A Decade of Longitudinal Resilience Research in the Military across The Technical Cooperation Program’s Five Nations

Summary of Findings and Lessons Learned

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Military personnel are exposed to a variety of stressors throughout their career, from training and separation from family to potentially traumatic experiences in combat environments. However, not all individuals exposed to the same stressors will develop mental health problems. As well, of those that do, symptoms may vary in intensity, and different degrees of dysfunction may be apparent in individuals’ everyday lives. In fact, similar to other populations exposed to traumatic events, the majority of military personnel do well, even following deployments involving high levels of trauma. It has been suggested that among such individuals, certain resources may be present that can affect vulnerability to combat-related stressors (Sutker et al., 1995). Although military mental health research has traditionally studied vulnerability factors (i.e., the variables that increase risk of developing mental health symptoms following a traumatic deployment), in recent years, research has increasingly focused on the role of resources or protective factors for maintaining well-being following trauma. The identification of those factors that protect against the adverse effects of stress is important for military organizations, as it may provide an empirical basis for the targets of resilience training and intervention programmes.

Although various perspectives exist, psychological resilience has been defined as “the sum total of dynamic psychological processes that permit individuals to maintain or return to previous levels of well-being and functioning in response to adversity” (The Technical Cooperation Program, 2012, p.4). Resilience has been measured in a variety of ways in past research, often in the form of psychological characteristics that have been shown to be associated with better mental health outcomes following stressful experiences, such as hardness, mastery, and optimism. Such characteristics may serve as resources to facilitate functioning after exposure to traumatic stressors and thus play a protective role in the development of mental health symptoms.

Although identifying protective factors is an important goal in resilience research, the majority of past studies in this area have been cross-sectional in nature. That is, most research has examined the correlation between factors thought to underlie resilience with

2 Vogt et al., 2008; Yi et al., 2008.
measures of mental health or other outcomes assessed at one point in time, such as following a combat deployment. Numerous cross-sectional studies have examined the relationship between psychological resilience, measured by hardiness or other similar characteristics, and well-being. For example, a study of Canadian Armed Forces (CAF) officer candidates undergoing basic training found that both general and military-specific hardiness were significantly associated with positive outcomes, including psychological well-being and favourable perceptions of training (Skomorovsky & Sudom, 2011). Also pointing to the protective role of resilience in health, a study of US Army personnel who had been deployed to Iraq found that “psychological capital”, a higher-order resilience construct that includes the traits of self-efficacy, optimism, hope, and ego resilience, was associated with better psychological and physical health (Schaubroeck et al., 2011). These associations were particularly strong among those with higher levels of exposure to potentially traumatic events. Another study examined the relationship between dispositional resilience, measured as hardiness, and post-traumatic stress disorder (PTSD) symptoms among US service members following deployment (Escolas et al., 2013). It was found that, in addition to the direct relationship between lower hardiness and higher PTSD, PTSD was more likely to be present among those with longer time in the military (and, presumably, greater exposure to potentially traumatic events and other military stressors). However, the relationship between time spent in the military and PTSD was only present among those with low to average levels of hardiness. Last, a study of US Navy personnel indicated that those higher in resilience and post-deployment social support exhibited greater post-deployment adjustment several months after return from deployment (Cunningham et al., 2014).

While the above studies highlight the associations of resilience with various outcomes among military personnel, their cross-sectional nature has limited the extent to which the protective role of resilience can be examined. That is, it is not possible to determine the impact of resilience on mental health outcomes, or to examine the risk and protective factors for mental health. Also, with cross-sectional research, it is not possible to determine whether resilience can change over time, as a result of exposure to either stressors or resilience training programmes. Longitudinal research would aid in identifying the risk and protective factors for mental health. This would allow for informing the content of resilience training and intervention programs, as well as the ability to identify groups of individuals that may be at highest risk of negative outcomes following traumatic stress. As well, to the extent that resilience is a dynamic state, longitudinal research would allow for the examination of changes in resilience at the individual and group level and the identification of factors, such as traumatic stressors or resilience training programmes that can influence such changes.

It is clear that further longitudinal research on psychological resilience is needed in order to understand the factors that underlie resilience, so that prevention and intervention programmes for military personnel can be enhanced and developed accordingly. However, before considering further research, it is important to understand the findings and
implications of past studies so that gaps in research can be identified and addressed. To that end, the objective of the current article is to summarize the longitudinal research on resilience that has been conducted on military personnel across The Technical Cooperation Program\(^3\) (TCP) nations over the past decade.

**Method**

A search for relevant papers or reports published since 2005 in Ebscohost, PsychInfo, and Web of Science was conducted using the words “longitudinal” or “prospective”, “military”, and any of the following as search terms, which have commonly been used to describe psychological resilience in past research: “character strength”, “coping flexibility”, “grit”, “hardiness”, “positive emotion”, “positive psychology”, “post-traumatic growth”, and “resilience”. Also, queries were sent to subject matter experts from each of TCP nations to request copies of any relevant internal reports published during this time.

In order to be included in the review, papers had to (i) include multiple time points of data collection and (ii) focus on psychological or behavioural outcomes, assessed at a later point of data collection. A total of 37 papers and/or reports were identified and included in the review. A summary of all papers that were reviewed is provided in the Appendix (see p.18sq). Papers focused on a range of psychological and behavioural outcomes, including mental health, violence and aggression, and training success.

**Results and Discussion**

**Resilience Definitions and Concepts**

Before describing the findings of longitudinal studies on resilience, it is important to understand the variety of perspectives and definitions of resilience that have been used in past research. The extent to which resilience has been explicitly defined in the literature that was reviewed largely varied. Some researchers examined the various trajectories of posttraumatic stress symptoms following military deployment and defined resilience as the maintenance of low levels of symptoms following adversity (Bonanno *et al.*, 2012, Segovia *et al.*, 2013). In other work, similar definitions of resilience were provided, although psychosocial characteristics believed to facilitate resilience were also outlined. Park and Peterson (2012), for instance, examined a range of psychosocial factors associated not only with well-being, but also with improved mental health, or, posttraumatic growth (PTG) following deployment.

In addition to defining resilience as the presence or extent of mental health symptoms following adversity, a number of researchers have recognized resilience as a

\(^3\) The Technical Cooperation Program dates back to 1958. It involves Australia, Canada, New Zealand, the United Kingdom and the United States. The aim of TCP is to foster cooperation in the science and technology needed for conventional, i.e. non-atomic, national defence. TCP encompasses basic research, exploratory development and demonstrations of advanced technology development. This scope includes the exploration of alternatives and concepts prior to development of specific weapon systems; feasibility demonstrations of innovative new concepts, techniques or equipment and their test and evaluation; the pursuit of alternate solutions to potential military problems; and generic systems. Cf. TCP’s official website: http://www.acq.osd.mil/ttcp/overview/.
multidimensional construct consisting of personal characteristics or protective processes that might be associated with more favourable outcomes following adversity. For instance, resilience was conceptualized in some work as a multidimensional construct consisting of qualities that enable individuals to thrive in the face of adversity,\(^4\) while other researchers adopted the definition established by TCP, described above.\(^5\)

Regarding specific concepts, a small number of researchers have conceptualized resilience in terms of individual characteristics, such as hardiness.\(^6\) Reflecting the manner in which individuals perceive themselves, others and the world around them, hardiness consists of dimensions of commitment, control, and challenge. Specifically, these dimensions describe an individual’s sense of internal balance and confidence, sense of control over threatening stimuli, and motivation to learn and grow from novel experiences, respectively (Bartone, Kelly & Matthews, 2013). Finally, coping\(^7\) and social resources\(^8\) that may serve a protective role in the development of psychological health issues have also been used as indicators of resilience.

**Longitudinal Resilience Research Initiatives across Nations**

A summary of all papers and internal reports identified as relevant for the review is provided in the Appendix. As shown, the vast majority of these were published in 2012 or later. Also, studies were primarily based on US military personnel. However, longitudinal research on psychological resilience has also been conducted on military personnel in Australia, Canada, New Zealand and the UK. Following is an overview of the general methodological approaches of the major research initiatives across nations.

Following the general push for longitudinal military health research after the Gulf war, the Millennium Cohort Study began in 2001 to prospectively follow a large cohort of US military personnel over two decades. Although it was not explicitly developed for this purpose, the Millennium Cohort Study has served in longitudinal analyses of psychological resilience to explore different trajectories of mental health following trauma (Bonanno et al., 2012).

Within the US, a number of programmes of research aimed at identifying factors contributing to resilience within specific military branches have since been initiated. The prospective Readiness and Resilience National Guard Soldiers (RINGS) cohort study and related prospective National Guard cohort studies were conducted to identify pre-deployment factors that are predictive of PTSD symptoms reported by soldiers deployed to Operation Iraqi Freedom (Polusny et al., 2011 and 2014). For these studies, questionnaires were administered one month prior to deployment to assess baseline psychosocial risk and protective factors, and approximately two months after return from deployment to assess

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4 Hourani et al., 2012; Youssef et al., 2013; Green et al., 2014.
8 Vasterling et al., 2010.
deployment-related factors, post-deployment risk and protective factors, and mental health outcomes (Polusny et al., 2011).

