A systematic review of the usefulness of pre-employment and pre-duty screening in predicting mental health outcomes amongst emergency workers

Ruth E. Marshalla, Josie S. Milligan-Savillea,b, Philip B. Mitchella,b, Richard A. Bryantc, Samuel B. Harveys,b,d,⁎

a School of Psychiatry, University of New South Wales, Sydney, Australia
b Black Dog Institute, Sydney, Australia
c School of Psychology, University of New South Wales, Sydney, Australia
d St George Hospital, Sydney, Australia

ARTICLE INFO

Keywords:
Mental health
Psychiatry
Psychology
Post-traumatic stress disorder
Health screening

ABSTRACT

Despite a lack of proven efficacy, pre-employment or pre-duty screening, which alleges to test for vulnerability to PTSD and other mental health disorders, remains common amongst emergency services. This systematic review aimed to determine the usefulness of different factors in predicting mental disorder amongst emergency workers and to inform practice regarding screening procedures. Systematic searches were conducted in MEDLINE, PsycINFO and EMBASE to identify cohort studies linking pre-employment or pre-duty measures in first responders with later mental health outcomes. Possible predictors of poor mental health were grouped into six categories and their overall level of evidence was assessed. Twenty-one prospective cohort studies were identified. Dynamic measures including physiological responses to simulated trauma and maladaptive coping styles (e.g. negative self-appraisal) had stronger evidence as predictors of vulnerability in first responders than more traditional static factors (e.g. pre-existing psychopathology). Personality factors (e.g. trait anger) had moderate evidence for predictive power. Based on the evidence reviewed, however, we are unable to provide emergency services with specific information to enhance their current personnel selection. The results indicate that pre-duty screening protocols that include personality assessments and dynamic measures of physiological and psychological coping strategies may be able to identify some personnel at increased risk of mental health problems. However, further longitudinal research is required in order to provide meaningful guidance to employers on the overall utility of either pre-employment or pre-duty screening. In particular, research examining the sensitivity, specificity and positive predictive values of various screening measures is urgently needed.

1. Introduction

Mental disorders are now the leading cause of sickness absence in most developed countries (Black, 2008; Cattrell et al., 2011; Harvey et al., 2009; Murray et al., 2012). The impact is particularly great amongst a number of high-risk occupations, such as emergency service workers, where repeated exposure to destressing or traumatic incidents can have a range of adverse mental health outcomes. (Harvey et al., 2015) Recent estimates suggest that up to 10% of first response emergency workers may be suffering from post-traumatic stress disorder (PTSD) (Berger et al., 2012), with similar numbers reporting other trauma-related mental health disorders, such as depression. While such figures highlight the increased risk associated with emergency service work, they also demonstrate that even amongst this trauma-exposed group only a minority will develop PTSD or other long-term mental health problems (Bryant and Guthrie, 2007). This raises the question of whether it is possible to predict which individuals will be resilient to the cumulative trauma exposure that occurs with emergency service work. Pre-employment screening is carried out by many emergency services in the hope of identifying pre-morbid predictors for mental health disorder in order to reduce the cost of absenteeism, but there remains surprisingly little evidence regarding its effectiveness or any useful information to guide this process.

Epidemiological research with the general population (Kessler...
et al., 1995), and studies of other high-risk groups such as disaster victims (Shore et al., 1986), Vietnam veterans (Green et al., 1990), and victims of crime (Resnick et al., 1993), have shown that predisposing factors for PTSD can be reliably identified. Risk factors identified from prospective studies in other groups include existing psychopathology, childhood trauma, personality characteristics such as introversion and neuroticism, and maladaptive coping strategies such as heavy alcohol use (Davidson and Foa, 1993). However, when pre-exposure screening has been attempted in high-risk work situations, for example amongst military personnel prior to overseas deployment, the results have been mixed. Within the UK military, prospective studies have found that while there it is possible to identify those at increased risk, screening on the basis of pre-exposure symptoms levels was not helpful in predicting subsequent psychological morbidity (Rona et al., 2006). In contrast, controlled studies undertaken in the US military have found pre-deployment screening was associated with reduced mental health problems (Warner et al., 2011b). A systematic review of pre-employment physical health screening across a variety of civilian occupational settings found that questionnaire based assessments had either no or very weak ability to predict a variety of health and work outcomes (Madan and Williams, 2012).

Concerns regarding the use of pre-employment screening go further than a lack of proven efficacy. Even if a pre-employment screen is able to identify workers who are at increased risk, there will be variations in the positive predictive value of any measure or group of measures. As a result, any pre-employment test used to exclude candidates being offered a position will mean some individuals who would have remained healthy will miss out on potential career opportunities.

