

# PTSD, Acute Stress, Performance and Decision-Making in Emergency Service Workers

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Despite research identifying high levels of stress and traumatic stress symptoms among those in the emergency services, the impact of these symptoms on performance and hence public safety remains uncertain. This review paper discusses a program of research that has examined the effects of prior critical incident exposure, acute stress, and current post-traumatic symptoms on the performance and decision-making during an acutely stressful event among police officers, police communicators, paramedics and child protection workers. Four studies, using simulation methods involving video simulators, human-patient simulators, and/or standardized patients, examined the performance of emergency workers in typical workplace situations related to their individual profession. Results varied according to level of acuity of stress and the nature of performance and decision-making. There was no evidence that PTSD had a direct impact on global performance on tasks for which emergency responders are highly trained. However, PTSD was associated with assessment of risk in situations that required professional judgement. Further, individuals experiencing PTSD symptoms reported higher levels of acute stress when faced with high acuity situations. Acute stress in these studies was associated with performance deficits on complex cognitive tasks, verbal memory impairment and heightened assessment of risk.

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Society relies on professionals in emergency service occupations to make sound judgements and perform effectively in response to highly stressful, life-threatening events. Yet, as a result of working in such environments, individuals in the emergency services are prone to high rates of stress-related problems<sup>1</sup> including posttraumatic stress disorder.<sup>2</sup> Studies of paramedics report trauma symptoms in a range consistent with PTSD in 20 to 30 percent of respondents.<sup>3–5</sup> A study of police communicators found that 31 percent reported symptoms at a level consistent with a diagnosis of PTSD.<sup>6</sup> Child protection workers, charged with assessing children at risk of abuse, report high levels of posttraumatic symptoms

related not only to exposure to the trauma of others, but also to threats and assaults against themselves.<sup>7</sup> Following a critical event such as a police shooting of a civilian, trauma symptoms in the high or severe range can affect as many as 46 percent of the officers involved.<sup>8</sup>

This association between emergency service work and posttraumatic stress has been recognized by organizations providing disability insurance to workers such as the U.S. Federal Employees' Compensation Act (FECA).<sup>9</sup> More explicitly, Section 24.2<sup>2</sup> of the Alberta (Canada) Workers' Compensation Act that came into effect in December 2012 provides that:

If a worker who is or has been an emergency medical technician, firefighter, peace officer or police officer is diagnosed with post-traumatic stress disorder by a physician or psychologist, the post-traumatic stress disorder shall be presumed, unless the contrary is proven, to be an injury that arose out of and occurred during the course of the worker's employment in response to a traumatic event or series of traumatic events to which the worker was exposed in carrying out the worker's duties [10].

This approach suggests an underlying assumption that PTSD, impairment of functioning, and disability are linked. To this end, psychiatrists and other mental health professionals are frequently called

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upon to make judgements about whether the distress that is experienced by an individual following an event meets the criteria for PTSD, and subsequently the degree to which these symptoms impair functioning. In the first instance, concerns have been raised regarding the readiness of clinicians to diagnose PTSD in high-risk occupations without conducting comprehensive assessments.<sup>11,12</sup> Second, although the AAPL Practice Guidelines on Forensic Evaluation of Psychiatric Disability<sup>13</sup> require that a clinician correlate the requirements of the job with the claimed impairments,<sup>14</sup> limited empirical data are available to support judgements in this area.

Perhaps in part due to confounds of comorbid psychiatric disorders<sup>15</sup> and motivational factors such as the fear of losing disability benefits, that may contribute to exaggeration of symptoms,<sup>16</sup> research on the specific deficits that are attributable to PTSD has been somewhat contradictory.<sup>17</sup> PTSD has been associated with mild impairments in memory, attention, and learning in individuals who are seeking treatment and who manifest a high incidence of psychiatric comorbidities.<sup>14,18,19</sup> However, researchers reported an absence of neuropsychological deficits associated with PTSD and trauma exposure in non-patient populations.<sup>20</sup> Furthermore, individuals with PTSD largely perform within the normal range of standardized tests of neuropsychological functioning, suggesting that, where deficits are present, they are not at the level of clinical impairment.<sup>15,21,22</sup>