Studies focusing on other branches of the US military include the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) and the Marine Resiliency Study. The Army STARRS was created in 2009 to identify modifiable risk and protective factors for suicidal behaviours. Components include analyses of historical administrative data, as well as various data collections among new soldiers and soldiers who have been on active duty. Its longitudinal component consists of a pre-post deployment study of these new soldiers and active duty soldiers involving four waves of data collection: prior to deployment, within one month after deployment, two months later, and another six months after that (Ressler & Schoomaker, 2014). Having started in 2008, the Marine Resiliency Study similarly consists of a prospective longitudinal investigation of biological, psychophysiological, psychosocial, and neurocognitive factors that may moderate or mediate the impact of combat stressors in a cohort of US Marine Corps personnel (Baker et al., 2012). Specifically, clinical interviews were conducted with approximately 2600 Marines in four battalions deployed to Afghanistan or Iraq at pre-deployment, and at one week, three months, and six months post-deployment. Results were integrated with archival personnel and medical records to identify risk factors for PTSD.

Rather than focusing on different military branches, programmes of research in other countries have included all branches. The Longitudinal Australian Defence Force (ADF) Study Evaluating Resilience (LASER), for example, was launched in 2009 to comprehensively examine the social, psychological, and situational factors that affect resilience in the ADF, as well as interactions between pre-military factors and military service as determinants of psychological resilience. LASER involves five waves of data collection, starting at enlistment, followed by the end of initial military training, and at yearly intervals for the subsequent three years. In line with analyses conducted on the Millennium Cohort Study, one aim of LASER is to identify various trajectories that emerge after trauma.

In the Canadian Armed Forces (CAF), a programme of research on psychological resilience was initiated consisting of various studies involving data linkage with the CAF Recruit Health Questionnaire (RHQ). The RHQ is a comprehensive voluntary health survey administered to CAF Regular Force recruits and officer candidates in the first few weeks of their basic training. In addition to collecting information on various health determinants and outcomes, it contains validated scales to assess a number of psychosocial variables that may serve as protective factors. Hence, RHQ data may be linked with personnel or administrative data collected at later points in the military career, including after deployment, to conduct prospective research on risk and protective factors.

The New Zealand Defence Force (NZDF) has assessed resilience among recruits undergoing basic military training, consisting of a series of challenges over a 16-week
period. The impact of basic training challenges on resilience, grit, self-efficacy, psychological distress, and coping style have been examined. Specifically, recruits were administered a survey in the first week of training, and again at the end in the final week of training, in order to examine trends in self-reported resilience and related constructs over the training period (Liddell, n.d.).

Finally, the UK has conducted several studies on resilience in its military personnel, which have focused on mental health of members deployed in a combat environment as well as mental health of Royal Navy personnel serving on ships. The results of relevant studies on psychological resilience across nations are described below.

Overview of Findings

Researchers have conceptualized resilience in a variety of ways across studies. Several studies have examined resilience in terms of the presence or extent of PTSD or other mental health symptoms following deployment. For example, the Marine Resiliency Study examined resilience in relation to PTSD symptoms following combat deployment. As part of that study, Baker and colleagues (Baker et al., 2012) collected data at four time points across Marine bases: at pre-deployment and at 1 week, 3 months, and 6 months post-deployment, and combined these data with medical and career histories. A moderate positive relationship between deployment history and PTSD was found, such that greater exposure to combat was associated with increased PTSD prevalence. As well, using a cohort from the Marine Resiliency Study, Boasso and colleagues (Boasso et al., 2015) examined trajectories of PTSD over time, defining resilience based on the consideration of both trauma exposure and symptoms. It was found that Marines with higher combat exposure showed a temporary clinically significant increase in PTSD symptoms followed by a gradual decrease, which the researchers termed “True Resilience”. On the other hand, Marines who reported lower levels of combat exposure had consistently low symptoms over time (i.e., “Artifactual Resilience”).

The Millennium Cohort Study has also examined trajectories of mental health symptoms following deployment. As part of it, Bonanno and colleagues (Bonanno et al., 2012) examined trajectories of resilience among deployed US service members by using self-report measures at pre-deployment and at two follow-up points three years apart, finding that the majority of military personnel remained without PTSD after exposure to adverse deployment experiences. Less favourable trajectories of PTSD were associated with increased drinking and smoking, which may indicate the use of less adaptive coping strategies among those who develop mental health problems.

Although some researchers have conceptualized resilience in terms of the course of mental health symptoms over time, others have regarded it as the absence of mental health problems following trauma. For example, in a longitudinal study of repatriated Vietnam prisoners of war (RPW), Segovia and colleagues (Segovia et al., 2013) defined resilience as not having been diagnosed with a psychiatric illness over a 37-year follow-up period. Defined in this way, it was found that resilient RPWs were less likely to experience sleep
difficulties before, during, and after captivity, suggesting that sleep quality may one factor that contributes to the ability to maintain health following trauma, and may be used to identify at-risk individuals. However, the authors acknowledged that defining resilience as the absence of a psychiatric diagnosis does not fully capture the potential responses to trauma (Segovia et al., 2013).

Rather than studying the degree of symptoms or diagnosis of mental health problems, other researchers have taken a positive psychology approach and measured resilience in terms of post-traumatic growth following stressful events. In particular, a study of the longitudinal course of post-traumatic growth over time among US military veterans found that there were several trajectories of PTG, from consistently low to consistently high (Tsai et al., 2016). Growth tended to persist over time, and was associated with certain psychosocial factors (e.g., including purpose in life, religiosity), as well as the presence of post-traumatic stress symptoms. Although longitudinal research on PTG in response to trauma is limited, it represents one means by which resilience can be measured, in addition to mental health difficulties.

Rather than defining resilience as the presence or extent of mental health or personal growth following deployment, others have operationalized it in terms of factors that may serve a protective role, either by directly contributing to more favourable outcomes in response to adversity among military personnel or by helping to buffer the impacts of trauma. On the whole, these fall under the broader categories of dispositional attributes, coping behaviours, and social environment.

Dispositional Attributes

Several studies have used individual characteristics, such as hardiness, that function in a protective role during adverse events to operationalize resilience. In addition to hardiness, attitudes or belief styles that might serve as protective mechanisms following adversity, including those pertaining to the degree of control one has over his/her life, such as mastery, self-determination or self-efficacy, have been used as indicators of resilience. In addition, a number of researchers have operationalized resilience as one’s disposition towards accepting stress, adapting to change, and having a high sense of self-efficacy.\(^\text{11}\)

Hardiness has frequently been studied in military personnel for its role in resilience of military members, particularly for its role in the prediction of mental health issues. In a study of US soldiers, military-specific hardiness, deployment stressors, and psychological and physical health were assessed during a peacekeeping deployment, and health was measured again after the deployment (Dolan & Adler, 2006). It was found that, once adjustments were made for depression during deployment, military hardiness moderated the effect of deployment stressors on post-deployment depression. Specifically, among soldiers who experienced high levels of stressors during deployment, those who were high in hardiness subsequently reported lower levels of depression. As well, using a measure of

\(^{11}\) Hourani et al., 2012 ; Youssef et al., 2013 ; Weidlich, 2013 ; Elbogen et al., 2014 ; Green et al., 2014.
resilience that includes elements of hardiness and coping with stress, Hourani and colleagues (Hourani et al., 2012) found that US Marines with higher resilience measured in the weeks before separation from the military had lower odds of demonstrating chronic mental health problems at follow-up nine months after leaving the military, and greater odds of demonstrating improvement over time, as opposed to chronicity.

In addition to its association with mental health symptoms, hardiness has been linked to more positive attitudes toward mental health care. An evaluation of hardiness training among New Zealand military personnel indicated a reduction over time in mental health stigma, an increase in supportive attitudes toward seeking mental health care, and an increase in mental health literacy, following the training (Gerling, 2015).

Hardiness has also been assessed as a predictor of successful completion of military training, as well as a predictor of military leadership performance. Bartone, Roland, Picano, and Williams (Bartone et al., 2008) found that hardiness was higher among US Army Special Forces candidates who completed a Special Forces course, compared to non-graduates. The higher levels of hardiness found among graduates indicate that hardiness is linked to the ability to adapt and succeed in highly stressful situations, since the Special Forces occupation involves high levels of stress. Also, the commitment and control aspects of hardiness measured in freshmen cadets were found to positively predict military leadership performance an average of seven years later (Bartone, Kelly & Matthews, 2013), suggesting that hardiness may be used to predict performance in a variety of military settings.

Dispositional attributes underlying resilience have also been linked to other outcomes such as aggression and alcohol use. Elbogen and colleagues (Elbogen et al., 2014) found that resilience and self-determination were associated with lower levels of violence and aggression measured one year later among US military personnel who served in Operation Enduring Freedom (OEF) or Operation Iraqi Freedom (OIF), regardless of whether they were initially considered at risk. In the same group of US military personnel, Green and colleagues (Green et al., 2014) found that resilience increased over a one year period in close to half of participants. Adjusting for a number of other factors, including combat exposure, PTSD and history of alcohol abuse, lower resilience was found to be a significant predictor of both alcohol use and misuse one year later. As well, levels of alcohol use one year later were found to be lower among participants who experienced greater increases in resilience over that period, suggesting that changes in resilience may result in measurable changes in mental health outcomes (Green et al., 2014).