In spite of a lack of proven efficacy, pre-employment screening which alleges to test for vulnerability to mental disorder remains common amongst emergency service and first responder organisations. Establishing which, if any, pre-employment screening measures are reliably able to predict mental health outcomes amongst emergency service workers is an essential first step in deciding whether the benefits of pre-employment testing outweigh the potential risks and costs.

The aim of this systematic review is to determine the effectiveness of pre-employment or pre-duty screening as predictors of mental disorder amongst emergency service workers. While we considered all mental disorders in this systematic review, given that depression, anxiety, adjustment disorders and post-traumatic stress disorders are known to be the most prevalent mental disorders amongst emergency workers, we focused particularly on studies measuring these outcomes. To the best of our knowledge this is the first systematic review of pre-employment screening in the emergency services.

2. Methods

2.1. Search strategy

Systematic searches were conducted in MEDLINE, PsycINFO and EMBASE electronic databases. A comprehensive range of subject headings and key words combining emergency personnel (e.g. firefighters, police officers, paramedics, first responders), pre-employment screening or risk prediction measures, mental health outcomes and prospective study design were devised for each database (see Supplementary Table 1 for the full search strategy).

2.2. Inclusion criteria

The criteria for full text articles to be included in this systematic review were:

a) Prospective cohort studies linking baseline pre-employment or pre-duty screening data with mental health outcomes, and;

b) Use of validated mental health outcome measures, specifically for depression, anxiety, adjustment disorders and post-traumatic stress disorder (PTSD), and;

c) Participants were first responders or emergency personnel (police officers, firefighters and paramedics), and;

d) Minimum follow-up of four weeks, and;

e) Published in the English language.

2.3. Selection process

Two researchers (RM and JM-S) independently analysed each title and abstract identified by the above search strategy in order to exclude papers which were either duplications or did not meet the inclusion criteria. Of the remaining studies, the full text was obtained in order to establish relevance. Any indecision regarding a study’s inclusion was referred to a third senior researcher (SBH) for consideration. The reference lists of all the included articles were then scrutinised in order to identify any research publications not previously captured. Finally, a senior author search (utilising the senior author of each included article) was conducted to find any other studies which met the inclusion criteria.

2.4. Quality assessment of the studies

Included studies were assessed for their methodological quality using the Newcastle-Ottawa Scale (NOS) for cohort studies (Wells et al., 2000). Each paper was awarded a score out of nine given compliance on a number of criteria, including representativeness of the exposed cohort, selection of the non-exposed cohort, ascertainment of exposure, comparability of the cohorts on the basis of the design or analysis and assessment of outcome, methods used and adequacy of follow up. As a number of the factors measured could be influenced by existing symptom severity (e.g. coping mechanisms or personality measures may be altered by the presence of existing mental health symptoms), care was taken to assess how researchers controlled for potential confounders. Studies receiving a score of seven or above were considered to be of ‘high’ quality, those scoring four to six graded as ‘adequate’ quality, and those receiving a score of three or less considered ‘weak’.

2.5. Overall strength of evidence ratings

In addition to rating the quality of each individual study included, the overall level of evidence for each category of risk factors considered was also estimated. This was done using a modified version of the Royal College of General Practitioners (RCGP) star rating system. As outlined in Table 1, four levels of evidence were defined based on the amount and quality of observational data found; strong evidence, moderate evidence, limited or contradictory evidence and inconclusive evidence.

Table 1

<table>
<thead>
<tr>
<th>Levels of Evidence</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>★★★</td>
<td>Strong Evidence</td>
</tr>
<tr>
<td>★★</td>
<td>Moderate Evidence</td>
</tr>
<tr>
<td>★</td>
<td>Limited or Contradictory Evidence</td>
</tr>
<tr>
<td>?</td>
<td>Inconclusive Evidence</td>
</tr>
</tbody>
</table>
3. Results

A total of 320 research papers were identified by the search strategy. Of these, 21 prospective cohort studies were found to meet all of the inclusion criteria. Fig. 1 demonstrates the flowchart of the selection process. There was a high level of consensus between the researchers regarding which studies meet the inclusion criteria, with a kappa coefficient of 0.89 following the initial screening.