To assess apparently contradictory research findings, Brewin and colleagues<sup>17</sup> conducted a meta-analysis and determined that there is a mild to moderate association between memory impairment related to emotionally neutral information and PTSD in both civilian and military samples. This relationship is stronger for verbal memory than for visual memory. More recently, Horner and colleagues found that patients with PTSD have deficits in attentional functioning compared with controls on one measure of focused attention, digit span memory, but not on all measures.<sup>23</sup> The findings suggest that attentional impairment in people with PTSD may be selective and that a more nuanced approach to assessing the impact of PTSD on performance is needed.

Acute stress has also been associated with altered perceptions and impaired performance. Given the nature of the work environment encountered by

emergency service occupations, situationally provoked acute stress must be considered in tandem with PTSD. Both state and trait anxiety, even when mild, are associated with an increased likelihood of interpreting ambiguous stimuli, such as facial expressions, as threatening.<sup>24</sup> Anxious individuals have an attentional bias toward threat stimuli, assessing the risks in a particular situation as being higher than do individuals in neutral or positive moods and responding faster to a threat.<sup>25,26</sup> In this way, risk appraisal influences judgment regarding the likelihood of future events (i.e., that the risk will lead to a negative outcome)<sup>27</sup> and subsequently guides the behavior of the individual. For instance, police officers experiencing anxiety are more easily distracted by task-irrelevant threat-related information and show a response bias toward shooting.<sup>28</sup> Other research consistently notes that anxious individuals are more risk averse.<sup>27</sup> Further, anxious individuals demonstrate impairments in verbal reasoning, especially in performing high-demand tasks, when compared with individuals with low levels of anxiety.<sup>27</sup> Research on biological correlates of emotional anxiety supports this finding. For instance, acute cortisol elevations have been associated with impairments in verbal, social, and declarative memory and in selective attention.<sup>29,30</sup> Increased cortisol production is most likely to occur when stressors are uncontrollable, ambiguous, novel, of long duration, or contain an element of psychosocial evaluation.<sup>31</sup> This finding has important implications when considering the impact of PTSD on performance in emergency-response professionals.

In this review, we present a program of research that has examined the effects of prior critical incident exposure, acute stress, and current posttraumatic symptoms on performance and decision-making during an acutely stressful event among police officers, police communicators, paramedics, and child protection workers.

## Studies

In each of four studies, participants completed a series of questionnaires before participating in a simulated stressful scenario. Demographic information was obtained through short questionnaires that assessed age, gender, and years of service. Trauma exposure in the workplace was assessed in two studies (child protection and police communicators) using a specifically designed instrument. In a third study,

with police recruits, the Critical Incident History Questionnaire (CIHQ)<sup>32</sup> was used to assess police duty-related trauma history by measuring the frequency of exposure to each of 34 critical incidents (e.g., being shot at).

Traumatic stress symptoms were elicited by the Impact of Event Scale-Revised (IES-R),<sup>33</sup> which assesses posttraumatic stress symptoms for any specific life event. It extracts dimensions that parallel the defining characteristics of the DSM-IV criteria for PTSD,<sup>34</sup> which are signs and symptoms of intrusive cognitions and affects, together or oscillating with periods of avoidance, denial, or blocking of thoughts and images. This scale is reported to have high internal consistency with a Cronbach  $\alpha$  of .86 and a test-retest reliability of .87.<sup>33</sup>

The stress responses of the workers were assessed with a subjective anxiety measure (the State-Trait Anxiety Inventory; STAI) and a physiological measure (salivary cortisol). Baseline measurements were taken at the start of the study sessions, and response measures were obtained at specific times after each simulation. The STAI is a commonly used assessment for stress manipulations, as it has been shown to be sensitive to acute stress manipulations.<sup>35</sup> The state anxiety (S-anxiety) scale consists of 20 statements (e.g., "I am tense"), to which respondents indicate their level of agreement on a 4-point scale regarding how they feel at the given moment (1, not at all; 2, somewhat; 3, moderately so; and 4, very much so). The internal consistency of the STAI S-anxiety scale is high, with an  $\alpha$  of .92.