Studies on changes in resilience, measured on the basis of personal attributes, have produced mixed findings. Weidlich (2013) found that military healthcare providers who participated in a resiliency training programme demonstrated no significant changes in resilience as a result of training. Others have found that resilience may vary over time, although in different directions. For example, in a study of NZDF recruits, it was found that self-reported grit and resilience decreased over time from pre- to post-training, although other measures (i.e., psychological distress and self-efficacy) did not change (Liddell, n.d.).
Similarly, Vogt and colleagues (Vogt et al., 2008) found that hardiness decreased over time among those who experienced greater stress reactions, indicating that stressful experiences may lead to a loss in resilience and greater susceptibility to negative outcomes in some individuals. Sudom, Lee and Zamorski (2014) found that, although overall levels of resilience did not change significantly over time from basic training to post-deployment among CAF military personnel, when examined at the individual level, greater than expected increases and decreases in resilience were observed.

Given the multidimensionality in the manner in which resilience has been operationalized in these studies, one issue that might account for these inconsistencies is that the various dimensions operated differentially. Attempts to examine resilience in terms of its dimensions have demonstrated that different facets of resilience may operate in different ways. For example, Youssef and colleagues (Youssef et al., 2013) found that resilience was predictive of later suicidality in OEF/OIF veterans to a greater degree than alcohol misuse and PTSD, even after controlling for a number of demographic and clinical variables, including initial suicidality. However, when more specific facets of resilience were examined, it was found that secure relationships and tolerance demonstrated the strongest protective effects against suicidality, compared to other facets. Therefore, the results of studies examining resilience as a single, unidimensional variable may be limited, and may give rise to varying results across studies.

Other than hardiness and related attributes, several studies have examined the role of the Big Five personality dimensions in resilience. Lee and colleagues (Lee, Sudom & Zamorski, 2013) found that higher levels of conscientiousness, as well as lower levels of agreeableness and neuroticism measured at basic military training, were significantly associated with mental health among military personnel returning from deployment in Afghanistan an average of four years later. They noted, however, markedly weaker associations compared to cross-sectional analyses involving similar constructs (ibid.) and attributed these to possible changes in dispositional attributes between basic training and return from deployment. In a complementary study, Sudom, Lee and Zamorski (2014) examined changes in dispositional attributes over time in a small sample of CAF military personnel. While limited evidence of changes in these dispositional attributes on average was found, considerable individual variation was observed in conscientiousness, neuroticism, openness, and hardiness, with certain individuals exhibiting decreasing levels and other individuals exhibiting increasing levels. As well, differences were observed between those with deployment experience and those without: individuals having been deployed showed evidence of greater resilience both at baseline and follow-up, and they maintained a high level of social support over time, whereas non-deployed individuals showed a decrease in social support. These findings indicate the complexity of resilience and the importance of considering individual differences in the trajectories of resilience over time.

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Although changes in resilience over time could explain the weaker associations between dispositional attributes and post-deployment health outcomes, such results could also be indicative of the presence of more complex processes, such as mediated or moderated effects involving other variables. The presence of mediators or moderators could also explain varying results across studies. Such variables include coping appraisals and behaviours, as well as various characteristics of the social environment.

**Coping Behaviours**

Results of research examining coping as an intervening variable in the relationship between stressors and mental health outcomes have been mixed. Australian Defence Force LASER research has suggested that coping strategies may influence changes in mental health following initial training of military members (Crane et al., 2013). However, from the time of entry to completion of initial training, different strategies were associated with mental health, suggesting that adaptive coping strategies can change over time, and this flexibility in the use of coping strategies may be an important part of understanding mental health changes (ibid.).

Another component of the LASER study examined the relationship between pre-military trauma exposure and mental health outcomes, and the influence of coping styles on this relationship (O’Donnell et al., 2015). It was found that coping strategies used at the time of entry into the ADF (i.e., reappraisal, acceptance, self-blame, support-seeking, avoidance, and risk taking) did not influence the relationship between prior trauma exposure and mental health outcomes, once mental health at entry was controlled. It was suggested that coping strategies may change during training, which may account for the lack of mediating effect, and that the relationship between such changes and mental health is important to consider. In addition, pre-military trauma did not strongly increase the risk of later mental health problems in this population, in contrast with the civilian literature (ibid.). It was suggested that resilience over time may be more robust in the military than in the civilian population, possibly due to selection standards for recruits. Despite having past trauma exposure, recruits may enter the military with a relatively high degree of resilience that enables them to cope with the demands of service; also, selection standards increase the likelihood that individuals functioning at a high level enter the military.

It has been proposed that stress appraisal and coping processes can directly facilitate resilience following adversity, resulting in more favourable outcomes (Liddell, Roesch, Aldridge, Vickers et al., 2009). Park and Peterson (2012) found that coping via greater expression of positive emotions, cognitive reappraisal, problem-focused coping, flexibility, control and acceptance, as well as the self-perceived ability to handle stress was associated with enhanced post-deployment well-being among US soldiers deployed to Iraq, even after controlling for their age, sex, and pre-deployment levels of well-being. In addition, coping though the expression of positive emotions and cognitive reappraisal during deployment was associated with greater post-traumatic growth after deployment. Results of additional path analyses suggested that positive emotions and coping mediated the effect of pre-deployment well-being on post-deployment well-being (ibid.).
In another US study, greater use of avoidance coping was found to be linked with higher levels of PTSD symptoms at discharge among veterans admitted to a rehabilitation program for PTSD. Further, greater PTSD symptomatology at discharge was linked with greater use of avoidance coping three months later. It was suggested that elevated pre-treatment avoidance coping contributed to the persistence of PTSD symptoms during treatment, and that treatment-resistance, in turn, contributed to the continued use of avoidance coping (Badour et al., 2012). In a study of recruits undergoing basic training in the New Zealand Army (Liddell, n.d.), it was found that those who used problem-focused coping at the start of basic training not only had higher initial levels of grit and self-efficacy, they also demonstrated higher levels of grit at the end of basic training compared to those who used avoidance or social support to cope. Initial levels of grit and self-efficacy were also associated with levels of resilience at the end of the basic training, indicating that the dispositional attributes characterizing those who tended to use problem-focused coping were associated with greater resilience (ibid.).

Beyond playing a protective role in the face of adversity, coping has been proposed to serve as the mechanism through which dispositional attributes give rise to resilience. For example, in their study of US military recruits, Roesch and colleagues (Roesch, Aldridge, Vickers et al., 2009) found that approach coping mediated the associations of each of the Big Five personality factors with positive affect, while avoidance coping mediated the association of neuroticism with negative affect. At the same time, the researchers found that certain personality factors moderated the relationship of coping with positive and negative affect. Specifically, avoidance coping demonstrated a stronger association with negative affect among individuals with high agreeableness, high neuroticism and low conscientiousness. Approach coping demonstrated a stronger association with positive affect among individuals with high extroversion, while avoidance coping showed a stronger association with positive affect among individuals with low agreeableness. Thus, coping may have different effects depending on the dispositional attributes of military personnel.

In a similar vein, other evidence suggests that the effects of coping on the well-being of military personnel vary based on context. For example, it was found that different occupational stressors, psychological, and lifestyle factors predicted psychological strain over one year among UK Royal Navy personnel serving on ships compared to those serving ashore (Bridger et al., 2011). Specifically, poor mood and work-family issues predicted strain among personnel serving on shore, while dissatisfaction with living conditions, lack of control, and greater use of avoidance coping predicted strain among those serving on ship. Taken together, these results suggest the importance of considering coping as a mechanism that facilitates resilience, but also underline the need to consider the role of the social environment in studies on the well-being of military personnel.

**Social Environment**

Similar to personal attributes and coping styles, social support and other aspects of the social environment may facilitate resilience in military personnel. In a number of studies, the social environment in which individuals find themselves was believed to
influence resilience. After controlling for demographic confounders and pre-deployment levels of PTSD, it was found in one study that life and family concerns experienced on the home front were associated with symptoms of PTSD in both active-duty and National Guard US soldiers deployed in support of OIF (Vasterling et al., 2010). On the other hand, other findings have suggested that support inherent in relationships may facilitate treatment use among those in greatest need of treatment. For instance, in a study of married National Guard soldiers deployed to Iraq, associations between relationship adjustment and mental health treatment seeking were found to be particularly strong among soldiers who reported more PTSD symptoms (Meis et al., 2010).

The majority of other studies that have examined social context focused on social support as a resource that can lead to more positive outcomes following adversity. One study revealed that US airmen who demonstrated resilient patterns following a deployment to Iraq – defined as no change in PTSD, depression or alcohol use from pre- to post-deployment – reported higher levels of social support from friends, family, and significant others compared to those who demonstrated a deterioration in their mental health (Cigrang et al., 2014). However, since social support was assessed post-deployment, it is not possible to determine whether it contributed to these mental health outcomes or whether these mental health outcomes contributed to social support.

