

High Adversity Resilience Training (HART): Development for emergency responders and defence



Authors:

Jurie G. Rossouw¹ 
 Jörgen Herlofson² 
 Dirk J. Geldenhuys³ 
 Chelsea L. Erieanu⁴ 

Affiliations:

¹Hello Driven Pty Ltd, Sydney, Australia

²Empatica AB, Uppsala, Sweden

³Department of Industrial and Organisational Psychology, Faculty of Economic and Management Sciences, University of South Africa, Pretoria, South Africa

⁴Unaffiliated, Sydney, Australia

Corresponding author:

Jurie Rossouw,
j@hellodrivn.com

Dates:

Received: 07 June 2023

Accepted: 14 Feb. 2024

Published: 22 Mar. 2024

How to cite this article:

Rossouw, J.G., Herlofson, J., Geldenhuys, D.J., & Erieanu, C.L. (2024). High Adversity Resilience Training (HART): Development for emergency responders and defence. *Journal of Applied Neurosciences*, 3(1), a8. <https://doi.org/10.4102/jan.v3i1.8>

Copyright:

© 2024. The Authors.
 Licensee: AOSIS. This work is licensed under the Creative Commons Attribution License.

Read online:



Scan this QR code with your smart phone or mobile device to read online.

Orientation: High adversity occupations (HAOs) such as first responders, healthcare workers, and military personnel are subject to extreme exposure to potentially traumatic events (PTEs), thus increasing their risk of mental illness and post-traumatic stress disorder (PTSD). There is a recognised gap in providing comprehensive, proactive resilience training to mitigate these risks effectively.

Research purpose: This study aimed to introduce the High Adversity Resilience Training (HART) programme, designed to equip HAOs with resilience tools through a holistic, preventive approach based on the Predictive 6-Factor Resilience (PR6) model.

Motivation for the study: Existing programmes for HAOs often lack comprehensive and proactive approaches. The HART programme aims to fill this gap, offering a systemic and evidence-based resilience training framework.

Research approach/design and method: The study employs a literature review to identify HAO challenges and the need for preventative resilience programmes, leading to the development of the HART programme.

Main findings: The HART programme provides a comprehensive approach for resilience training that addresses both individual skills and supportive organisational environments, crucial for mitigating adversity in HAOs.

Implications for practice: The findings were incorporated into the HART programme, which includes a comprehensive awareness protocol involving leadership, management, workers, family members, and internal champions. This helps to overcome previous shortcomings and reduce risk for HAO workers.

Contribution/value-add: By integrating neurobiological insights with resilience training, the HART programme presents a novel approach to enhancing resilience in HAOs. This expands on existing theories of occupational stress and resilience, providing a comprehensive model adaptable across various high-adversity settings.

Keywords: resilience; post-traumatic growth; first responders; care providers; mental wellness; emergency responders; strength-based.

Introduction

First responders, healthcare workers, military personnel, and others who respond to emergencies face complex and extreme exposure to potentially traumatic events (PTEs), resulting in elevated risks of mental illness and post-traumatic stress disorder (PTSD) compared to the general population (Dell et al., 2022; Ponder et al., 2023; Stevelink et al., 2020).

The elevated risks in these high adversity occupations (HAOs) are well documented; however, there exists a gap in providing a comprehensive and integrative approach to primary prevention, as programmes tend to be reactive rather than proactive, as well as being isolated (e.g., focussing only on PTSD) rather than systemic (Crane et al., 2021; Dell et al., 2022; Hamling, 2018; McCreary, 2019).

A conceptual pathway to primary prevention is through development of personal resilience, which is defined as the capacity to 'advance despite adversity' (Rossouw & Rossouw, 2016). Resilience acts as a broad protective mechanism against mental ill-health such as burnout (Joyce et al., 2018) and depression (Elisei et al., 2013).

While several programmes and interventions have been trialled to counter this risk by developing protective mechanisms through resilience for HAOs (Crane et al., 2021; McCreary, 2019), McCreary

points out that these programmes often have a scarce evidence base or lack a comprehensive evaluation of their efficacy. Others observe the lack of qualitative research to support prevention of mental illness in HAOs (Rippstein-Leuenerberger et al., 2017; Wild et al., 2020).