A summary of each of the 21 relevant studies identified is provided in Supplementary Table 2. All of the identified studies focused on groups of trainee police officers, firefighters or both. More than half of the studies focused on police officers (Apfel et al., 2011; Galatzer-Levy et al., 2013, 2014; Inslicht et al., 2010, 2011; Maguen et al., 2009; McCaslin et al., 2008; Meffert et al., 2008; Najstrom and Jansson, 2007; Pole et al., 2009; Wang et al., 2010; Williams et al., 2010; Yuan et al., 2011); six studied firefighters (Bryant and Guthrie, 2005, 2007; Bryant et al., 2007; Guthrie and Bryant, 2005, 2006; Heinrichs et al., 2005); and the remaining two studies included both trainee firefighters and police officers (Orr et al., 2012; Pineles et al., 2013). Sample sizes ranged from 43 to 278 recruits. None of the studies used data derived from pre-enlistment screening, meaning that all subjects had already been accepted into emergency service training and that all baseline pre-trauma measures were taken during or immediately after academy training (i.e. post-recruitment but pre-duty). Follow up ranged from 12 months (9 studies) to four years (4 studies). Outcome measures also varied with six of the studies looking only at symptoms of PTSD, two measuring only Common Mental Disorders (CMD), and 13 of the 21 studies assessing a combination of PTSD and CMD symptoms at follow up. All of the studies tended to focus on level of symptoms, rather than diagnostic criteria. Each of the studies received a quality score of four or above, so all were of ‘adequate’ or ‘high’ quality.

It is worth noting that a small number of cohorts have contributed data to more than one of the studies identified. For example, a number of the publications report on different aspects of data collected from 400 police trainees recruited from four urban police departments in the US (New York, Oakland, San Francisco and San Jose) as part of a large prospective study of bio-psycho-social predictors of stress responses to critical incident exposure (Apfel et al., 2011; Galatzer-Levy et al., 2013;
3.2. Pre-employment trauma history

17 of the 21 studies considered trauma history as a variable, with only one finding a link between previous traumatic experience and poorer mental health outcomes: Wang et al. found that higher levels of childhood trauma predicted symptoms of depression 12 months into police recruits’ career (Wang et al., 2010). Although, Inslicht et al. found a trend between prior cumulative civilian trauma exposure, peritraumatic distress and posttraumatic stress symptoms in their study, they did not directly test this hypothesis (Inslicht et al., 2010). The vast majority of studies examining this baseline measure did not find an association. For example, Abfel et al.’s cohort of 243 police did not find any direct correlation between childhood trauma and the development of PTSD (Apfel et al., 2011). Similarly, Yuan et al. found that those with lower prior exposure to trauma had fewer symptoms of PTSD after two years of active police duty, this did not account for a significant amount of variance in PTSD symptoms in their final model (Yuan et al., 2011). McCaslin et al. also found previous trauma alone was not associated with the later development of PTSD, but may increase an individual’s vulnerability mediated by trait and peritraumatic dissociation (McCaslin et al., 2008).

3.3. Physiological factors

Ten studies examining the predictive role of physiological factors

---

**Table 2**

Levels of evidence for the predictive power of factors investigated.

<table>
<thead>
<tr>
<th>Factors investigated</th>
<th>MH outcomes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PTSD</td>
<td>CMD</td>
</tr>
<tr>
<td>Pre-existing psychopathology</td>
<td>★ ★</td>
<td>Limited evidence: Only three of the 20 studies that looked at baseline psychopathology found an association between sleep difficulties, depression or psychological distress and subsequent development of mental health problems.</td>
</tr>
<tr>
<td>Pre-employment trauma history</td>
<td>★ ★</td>
<td>Inconclusive or limited evidence: Only one of 17 studies looking at previous trauma found an association between previous trauma and symptoms of depression at 12-month follow up. One high quality study found a trend between previous trauma and PTSD symptoms but numerous other studies did not.</td>
</tr>
<tr>
<td>Physiological factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>● Cortisol</td>
<td>★★ ★★</td>
<td>Moderate evidence of predictive power: Three (two high quality and one of adequate quality) out of four studies measuring salivary cortisol indicated an association between baseline levels and later development of both PTSD and psychological distress, but with inconsistency regarding the nature of the response (elevated or blunted) and mental health outcomes.</td>
</tr>
<tr>
<td>● Urinary catecholamines/salivary MHPG</td>
<td>★ ?</td>
<td>Limited and contradictory findings from two high quality studies investigating a possible link between power of urinary catecholamines or salivary MHPG and PTSD: One found no association between urinary catecholamines and PTSD symptoms over two years, the other reporting that prolonged elevation of salivary MHPG predicted peritraumatic distress and PTSD symptoms at 12 months. Inconclusive evidence regarding other mental health disorders.</td>
</tr>
<tr>
<td>● SC/EMG</td>
<td>★★★ ★★</td>
<td>All four studies measuring baseline skin conductance, eye blink or corrugator EMG responses to simulated trauma in laboratory settings found a higher levels of emotional distress or severity of PTSD symptoms at follow up. Less evidence available for CMD.</td>
</tr>
<tr>
<td>Personality factors</td>
<td>★★ ★★</td>
<td>Moderate evidence that personality factors, particularly trait anger, neuroticism and low levels of self-worth predict PTSD and/or depression symptoms at follow up.</td>
</tr>
<tr>
<td>Coping styles</td>
<td>★★★ ★★</td>
<td>Moderate to strong evidence that a range of pre-employment coping strategies have a significant impact on subsequent mental health outcomes. While adaptive coping skills appear to be a key protective factor, to date there is no consensus regarding which are most effective.</td>
</tr>
<tr>
<td>Social factors</td>
<td>★ ★</td>
<td>Limited and contradictory evidence: Only three studies looked at social factors pre-employment. Two of these (both of high quality) found a link between baseline ratings of social support and later development of PTSD symptoms, while the other study (also of high quality) found no such association.</td>
</tr>
</tbody>
</table>