Similar to coping, the specific effects of social support may vary depending on other factors. To be sure, the role of social support may differ depending on the study population. Elbogen and colleagues (Elbogen et al., 2014) found that social support predicted decreased aggression and violence at one-year follow-up in a sample of US OIF and OEF veterans who were initially at high risk for violence and aggression, but not among those who were initially at low risk. In another study, important differences were observed between male and female Marine recruits, in that social support buffered the negative impact of stress on hardiness among male recruits. However, a reverse-buffering effect was observed among female recruits, with stress demonstrating a positive association with hardiness among female recruits with high social support, but no association among those with low social support (Vogt et al., 2008).

The role of social support in resilience may also differ depending on the type of social support being considered. In their study of Canadian military personnel returning from deployment overseas, Lee and colleagues (Lee, Sudom & Zamorski, 2013) found that mental health was differentially predicted by different types of social support. No significant associations were observed for tangible and informational social support, while positive social interaction was found to be associated with better post-deployment mental health. In addition, contrary to expectations, affectionate social support was associated with poorer post-deployment mental health.

Another aspect of the social environment that has received attention is the occupational social context, with a number of studies having considered variables such as organizational support, leader support, or unit cohesion. Park and Peterson (2012) found that US Army soldiers who felt their unit was cohesive and would take care of their family,
as well as those who viewed their leadership more favourably during deployment, were more likely to experience post-traumatic growth a year after returning from their deployment. Similarly, more favourable perceptions of the unit and leadership among US peacekeepers during deployment were found to be associated with the perception that there were more benefits to the deployment as well as lower levels of PTSD (Britt et al., 2007). As well, in a prospective study of UK military personnel deployed to Iraq, Rona and colleagues (Rona et al., 2009) found that psychological symptoms at baseline and combat exposure predicted greater post-deployment PTSD symptoms and psychological distress, while unit support was found to have a protective role in the development of mental health problems. Perceptions of organizational support, however, may depend on initial mental health. For example, it was found that initial PTSD symptoms predicted subsequently lower levels of perceived organizational support in a study of US peacekeepers (Barnes et al., 2013).

Several studies of US National Guard soldiers have examined the role of unit cohesion as a determinant of well-being after deployment to Iraq. Polusny and colleagues (Polusny et al., 2011) examined both unit cohesion (assessed prior to deployment) and post-deployment social support. They found that only the latter had a protective effect against new-onset PTSD, after controlling for a variety of pre-deployment and deployment factors among National Guard soldiers without PTSD at baseline. Other studies, however, suggest that the effects of unit cohesion on post-traumatic stress symptoms after deployment may vary by sex, with evidence of stronger protective effects among male soldiers (Polusny et al., 2014). Such differences may in part relate to lower levels of unit cohesion reported by women (Kline et al., 2013). Kline and colleagues (Kline et al., 2013) found that female National Guard soldiers had a higher prevalence of post-traumatic stress and depression symptoms than males, as well as lower military preparedness and unit cohesion. These risk factors were associated with higher rates of PTSD measured after deployment, although the relationship between sex and PTSD was attenuated when risk and resilience factors, including cohesion, were considered. Therefore, differences in perceived preparedness and unit cohesion may account for some of the sex differences in post-deployment mental health outcomes.

Alternatively, failure to consistently observe a relationship between unit cohesion and post-deployment mental health may relate to changes in levels of unit cohesion throughout the deployment cycle. Indeed, pre-deployment unit cohesion and deployment unit cohesion have been found to have varying effects on post-deployment PTSD (Han et al., 2014; Franz et al., 2013). Franz and colleagues (2013) assessed whether the effect of unit cohesion on post-deployment PTSD symptoms was mediated by levels of perceived threat experienced during deployment. While they found no evidence of a mediated effect for pre-deployment unit cohesion, they did observe a mediated effect for deployment unit cohesion, possibly reflecting changes in levels of cohesion through the deployment cycle.

13 Polusny et al., 2011 and 2014; Franz et al., 2013; Kline et al., 2013; Han et al., 2014.
The role of unit cohesion may also vary across groups of individuals, depending on the outcome of interest. For instance, in a UK study of military personnel, sense of comradeship and other aspects of unit support were found to be protective against psychological distress, but not PTSD at follow-up, after controlling for baseline mental health and combat exposure (Rona et al., 2009). Also, Han and colleagues (Han et al., 2014) found that deployment unit cohesion was a protective factor against post-deployment PTSD among active duty soldiers, but not among National Guard soldiers. Post-deployment social support, on the other hand, was protective against PTSD in both groups, particularly emotional and instrumental support from family and friends. Thus, post-deployment support from family may be particularly important. Not surprisingly, findings of other studies show that well-being may be impacted by the strain of workplace stressors on relationships with family and friends. In a study of UK Royal Navy personnel, it was found that work-family conflict, but not perceived support from leaders and peers, predicted future psychological strain among personnel working on ships (Bridger et al., 2011).

Summary

This review of longitudinal research on resilience across TCP nations indicated that the majority of longitudinal research over the past several years has been conducted in the US, as part of large programmes of research such as the Millennium Cohort Study and the Marine Resiliency Study. Such studies have primarily focused on resilience in relation to PTSD following deployment, although some research has also begun to focus on post-traumatic growth. Canada has led a more limited research programme, mainly utilizing existing health surveillance and post-deployment screening tools to examine resilience from basic training to following combat exposure, and focusing on the individual characteristics that confer better outcomes in response to stress. Australia has led a longitudinal research effort (i.e., LASER) to assess the factors that affect resilience in the ADF and the trajectories of responses to trauma, including the importance of strategies to cope with stressors, while New Zealand has assessed resilience among recruits undergoing basic military training. Finally, the UK has also led several studies focused on factors that serve a protective role in mental health.

Overall, the results of longitudinal research on psychological resilience are varied, with researchers using different definitions and outcomes to assess resilience, as well as different conceptual and methodological approaches. While some have measured resilience as the presence or degree of mental health symptoms or diagnosis following deployment, others have measured resilience in terms of the individual or social predictors or intervening processes, such as coping, that predict better adaptation to stressors. Overall, the results point to factors that are associated with mental health issues such as PTSD, with post-traumatic growth following trauma, and with other important outcomes such as aggression, alcohol use, and training success. The studies reviewed also highlight the challenges inherent in longitudinal research in military populations, and indicate the need
for further longitudinal study of the extent to which psychological resilience changes over time and is linked to various outcomes.

**Ongoing Challenges in Longitudinal Resilience Research**

One of the main challenges in studying resilience longitudinally reflects the difficulty of assessing resilience as a dynamic process. Variations in factors such as hardiness or social support over time can make it problematic to study how such characteristics affect outcomes, and the results observed will likely reflect the timing of measures. Since research is limited by the particular follow-up periods used, changes that occurred between survey administrations or clinical assessments are unknown. For example, the conflicting results regarding the protective effects of social support may reflect challenges in accurately assessing social support in longitudinal studies of resilience, given high levels of variation over time. Indeed, Sudom, Lee, and Zamorski (2014) observed greater than expected individual variation in social support over an average of six years in their pilot study of Canadian military personnel. In the military setting, changes in support may be expected when members transition through initial training and into the workplace. However, the extent to which social support fluctuated in the intervening years, or the drivers of such change, are unclear. Assessments of social support and other resilience variables made at the same time as outcome assessments would be the most accurate, although this can also be problematic since mental health outcomes may influence social support networks as well as other aspects of resilience. Furthermore, it may not always be possible to control the timing of assessments, especially when studies are based on existing data of which the administration of particular measures is predetermined. In such instances, it is crucial that researchers clearly identify the sequence in which measures were taken and carefully consider how it may have influenced results.

In order to facilitate the analyses of resilience as a dynamic process, it may help to assess its relevant constructs at a larger number of time points. Surprisingly few studies have included assessments of resilience constructs at three or more time points. Yet, doing so would allow for more sophisticated analytical techniques to be used, such as multilevel analysis, in which variations in resilience over time may be assessed both within and across individuals. Furthermore, mixed method approaches incorporating the collection and analysis of qualitative data could be of use to provide greater context from which to understand changes in resilience. For example, diary studies, in which data are collected on a daily basis, have increasingly been used in organizational research over the past decade, particularly to examine research questions pertaining to stress and health (Ohly et al. 2015). This approach is particularly amenable to examining constructs or processes that fluctuate on an everyday basis and allows for the collection of data in its natural life context (Ohly et al. 2015).

A common issue in many of the studies reviewed was loss to follow up (Sudom, Lee & Zamorski 2014; Phillips et al., 2010). The reasons for this are varied, and may include logistical issues such as changes in contact information over time; it may also
include issues related to respondents’ unwillingness to participate due to, for example, perceived lack of confidentiality since they will have to be made aware that their responses across surveys will be linked. This may be a particularly important issue to consider for military personnel who fear stigma or career repercussions when mental health issues or actions taken during a deployment are being assessed. Methods to reduce loss to follow-up should be considered. For example, where possible, greater efforts to trace participants over time using a variety of methods to obtain contact information can help to ensure that researchers have the most accurate information possible. As well, the use of a telephone survey or in-person interview rather than a mailed paper-and-pencil questionnaire can also help to ensure higher response rates; both methods have been successfully used in large-scale surveys of military and veteran populations in Canada (Thompson et al., 2011).

