Indicators of Resilience among First Responders:

A Systematic Review

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Abstract

First responders are a diverse group, consisting of several professions. No systematic review has yet been conducted examining which indicators predict resilience among first responders, this study will aim to provide such a review. An initial search in several databases produced 18.179 studies, after a careful selection 27 studies remained. Indicators found in these studies can be divided into different categories; sociodemographic, personal, biological, social, work related, and trauma characteristics. Consensus exists regarding some indicators, however, mixed results are found regarding other indicators of resilience. More research into these indicators is necessary. Studies investigating the effect of trauma on first responders almost exclusively study risk factors. More research into resilience and other protective factors would be welcome.

Keywords: resilience, psychological capital, first responder, police, military, firefighter, paramedic, rescue worker, recovery worker

Introduction

First responders are a diverse group, consisting of people of several professions such as; police, firefighters, emergency/paramedical teams, rescue workers, military, and volunteer first responders (Benedek, Fullerton &Ursano, 2007). The Homeland Security Presidential Directive in the United States uses the following definition for the term first responder;

> *"First responder refers to those individuals who in the early stages of an incident are responsible for the protection and preservation of life, property, evidence, and the environment, including emergency response providers[…….], as well as emergency management, public health, clinical care, public works, and other skilled support personnel (such as equipment operators) that provide immediate support services during prevention, response, and recovery operations."* (HSPD-8)

Studies among first responders show that first responders find their work rewarding (Kop, Euwema & Schaufeli, 1999; Thoresen, Tønnessen, Lindgaard, Andreassen &Weisaeth, 2009; Shih, Liao, Chan &Gau, 2002). A study examining stressors and rewarding aspects among police officers found that police officers reported more rewarding than stressful aspects of their work (Kop et al., 1999). Another study was performed among Norwegian personnel of different organisations who were deployed to offer aid after the Tsunami in 2004. This study revealed that these aid workers found their experiences in the area a meaningful, successful and valuable personnel experience (Thoresen et al., 2009). Seventy-six percent of nurses involved in the early recovery phases of a massive earthquake in Taiwan reported having experienced positive aspects of their work (Shih et al., 2002). Unfortunately, first responders are also at risk to suffer from several psychological complaintssuch as PTSD, depressive symptoms, substance abuse, and social dysfunction (Fullerton, Ursano & Wang, 2004; Wagner, Heinrichs & Ehlert, 1998; Berninger, et al., 2010). Disaster workers involved in dealing with an air crash in the United States showed significantly higher rates of

depression, acute stress disorder, and PTSD than people who were not involved in the air crash (Fullerton et al., 2004). A study among male firefighters in Germany showed a PTSD rate of 18.2%, the study also revealed that firefighters suffering from PTSD had more depressive symptoms, substance abuse, and social dysfunction than those without PTSD (Wagner et al., 1998). The study by Berninger et al. (2010) showed a PTSD prevalence among firefighters exposed to the World Trade Centre Disaster of 9.8% in the first year after the disaster, this prevalence increased to 10.6% in the fourth year after the disaster. Studies have also revealed several protective factors against the development of these complaints; such as receiving training to deal with situations first responders may encounter (Thoresen et al., 2009), being married (Fullerton et al., 2004), self-efficacy, collective efficacy, a sense of community (Pietrantoni & Prati, 2008), and social support (Marmar, et al., 2006).

A concept that has been used in connection with dealing with stressful events is resilience (Mansfield, Beltman, Price & McConney, 2012; Pipe, et al., 2012; Gupta, Sood & Bakhshi, 2012; Avey, Luthans & Jensen, 2009; van Breda, 2011). In recent years increased attention has been focused on studying resilience among different professions. Some of these studies focus on specific professions such as teachers, medical staff or (groups of) first responders (Mansfield et al., 2012; Pipe, et al., 2012; Gupta et al., 2012) while other studies take a more general approach by including people from all professions (Avey et al., 2009; van Breda, 2011). In these studies, different definitions of resilience are used (Mansfield et al., 2012; Pipe, et al., 2012; Gupta et al., 2012; Avey et al., 2009; van Breda, 2011). Some researchers seem to view resilience as a similar concept to psychological capital, while others see resilience as a part of a person's psychological capital (Avey et al., 2009). According to Avey et al. (2009) the construct of psychological capital consists of several components; namely, efficacy, hope, resilience, and optimism. However, most studies seem to agree that

resilience is *'a concept that determines a person's capability to deal with adversity'* (van Breda, 2011; Gupta et al., 2012; Mansfield et al., 2012).

Studies investigating resilience have provided several indicators capable of predicting a person's resilience. Some of these indicators, which were found among various populations, are; a secure attachment style in early life (Svanberg, 1998), trait optimism (Tusaie & Patterson, 2006), high self-esteem (McGregor, Nash & Inzlicht, 2009), a strong sense of coherence (Surtees, Wainwright & Khaw, 2006), and low resting heart rate (Oldehinkel, Verhulst & Ormerl, 2008).