MHPG=3-methoxy-4-hydroxyphenylglycol; SC=Skin Conductance; EMG=Electromyogram.

---

Galatzer-Levy et al., 2014; Inslicht et al., 2010; Inslicht et al., 2011; Maguen et al., 2009; McCaslin et al., 2008; Meffert et al., 2008; Pole et al., 2009; Wang et al., 2010; Yuan et al., 2011). Additionally, a number of other papers report on different follow ups of an established cohort of Australian firefighters (Bryant and Guthrie, 2005, 2007; Bryant et al., 2007; Guthrie and Bryant, 2005, 2006). As each publication tended to report on different outcomes or different follow up periods, we have discussed results according to each publication rather than each cohort. However, we have made sure to identify when repeat data from one cohort is being described in order to avoid confusion or overstating the level of evidence.

Factors investigated as possible predictors of poor mental health outcomes were grouped under the following headings: pre-existing psychopathology, pre-employment trauma history, physiological factors, personality factors and pre-employment measures of coping styles and social factors. A summary of the findings for each of these is provided below, and the levels of predictive power for each of the are shown in Table 2:

3.1. Pre-existing psychopathology

Baseline psychopathology, including depression, anxiety, psychological distress or other related symptoms, such as sleep, was measured in 20 of the identified studies, with only three of these finding evidence that pre-existing psychopathology predicted mental health symptoms at follow up.

Inslicht and colleagues found a relationship between sleep difficulties during police academy training, peritraumatic reactivity and the subsequent development of acute stress disorder and PTSD symptoms after three years of police work (Inslicht et al., 2011). Orr et al. found that amongst both police and firefighter trainees, higher baseline depression significantly predicted higher posttraumatic stress symptoms after 12 months of emergency service work (Orr et al., 2012). Higher baseline general psychopathology, as measured by the SCL 90 symptom checklist, was also associated with more severe PTSD symptoms at 12-month follow up in a study of Police cadets by Pole et al. (2009) However, the vast majority of other similar sized cohort studies that measured baseline psychopathology with the same or similar measures and did not find any association with mental health outcomes at follow up.
were identified, with nine of the ten finding that biological markers measured at baseline predicted the subsequent development of post-traumatic stress symptoms, psychological distress, anxiety or acute stress disorder.

3.3.1. Hypothalamic-pituitary-adrenal axis and autonomic nervous system measures

When an individual perceives a threat, the body initiates a complex system of adaptive reactions via a range of stress response systems including the hypothalamic-pituitary-adrenal (HPA) axis, which governs the production of the glucocorticoids or stress hormones including cortisol, and the Autonomic Nervous System (ANS). Cortisol measures can be used to determine the level of activity of the HPA axis, though multiple tests are usually required due to the diurnal rhythm of cortisol levels, while heart rate variability, levels of catecholamines or 3-methoxy-4-hydroxyphenylglycol (MHPG), a metabolite of norepinephrine degradation, can be used to measure ANS activation.

Five studies investigated links between urinary catecholamines and/or salivary cortisol or salivary MHPG and later symptoms of PTSD or CMD, with four indicating evidence of predictive power. In an early prospective study of a relatively small number of firefighters (n=43), Heinrichs et al. found no significant differences in salivary cortisol or urinary catecholamines between those at “high” and “low” risk of developing PTSD symptoms at 24 month follow up (Heinrichs et al., 2005). In their later study, Abfel and colleagues found that police recruits with prolonged elevations of salivary MHPG in response to a 20 min video depicting real-life footage of police officers in traumatic incidents shown during academy training were at greater risk of developing PTSD symptoms a year later (Apfel et al., 2011). Using the same video within a laboratory stress test, Galatzer-Levy and colleagues found no such association between salivary MHPG as a measure of catecholamine response and vulnerability to poorer mental health outcomes (Galatzer-Levy et al., 2014). The same study, however, reported a link between blunted salivary cortisol responses to the 20 min critical incident video and subsequent trajectories of chronic psychological distress (Galatzer-Levy et al., 2014). This type of blunted HPA axis response to trauma is more similar to that typically described in established PTSD (Yehuda et al., 2015). Inslicht et al. found that greater baseline measures of cortisol awakening response in police recruits predicted higher levels of peritraumatic dissociation and acute stress disorder (but not PTSD) at 12, 24 and 36 month follow-up (Inslicht et al., 2011). In their study, Pineles and colleagues examined the relationship between waking salivary cortisol level and physiological, psychological and personality measures assessed at baseline (i.e. pre-trauma) and again following exposure to a highly stressful, potentially traumatic event (PTE) (Pineles et al., 2013). They found lower pre-trauma waking cortisol was associated with higher levels of depression and anxiety symptoms post-trauma, whereas higher waking cortisol was associated with greater “emotional responsiveness”. The authors suggest that baseline cortisol levels may predict different PTSD symptoms; individuals with low pre-PTE cortisol levels being predisposed to emotional numbing and those with high pre-PTE cortisol levels more likely to develop symptomology characterised by heightened psychophysiological reactivity.