Third, inconsistent definitions of resilience across studies, as well as the lack of conceptual clarity on how it may change over time or influence outcomes have resulted in the use of multiple approaches for its measurement. Depending on whether it is viewed as a trait, state, process, or outcome, different variables or measures have been used as indicators of resilience, and this may have contributed to further variation in results. Even when conceptualizing resilience in a similar way, researchers have varied in their use of measures. For example, conceptualized as a trait, resilience has been assessed using both a measure of hardiness, and the Connor-Davidson Resilience Scale, which captures a broader range of characteristics. Similarly, inconsistencies in findings pertaining to the protective role of social support may reflect differences in how social support was measured across studies, as either the source, quantity, or quality of social support. Accordingly, longitudinal research on resilience should be conducted within a clear theoretical framework in order to facilitate comparisons across studies. Although some researchers have taken a limited approach to the definition and measurement of resilience (e.g., by assessing resilience as the absence of a mental health diagnosis), the definition adopted by the TtCP, which captures resilience in terms of the psychological processes that allow individuals to return to previous levels of well-being following adversity, is broad enough to allow for the consideration of the factors that may directly or indirectly affect well-being.

Finally, many studies have used analytical techniques such as correlations or t tests to examine resilience across time. However, for studies in which a sufficient sample size can be obtained, more robust statistical methods, such as path analysis or multilevel modelling, could yield different results. Taking full advantage of the range of techniques that longitudinal designs allow would provide further insight into the process of resilience.

Conclusions

This paper reviewed the literature on psychological resilience across TtCP nations, focusing on a range of psychological and behavioural outcomes, including mental health, post-traumatic growth, violence and aggression, and training success, as well as the processes that may mediate or moderate the relationship between trauma and outcomes,
such as hardiness and social support. Although the numbers of cross-sectional studies on psychological resilience have increased over the past 10 years, there are still relatively few longitudinal studies on resilience in military populations, especially outside of the US. As well, the results of the studies are varied, due at least in part to differences in methodological and theoretical approaches across studies. Longitudinal studies are inherently more complex and costly; however, such studies are important in order to examine the process of resilience in relation to mental health and other outcomes, as well as in determining how resilience changes over time and is affected by deployment and other military stressors. Such research will also help to identify factors to target in resilience-building programmes and intervention, and to identify groups who may be most at risk for the development of mental health problems. Evidence for the importance of factors such as hardiness and social support in mental health and other important outcomes suggest that efforts to enhance resilience, such as through support programmes or through military training aimed at enhancing certain characteristics, may be of benefit to personnel. Resilience-building interventions throughout the military career may help to prevent or attenuate the potentially harmful effects of stressors such as combat deployment. Finally, the identification of characteristics that predict success in military selection and training programs (e.g., hardiness) may help in designing training to enhance resilience in military personnel.
## Appendix