While studies have been performed to investigate resilience among (groups of) first responders and studies have been conducted investigating indicators of resilience, no systematic review has been conducted to examine which indicators are known to predict resilience among first responders specifically. This study will aim to conduct such a systematic review in order to bring together research into this topic and provide a unified view on the topic.

Method

In order to investigate which indicators can predict resilience among first responders a systematic review was conducted. Articles were searched for in the following databases; PsycINFO, PubMed, and ScienceDirect. Since ScienceDirect also includes journals that focus on subjects which use a different interpretation of the term resilience several subjects have been excluded from this review. The following subjects in ScienceDirect were included; "Arts and Humanities", "Business, Management and Accounting", "Decision Sciences", "Medicine and Dentistry", "Neuroscience", "Nursing and Health Professions", "Psychology", and "Social Sciences".

Several combinations of search terms were used to gather sources for this review. The following search terms were used; “resilien*”, “psychologic* capital”, and “adaptab*” these terms were coupled with the terms “first respond*”, “police”, “firefighter”, “paramedic*”, “rescue work*”, “recovery work*”, and “military”.

Using these search terms in the above mentioned electronical databases led to a number of hits. First, overlap between the different databases was eliminated. For practical reasons only articles written in English were used for this review, articles written in other languages were excluded from this systematic review. After this initial selection, titles and abstracts of the remaining articles were screened to determine their relevance for this systematic review. After title and abstract screening, articles were read entirely to determine their relevance for this review. Articles were selected if (1) they dealt with resilience, (2) investigated indicators of resilience, and (3) focused on (a group of) first responders (see figure 1.). For this systematic review only articles were used, books and chapters of books are excluded.

Since this is, to the authors knowledge, one of the first systematic reviews investigating indicators of resilience among first responders no selection of articles was made based on year of publishing. In order to limit the heterogeneity of the group only studies examining active duty first responders were used. Studies that solely examined resilience among veterans or retired first responders were excluded.

Results

Initial searches with the search terms led to 18.179 hits (PsycINFO N=531, Pubmed N=1.109, ScienceDirect N=16.539). When overlap between the different databases was removed 9.158 articles remained. After screening for languages other than English 323 articles were removed. Articles removed were written in French (N=205), German (N=26), Spanish (N=25), Chinese (N=15), Russian (N=14), Italian (N=8), Japanese (N=5), Portuguese

(N=5), Polish (N=3), Swedish (N=3), Danish (N=2), Serbian-Croatan (N=2), Turkish (N=2), Dutch (N=1), Hebrew (N=1), Hungarian (N=1), Norwegian (N=1), Romanian (N=1), Serbian (N=1), Suisse (N=1), and Thai (N=1). The remaining 8.836 articles were screened using the title and abstract.

Screening of titles and abstracts led to the inclusion of 187 articles. Articles excluded after screening of title and abstract were excluded because they either did not deal with (a group of) first responders (N=4.626), (indicators of) resilience (N=3.451), or were not scientific articles[1] (N=572).

After full text screening 27 articles remained. Twenty-seven articles were removed because full text screening revealed they did not deal with (a group of) first responders, 133 articles were removed because they did not examine indicators of resilience or psychological capital (see Figure 1.). Of the included 27 articles 18 articles were empirical studies and 9 were reviews. Only one article investigated psychological capital, the remaining 26 articles used the term resilience. Articles included in this systematic review were published between 2002 and 2013. For an overview of the selected articles for this systematic review see Table 1.

Indicators of resilience among first responders

Indicators of resilience and psychological capital can be grouped into different categories. For this review the following categories have been used; sociodemographic characteristics, personal characteristics, biological characteristics, social characteristics, work related characteristics, and trauma characteristics. Each of these categories will be discussed in more detail in the following section.

[1] Hits were removed because they consisted of (chapters of) books, table of contents, presentation of subjects of a symposium and obituaries.