In response to this gap in literature, our study introduces the High Adversity Resilience Training (HART) programme, an initiative aimed at equipping HAOs with the tools to build resilience in the face of high adversity. The HART programme, is grounded in the Predictive 6-Factor Resilience (PR6) model, which offers an integrated framework for resilience training that addresses both individual and systemic factors (Rossouw & Rossouw, 2016; Rossouw et al., 201, 2019). Prevention is increasingly proposed to benefit from a comprehensive cultural approach (Al Jowf et al., 2022, 2023; Dell et al., 2022; Hamling, 2018) Consequently, the HART programme, follows in its design to not only mitigate the impact of PTEs but also to foster a systemic culture of resilience that supports HAOs in their demanding roles.

In developing the HART programme, this study provides an evidence-based approach to resilience training targeted specifically for HAOs. By doing so, we aim to shift the paradigm from a focus on individual-centric, post-trauma interventions to a more holistic, preventive, and cultural approach to resilience training.

Method

This study is based on a literature review, consisting of two phases. The challenges identified within high adversity settings are identified, followed by arguments on the importance of preventative programmes and resilience. This phase concludes with the identification of the shortcomings of current training programmes for HAOs, informing the current programme. The second phase of the study offers a detailed description of the HART programme.

To obtain consolidated, integrated theories, scholarly publications by seminal authors were primarily consulted. This was augmented by e-journals located in databases such as EBSCOHost, Emerald, Google Scholar, ProQuest, SAE Publications and ScienceDirect, which cover multidisciplinary subjects. Access to these databases was facilitated through <http://www.unisa.ac.za/library> web portal. Data were also retrieved from the reference lists of publications found during the database searches.

Data-gathering method

Inclusion and exclusion criteria were used to ensure the retrieval of relevant data for this study. This was done by reading the table of contents of books, as well as article abstracts of peer-reviewed articles published in English. The time frame for inclusion was not limited, but was chronologically managed, working backwards from 2023. The keywords used in the search included 'resilience', 'emergency services', 'first responders', 'military', 'PTSD',

'high adversity'. Boolean operators ('and', 'or', 'not') were used to refine and broaden the search results.

Review of findings

High adversity occupations are at a higher risk of damage to their physical and mental health than the general population (Dell et al., 2022; Hamling, 2018; Ponder et al., 2023). As frontline workers, first responders are often exposed to traumatic situations and emergency events where they must mitigate damage and provide care (Wild et al., 2020).

This service comes at a cost: first responders are at a higher risk of ill health – including PTSD, cardiovascular issues, anxiety, and depression (Hamling, 2018). First responders face a higher risk of suicidal ideation and death (Henderson et al., 2016). Many first responders are also shift workers: a demographic that is more at risk of health problems such as peptic ulcer disease, coronary heart disease, and compromised pregnancy outcome (Knutsson, 2003).

The working environment and complexity of organisational structure that characterise HAOs can affect health, as work strain can be magnified in these paramilitary-style, hierarchical structures (Dell et al., 2022; Hamling, 2018). Research on volunteer firefighters shows that an estimated 12% – 16% meet criteria for PTSD (Bryant & Guthrie, 2007). First responders, such as intensive care unit (ICU) workers, also have a higher rate of PTSD than general medical staff (Mealer et al., 2012).

Personal trauma and the degree of exposure can contribute to vicarious trauma (Baird et al., 2006). Vicarious trauma (VT), also called 'compassion fatigue' (CT) when it falls short of a traumatic experience, describes the way in which a professional's perception of the world and themselves can be altered in a harmful way through exposure to the traumatic material of the people they work with.

This can result in a reduced capacity for 'bearing the suffering of clients' (Figley, 1995, p. 7) and a high likelihood of experiencing second-hand psychological distress (Boscarino et al., 2004). First responders are at 'chronic risk' for this type of traumatic stress (Fisher & Abrahamson, 2002).