### Summary of Papers Included in Review of Longitudinal Resilience Research

<table>
<thead>
<tr>
<th>Source</th>
<th>Nation</th>
<th>Participants</th>
<th>Resilience Concept</th>
<th>Outcome</th>
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<tbody>
<tr>
<td>Badour, Blonigen, Boden, Feldner &amp; Bonn-Miller (2012)</td>
<td>US</td>
<td>1073 veterans admitted to rehabilitation programme between 2000 and 2008 and resistant to treatment</td>
<td>Coping</td>
<td>PTSD and avoidance coping</td>
<td>Avoidance coping scales from Brief COPE, PTSD Checklist – Military (PCL-M)</td>
<td>Measures taken at programme intake, discharge, and 3 months after completion via paper surveys, cross-lagged path analysis</td>
<td>Greater avoidance coping at intake predicted more severe PTSD symptoms at discharge; PTSD symptoms at discharge predicted more avoidance coping at follow-up</td>
<td>Avoidance coping may predict poorer treatment response in those seeking treatment for PTSD</td>
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<tr>
<td>Baker et al. (2012)</td>
<td>US</td>
<td>2,600 Marines in 4 battalions deployed to Iraq or Afghanistan</td>
<td>Risk and resilience factors measured by a range of measures of physical and mental health</td>
<td>PTSD</td>
<td>Measures of arousal, cardiovascular and physical fitness, mental health (PTSD Checklist, 12-item Short Form Health Survey, International Classification of Disease 9), stress reactivity, genetics, neurocognitive function, deployment stressors, social and military support</td>
<td>Structured clinical interviews on Marine bases conducted at 4 times: at pre-deployment and at 1 week, 3 months, and 6 months post-deployment; combined with medical and personnel data</td>
<td>A moderate positive relationship between deployment history and PTSD prevalence was found</td>
<td>Pre-deployment factors may affect vulnerability to developing later PTSD</td>
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<tr>
<td>Barnes, Nickerson, Adler &amp; Litz (2013)</td>
<td>US</td>
<td>1039 soldiers deployed on a peacekeeping mission in Kosovo</td>
<td>Perceived organizational support (POS)</td>
<td>Perceived organizational support and mental health</td>
<td>Peacekeeping events scale, deployment stressors, PCL, perceived organizational support</td>
<td>Longitudinal study with 4 time points: before deployment, near the end of deployment, 3-4 months after and 8-9 months after</td>
<td>Only the path between previous PTSD and subsequent POS was significant and negative, but POS was not associated with subsequent PTSD</td>
<td>Prior stress symptoms may influence perceptions of organizational support</td>
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<td>Bartone, Kelly &amp; Matthews (2013)</td>
<td>US</td>
<td>2383 cadets in West Point class of 2005/6</td>
<td>Hardiness components of challenge, commitment and control; total hardness</td>
<td>Military Programme Score (MPS) at senior year; self- and commander ratings of leader adaptability 3 years after graduation</td>
<td>Dispositional Resilience Scale</td>
<td>Baseline measures taken at entry into West Point, outcome measures taken during senior year and 3 years after graduation; sequential regression analysis with SAT and Whole Candidate Scores as covariates</td>
<td>Commitment and control positively associated with MPS, but challenge negatively associated with MPS; commitment and control positively associated with self-ratings of adaptability; control positively associated with commander ratings of adaptability</td>
<td>Should treat hardiness components separately; challenge facet may not yield good findings in contained training environment, but may be more adaptive later on</td>
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<td>Bartone, Roland, Picano &amp; Williams (2008)</td>
<td>US</td>
<td>1138 U.S. Army Special Forces candidates</td>
<td>Hardiness</td>
<td>Completion of US Special Forces course</td>
<td>Dispositional Resilience Scale</td>
<td>Surveys administered before and after completion of course</td>
<td>Special Forces course graduates were significantly higher in psychological hardness compared to non-graduates</td>
<td>Psychological hardness is an important factor associated with successful performance in highly demanding situations</td>
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<tr>
<td>Boasso, Steenkemp, Nash, Larson &amp; Litz (2015)</td>
<td>US</td>
<td>892 Marines from the Marine Resiliency Study</td>
<td>True Resilience (low symptoms after high combat exposure); Artifactual Resilience (low symptoms after low combat exposure)</td>
<td>PTSD</td>
<td>Combat Experiences Scale (CES); Clinician Administered PTSD Scale (CAPS); PTSD Checklist - Specific version (PCL-S);</td>
<td>Surveys and clinician interviews at four time points: 1 month pre-deployment, and 1, 5, and 8 months post-deployment; Growth mixture modelling to examine PTSD trajectories</td>
<td>Marines with higher combat exposure showed a temporary increase in PTSD symptoms followed by a gradual decrease (True Resilience); Marines with lower combat exposure had consistently low symptoms (Artifactual Resilience)</td>
<td>Resilience is characterized by a clinically significant increase in PTSD symptoms, which subsequently decline over time</td>
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<td>Bonnano et al. (2012)</td>
<td>US</td>
<td>3393 National Guard, reserve or active duty personnel in all branches who deployed once; 4396 who deployed multiple times</td>
<td>Trajectories of PTSD symptoms</td>
<td>PTSD</td>
<td>Post-deployment Checklist – Civilian version (PCL-C), 36-item Short Form Health Survey (SF-36) Physical Component Summary score, Social Readjustment Rating Scale, alcohol consumption (heavy weekly drinking and binge drinking), lifetime smoking habits, combat experiences, injury status</td>
<td>Self-reports obtained prior to deployment and two follow-ups spaced 3 years apart; PTSD trajectories examined using latent growth mixture modelling</td>
<td>Similar trajectories found for single and multiple deployers; low PTSD from pre- to post-deployment was most common trajectory</td>
<td>Most remain without PTSD after exposure to adversity; relationship of less favourable trajectories with drinking and smoking may indicate tendency of individuals to use these as less adaptive forms of coping</td>
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<td>Bridger, Brasher, Dew &amp; Kiliminster (2011)</td>
<td>UK</td>
<td>4949 Royal Navy personnel were sent phase 1 survey, stratified by branch; N=2596 at phase 1; N=1305 at phase 2</td>
<td>Coping, leader support, positive affect, perceived control</td>
<td>Psychological strain</td>
<td>Occupational stressors, coping styles inventory, Positive and Negative Affect Schedule (PANAS); 12-item General Health Questionnaire (GHQ-12)</td>
<td>Prospective paper and pencil survey with phase 1 in 2007 and phase 2 one year later; multiple linear regression to identify factors at Phase 1 that predicted strain at Phase 2</td>
<td>Lack of autonomy and control and dissatisfaction with living conditions predicted strain twelve months later for those serving on ships, but not for those ashore</td>
<td>Work environment can affect psychological health of personnel serving on ships</td>
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<td>Britt, Dickinson, Moore, Castro &amp; Adler (2007)</td>
<td>US</td>
<td>1685 U.S. soldiers who were on a peacekeeping mission in Kosovo</td>
<td>Morale, confidence in unit functioning and leadership, engagement in meaningful work</td>
<td>PTSD; costs and benefits of deploying</td>
<td>Morale scale; Centre for Epidemiological Studies-Depression scale (CES-D); meaningful work; confidence in unit functioning; deployment stressors; work overload; benefits and costs of deployment; PCL-C</td>
<td>Measures taken at mid-deployment and post-deployment; structural equation modelling</td>
<td>Engagement in meaningful work and confidence in unit functioning and leadership predicted morale; negative experiences during deployment predicted depression</td>
<td>Correlates and consequences of morale are different than those of depression; positive and negative well-being are not along same continuum</td>
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<td>Cigrang et al. (2014)</td>
<td>US</td>
<td>164 U.S. security forces airmen</td>
<td>Social support</td>
<td>PTSD, depression and alcohol use</td>
<td>Combat exposure adapted from peacekeeping experiences scale, PCL-M, 9-item Patient Health Questionnaire (PHQ) depression scale, Alcohol Use Disorders Identification Test (AUDIT), Marital Satisfaction Inventory-Brief Form, Multidimensional Scale of Perceived Social Support</td>
<td>Surveys administered prior to, during and 6-9 months after deployment to OIF</td>
<td>1/3 of those who were in a relationship pre-deployment were breaking up or broken up at follow-up; significant increases in PTSD, depression and AUDIT scores post-deployment; resilient airmen reported more social support and fewer combat events</td>
<td>Effects of deployment related to levels of traumatic experiences and do not spontaneously remit in first 6-9 months post-deployment, particularly when social support is low</td>
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<tr>
<td>Crane, Forbes &amp; Elliott (2012)</td>
<td>AUS</td>
<td>Enlistees with surnames L-Z and all officer appointees (N=1294); from Army, Navy, and Air Force</td>
<td>TTCP definition</td>
<td>Distress; PTSD; somatic symptoms; sleep impairment; alcohol use; general health</td>
<td>10-item Kessler Distress scale (K10); 4-item PCL-C; AUDIT alcohol consumption items; Dimensions of anger reactions scale; PHQ; sleep impairment index, 2-item Connor-Davidson Resilience Scale (CD-RISC); arousal knowledge, coping flexibility, Brief COPE, confidence in helping others, self-efficacy, perceived stigma</td>
<td>Measures pre-military factors and sample followed over 5 waves (baseline, after 3 month training for enlistees and 6-12 months for officers, and annually after that)</td>
<td>Increase in distress, PCL-C scores, anger and sleep problems from baseline to Time 2 for general enlistees; increase in alcohol use for officers; decrease in arousal knowledge, coping flexibility, support seeking, confidence in helping others and self-efficacy in all groups</td>
<td>Increases in symptoms and decreases in resilience likely reflect timing of assessments during training - a stressful period</td>
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<tr>
<td>Crane et al. (2012)</td>
<td>AUS</td>
<td>Full-time general enlistees with surnames between L-Z and all appointed Officers entering ADF between November 2009 and December 2012 (expected N=1200)</td>
<td>Adopts TTCP definition of resilience and emphasizes that it is a process existing in the context of adversity and involving trajectories</td>
<td>Distress; PTSD; somatic symptoms; sleep impairment</td>
<td>Resilience; K10; impact on functioning; self-rated health; self-efficacy; stigma; life satisfaction; smoking; AUDIT-C; anger; personality index; supportive and negative interactions; social identification with ADF; community Participation; social networking site use; morale; mate support; coping strategies; access to professional support; mental health literacy; thought control; ruminative response; flexible coping; stressful events; potentially traumatic events; PCL-C; 15-item PHQ somatic symptoms scale; Sleep Impairment Index</td>
<td>Longitudinal cohort study with panel design involving 5 waves of data collection at pre-enlistment, 1 year, 2 years, and 3 years after basic training completed</td>
<td>Outlines the protocol and challenges of the study</td>
<td>Outlines the methodology and challenges of studying resilience longitudinally in military populations</td>
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<tr>
<td>Dolan &amp; Adler (2006)</td>
<td>US</td>
<td>629 U.S. soldiers stationed at a US base in Germany who were deployed to Kosovo for a 6 month peacekeeping mission</td>
<td>Military hardiness</td>
<td>Physical and mental health</td>
<td>Deployment Stressors Scale, Physical Symptoms Scale (PSS), Military Hardiness Scale, CES-D</td>