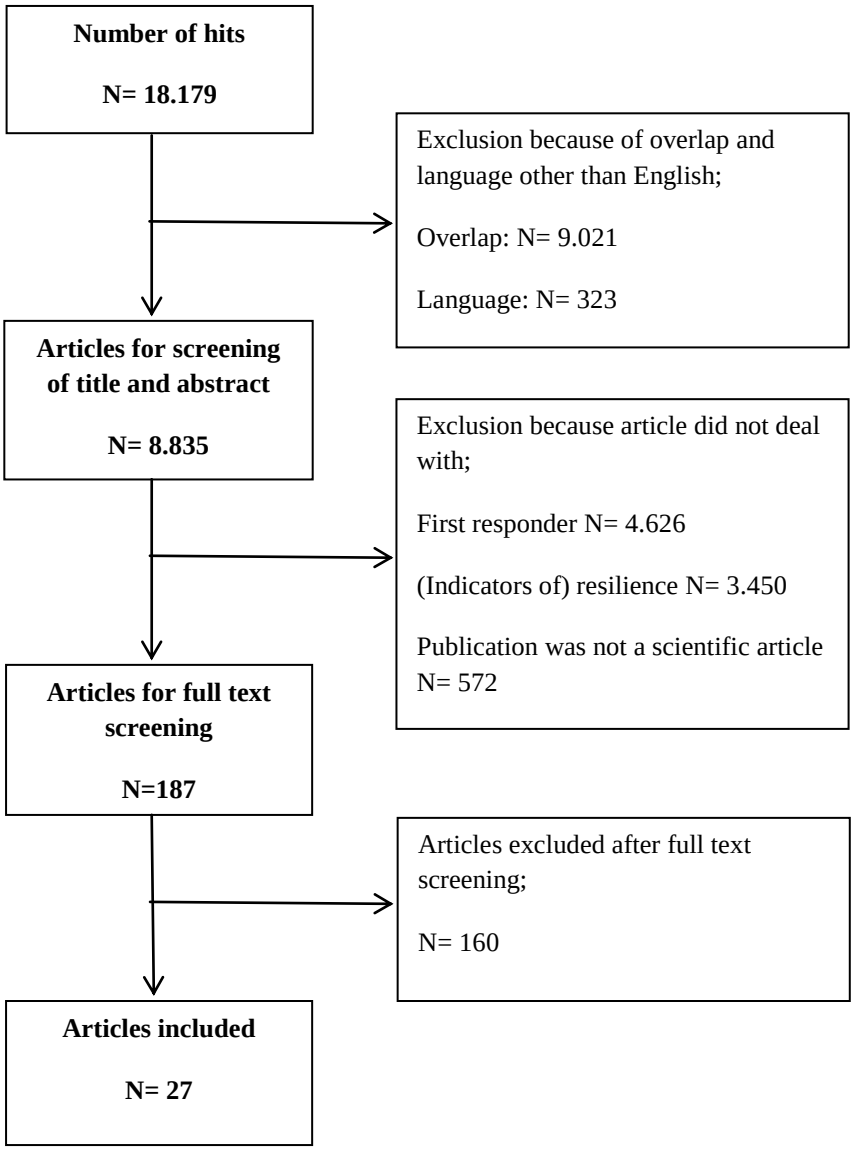

Figure 1. Flow chart of process of systematic literature search

Sociodemographic characteristics

According to several articles sociodemographic characteristics can be indicative of resilience among first responders (Chang & Taormina, 2011; Dickstein, Suvak, Litz & Adler, 2010; Gayton & Lovell, 2012; Hickling, Gibbons, Barnett & Watts, 2011; Waters, 2002).

Age was found to act as an indicator of resilience in both a population of ambulance service paramedics (Gayton & Lovell, 2012) as well as among a population of health care officers among active duty personnel (Hickling et al., 2011). People higher in age were found to be more resilient than younger people (Gayton & Lovell, 2012). It should, however, be

noted that the study of Gayton and Lovell (2012) found a high correlation between age and years of experience when examining resilience which may act as a confounding factor in this relationship. Studies by Galatzer-Levy, Brown, Henn-Haase, Metzler, Neylan, and Marmar (2013) and Dickstein et al. (2010) also investigated whether age was an indicator of resilience among police officers and found no significant effect to indicate such a relationship.

Another indicator of resilience was found to be having adequate financial resources (Hickling et al., 2011; Waters, 2002). The study of Waters (2002) focused on both first responders and families. Waters also stated that having educational resources acted as an indicator of resilience. However, both studies by Dickstein et al. (2010) and Galatzer-Levy et al. (2013) found no indicative role of education for resilience. Satisfaction with medical care available was also seen as indicative for resilience in a study among Chines rescue workers (Chang & Taormina, 2011). When looking at the indicative ability of substance use it was found that people using little alcohol were more likely to be resilient (Dickstein et al., 2010). However, another study found no difference in alcohol use between resilient and non resilient police officers (Prati & Pietrantoni, 2010).

Personal characteristics

In this section personal characteristics will be discussed that can be seen as indicators of resilience among first responders. The term personal characteristics has been chosen based on research by Bates et al. (2010). Bates et al. propose a military demands resources model for talking about resilience in the military. Their model consists of internal (personal) and external (environmental) resources for resilience. The external resources will be discussed in the section of work related characteristic. Bates et al. name several internal resources of resilience; awareness, beliefs and appraisals, coping, decision making, and engagement (Bates et al., 2010).