3.3.2. Electromyogram responses and skin conductance

Four studies investigated skin conductance, eye blink or corrugator electromyogram (EMG) responses to laboratory threat, fear, shock or startling and the subsequent development of post-trauma distress, with all four finding the measures used predicted mental health outcomes at follow up. Guthrie and Bryant measured pre-trauma physiological activity (eye blink EMG and skin conductance) amongst 71 trainee firefighters and found higher arousal levels were predictive of post-trauma startle response and the severity of PTSD symptoms in the trauma-exposed group (Guthrie and Bryant, 2005). A year later the same authors reported that reduced extinction of an averesely condi- tioned corrugator EMG response during a pre-trauma fear-conditioning paradigm predicted 31% of the variance in severity of post-traumatic stress symptoms (Guthrie and Bryant, 2006).

Controlling for trait anxiety, Najstrom and Jansson assessed police recruits at baseline and found that elevated skin conductance reactivity in response to masked threat stimuli consistently predicted greater emotional distress to negative life events at 24 months (Najstrom and Jansson, 2007). Orr et al. also found increased skin conductance and poorer extinction of corrugator EMG responses predicted higher posttraumatic stress symptoms in police and firefighter trainees (Orr et al., 2012).

In their study with 138 police academy cadets exposed to repeated startling sounds under increasing threat of electric shock, Pole et al. found that greater subjective fear under low threat, higher levels of skin conductance under high threat and slower habituation (i.e. failure to adapt to repeated aversive stimuli) were predictive of PTSD symptom severity following 12 months exposure to duty-related trauma (Pole et al., 2009).

3.4. Personality factors and pre-employment measures of coping style

Thirteen studies considered the role of personality, schema and/or cognitions in predicting future mental health problems, with five of these looking specifically at coping strategies employed by individuals prior to trauma exposure (e.g. adaptive self-appraisal, mindfulness).

3.4.1. Personality factors

Eleven of the thirteen studies (85%) examining personality traits found that personality factors, particularly trait dissociation and trait anger, were associated with vulnerability to PTSD symptoms. Measuring a range of personality and biological characteristics amongst firefighters who had just completed their basic training, Heinrichs and colleagues found that personality factors predicted PTSD symptoms at two year follow up, with high level hostility and low-level self-efficacy (an individual’s perception of competence and the capacity to act autonomously and efficiently) at baseline accounting for 42% of the variance while controlling for other factors (Heinrichs et al., 2005). Similarly, in a study of 180 police recruits, Meffert et al. found higher levels of trait anger measured at baseline predicted the development of PTSD symptoms after 12 months active duty (Meffert et al., 2008). The same cohort were assessed by McCaslin et al. who found trait dissociation assessed at training was predictive of both peritraumatic dissociation and PTSD symptoms at 12 months (McCaslin et al., 2008). Galatzer-Levy et al. found that lower levels of self-reported positive affect predicted the development of chronic and worsening stress, whereas higher levels of positive emotion and lower levels of negative affect predicted trajectories of resilience (Galatzer-Levy et al., 2013). Studying the same cohort of police recruits, Wang and colleagues found lower levels of self-worth during training predicted symptoms of depression at 12-month follow-up (Wang et al., 2010).

Four studies measured personality characteristics using the NEO Personality Inventory-Revised (NEO-PI-R) or its abbreviated version, the NEO Five-Factor Inventory (NEO-FFI), based on the Five Factor Model of personality: neuroticism, extraversion, openness, agreeableness and conscientiousness (Costa and McCrae, 1992). Only neuroticism was found to be associated with higher posttrauma vulnerability, and this was only identified in two of the four studies. Pineles and colleagues found higher levels of pre-trauma neuroticism predicted higher post-trauma distress, anxiety and depression in a study of 60 police and firefighter trainees (Pineles et al., 2013). Baseline neuroticism correlated significantly with PTSD symptoms following two years of active police service in the study by Yuan et al. (2011) but did not remain a significant predictor in the final hierarchical linear regression analyses. Wang et al. (2010) and Orr et al. (2012) found no significant
association between baseline neuroticism and later depression or symptoms of posttraumatic stress. They note, however, that none of their sample of 99 police officers and firefighters met DSM-IV criteria for a diagnosis of PTSD when assessed post-trauma, and had relatively low levels of sub-clinical post-traumatic stress.