<td>Surveys administered during and after deployment; Hierarchical moderated regression</td>
<td>Military hardiness associated with better psychological health during and after deployment; hardiness moderated the impact of stressors on depression</td>
<td>Military-specific hardiness is important for mental health among those exposed to high levels of deployment stress</td>
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<tr>
<td>Elbogen et al. (2014)</td>
<td>US</td>
<td>Sex-stratified random sample of veterans who served after 9/11 in OEF or OIF (N=1090)</td>
<td>Resilience; self-determination; social support; self-care; employment; meets basic needs; no pain; healthy sleep</td>
<td>Violence and aggression at Wave 2</td>
<td>CD-RISC; Quality of Life Interview; PHQ sleep index; family violence and criminal arrests; combat exposure; Davidson Trauma Scale (DTS); Loss of Consciousness; AUDIT; Drug Abuse Screening Test; Conflict Tactics Scale; MacArthur Community Violence Scale</td>
<td>Two wave study (2009/10 and 2010/1); web or paper surveys; stratified analyses by risk group (high or low based on baseline exposures)</td>
<td>Protective mechanisms associated with violence in high-risk group include resilience, self-determination, social support, self-care, employment; decrease in odds of violence in low risk group of 11%, while decrease of 25% in high risk group when protective factors are high</td>
<td>Interventions to reduce homelessness, retain veterans for civilian work, enhance financial literacy, improve social support may help reduce violence; value of resilience training in rehabilitation programmes</td>
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<td>Franz et al. (2013)</td>
<td>US</td>
<td>670 regular active duty and 104 National Guard Army soldiers who deployed as part of OIF between 2003 and 2005 and were part of the Neurocognition Deployment Health Study</td>
<td>Perceived preparedness, unit cohesion, prior stressors</td>
<td>Post-deployment PTSD</td>
<td>PCL-C; Perceived Threat Scale; adapted CES; post-deployment stressors and unit cohesion measured with Prior Stressors and Social Support modules from Defence Risk and Resilience Inventory (DRRI); Perceived Preparedness module</td>
<td>Paper surveys administered pre-deployment and post-deployment on average 73.5 days after tour for active duty and 197.5 after tour for National Guard</td>
<td>Pre-deployment PTSD, prior deployment, unit cohesion, and preparedness associated with deployment threat appraisal; threat appraisal mediated the relationship between these predictors (except cohesion) and PTSD severity</td>
<td>Resilience factors may exert their effect by influencing threat appraisal; multiple pre-deployment risk factors may predict threat appraisal beyond combat intensity</td>
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<tr>
<td>Gerling (2015)</td>
<td>NZ</td>
<td>Sample of 210 instructors and recruits in a resilience training programme</td>
<td>Mental health stigma: confidence in ability to help others</td>
<td>Mental health stigma; confidence in ability to help others</td>
<td>Attitudes towards mental health, help seeking and supporting others; learner reactions to the material measured with both quantitative and qualitative questions</td>
<td>Data collected before and after Hardiness lesson during recruit training</td>
<td>Significant improvements in mental health stigma after lesson; improved confidence in ability to help others</td>
<td>Stigma may be good target for Hardiness lesson</td>
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<tr>
<td>Green, Beckham, Youssef &amp; Elbogen (2014)</td>
<td>US</td>
<td>Active duty and reserve force participants of the National Post-Deployment Adjustment Study (NPADAS); N=1388 with follow up of N=1099</td>
<td>Ability to thrive despite adversity; dynamic multidimensional construct comprising protective processes that aid to find positive meaning in stressful situations</td>
<td>AUDIT (continuous scores and above versus below cut-off)</td>
<td>CD-RISC; CES; DTS; AUDIT</td>
<td>Web-based survey at baseline and at one-year follow-up; multiple linear regression and multiple logistic regression</td>
<td>Resilience decreased for 39%; remained the same for 12% and increased for 49%; lower resilience at baseline predicted alcohol misuse at one-year follow-up</td>
<td>Resilience is a dynamic process; increased resilience is protective against alcohol misuse</td>
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<tr>
<td>Han et al. (2014)</td>
<td>US</td>
<td>1008 male regular active duty and National Guard soldiers</td>
<td>Unit support; post-deployment social support</td>
<td>PTSD</td>
<td>PCL-C, CES of DRRI, Post-deployment stressful life events DRRI scale, Unit support scale of DRRI, General social support scale from DRRI</td>
<td>Surveys administered 90-110 days prior to deployment and 70-200 days after deployment; multiple regression analyses</td>
<td>Pre-deployment unit support not associated with post-deployment PTSD; higher unit support during deployment associated with lower post-deployment PTSD among active duty only; higher post-deployment social support associated with lower post-deployment PTSD</td>
<td>Both active duty and National Guard soldiers may benefit from stronger post-deployment social support, particularly from friends and family for National Guard soldiers; may be beneficial to find ways to increase social support among returnees</td>
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<td>Hourani et al. (2012)</td>
<td>US</td>
<td>US Marines preparing to discharge (N=475)</td>
<td>Personal qualities that enable one to thrive in the face of adversity</td>
<td>Combined positive screen on at least one of anxiety, depression or PTSD plus some level of functional impairment</td>
<td>CD-RISC; Combat Exposure Scale; Multidimensional Scale of Social Support; post-deployment stressors scale; Post-Deployment Health Reassessment; Overall Stress Index; number of pain sites; previous trauma; risk-taking; health behaviours; CES-D; PHQ; PCL-C</td>
<td>Baseline paper surveys during pre-separation workshop; follow-up survey approximately 6 months later (web survey option)</td>
<td>Risk factors for mental health problems included higher pre-separation combat exposure, post-separation stress, and experiencing multiple areas of pain after separation; protective factors include having higher scores on pre-separation resilience and perceived social support at follow-up</td>
<td>Resilience has a greater impact on functional impairment than on mental health symptoms; role of resilience is in maintaining functionality despite having a mental health problem; social support bolsters resilience, but stress erodes it</td>
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<tr>
<td>Kline et al. (2013)</td>
<td>US</td>
<td>922 New Jersey National Guard soldiers (91 women) deployed to Iraq in 2008-2009</td>
<td>Military preparedness and unit cohesion</td>
<td>PTSD, post-traumatic stress score</td>
<td>PCL-C; 9-item PHQ depression scale; alcohol items from National Household Survey on Drug Use and Health; other mental health problems; Allen’s Trauma History Screen; Carney’s military preparedness scale; Combat Exposure Scale; unit cohesion scale from DRRI</td>
<td>Surveys administered during mandatory pre-deployment screening and during mandatory reintegration events 3 months post-deployment; hierarchical multiple regression</td>
<td>Higher prevalence of post-traumatic stress symptoms risk factors for women than men (higher pre-deployment PTSD and depression symptoms, lower military preparedness and unit cohesion); higher post-deployment PTSD among women; gender difference attenuated when risk/protective factors controlled</td>
<td>Differences in perceived preparedness and unit cohesion may account for some of the sex differences in post-deployment mental health outcomes</td>
</tr>
<tr>
<td>Lee, Sudom &amp; Zamorski (2013)</td>
<td>CAN</td>
<td>1584 male CAF Regular Force members who were deployed between 2008 and 2010 in support of the Afghanistan mission and reported at least 1 combat event</td>
<td>TTCP definition</td>
<td>SF-36 Mental Component Summary (MCS) score</td>
<td>PANAS, adapted Bartone Hardiness scale, Mastery scale, Big Five Inventory, Social Support Scale; SF-36, CES</td>
<td>Paper survey during basic training and between 90 to 180 days after return from deployment; examined direct and interactive effects of resilience characteristics</td>
<td>Direct effects of conscientiousness, neuroticism and positive social interaction as expected, but direct effects of positive affect and affectionate support contrary to hypotheses; marginal interactive effect of agreeableness contrary to hypotheses</td>
<td>Unexpected results may be due to changes in resilience characteristics since baseline and emphasize the need to assess these characteristics at different time points; results emphasize need to explore changes in resilience over time</td>
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<tr>
<td>Liddell</td>
<td>NZ</td>
<td>76 recruits in basic training out of initial 127, mostly between 16 and 19 years and male</td>
<td>Resilience, grit, self-efficacy, distress, coping (problem focused and emotion focused)</td>
<td>Resilience, grit, self-efficacy, distress</td>
<td>GRIT scale, Brief Resilience Scale, K10, General Self-Efficacy Scale, Coping Style Preference (problem-focused, social support, avoidance)</td>
<td>Survey administered in first week of basic and final week of basic</td>
<td>Decrease in grit and resilience after training but not in self-efficacy or distress; Time 1 problem focused coping associated with higher Time 2 grit; Time 1 grit associated with Time 2 resilience and self-efficacy; Time 1 resilience associated with Time 2 distress; Time 1 self-efficacy associated with Time 2 grit and resilience</td>
<td>Resilience may increase once sufficient recovery from basic has taken place</td>
</tr>
<tr>
<td>Meis, Barry, Kehle, Erbes &amp; Polusny (2010)</td>
<td>US</td>
<td>223 married or coupled Minnesota National Guard soldiers deployed to OIF</td>
<td>Relationship adjustment</td>
<td>Participant reports of treatment utilization over following year</td>
<td>Abbreviated Dyadic Adjustment Scale; items from Navy Quality of Life Survey; PCL-C; mental health services utilization (MHSU)</td>
<td>Surveys administered 2-3 months after return from OIF and one year later; logistic regression to examine main and interactive role of variables with MHSU</td>
<td>PTSD symptom severity associated with higher MHSU; lower relationship adjustment associated with higher MHSU; as relationship adjustment improved, association between PTSD and MHSU was strengthened</td>
<td>Support inherent to relationship may facilitate treatment use in those with greatest need for treatment</td>
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<td>O'Donnell et al. (2015)</td>
<td>AUS</td>
<td>7943 ADF personnel recruited from 2009-2014</td>
<td>Coping styles</td>
<td>Mental health (depression, anxiety, and PTSD)</td>
<td>Lifetime Trauma Exposure Checklist (LTEC), Brief COPE scale, K10, PCL-C</td>
<td>Surveys completed at two time points: enlistment (Enlistees)/early training (Officers), and end of training (Enlistees)/12 months into training (Officers)</td>
<td>Prior trauma had little effect on mental health; coping styles measured prior to training did not play an important role in mediating the relationship between prior trauma exposure and mental health</td>
<td>A range of factors other than prior trauma exposure may contribute to mental health problems after training</td>
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<tr>
<td>Park &amp; Peterson (2012)</td>
<td>US</td>
<td>Over 550 soldiers in 4th Infantry Division study</td>
<td>Resilience trajectories; post-traumatic growth; dispositional affect; meaning; optimism; coping; social support; leadership support</td>
<td>Satisfaction with life; low depressive symptoms and PTSD</td>