Several personality traits have been mentioned as indicators of resilience (Lee, Sudom & McCreary 2011; Naz, Saleem & Mahood, 2010; Solomon, Berger & Ginzburg 2007). Lee et al. (2011) investigated whether the big five personality traits were indicative of resilience, they found that all big five personality traits served as indicators of resilience. People who scored high on agreeableness, conscientiousness, extraversion, and openness were found to be more resilient (Lee et al., 2011). The indicative effect of extraversion on resilience was also mentioned in the article by Naz et al. (2010), this study defined extraversion as containing the elements sociability, initiating conversation, and a sense of humour. The fifth element of the big five, neuroticism, was also found to be an indicator of resilience, with people with low levels of neuroticism being more resilient (Lee et al., 2011). Other personality traits related to resilience are altruism, sensation seeking (Solomon et al., 2007), optimism (Everly, McCormack and Strouse, 2012; McAllistar & McKinnon, 2009; Smith et al., 2011), and spirituality (Johnson, 2002; Naz et al., 2010).

Hardiness is also seen as indicators of resilience (Alexander & Klein 2009; Lee, et al., 2011; Simmons & Yoder, 2013). Hardiness refers to the ability to deal with adversity and consists of several personality characteristics such as; control, commitment, and challenge (Simmons & Yoder, 2013). People who are very hardy show more commitment to their work, a high sense of life, greater feelings of control and are more open to change and challenges they may encounter during their life (Bartone, 2006). The precise manner in which hardiness influences resilience is not yet entirely clear, but can probably be explained by the way people interpret events. Hardy people see events as something they have control over, as an opportunity to grow and overall challenging (Bartone, 2006). When discussing the different personality traits as indicators it should be taken into account that overlap between these individual characteristics is possible. Lee et al. (2011) note that strong correlations exists between several of the variables examined in their study. Lee et al. especially mention the

high correlation between hardiness, optimism, self-esteem, and mastery and suggests that some of these variables may be redundant (Lee et al., 2011).

Another indicator that was mentioned in several articles was self-esteem (DiMaggio, Madrid, Loo & Galea, 2008; Lee et al., 2011; Prati & Pietrantoni 2010). Prati and Pietrantoni (2010) tried to explain the relationship between self-esteem and resilience by stating that people with high self-esteem are more likely to positively frame an incident, have a stronger sense of mastery use more adaptive coping and have a stronger social support system (Prati & Pietrantoni 2010). Good coping skills were mentioned as being indicative of resilience (Bates et al., 2010; Johnson, 2002; Naz et al., 2010; Simmons & Yoder, 2013; Waters, 2002). Several different forms of coping have been described in these studies, whereas Johnson (2002) names active coping, Simmons and Yoder (2013) refer to adaptive coping as an indicator of resilience. According to Norris, Friedman, Watson, Byrne, Diaz, and Kaniasty (2002) not only coping skills themselves, but also a person's belief that he or she will be able to cope with adversity is indicative of resilience (in DiMaggio et al., 2008). This finding is supported by Naz et al. (2010) who name self-confidence, an individual's belief in his ability to cope with adversity, as one of four factors that contribute to resilience among rescue workers. However, Dickstein et al. (2010) also investigated the relationship between coping and resilience and found no significant effect.

Simmons and Yoder (2013) noted that personal control is an indicator of resilience. Personal control refers to the belief that individuals have control over their own lives (Simmons & Yoder, 2013). Two other indicators of resilience are related to personal control; self-confidence and self-control (Naz et al., 2010). Self-control consists of communication skills, strong will power, emotional stability, and appositive self-concept (Naz et al., 2010). The indicative quality of self-control was also found in a study by Everly et al. (2012) who investigated characteristics of resilient navy SEALS. These authors also mention several other

indicators of resilience for navy SEALS; namely, calm innovative thinking, decisive action, tenacity, honesty, and interpersonal connectedness (Everly et al., 2012). However, Pickering, Hammermeister, Ohlson, Holliday and Ulmer (2010) found no significant indicative effect of self-confidence on resilience. This study investigated among others the indicative effect of foundation skills (commitment, self-confidence, and goal setting) on resilience among Warrior Transition Unit cadre members and found no significant relationship (Pickering et al., 2010).

McAllistar and McKinnon (2009) mention that internal locus of control, empathy, positive self-image, prosocial behaviour, adaptability to change, and a person's ability to organise daily tasks are indicators of resilience. Alexander and Klein (2009) also mention an internal locus of control as an indicator of resilience. McAllistar and McKinnon name five dimensions of resilience in their article, two of which are related to social characteristics and three which are related to personality; namely, connectedness to the physical environment, supportive mind set and a connectedness to a sense of inner wisdom.