### Salivary Cortisol

Activation of the hypothalamic-pituitary adrenal axis, which occurs during acute stress responses, was measured by determining salivary cortisol levels. Salivary cortisol levels are closely associated with plasma cortisol levels,<sup>36</sup> yet are collected in a simple, noninvasive manner.<sup>37</sup> Analyses of salivary cortisol were conducted with an immunoassay technique.<sup>38</sup> Two baseline measures were obtained in the introduction phase (at 10 and 1 minute before each scenario), as well as 20 and 30 minutes after the onset of each event. To control for diurnal variations in baseline cortisol levels, data collection occurred between the hours of 11 a.m. and 5 p.m., when baseline cortisol levels are stable.

### Study I: PTSD, Acute Stress, and Performance in Police Recruits

In the first study,<sup>39</sup> police recruits participated in a scenario utilizing a FATS (Firearms Training Systems) simulator. FATS simulation involves the projection of a realistic situation onto a blank screen in a specially designed simulation room. The simulation is programmed to respond to the police recruits' actions (i.e., communications, chemical spray, and firearms). The scenario constructed for this research involved a 911 call to respond to a domestic dispute in which the officer's entry is first barred by an aggressive male, who subsequently allows the officer into the home and down a blind hallway. Upon entry to a room at the end of the hallway, an unresponsive female is discovered lying on the floor, and the officer must determine the correct line of action. Possible considerations involve the ongoing presence of the perpetrator, the victim's need for medical attention, and the safety of the officer. Participants were videotaped during the simulations for the purpose of later evaluation. The videotaped performance of each participant was assessed independently by three expert raters at the Ontario Police College on two measures: one measuring specific behavioral competencies in the scenario and a second ranking performance against peers.

Eighty-four police recruits enrolled in basic constable training participated in the study. Participants represented 14 different police services, 71.4 percent were male, 45.8 percent were single, and the mean age was 30.31 (SD 6.0). They had been with their current police service for a mean of 9.16 weeks (SD 16.06). Twenty percent had worked in the emergency services including policing, ambulance, fire, and hospital or had been in the military.

### Results

Of the 84 participants, 79.3 percent reported being exposed to at least one critical event, including being seriously injured or beaten, being threatened with a weapon, being present when another officer was severely injured, receiving threats against loved ones in retaliation for their police work, and seeing someone die or discovering human remains. With respect to trauma symptoms, 51 percent of the recruits scored in the no-to-low trauma symptom range, 16 percent scored in the moderate range, 14 percent scored in the high range, and 19 percent scored in the severe range.<sup>40</sup> Cortisol levels were not

associated with symptoms of PTSD. However, increases in subjective anxiety during the scenario correlated significantly with the IES-R avoidance subscale ( $r = .273$ ;  $p \leq .01$ ), the IES-R intrusion subscale ( $r = .273$ ;  $p \leq .01$ ), and the IES-R total score ( $r = .265$ ;  $p \leq .01$ ).<sup>40</sup>

There was a wide range of performance within the sample. Pearson correlation analyses revealed that the recruits' scores on the IES-R did not correlate with their scores on the behavior competencies ratings ( $r = .06$ ;  $p = .63$ ) or on the relative rankings of performance ( $r = .08$ ,  $p = .46$ ). Similarly, degree of exposure to critical events, as measured by scores on the Critical Incident History Questionnaire, did not correlate with the recruits' scores on the behavior ratings ( $r = .06$ ;  $p = .60$ ) or on the relative rankings of performance ( $r = .11$ ;  $p = .31$ ).<sup>39</sup>

Acute stress, as measured by the STAI, did not correlate with performance at any time. Cortisol levels 20 minutes after the event correlated significantly with both the relative ranking of performance and the performance checklist ( $r = .18$ ,  $p = .05$  and  $r = .19$ ,  $p = .04$ ). Thus, although subjective distress was not associated with performance, greater cortisol levels were associated with better performance in this study.<sup>41</sup>