3.4.2. Coping styles

All five of the studies that looked at various pre-employment measures of coping strategies found an individual's cognitive style or way of dealing with potentially traumatic events had a significant impact on subsequent mental health outcomes.

Bryant and Guthrie found that post-traumatic stress symptomology amongst firefighters who had been on active duty for 20 months was predicted by pre-trauma catastrophic thinking (24% of variance) (Bryant and Guthrie, 2005). After four years of service, 12% of the same cohort met criteria for PTSD, with negative self-appraisals measured pre-trauma accounting for 20% of the variance in severity (Bryant and Guthrie, 2007). Bryant et al. also found deficits in the retrieval of specific autobiographical memories to positive cues at baseline predicted the severity of PTSD after exposure to trauma, postulating that these deficits may be due to poor problem solving or rumination, both related to maladaptive coping (Bryant et al., 2007). Williams et al. found mindfulness to be the best predictor of mental health a year after baseline assessment of police recruits, with officers who were able to identify emotions and used mindfulness as a coping strategy experiencing less depression than those who had difficulty identifying feelings and a tendency to suppress negative thoughts (Williams et al., 2010). In the fifth and final study, a combination of factors including positive thinking and higher self-worth at baseline were found to predict better mental health outcomes, including fewer symptoms of PTSD after two years of service amongst police trainees (Yuan et al., 2011).

3.5. Social factors

Three prospective studies were identified that examined the impact of pre-employment measures of social factors, including perceived support. Of these, two found a link between baseline ratings of social support and subsequent PTSD symptoms (Inslicht et al., 2010; Yuan et al., 2011), and one found no such association (Meffert et al., 2008). Yuan et al. found better self-rated social adjustment and greater perceived social support were the key protective factors in their study of 233 police trainees (Yuan et al., 2011). However Meffert et al. (2008) in a study of similar size and quality, found no link between self-reported social support at baseline and PTSD symptoms measured following 12 months of police duty. In their 2010 study, Inslicht et al. found a family history of mood, anxiety and substance related disorders increased vulnerability to peritraumatic distress following critical incident exposure and subsequent risk of developing posttraumatic stress symptoms at 12 months (Inslicht et al., 2010). They were, however, unable to examine if this was due to genetic vulnerability or social modelling of adaptive (or maladaptive) responses to stress within the family context.

4. Discussion

To the best of our knowledge, this is the first systematic review investigating the utility of pre-employment and pre-duty mental health screening amongst emergency services personnel. We were able to identify and combine findings from 21 prospective cohort studies which followed trainee police officers and/or firefighters for their first one to four years of service. In general, dynamic measures including physiological responses to simulated trauma (e.g. HPA activity or skin conductance) and maladaptive coping styles (e.g. negative self-appraisal, catastrophic thinking or rumination) had more evidence for being predictors of psychological vulnerability than the more traditional assessments of static factors such as trauma history or pre-existing psychopathology. Personality factors, particularly trait anger and dissociation, neuroticism and low levels of self-efficacy, were also found to have moderate levels of evidence for predictive power. While these findings are a useful starting point for organisations considering how or if they should screen their personnel, the research evidence available at present does not allow for firm conclusions regarding the overall risks and benefits of specific screening measures.

The main strength of this review is the detailed systematic search strategy, involving multiple independent reviewers, and the quality assessment of all included studies. The strict selection criteria used ensured only prospective cohort studies were included in order to provide evidence regarding the temporal predictive power not achievable via cross-sectional design. As with all systematic reviews, this review is limited by the risk of publication bias. Additionally, all of the identified studies in the review involved trainee police officers and firefighters, a number from a single US cohort, meaning it is unclear how generalizable the results are to other groups such as paramedics or first responders from other countries. All of the studies identified in our systematic search used data collected anonymously after recruitment, but before exposure to emergency service work. While this design allows for clear delineation of the temporal relationships and avoids recall bias, the fact that data was collected anonymously also limits the generalizability of our results. It is well established that individuals answer questions about psychological symptoms differently when they know they may be identified (Warner et al., 2011a). This is likely to be even more important when new employees are entering a workplace. Thus, it is not clear that a measure that predicts further mental health problems when reported anonymously will work in the same when if it was used as part of a non-anonymously pre-employment screening process.

