determining cause of death, and reporting findings to family members of the deceased. The latter task, reporting findings, was directly associated with increased depression, which is consistent with findings described by Sollie, Kop [18] that interaction with families of victims increases trauma symptoms.

Brondolo, Eftekharzadeh [25] performed a comprehensive longitudinal analysis of PTSD and depression in 259 medical examiners/pathologists, investigators, autopsy technicians, clerics, and laboratory personnel. A cohort of 151 of these participants were assessed a second time three months after the first assessment. Several instruments were used in this study including the Post-Traumatic Cognitions Scale (PTCI) which measures symptoms indicative of VT such as negative emotions and negative perceptions of the world, the family contact scale which determines the frequency of contact with family members of the deceased, the Beck Depression Inventory-II (BDI-II), and the Posttraumatic Stress Diagnostic Scale (PDS). Results indicated that medical examiners exhibited signs of PTSD, depression, and alienation. This last symptom is not surprising, as the authors note that there are stigmas associated with this profession which would contribute to the feeling of being alienated from first responders and other forensic science practitioners. It was also found that individuals who scored highly on the family contact scale also scored higher on the BDI, and family contact was noted as an acute stressor for this group of professionals.

Thus far, only positions that are associated with forensic science job functions have been discussed. This includes law enforcement investigators, CSIs, SANEs, digital examiners, medical examiners, and coroners. However, a key stakeholder in the justice system who is also exposed to graphic material resulting from criminal activity

includes individuals in the legal community such as attorneys, officers of the court, and judges. Polak, Bailey [26] reviewed the literature and found studies which indicated that the majority of judges exhibited at least one symptom of VT, and after seven or more years of experience, many of them externalized their hostility and felt intolerance towards others. The majority of judges polled in these studies also noted that they had received insufficient training about trauma and felt overwhelmed by the prevalence of victims' trauma in the courtroom. Based on the review of the literature, female judges reported more symptoms and suffered from higher amounts of depression, experienced more physical symptoms such as difficulty sleeping and loss of appetite, and exhibited cognitive symptoms such as difficulty while concentrating. Additionally, judges who had seven or more years of bench experience exhibited more anger, frustration and even intolerance of others. It is unclear from the studies if these symptoms are due to exposure to forensic evidence material, or due to other reasons. However, studies such as these indicate a clear gap in the body of research, not only for the forensic science professions detailed above, but also for those who have not been mentioned, such as bench scientists and others who are tasked with administrative duties and crime scene clean-up.

1.3. Coping mechanisms and interventions for trauma

The research indicates that trauma in the form of VT, STS, burnout, and even PTSD is prevalent throughout most professions within the criminal justice system. However, in many polls, most individuals in these professions feel a very strong sense of job satisfaction [18,27]. Research has demonstrated that police officers are a resilient group, so perhaps their forensic practitioners mirror this resiliency [15], which is an important characteristic to maintain as trauma affects divorce rates, personal relationships, and even sexual desire [28]. There have been multiple studies published which discuss various coping mechanisms individuals exercise when faced with trauma, especially regarding police officers. Often, researchers will use the Critical Incident Technique (CIT) to determine which factors help or hinder effective performance when trying to gain an understanding about more esoteric events. This method was used during World War II to assess how pilots were able to return safely after performing an airstrike mission [29]. This qualitative instrument asks questions to determine how difficult it would be to cope with certain incidents, and to determine perceptions of how one copes with stress. The CIT has been shown to be a valid instrument for police jurisdictions serving small rural agencies and ones serving populations of greater than 100,000 citizens [30]. These types of qualitative assessments such as the CIT, and other quantitative tools such as the perceived stress scale and the coping orientation to problems experienced (COPE) scale, provide researchers with a glimpse into how people deal with stress [31].

In a study on how organizational challenges and interventions impact CSIs, Clark, Distelrath [27] surveyed 51 active practitioners across 14 agencies, both sworn and civilian, who averaged 17 crimes scenes each per month. The majority were male (36 of the 51), and almost half (24 of the 51) were between the ages of 30 and 50. The CSIs were asked about their perceived levels of stress and levels of organizational support they felt they had available to help combat this stress. The results of this study indicated that most CSI experience physical symptoms of stress, feel they have too much work, and feel the stress of making a potential mistake to the detriment of losing a case. An interesting finding was that CSIs felt less stress when an alleged perpetrator died, which was attributed to them knowing there would not have to be a trial to resolve the case. CSIs also exhibited more stress when on a rotational schedule, which could be attributed to a lack of social support from consistent coworkers. Another feeling that was shared by CSIs was a feeling of being unappreciated by their organizations. These stressors were mirrored in the study involving CSIs by Sollie, Kop [18]. Both studies indicated that CSIs had an immense amount of job satisfaction but felt that standby and rotational shifts negatively impacted their personal life, adding to burnout. When surveyed, these CSI had several resiliency strategies to help them cope with stress, which included emotionally distancing themselves, participating in decision-making at a crime scene, seeking support from colleagues and team leaders, and the use of humor [18,27].