## Study 2: PTSD, Acute Stress, and Risk Assessment in Child Protection Workers

This study investigated the degree to which the previous experiences of workers and their preexisting emotional state interact with context variables encountered in a clinical situation, and whether these, in turn, influence professional judgment regarding the acute risk to a child.<sup>42</sup> The research design was a prospective randomized controlled trial that utilized standardized patients performing in scenarios constructed to depict typical child protection cases in a  $2 \times 2$  factorial design. Two 15-minute scenarios to simulate acutely stressful clinical encounters were developed and pilot tested with a cross-section of child protection workers to ensure that they were comparable with real client encounters. One scenario involved an interview with a mother (fictitiously named Ms. Smith) of an infant following a report by the child's daycare provider that welts had been observed on the child. A second scenario involved an interview with the mother (fictitiously named Ms. Samuels) of a latency-aged child after a report by a school that the child had reported physical abuse.

Each scenario was presented in one of two forms: with a confrontational parent and with a nonconfrontational parent. The order of interviews was counterbalanced to allow for examination of various order effects. Standardized patients (SPs) were used to portray the role of parents. SPs are healthy individuals trained to portray the personal history, physical symptoms, emotional characteristics, and everyday concerns of actual patients. At the end of each scenario, participants completed risk assessment measures; the Ontario Risk Assessment Measure (ORAM) and the Ontario Safety Assessment (OSA) (described in detail in Ref. 42). The workers were familiar with both tools and used them as a standard part of mandated practice.

Ninety-six child protection workers employed at 12 different child protection offices located in a large urban center, smaller cities, and rural communities participated in the study. The participants were intake workers (48%), family services workers (34.4%), or managers and supervisors (4.3%) or they worked in other positions (13.5%) in the child protection agency.

## Results

Eighty-five percent of respondents indicated that they had been exposed to at least one critical incident at work, including death of a child, death of an adult client, and assaults and threats against themselves. Scores on the Impact of Event Scale indicated that a sizable minority of participants were currently experiencing high levels of traumatic stress symptoms. Thirty individuals (32%) scored in the high or severe range of the scale. Of these, 18 (19%) fell in the range that is considered consistent with a clinical picture of PTSD. These high rates of reported exposure to critical events and traumatic stress symptoms are consistent with previous research on child protection workers.<sup>7</sup> The number of critical events to which workers reported being exposed was correlated negatively with STAI scores at the end of the scenario ( $r = -.390$ ,  $p < .001$ ). Scores on the IES-R correlated positively with peak STAI scores ( $r = .309$ ,  $p < .001$ ). That is, workers with less exposure to critical events but with higher levels of traumatic symptom scores experienced greater anxiety during the simulations.<sup>42</sup>

Analyses revealed that the number of critical incidents reported by participants was negatively associated with the ORAM risk category (Spearman's

Rho =  $-.253$ ,  $p \leq .013$ ) but was not significantly associated with a finding of safe or unsafe on the OSA ( $t = -1.785$ ,  $p \leq .077$ ). That is, on the ORAM assessment tool only, as the number of exposures to critical events increased, workers were less likely to determine that a child was at risk of abuse.<sup>42</sup>

As workers had higher levels of symptoms of traumatic stress, they were less likely to determine that a child was at risk of abuse or neglect on the OSA (IES-R Total Score,  $t = 4.116$ ,  $p \leq .001$ ). STAI scores immediately after the first interview (the peak STAI score) were significantly associated with identifying that a child was at risk ( $t = 2.003$ ,  $p \leq .048$ ).<sup>42</sup> Peak cortisol response was significantly associated with increased assessed risk on the ORAM for the infant ( $r = .209$ ;  $p \leq .01$ ) but not the older child. Further, in the first scenario, when workers reported greater subjective and physiological stress responses, they rated the overall risk to the child as being greater in the confrontational condition than in the nonconfrontational condition ( $p \leq .05$ ). The overall perceived risk to the child did not differ between the two conditions in the second scenario, when the workers exhibited lower stress responses.