Other indicators of resilience are temperament, cognitive functioning, shyness, self-efficacy, intelligence,and good communication and conflict mediation skills (DiMaggio et al., 2008; Waters, 2002). Pickering et al. (2010) describe in their article how cognitive skills such as imaginary/ mental practice and focusing as well as emotion management are able to predict resilience among cadre members. Johnson (2002) also gave an overview of several indicators of resilience in a study focusing on military personnel. According to this article cognitive flexibility, self-efficacy, restoration, and meaning making are indicators of resilience among military personnel (Johnson, 2002). Lee et al. (2011) found that mastery and positive affect acted as indicators of resilience among Canadian recruits. Mastery as an indicator of resilience was also found by Smith et al. (2011), who also notes mindfulness as an indicator of resilience among urban firefighters.

There are also variables which are indicative of a reduced resilience such as; vulnerability, which means that a person is anxious, fatigued, and unable to concentrate or complete tasks (Naz et al., 2010), being depressed (Dickstein et al., 2010), having negative emotions such as fear, anxiety or anger (Galatzer-Levy et al., 2013), high peritraumatic stress, and more perceived threat (Prati & Pietrantoni, 2010).

Biological characteristics

In this section several different biological characteristics will be discussed. It has been noted that the relationship between biological characteristics and resilience is complex and dynamic, another problem is that much of the research in this area is correlational which makes it difficult to establish causality (Johnson, 2009).

A study among firefighters revealed that high right amygdala activity as well as high activity of the left orbitofrontal cortex indicates high resilience, it should be noted that these two areas also showed a high correlation with each other (Reynaud et al., 2013). A study among special forces soldiers showed that the subgenual prefrontal cortex activation as well as activation of the right nucleus accumbens did not differ between condition of reward anticipation and no reward anticipation in contrast to civilians who did show different activations of this area. These findings indicate a more hardy reward system among special forces soldiers compared to civilians which may be indicative of resilience (Vythilignham, et al., 2009). No relationship was found between peak activation of the right insula and resilience (Reynaud et al., 2013).

In an article by Johnson (2009) neuropeptide Y was mentioned as a factor that may contribute to resilience. A less clear relationship was found for brain derived neurotrophic factor (BDNF), this nerve growth factor has been found to act as a risk factor in some areas of the brain while it can also act as a resilience factor in other areas (Johnson, 2009). Lower

levels of catechol-O-methyltransferase (COMT), an enzyme that plays a role in the synthesis of dopamine and noradrenaline, are associated with emotional lability and poor tolerance of negative affect (Johnson, 2009). High levels of dehydroepiandrosterone (DHEA) were found to be related with better scores on an underwater navigation task. DHEA counteracts the negative effects of increased glucocorticoid levels in the brain after stress reactivity of the HPA axis (Johnson, 2009).

Finally, the 5-HTTLPR genotype acts as an indicator of resilience, the gene is associated with increased availability of serotonin, stronger emotion regulation skills and a decreased risk of depression (Johnson, 2009).

Social characteristics

Several studies have found social characteristics to be indicative of resilience among first responders (Chang & Taormina, 2011; DiMaggio et al., 2008; Hickling et al., 2011; Lee et al., 2011; McAllistar & McKinnon, 2009; Prati & Pietrantoni, 2010; Simmons & Yoder, 2013; Smith, et al., 2011; Solomon et al., 2007), in the following sections the results from these studies will be discussed.

Several studies have named social support as an indicator of resilience for first responders, the larger the support network of a person the higher their resilience (Hickling et al., 2011;Lee et al., 2011; Prati & Pietrantoni, 2010;Simmons & Yoder, 2013;Waters, 2002; Smith et al., 2011). A study investigating resilience among service members mentioned that it is also important for service members to receive support from unit members since this would increase the feeling of camaraderie and personal control (Simmons & Yoder, 2013). This study also mentioned the importance of social support in preventing PTSD in the transition period from the military to home (Simmons & Yoder, 2013). Devenson (2003) notes that while social support may be an indicator for resilience, the context of social support should

always be taken into account. People may receive social support in cases in which a crisis is acknowledged by others but may lack this support in situations which are shameful for the individual (in McAllistar & McKinnon, 2009). McAllistar and McKinnon note the importance of taking the community into account when talking about resilience since many layers of a society such as; the individual, peers, organizations, culture, media, etc., all influence a person's resilience. The indicative ability of communities is mentioned by Solomon et al. (2007), who state that strong cohesive communities and religious communities are indicative of resilience. McAllistar and McKinnon also suggest connectedness to the social environment as one of the five dimensions surrounding resilience.

DiMaggio et al. (2008) name family functioning as an indicator of resilience. The importance of family is also noted by McAllistar and McKinnon (2009) who name connectedness to family as one of the five dimensions surrounding resilience. Waters (2002) mentioned that support from family and the community may help an individual coping with and recovering from problems. This was also mentioned in the article by Prati and Pietratoni (2010) who noted that social support from family as well as from friends and colleagues acts as a protective factor which indicates resilience. Aside from having relationships with others and the relationship with the community it is also important that a person is satisfied with these relationships (Chang & Taormina, 2011).