<td>Satisfaction with Life Scale, PANAS, Brief COPE, Meaning in Life Scale, Orientation to Happiness scale, Psychological Capital questionnaire, Hardiness, Big Five, Mattering, Short-Form Mississippi PTSD, CES-D, Posttraumatic Growth Inventory (PTGI), Authentic Leadership, Multifactor Leadership Questionnaire</td>
<td>First three waves of data collection before, during and after deployment to Iraq; measures taken using paper and pencil surveys</td>
<td>Well-being decreased during deployment, but increased again immediately post-deployment; factors predicting well-being post-deployment included positive affect, optimism, unit cohesion, trust, social support, meaning</td>
<td>Factors associated with well-being following deployment include psychological, social, family, and spiritual fitness; these factors also predicted growth but to a lesser extent</td>
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<tr>
<td>Polusny et al. (2011)</td>
<td>US</td>
<td>522 National Guard soldiers from the Readiness and Resilience in National Guard Soldiers (RINGS) study</td>
<td>Military preparedness and unit cohesion</td>
<td>New-onset PTSD</td>
<td>Time 1: PCL-C; DRRI scales (Prior Stressors, Concerns about Family Life; Childhood Family Environment, Preparedness, Unit Social Support); Time 2: PCL-M; DRRI scales (Combat Experiences, Aftermath of Battle, Perceived Threat); Post-Deployment Stressors Scale; Post-Deployment Support Scale</td>
<td>Surveys administered one month prior to deployment and 2-3 months after return; hierarchical logistic regression</td>
<td>4-fold increase in new-onset PTSD after deployment; PTSD was predicted by pre-deployment stressors and perceptions of military preparedness</td>
<td>Study suggests vulnerability and protective that factors for PTSD that can be used in prevention strategies</td>
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<tr>
<td>Polusny et al. (2014)</td>
<td>US</td>
<td>712 men and 89 women who were National Guard soldiers from two Brigade Combat Teams deployed in OEF or OIF</td>
<td>Perceived preparedness; unit support</td>
<td>PTSD</td>
<td>Time 1: PCL-C, DRRI scales (Prior Stressors, Deployment Social Support, Preparedness, Concerns about Family Life); Time 2: PCL-M, DRRI scales (Combat Experiences, Aftermath of Battle, Sexual Harassment)</td>
<td>Surveys administered 1 month prior to deployment and 2-3 months after</td>
<td>Higher post-deployment PTSD in women, PTSD even after controlling for risk and protective factors; interpersonal victimization and concerns about family more salient but unit support less salient for women</td>
<td>Effects of pre-deployment risk/protective factors for risk of post-deployment PTSD differ by gender</td>
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<tr>
<td>Ressler &amp; Schoomaker (2014)</td>
<td>US</td>
<td>Series of studies of different Army cohorts; Historical Admin Data Study; New Soldier Study, All Army Study; Clinical Reappraisal Study; Soldier Health Outcomes Study; Pre/Post Deployment Study</td>
<td>Suicidal behaviours, mental health</td>
<td>Suicidal behaviours</td>
<td>Measures of mental health, role functioning, suicidal ideation and behaviours</td>
<td>Project includes studies to develop methods for mitigating or preventing suicide behaviours and improving mental health and behavioural functioning of soldiers during and after Army service</td>
<td>Pre-enlistment mental health problems predicted suicide attempts and role impairment; predictors of Army suicides were largely similar to those reported elsewhere for civilians</td>
<td>Goal is to identify modifiable risk and protective factors in order to provide mental health and well-being prevention and interventions that are in parallel with successful efforts</td>
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<tr>
<td>Roesch, Aldridge, Vickers &amp; Helvig (2009)</td>
<td>US</td>
<td>673 U.S. Navy recruits in study on personality, mood and well-being</td>
<td>Coping, social support, personality; Coping flexibility in terms of using appropriate coping for situation and self</td>
<td>Positive and negative affect</td>
<td>Abbreviated NEO Personality Inventory; Ways of Coping Questionnaire; 20-item Naval Health Research Centre Mood Questionnaire</td>
<td>Measures taking prior to basic training in group sessions via paper survey, and weekly administrations after that for 7 weeks</td>
<td>Individuals high on neuroticism or agreeableness, or low on conscientiousness, who used more avoidance coping had higher negative affect; those high in extraversion who used more approach coping and those low in agreeableness who used more avoidance coping had higher positive affect</td>
<td>Importance of considering behavioural-concordance model of coping in developing interventions</td>
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<td>Rona et al. (2009)</td>
<td>UK</td>
<td>1885 respondents across all military branches</td>
<td>PTSD and psychological distress</td>
<td>PTSD and psychological distress</td>
<td>Baseline survey: PCL-C, GHQ-12, physical symptoms, SF-36; Follow-up survey: same measures, deployment exposures and perceptions of unit support based on Land Combat Study and U.S. Deployment Experiences Survey</td>
<td>Baseline measures taken in 2002 at entry and follow-up measures taken 2-4 years later</td>
<td>Psychological symptoms at baseline, combat exposure, and unit support associated with PTSD and psychological distress; many combat exposure items associated with PTSD, but fewer associated with distress; unit support protective against distress</td>
<td>Pre-deployment screening would be unlikely to prevent PTSD, as strongest predictor is trauma itself; improving support may help prevent psychological symptoms</td>
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<tr>
<td>Segovia, Moore, Linnville, Hoyt &amp; Hain (2013)</td>
<td>US</td>
<td>224 repatriated Vietnam prisoners of war (RPW)</td>
<td>Intact psychological functioning despite trauma</td>
<td>Resilience defined as never having any psychiatric diagnosis over the 37 year period</td>
<td>Captivity duration, solitary confinement, torture, sleep difficulties assessed as part of Initial Medical Evaluation Form for period before, during and after captivity</td>
<td>Initial measures taken during medical exam in 1973 and outcome measured in 2010; participants receive annual evaluations</td>
<td>Resilient RPW less likely to report sleep disturbances before, during or after captivity; least resilient were those who experienced sleep disturbances during or after captivity; most resilient never experienced sleep disturbances</td>
<td>Self-reported sleep quality may contribute to ability to maintain health following trauma and can be used to identify at risk individuals</td>
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<tr>
<td>Sudom, Lee &amp; Zamorski (2014)</td>
<td>CAN</td>
<td>34 CAF Regular Force members (14 deployed, 20 control) with response rate of 17%</td>
<td>TTCP definition</td>
<td>Resilience characteristics</td>
<td>PANAS, adapted Bartone Hardiness scale, Mastery scale, Big Five Inventory, Social Support Scale</td>
<td>Paper survey during basic training and, on average, 6.6 years after</td>
<td>At group level, conscientiousness increased and social support decreased; at individual level, greater than expected variation was observed for conscientiousness, neuroticism, openness, hardiness and social support</td>
<td>Limitations of this approach for wider scale longitudinal studies; resilience characteristics are dynamic and more dynamic approaches are needed</td>
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<tr>
<td>Tsai, Sippel, Mota, Southwick &amp; Pietrzak (2016)</td>
<td>US</td>
<td>Nationally representative sample of 1,838 US veterans who reported at least one potentially traumatic event</td>
<td>Course of posttraumatic growth (PTG)</td>
<td>Post-traumatic growth</td>
<td>Trauma History Screen, PCL-S, PTGI-Short Form, 15 validated measures grouped using exploratory factor analysis into 8 factors (physical health, mental health, substance abuse, protective psychosocial characteristics, social connectedness, altruism, spirituality, active lifestyle)</td>
<td>Web-based surveys completed at two time points (October-December 2011 and September-October 2013); trajectories examined using hierarchical linear modelling</td>
<td>Five courses of PTG identified: Consistently Low (33.6%), Moderately Declining (19.4%), Increasing (16.8%), Dramatically Declining (15.7%); Consistently High (14.5%); PTSD, medical conditions, purpose in life, altruism, gratitude, religiosity, and active reading lifestyle predicted maintenance or increase in PTG</td>
<td>Different courses of PTG can occur; PTG is common, can persist over time, and is associated with posttraumatic stress and certain psychosocial factors</td>
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<td>Vasterling et al. (2010)</td>
<td>US</td>
<td>1083 (774 deploying and 309 non-deploying) active duty or National Guard soldiers</td>
<td>Life and family concerns and postwar stressors</td>
<td>PTSD</td>
<td>PCL-C, DRRI measures (combat experiences, post-battle experiences, deployment concerns, life and family concerns, post-deployment life events)</td>
<td>Written surveys conducted in small groups at pre- and post-deployment</td>
<td>Deployed, but not non-deployed, soldiers reported increased PTSD symptom severity from Time 1 to Time 2, deployment-related stressors contributed to longitudinal increases in PTSD symptoms</td>
<td>The study provides evidence that war-zone deployment leads to increased PTSD symptoms; multiple determinants of deployment-related increases in PTSD suggest opportunities for prevention programmes</td>
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<tr>
<td>Vogt, Rizvi, Shipherd &amp; Resick (2008)</td>
<td>US</td>
<td>1571 male and female Marine Recruits who participated in a stressful training program</td>
<td>Stressful events may impact hardness and social support may buffer their impact</td>
<td>Stress reactions and hardness</td>
<td>Training stress, brief Bartone Hardiness Scale, perceived social support from unit members and unit leaders, PANAS</td>
<td>Longitudinal panel design with surveys done at day 5 of 13-week basic training and 2 days before graduation; structural equation modelling</td>
<td>For both genders, the negative impact of stress reactions on hardness was strongest when social support was low; stress reactions predicted enhanced hardness when social support was high for women only</td>
<td>Social support can help preserve internal resources in the face of stress; hardness is protective against stress; these effects may only apply to men; for women, stress reactions may increase hardness when support is high</td>
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<tr>
<td>Weidlich (2013)</td>
<td>US</td>
<td>93 Army nurses, Licensed Practical Nurses and Medics undergoing Care Provider Support Programme (CPSP) resiliency training</td>
<td>Resilience and coping</td>
<td>Resilience and coping</td>
<td>CD-RISC, Ways of Coping, Professional Quality of Life</td>
<td>Prospective cohort study with assessment prior to and after receiving resiliency training</td>
<td>No change in resilience or coping after CPSP, but burnout was significantly reduced after training</td>
<td>Resiliency training was effective in reducing burnout, which leads to decreased compassion fatigue</td>
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<tr>
<td>Youssef, Green, Beckham &amp; Elbogen (2013)</td>
<td>US</td>
<td>176 OEF and OIF veterans, separated from active duty or in National Guard</td>
<td>Resilience defined as qualities that enable one to thrive in the face of adversity, possibly a protective factor in suicide risk</td>
<td>Suicide ideation</td>
<td>Beck Suicide Ideation scale, CD-RISC, DTS, AUDIT</td>
<td>Prospective study with baseline interviews and follow-up interviews 3 years after</td>
<td>Baseline resilience predictive of suicidality; low resilience stronger predictor than alcohol misuse and PTSD; secure relationships and positive acceptance of change most strongly protective</td>
<td>Assessing resilience can provide insights into clinical status and suicidality</td>
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Bibliography