In summary, across the two scenarios, the state anxiety was associated with greater rating of risk on one of the assessment measures.<sup>43</sup> Peak cortisol levels were associated with greater rating of risk for the younger child only. Increased levels of posttraumatic symptoms reduced the likelihood that a worker would determine that a child was at risk.<sup>42</sup>

### Study 3: PTSD, Acute Stress, and Performance in Paramedics

For the purpose of this study, a high-acuity event was created with the use of a high-fidelity mannequin placed in an ambulance simulator. The paramedics were required to manage a cardiac patient complaining of chest pain, in both a low-stress and a high-stress scenario. To create a high-acuity situation, several stressors were added to the scenario. Auditory noise was introduced by setting the volume and alarms on monitors at maximum and by having constant 2-way radio communication noise. A socio-evaluative stressor was introduced by an actor, playing the role of patient's partner, presenting as visibly distressed and challenging the participants' actions and decisions. Patient presentation and treatment expectations for the scenario were developed by consensus with 4 experts in the field of prehospital care.

Clinical performance was videotaped and scored on a checklist of specific actions and a global rating of performance. The paramedics also completed patient care documentation after each scenario, and the notations were scored for accuracy and completeness.<sup>44</sup>

Twenty-two advanced-care paramedics, 17 men and 5 women, from regional land and air ambulance services in Canada took part in the study. Advanced-care paramedics function within nationally defined core competencies<sup>45</sup> and perform delegated medical acts such as electrocardiogram acquisition and interpretation, advanced life support procedures such as tracheal intubation, and administration of emergency medications that require dosage calculations.

### Results

In this sample, 27.3 percent of the paramedics scored in the no-to-low trauma symptom range, 9.1 percent scored in the moderate range, 13.6 percent scored in the high range, and 50 percent scored in the severe range. Posttraumatic stress did not correlate significantly with either the anxiety or the cortisol responses to the scenarios.<sup>46</sup>

The paramedics reported greater anxiety and had higher cortisol responses to the high-stress scenario than the low-stress scenario. Correspondingly, scores on the global rating of performance were significantly lower in high-stress scenarios than in low-stress ones ( $p \leq .05$ ); however, there was no difference on the checklist scores between the low- and high-stress scenarios. Further, paramedics demonstrated a higher number of commission errors (reporting information and procedures that were not part of the scenarios) after high-stress scenarios. There were no differences in omission errors (failing to report information or actions that were part of the exercise) between the two scenarios.<sup>44</sup>

The paramedics' posttraumatic symptom scores in this study were not significantly associated with any of the performance measures. It is possible that the absence of association was related to sample size, as correlations were high ( $r \geq .30$ ) but did not reach statistical significance.

### Study 4: PTSD, Acute Stress, and Performance in Police Communicators

This study sought to gain better understanding of the experiences of psychological distress and physiological stress in a relatively unexamined group of emergency responders, the police communicators.

Communicators responded to simulated 911 calls from members of the public in a large computer room designed to resemble an active dispatch center with the sounds of other communicators in the background. An initial call was routine, followed by a call that contained strong emotional content. The participants were required to document the information that was conveyed during the call. Immediately after the scenario, the communicators were required to complete a series of tests tapping into cognitive ability. In a Stroop-like task, participants had to read, as fast as possible without making errors, the words in a chart, regardless of the font type (e.g., LARGE large SMALL should be reported as “large, large, small”). In a more complex version of the chart task, participants were required to report the words as fast as possible without making errors, but based on the font rather than the word itself (e.g., LARGE large SMALL should be reported as “large, small, large”). The participants also completed a spelling test of commonly used words in police communications, and a test of the  $\alpha$ -codes alphabet (e.g., when hearing the letter “a”, the correct response is “alpha”).