Work related characteristics

Several work related characteristics are able to give an indication of resilience among first responders (Alexander & Klein 2009; Alvarez & Hunt, 2005; Bartone, 2006; Burke & Shakespeare-Finch, 2011; Chang & Taormina, 2011; Gayton & Lovell, 2012; Prati & Pietrantoni, 2010; Solomon et al., 2007; Walumbwa, Petersen, Avolio & Hartnell, 2010).

Resilience at work is influenced by how resilient a leader is. Resilient leaders can be an indicator of resilient personnel, these leaders provide a role model to personnel how to deal with stressful situations and which meaning to give to an event (Bartone, 2006). Leader resilience also influences resilience in a unit or team by the way stressful occurrences are handled and spoken of in a team (Bartone, 2006). These findings were corroborated by the study of Walumbwa et al. (2010) who found that leader psychological capital was an indicator of follower psychological capital in a sample of police officers. This study also noted that a positive working climate contributed to follower psychological capital (Walumbwa et al., 2010). Bates et al. (2010) also mentioned the importance of leadership in relation to resilience in the military as well as the importance of a unit.

Another indicator of resilience is voluntary nature of the work executed. Body handlers who volunteer for their work are expected to show more resilience than people who are appointed to a task as part of their regular job (Solomon et al., 2007). However, it should be taken into account that causality is not entirely clear in this case, since it seems quite likely that more resilient individuals are also more likely to volunteer (Solomon et al., 2007).

Other work related indicators of resilience are having received training for dealing with traumatic events (Alexander & Klein, 2009; Alvarez & Hunt, 2005; Bates et al., 2010; Burke & Shakespeare-Finch, 2011), satisfaction with employment (Chang & Taormina, 2011), good organization, being appreciated, clear duties (Alexander & Klein, 2009), and short length of service (Prati & Pietrantoni, 2010). However, Gayton and Lovell (2012) found that a longer rather than a shorter length of service was indicative of increased resilience. Although they did mention that a strong correlation with age existed when examining this relationship (Gayton & Lovell, 2012).

Trauma characteristics

In this section trauma related indicators of resilience will be discussed. Several articles mentioned trauma related indicators (Burke & Shakespeare-Finch, 2011; Burke, Shakespeare-Finch, Paton & Ryan, 2006; Dickstein et al., 2010; Galatzer-Levy et al., 2013; Galatzer-Levy, Brown, Henn-Haase, Metzler, Neylan, & Marmar, 2011; Simmons & Yoder, 2013; Waters, 2002).

The most frequently mentioned trauma related indicator was having experienced a previous traumatic event (Burke & Shakespeare-Finch, 2011; Burke et al., 2006; Simmons & Yoder, 2013; Dickstein et al., 2010; Waters, 2002). Burke and Shakespeare-Finch (2011) found that having experienced a previous traumatic event makes a person more resilient in future occurrences of traumatic events, since it influences the way in which a person conceptualizes this future traumatic event. Simmons and Yoder (2013) stated in their article that all people are born with a baseline level of resilience which can be increased when people have to deal with adversity. This adversity can take place in any part of their life, childhood, work, accidents etc. (Simmons & Yoder, 2013). Burke et al. (2006) stated that having lived through a previous trauma is not only indicative of resilience but also predicts higher posttraumatic growth in police officers encountering a new traumatic event. However, Galatzer-Levy et al. (2013) found no relationship between previous traumatic events and resilience in a sample of police officers.

Trauma related characteristics indicative of a decreased resilience are reporting many daily hassles (Dickstein et al., 2010) and peritraumatic dissociation which refers to the acute dissociative experience that occurs immediately after or during a traumatic event (Galatzer-Levy et al., 2011).

Table 1. Selected articles concerning indicators of resilience among first responders.

Authors	Year	Research method	Population	Resilience Term	Indicators of resilience
Alexander & Klein	2009	Literature review	First responders	Resilience	Hardiness, locus of control, good organization, clear definition of duties, attention to personal physical needs, teamwork, sense of being appreciated
Alvarez & Hunt	2005	Cross sectional	144 canine handlers	Resilience	Training
Bartone	2006	Literature review	Military	Resilience	Hardy leaders
Bates et al.	2010	Literature review	Military	Resilience	Internal resources, external resources
Burke & Shakespeare-Finch	2011	Longitudinal design	78 police constables	Resilience	Prior traumatic event
Burke, Shakespeare-Finch, Paton & Ryan	2006	Cross sectional	94 police recruits	Resilience	Prior traumatic events
Chang & Taormina	2011	Cross sectional	102 male soldiers acting as rescue workers	Resilience	Wellness, medical care, employment, relationships. community