Although the Minnesota Multiphasic Personality Inventory (MMPI) is the psychological test most frequently used to determine the suitability of applicants for employment as police officers and emergency personnel worldwide, surprisingly none of the studies we found in our review looked at MMPI scores in relation to subsequent mental health outcomes. Previous studies have examined the MMPI ability to predict to retention, performance and misconduct as outcomes (Bartol, 1991; Cailouet et al., 2010; Selbom et al., 2007) but to date it appears that mental health outcomes have only been examined cross-sectionally (Haisch and Meyers, 2004).

In addition to these overall limitations, it is also important to note some of the limitations with the individual cohort studies we identified. Pleasingly, the majority of studies identified were rated as being of high methodological quality. The removal of the three papers rated as only adequate (Najstrum and Jansson, 2007; Pines et al., 2013; and Williams et al., 2010) quality impacts marginally on the finding regarding neuroticism, but not on the overall conclusions.

The majority of studies relied on self-reported symptomatology rather than diagnosis from clinical interviews. Psychological symptoms identified via self-report questionnaires are not equivalent to diagnosis by a qualified clinician although a recent meta-analysis of PTSD prevalence studies amongst emergency workers found that both self-report and diagnostic interviews provided similar results (Berger et al., 2012). Perhaps more importantly, there are also particular limitations to the way in which the outcome data is reported amongst the studies identified. All of the studies in our review looked at symptom severity over time as their main outcomes, rather than dichotomous outcomes such as presence or absence of a mental health diagnosis or caseness versus non-caseness on a non-diagnostic measure. Although structured clinical interviews were conducted at baseline in 13 of the 20 studies measuring baseline psychopathology, follow up usually focused on symptom levels via self-report. Two exceptions to this were the studies by Guthrie and Bryant (2005, 2006) who reassessed trainee firefighters with a diagnostic interview at 12 and 24 months. However, the low numbers of participants reaching diagnostic threshold led the authors
to focus on posttraumatic stress symptom severity rather than diagnosis (Guthrie and Bryant, 2006, p. 310). The lack of dichotomous outcomes meant we were not able to examine the relative positive predictive values of various measures or make comments regarding sensitivity or specificity. Such data is crucial in deciding the relative risks and benefits of any screening measure, particularly how many potential recruits would need to be excluded to prevent one case of mental illness. While we were able to make the important first step of identifying which factors appear to be useful predictors of future mental health problems, larger studies examining dichotomous outcomes are urgently needed.

Finally, most of the individual studies identified only followed new recruits for the first few years of their career, meaning we have no information on what factors may predict the later onset of mental health problems. Cumulative exposure to trauma over many years is known to be an important risk factor for mental illness amongst emergency workers (Harvey et al., 2015), meaning many of the emergency workers who become unwell as a result of their work don’t begin to experience symptoms until many years into their career. For this reason, the lack of any cohort studies following emergency workers beyond four years is another major limitation of the currently available literature.

The role of previous psychopathology and prior trauma history as independent risk factors for later mental disorder amongst emergency service personnel appears to be complex. As noted above, cumulative trauma is known to increase the risk of both depression and PTSD in this population (Harvey et al., 2015), suggesting prior trauma should be an important risk factor. Prospective studies of have also shown that prior psychological symptoms are a risk factor for future depression (Shea et al., 1992), and predict PTSD symptom trajectories in the aftermath of traumatic events (Pietrzak et al., 2014). Given these findings, it is notable that, neither of these factors was found to be a reliable predictor of future mental health problems in the vast majority of studies we identified. There are a number of possible explanations for this surprising result. First, there may be an element of self-selection whereby individuals choosing a career in the police or fire service may have already demonstrated themselves to be resilient despite being exposed to previous trauma or mental health problems. Secondly, most trainee police officers and firefighters would have already undertaken screening as part of their application to join the emergency services, meaning many with pre-existing psychopathology or trauma exposure may have been excluded from the samples in our study, leading to less variance so making associations harder to identify. Given the paucity of studies examining pre-employment (as opposed to pre-duty) screening, it is difficult to test this hypothesis at present. However, it is interesting to note that some prospective studies of other highly selected groups, such as military personnel, have shown that pre-exposure levels of psychological symptoms were not helpful screening measures in terms of predicting later mental health problems (Rona et al., 2006). Finally, as noted above, follow up was relatively short in all of the identified studies, meaning factors that have their impact over a longer time period or possibly only in relation to cumulative trauma exposure may not have been identified in this review (Halpern et al., 2011; Harvey et al., 2016; Pole, 2008).