One hundred thirteen police communicators were recruited from both rural and urban areas and were employed by both provincial and municipal policing services. Communicators ranged in age from 24 to 61 (mean, 40.9, SD 8.2) and had worked as communicators from 1 to 35 years (mean, 12.7, SD 8.4).<sup>6</sup>

## Results

Using the conservative diagnostic cutoff for PTSD on the IES-R of 33 suggested by Creamer and colleagues,<sup>47</sup> 31 percent of the sample had symptoms of traumatic stress that met the criteria for PTSD, a rate considerably above those reported in the literature for both female and male police officers.<sup>2,48</sup>

Performance on the complex chart task was significantly worse after the high-stress scenario and the time to complete the task was significantly longer than after the low-stress scenario. There were no differences in the spelling, less complex chart naming or the  $\alpha$ -code performance between the low-stress and the high-stress scenarios. Because the high-stress scenario followed the low-stress scenario, practice effects may have damped the effect size attributable to stress.

Levels of PTSD symptoms were significantly associated with greater errors in  $\alpha$  codes ( $r = 0.205$ ;  $p \leq .05$ ) after the high-stress scenario but not after the

low-stress scenarios (unpublished data). They were not associated with other measures of performance. PTSD symptoms were associated with greater anxiety levels after the scenario ( $r = .32$ ,  $p \leq .001$ ), but not with cortisol levels.

## Discussion

Consistent with previous research, individuals in this series of four studies involving emergency service professionals reported high levels of exposure to potentially traumatizing events, and correspondingly high levels of posttraumatic stress symptoms, relative to others in the general population. Percentages of individuals reporting symptoms on the Impact of Events Scale–Revised in the severe range, which is consistent with a diagnosis of PTSD, were 19 percent for police recruits,<sup>40</sup> 19 percent for child protection workers,<sup>7</sup> 50 percent for paramedics,<sup>46</sup> and 31 percent for police communicators.<sup>6</sup> When scores in the high range are considered, the percentage of these workers who were affected by traumatic stress symptoms was considerably higher. Clearly, this is a concern for workers, the organizations in which they are employed, and society as a whole.

Previous research has demonstrated associations between PTSD and specific performance deficits in individuals without comorbid mental health problems. For instance, PTSD has been associated with deficits in verbal memory<sup>17</sup> and focused attention.<sup>23</sup> In the current series of studies, PTSD was not associated with global performance indicators in police recruits or paramedics. However, it was associated with performance deficits on a verbal memory task in police communicators after high-stress scenarios, but not low-stress scenarios. Thus, PTSD may have a greater influence on performance in high-stress situations than in low-stress ones.

Incidents for which emergency workers are called to respond are characterized by heightened emotion, violence, and injury. In short, they are highly stressful. Three of the studies presented in this article (police recruits, child protection workers, and police communicators) demonstrated that those individuals who reported higher levels of PTSD symptoms also reported higher levels of subjective anxiety during high-acuity simulations. This finding is perhaps not surprising, given that the high-acuity simulations were likely to be reminiscent of the events that led to the development of PTSD in workers.

## PTSD, Acute Stress and Performance

**Table 1** Associations Among PTSD, Acute Stress, and Performance

	Acute Stress	Posttraumatic Stress
Police recruits	Subjective distress not correlated with performance Cortisol positively correlated with performance	No correlation between PTSD and performance
Child protection workers	Acute stress associated with higher likelihood of finding that a child is at risk	PTSD associated with less likelihood of finding that a child is at risk
Paramedics	Global performance lower during high-stress event More commission errors after high-stress event	No correlation between PTSD and performance
Communicators	More errors on complex tasks after high-stress event	PTSD associated with decreased performance in high-acuity scenarios