Authors	Year	Research method	Population	Resilience Term	Indicators of resilience
Dickstein, Suvak, Litz & Adler	2010	Longitudinal design	625 soldiers	Resilience	Previous trauma, stress reactivity, depression, alcohol use, aggressive behaviour
DiMaggio, Madrid, Loo & Galea	2008	Literature review	First responders	Resilience	Positive internal resources, family system functioning, external resources that ensure healthy functioning
Everly, McCormack & Strouse	2012	Literature review	Navy seals, Law enforcement professional, Children of the great depression	Resilience	Non dogmatic thinking, decisive action, tenacity, interpersonal connectedness, honesty, self-control, optimism
Galatzer-Levy, Brown, Henn-Haase, Metzler, Neylan & Marmar	2013	Longitudinal design	234 police officers	Resilience	Low levels of negative emotion
Galatzer-Levy, Brown, Henn-Haase, Metzler, Neylan, & Marmar	2011	Cross sectional	178 police officers	Resilience	Peritraumatic dissociation
Gayton & Lovell	2012	Cross sectional	146 paramedics, 73 paramedical students	Resilience	Years of workexperience, age

Authors	Year	Research method	Population	Resilience Term	Indicators of resilience
Hickling, Gibbons, Barnett & Watts	2011	Cross sectional	6.116 active duty personnel	Resilience	Age, social support, stable financial situation
Johnson	2009	Literature review	Navy and UMCS leaders	Resilience	Cognitive flexibility, spirituality, active coping, self-efficacy, meaning-making, restoration, 5-HTTLPR, neuropeptide Y, BDNF, COMT, DHEA
Lee, Sudom & McCreary	2011	Cross sectional	5.650 Canadian recruits	Psychological resilience	Agreeableness, conscientiousness, extroversion, neuroticism, openness, optimism, hardiness, self-esteem, mastery, positive affect, negative affect, interpersonal social support
McAllistar& McKinnon	2009	Literature review	Health professionals	Resilience	Internal locus of control, prosocial behaviour, empathy, positive self-image, optimism, ability to organise daily activities, connectedness to social environment, connectedness to family, connectedness to physical environment, connectedness to a sense of inner wisdom, positive mindset
Naz, Saleem & Mahood	2010	Cross sectional	Rescue workers	Resilience	Self-confidence, self-control, vulnerability, extraversion, spirituality
Pickering, Hammermeister, Ohlson, Holliday & Ulmer	2010	Cross sectional	27 Warrior Transition Unit cadre members	Resilience	Emotion management, cognitive skills

Authors	Year	Research method	Population	Resilience Term	Indicators of resilience
Prati & Pietrantoni	2010	Cross sectional	509 police officers	Resilience	Self-esteem, social support, length of service, low peritraumatic stress, low perceived threat
Reynaud, et al.	2013	Cross sectional	36 male firefighters	Resilience	Right amygdala activation, left orbitofrontal activation
Simmons & Yoder	2013	Literature review	Military personnel	Resilience	Life events, adaptive coping, personal control, hardiness, social support
Smith, et al.	2011	Cross sectional	124 firefighters	Resilience	Optimism, personal mastery, social support, mindfulness
Solomon, Berger & Ginzburg	2007	Cross sectional	87 male bodyhandlers	Resilience	Volunteer position, religious beliefs
Vythilignham, et al.	2009	Cross sectional	11 active duty soldiers, 11 civilians	Resilience	Subgenual prefrontal cortex
Walumbwa, Peterson, Avolio & Hartnell	2010	Longitudinal design	79 police leaders, 264 police followers	Psychological capital	Leader Psychological Capital, follower Psychological Capital
Waters	2002	Literature review	Families and first responders	Resilience	Health status, psychological status, educational resources, financial resources, communication skills, problem solving skills/coping, family and community social support, previous challenges