The use of humor as a coping mechanism is a common theme in many studies. For example, in a qualitative study performed by Evans, Pistrang [32], police officers did not feel the need to talk about negative events as it made them feel weak. Conversely, they recognized that keeping it "bottled up" was not healthy, and even stated that they would give advice to the new recruits to not bottle up their emotions. While this may seem like a contradiction, it is likely that these individuals were accustomed to venting their own bottled up feelings through the use of humor. They noted that using humor helped them cope, as long as the humor did not go too deep. Craun and Bourke [33] also noted that humor was a strong coping strategy with ICAC investigators, and even distinguished between light-hearted humor and gallows humor. The latter refers to humor that is neither dark nor light, but rather makes fun of disastrous situations. It is often only used around certain company because it can be seen as inappropriate, even though it is never at the expense of a victim. The researchers recruited their survey participants through a direct invitation to 61 ICAC commanders in the United States, who then sent the survey link to both sworn and civilian task force members. A total of 508 ICAC investigators responded and the majority of respondents were white (92.5%), married (79.2%), men (74.0%) with children (83.3%). Results indicated that gallows humor was used or witnessed by 97% of the investigators surveyed in this study. The research also indicated that humor as a coping mechanism reduced burnout and increased bonding with coworkers. Although gallows humor was used, lighthearted humor was used more frequently. Results also demonstrated that the use of light-hearted humor had the same coping effects as talking to a coworker. However, it was also noted that gallows humor, when overused, could serve as a "yellow flag" as it could be indicative of higher levels of STS in those individuals using it as a coping mechanism.

As Craun and Bourke [33] noted from their study, one strong coping strategy that is commonly used, aside from humor, is talking with a coworker. Heffren and Hausdorf [34] surveyed 421 police officers to determine stigmas surrounding talking about one's feelings. For this study, one large municipal police force in Canada was surveyed. A total of 77% were male, and the average length of time on the force was 16.4 years. The researchers determined that officers must have a supportive environment before they feel a willingness to talk. Also, officers did not feel comfortable talking to just anyone, including professionals. They prefer family and close friends, but will seek out a professional if those avenues are unavailable or not effective. However, police officers felt completely comfortable debriefing about a scene or an incident with peers who were also involved in the event. Therefore, one of the recommendations that Heffren and Hausdorf [34] describe is for organizations to make mandatory debriefings with peers, as this seems to have little to no stigma associated with it. A major theme in the literature appears to be the need for strong social support, not only from peers, but from leaders as well. In a longitudinal study performed by Birkeland, Nielsen [35] it was discovered that the support from leaders was more important than general support from friends or family and is correlated with lower levels of psychological distress.

Other significant positive coping strategies include partaking in activities such as exercise, prayer, meditation, and mindfulness. Kaplan, Christopher [36] describe the relationship between stress and dispositional mindfulness in law enforcement personnel. Dispositional mindfulness includes three activities or states that make one keenly aware of their own thoughts and feelings while they are in the moment. These three states are acting with awareness, nonjudging of the inner experience, and nonreactivity. In their study, the researchers invited 72 law enforcement personnel to an 8-week mindfulness-based resilience training course to train them on dispositional mindfulness. Participants were recruited from one police department in the Pacific Northwest and 57% were male, 81% identified as Euro-American, the average age was 43.5 years old, and the length of time on duty was 13.3 years. They found that personnel low in nonreactivity exhibited a significant relationship between stress and their perception of stress. Findings such as these could help inform future interventions toinclude mindfulness training and counseling. In a recent article by Jeanguenat and Dror [37], it was noted that the use of mindfulness in a work setting could positively impact decision-making and focus in forensic science practitioners. This type of self-care is impactful for those who have begun to question the meaning of their work, do not know their purpose, and have internalized a victim's trauma. Mindfulness and engaging in one's own spirituality have both been shown to have a positive effect on those suffering from VT, or other forms of trauma [38].

2. Summary

While many studies have been published on the prevalence of VT, STS, burnout, and PTSD in psychologists and police officers, very few studies have been performed using forensic science practitioners as a target population. The population in question considers professionals who, by design, are exposed to potentially traumatic material in the interest of completing a thorough investigation and analysis of evidence. Forensic science practitioners include CSIs, forensic nurses and/or SANEs, bench and digital media analysts, and medical examiners and coroners. Those in the legal community are also affected as they must become intimately involved in the details of cases derived from forensic evidence.

From a review of the literature, it is evident that in forensic disciplines and professions studied, those exposed to traumatic material exhibit some level of VT and STS symptoms. However, these symptoms are not just isolated to the exposure to material, but include other factors such as work environment, workplace stress, and burnout as well. Studies noted in this review have indicated that burnout leads to depression, lack of empathy for victims, and is more likely to occur in individuals who perform shift work, of which many forensic practitioners are frequently shift worker employees. As Jeanguenat and Dror [37] describe, forensic scientists face continual challenges in their day-to-day work life that could lead to VT or burnout. These include the recent controversies surrounding scientists' decision-making, subjectivity, and potential bias; constant exposure to graphic case details; funding pressures; the nature of the United States' adversarial system; and the criminal justice systems' general intolerance for human errors. Research has also demonstrated that burnout, which can be linked to both STS and VT, can lead to detachment, rigidity, apathy towards work, poor decision-making, and the idea that one is more important in a case than they should be. This leads to boundaries between the professional and personal lines to be blurred [5,7]. The prevalence of these symptoms would be of grave consequence as the forensic sciences must remain as unbiased as possible to ensure scientific rigor, validity, and neutrality in the presentation of forensic evidence to the criminal justice system. While the body of literature surrounding VT is growing, special attention is needed for individuals across forensic science disciplines so that healthy interventions can be deployed, and organizational structures can be adapted to support this profession.

Declaration of competing interest

The author declares there is no conflict of interest.

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