While some established static risk factors did not appear to be reliable predictors of future mental health problems amongst emergency workers, one of the most notable findings from this review is the strong evidence base for a range of more novel, dynamic risk factors. Amongst these are measures of physiological response to a stimulated trauma, such as skin conductance, EMG response or cortisol levels and psychological coping mechanisms used. Given that repeated exposure to trauma is one of the most important workplace risk factors for emergency service workers, it is perhaps not surprising that responses to simulation of this exposure prove to be some of the most useful predictors of future mental health. It may also be that these measures are less susceptible to response bias or demand characteristics than other measures, which is a major advantage when testing is being conducted in a workplace setting. While further work is needed to define the exact pattern of dynamic responses associated with the highest risk, particularly for the biological measures, this finding has particular implications for emergency service organisations. Taking physiological measurements during pre-employment screening may be costlier and more time consuming than simple measures of prior psychopathology and trauma exposure. If, however, they prove to be substantially better predictors of future problems, then such an investment may be justified. Measures of other dynamic factors such as coping styles may be relatively easy to administer without any additional cost.

Although routine work stressors were not within the scope of this review as they can’t be assessed pre-employment, it is important to note that four out of the six studies investigating social factors reported an association between contextual features, such as work environment, and the likelihood of developing later mental health symptoms. These findings raise two important issues. First, it is important not to focus on response to trauma as the only predictor of mental health difficulties amongst emergency service workers. Wang and colleagues found a significant relationship between increased symptoms of depression and responses to routine police work stressors rather than to critical incident stressors at 12 month follow up (Wang et al., 2010). Similarly, Maguen et al. reported that routine non-trauma related work environment stress was the factor most strongly associated with symptoms of PTSD amongst police officers assessed during academy training (i.e. pre-trauma exposure) and again after a year of active duty (Maguen et al., 2009). Secondly, the importance of contextual elements emphasises an increasing awareness that a range of protective factors can offset the impact of individual risk factors. For example, there is good evidence that increased levels of social and/or institutional support can reduce the risk associated with trauma exposure or other stressful work situations (Harvey et al., 2011; Stansfeld and Candy, 2006). This highlights how screening need not necessarily be used to only exclude those identified as being at heightened risk, but rather to also identify those requiring additional support or training. This type of selective prevention intervention has shown potential in early trials and may be easily achieved via new e-health technologies, though the effectiveness of this type program in working group is yet to be demonstrated (Mykletun and Harvey, 2012).

A number of the studies in this review indicate that a combination of the different factors appear to elevate risk or vulnerability to psychological distress, for example, Wang et al.’s finding that a combination of childhood trauma and low self-worth were associated with greater perceived work stress and vulnerability to poorer mental health outcomes (Wang et al., 2010). Understanding how different factors relate to each other and the causal pathways involved can be difficult. For example, research into childhood trauma indicates that chronic periods of stress in childhood may impair the HPA axis resulting in dysregulation of cortisol secretion which may become most noticeable during times of work stress or trauma exposure (Sherin and Nemeroff, 2011; Stephens and Wand, 2012). A number of large international studies have recently shown that risk algorithms, which define mathematical models combining risk factors to produce an overall risk level, can be very effective in highlighting those at the greatest risk of mental disorders (Bellon et al., 2016; Jakupcak et al., 2007). Similar risk algorithms may ultimately prove to be the best way to improve predictive power amongst pre-employment screening of emergency service workers. It is also possible that repeat testing over time may increase predictive accuracy, with some prospective studies of emergency workers exposed to major events demonstrating a number of clear symptom trajectories (Pietrzak et al., 2014).

Any type of health screening is not without risks, although the risks associated with mental health screening in the workplace may be even greater than in other settings. Previous studies have highlighted concerns regarding pre-employment screening’s ability to predict and
reduce future psychological illness and the risk of stigma and discrimination against those who are identified as high risk (Pachman, 2009). In the setting of pre-employment screening, it is expensive and unhelpful to screen out individuals on the basis of testing which has no or limited evidence-base for its effectiveness. Ineffective pre-employment screening programs risk excluding individuals that could have otherwise had healthy and fulfilling careers, and use up limited resources that may be better put into prevention and early intervention programs. If emergency services wish to use pre-employment or pre-duty screening, our results suggest that aside from basic personality and coping skills measures, many of the static measures currently used have limited effectiveness in predicting PTSD and common mental disorders. More dynamic measures of both physiological and psychological coping skills appear to be better predictors of future mental health problems. Based on research to date, we are unable to provide emergency services with specific information to enhance their personnel selection. Our results also highlight an urgent need for further research investigating the long term effectiveness of screening measures through longer cohort studies that examine dichotomous outcomes, rather than just symptom levels.

Funding and disclosures

This project was supported by funding from Department of Health New South Wales. The authors remained independent of the funder in their reporting of results.

Conflicts of interest

The authors declare that they have no conflict of interest relevant to this report.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jpsychres.2017.03.047.

References


Anxiety Stress Coping 26, 241–253.