Discussion

This systematic review aimed to provide an overview of indicators of resilience among (groups of) first responders. To the author's knowledge this was the first systematic review on this specific subject. An initial search in the databases Psychinfo, Pubmed, and ScienceDirect led to 18.179 hits, after a careful selection only 27 studies concerning indicators of resilience for first responders remained. Indicators found in the selected studies were divided into several categories; namely, sociodemographic, personal, biological, social, work related, and trauma characteristics.While some of the indicators of resilience are found to be significant in several articles (e.g., experience of a prior traumatic event (Burke & Shakespeare-Finch, 2011; Burke et al., 2006; Simmons & Yoder, 2013; Dickstein et al., 2010; Waters, 2002) and the availability of social support (Hickling et al., 2011; Lee et al., 2011; Prati & Pietrantoni, 2010; Simmons & Yoder, 2013; Waters, 2002; Smith et al., 2011)) other indicators remain disputed, with some authors finding a significant indicative relationships while other find no effect from that variable (e.g.,alcohol use (Dickstein et al., 2010; Prati & Pietrantoni, 2010) and self-confidence (Naz et al., 2010; Pickering et al., 2010)). As was already mentioned in the result section of this article some of the indicators of resilience influenced each other or were highly correlated. For instance, Prati and Pietrantoni (2010) stated in their article that they suspect an interplay between self-esteem and social support with regard to resilience. It was already mentioned in the study by Alvarez and Hunt (2005) that having received training is indicative of resilience but that training may also increase a person's feeling of self-efficacy and internal locus of control. Factors which also act as indicators for resilience among first responders (Alexander & Klein, 2009; McAllistar& McKinnon, 2009). Bartone (2006) mentioned that hardy people are more resilient and also show high commitment to their work, this work commitment could possibly influence some of the work related indicators mentioned in this article. Another article mentioned that certain personality traits such as

optimism and an internal locus of control will make it easier for people to form supportive relations (Friborg, Hjemdal, Rosenvinge & Martinussen, 2003) which may influence a person's level of social support. This interplay between the different indicators makes it difficult to determine the individual contribution of a variable to resilience among first responders.

Based on the findings from this review several recommendations for future research can be made. More research into the precise relationships between the different indicators and resilience would be important to determine which indicators are most important in relation to resilience and to find out if no confounding variables are seen as indicators of resilience. This sentiment is shared by Alvarez and Hunt (2005) in their article. Investigating these relationships may also provide more insight into the role the more disputed variables play in relation to resilience. Several issues should be taken into account when studying indicators of resilience. Because of the interplay between indicators the issue of multicollinearity should be considered. Several studies used in this review comment that multicollinearity influenced their research (Lee et al., 2011; Pickering et al., 2010). Investigating causality should also be a focus of future research. Much of the research in the area of resilience is correlational which makes it difficult to establish causality (Johnson, 2009). Establishing causality would be important when interventions are to be established for increasing resilience among first responders. Investigating the precise relationship between different variables is important to establish to what extent a specific indicator plays a role in resilience among first responders. One further recommendation for future research focuses on the terms resilience and psychological capital. Studies examining resilience or psychological capital sometimes differ in their view on these constructs, some see resilience as a similar concept to psychological capital, while others see resilience as a part of a person's psychological capital (Avey et al., 2009). Since some researchers view psychological capital as a distinct concept from resilience

(Avey et al., 2009), it is surprising that only one study could be included which used the term psychological capital rather than the term resilience (Walumbwa et al., 2010). If other researchers find psychological capital to be (almost) similar to resilience it would be preferable to have a singular definition to avoid confusion. In case resilience and psychological capital should be seen as distinct concepts it would be important to further investigate possible indicators of psychological capital for first responders.

Results from this review are not only relevant for future research but also for practical purposes. Indicators of resilience could be used for the implementation of resilience training programmes, these programmes could use these indicators to establish which areas of a person's live should be evaluated during training and which people would benefit more from a training programme. Knowledge about indicators of resilience can help when trying to decrease a person's vulnerability to stress (Bartone, 2006). Indicators of resilience can also be used by recruitment agencies for first responders. Since resilience is related to a decreased vulnerability for several psychological problems (Pietrzak et al., 2010). It seems likely that when more resilient personnel is recruited, less psychological complaints would be encountered as a result of the work undertaken by first responders. It has also been found that resilient people have more success regarding their career (Simmons & Yoder, 2013).

Several limitations could be mentioned with regard to this review. In order to unify the findings regarding this topic broad selection criteria have been used. Because of this broad approach many articles were found in the initial search, after screening of title and abstract many articles had to be excluded because they did not meet all inclusion criteria. Many articles dealt with risk factors for PTSD rather than protective factors related to resilience and psychological capital. This has already been noted by Bandura (2001), who stated that there is an investigatory focus on risk rather than adaptive factors (in Benight & Bandura, 2004). Future research into this topic would, therefore, be welcome to discover more about the

variables related to resilience among first responders. Another problem in interpreting the results of this review may be the broad array of professions used. While all professions consist of groups of first responders it seems likely that different professions will encounter different problems, which might mean that different indicators may predict resilience in a specific profession. However, this review aimed to provide a broad overview of indicators since a gap in the scientific literature on this area existed. Indicators found in this review can be used in other studies to determine their relevance to specific groups of first responders.

Several indicators of resilience have been described in this systematic review. Indicators can be grouped in different categories; namely, sociodemographic, personal, biological, social, work related and trauma characteristics. While many studies investigate the effect work related trauma has on first responders most studies aim solely at risk factors. Relatively few studies have investigated indicators of resilience. More research into indicators of resilience and their interactions would be welcome.

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