This association between trauma response and acute stress is vital in the emergency services, considering growing evidence that performance is impaired when individuals facing high demands exhibit elevated stress responses.<sup>29</sup> With the exception of one study (police recruits), we found that high-acuity events and the stress responses that they engender are associated with heightened assessment of risk in child protection workers,<sup>43</sup> decreased performance on complex cognitive tasks performed under time pressures in paramedics and police communicators;<sup>46</sup> increased commission errors and decreased global functioning in paramedics;<sup>44</sup> and verbal memory impairments in police communicators (unpublished data). This is consistent with previous findings from our own studies as well as those of other researchers (summarized in Table 1). For instance, paramedics exposed to high-stress events show impairments in the ability to calculate drug dosages, to provide cardiac resuscitation, and to recall pertinent details from clinical scenarios.<sup>49,50</sup> Further, anxious individuals demonstrate impairments in verbal reasoning, especially on high-demand tasks, when compared with individuals with low levels of anxiety<sup>27</sup> and are more likely to interpret situations as threatening.<sup>24–26</sup>

As noted earlier, levels of PTSD symptoms were not associated with global performance in police recruits or paramedics. However, these measures assessed specific competencies on highly learned tasks. They perhaps do not reflect the influence of PTSD on more complex clinical decision-making. An unexpected finding related to PTSD and professional judgment occurred in the child protection worker study. In this study increased levels of PTSD symptoms were associated with a reduced tendency to judge that a child was at risk of abuse. Previous research has determined that emotional arousal narrows and focuses attention, reducing the number of cues to which the individual attends.<sup>51</sup> Individuals with negative mood states are not only less likely to

consider a wide range of information, but they are also more likely to take risks. We concluded that this finding may suggest that workers with PTSD become inured to tragedy and risk or that they filter out information leading to a determination of risk.<sup>42</sup> This is clearly an area where more research is needed.

### Limitations

As we have indicated, there have been some inconsistencies in the findings of our four studies. This may reflect complex variations in the influence of PTSD and acute stress response to performance based on the nature of the tasks as in each of the studies individuals were given different tasks to reflect the nature of their jobs. It also may be due to the limitations of small sample sizes in these studies, particularly the paramedic study, which are due to the challenges of recruiting participants to a demanding and time consuming study. For instance, in the paramedic study the association between PTSD symptoms and performance was high ( $r \geq 0.30$ ), but did not reach statistical significance. Further, this study relied on self-report measures of PTSD symptoms and did not include clinical diagnostic interviews, which may limit the generalizability to clinical assessments.

A clear limitation of these studies is that they represent attempts to simulate realistic workplace situations and evaluate performance in a standardized manner. The methodology is based on a model that is well known in medical education. For instance, the use of standardized patients has been found to ensure consistency in patient presentation, allowing for comprehensive assessment of clinical competence.<sup>52</sup> Nevertheless, although the scenarios did effectively elicit stress responses, it is clear that simulations cannot replicate the multiple factors that influence stress and decision-making in real life situations. Thus, these findings add to empirical data in this area and

are a step beyond laboratory studies conducted on general populations, but we cannot be certain that the results accurately reflect performance in the workplace.

## Conclusion

Posttraumatic stress has been recognized, first in the scholarly literature and more recently in legislation governing workers' compensation, as being likely consequences of exposure to traumatizing events in emergency service work. Forensic psychiatrists and other forensic mental health practitioners are often called on to assess the extent of injury caused by this traumatic exposure and the degree to which the injury impairs an individual's ability to perform the duties required by their profession.<sup>13,14</sup> The results of this series of studies suggest, however, that the relationship between PTSD and performance is complex. That is, we did not find evidence that PTSD has a direct impact on global performance on tasks for which emergency responders are highly trained. However, PTSD may affect assessment of risk in situations that require professional judgment. Further, the impact of PTSD on performance and decision-making may be mediated by acute stress responses. That is, individuals experiencing posttraumatic stress symptoms report higher levels of acute stress when faced with high-acuity situations. Acute stress in these studies is associated with performance deficits on complex cognitive tasks, verbal memory impairment, and heightened assessment of risk. Given the nature of the work environment encountered by emergency service occupations, psychiatric assessments of disability associated with PTSD must consider situationally provoked stress in tandem with PTSD. This research not only has implications for assessment, but also for prevention. Preparation and support for workers in these environments must go beyond the knowledge and skills that they need in their work, to include training that assists them in managing acute stress reactions that may adversely affect their performance and well-being.

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