The resilience of professional healthcare workers can be damaged by the increased amount of workplace strain, which can contribute to burnout and be detrimental to the quality of care they provide (Aiken et al., 2013). First responders such as ICU workers have a higher risk of these issues than general medical staff (Mealer et al., 2012).

Dell et al. (2022) and Hamling (2018) point to a general lack of focus on sources of organisational stress faced in HAOs, including factors such as bureaucracy, workplace conflict, a lack of resources, burden of administrative duties, stigma, and challenges with shift work. This research indicates the tendency of organisational stress to erode resilience capacity of responders to be able to deal with the operational trauma exposure of their occupations, thereby increasing risk of

PTSD, burnout, and other forms of mental ill-health. Challenges regarding relationships with maintaining social and romantic connections further impact support networks valuable for resilience.

Challenges faced by high adversity occupations

Summarising the challenges in literature related to first responders, defence personnel, as well as recent coronavirus disease 2019 (COVID-19) challenges faced (Dell et al., 2022; Hamling, 2018; McAlearney et al., 2022) and Hamling

(2018), challenges that increase mental health risk for HAOs overall are grouped in three categories as illustrated in Figure 1.

Operational

The features of the work most associated with high adversity work, such as actual crisis response, working under pressure, exposure to trauma and death, personal risk of injury and death, and interacting with the public in high stress situations. This is the most common target of intervention programmes.



Note: Operational risks tend to be more visible and more readily associated with HAOs, including managing high pressure crises, life or death situations, personal risk, and trauma exposure. Alternatively, less visible risks include Organisational and Relational risks. Organisational risks include challenges with shift work, administrative burdens, resource availability, stigma, and other workplace factors less commonly associated with this type of work. Relational risks include disengagement with family members, withholding job experiences, and little time to maintain relationships.

FIGURE 1: Risk factors: displaying three categories of risk factors and challenges.

Organisational

These factors erode resilience capacity and are often neglected in programme focus. These include the pressures of shift work, high administrative loads, non-emergency time pressures, tough training regimes, a lack of resources, workplace stigma, rigid command structures and procedures, workplace conflict, and conflicting agendas.

Relational

These ancillary effects of high adversity work on family and social structures further erode resilience capacity, including not wanting or not being allowed to share difficult parts of the job with others, long hours and shift work leaving little time with family and friends, disengagement from family, difficulty maintaining relationships or friendships with people outside the field.

These three risk factors indicate that resilience is not only about building individual resilience skills but also about creating an organisational and social environment that creates safety and supports resilience at a systemic cultural level. Resilience, in this context, transcends the conventional focus on personal fortitude to include a comprehensive framework where the work environment itself acts as a catalyst for or barrier to resilience. The essential premise is that the resilience of individuals working in HAOs is significantly influenced by the organisational culture, policies, and support systems in place. Thus, by addressing the combination of operational, organisational, and relational risk factors collectively, limbic brain reactivity (LBR) can be reduced to protect mental health.

Current first responder interventions

programmes have been developed in response to the risks faced by HAOs. These include the Mental Agility and Psychological Strength training (MAPS), the Road to Mental Readiness (R2MR), the Master Resilience Training (MRT) designed as part of the Comprehensive Soldier Fitness programme (CSF), and the Provider Resilience mobile application (PRMA).

Various responses have been published regarding existing programmes. Some pointed out a lack of prevention efficacy, also not finding effects on social support and coping strategies (Skeffington et al., 2016). Others found low efficacy and little evidence of improvement, possibly because of factors such as classroom-style learning and no ongoing skills training (McCreary, 2019). Some pointed out a lack of scientific rigour prior to implementation (Eidelson & Soldz, 2012), as well as a lack of effect on suicide rates (DSPO, 2020), a lack of impact on secondary traumatic stress, compassion satisfaction, or burnout (Jakel et al., 2016). Current digital interventions are also found to lack a comprehensive evidence base (Wild et al., 2020).

Considering the combination of operational, organisational, and relational challenges faced by HAOs, it becomes evident that enhancing resilience requires a multifaceted cultural approach. Shortcomings regarding previous approaches can

be augmented through incorporating a neuroscience-based approach to build on existing evidence regarding prevention of PTSD and psychopathology. To this effect, we ground the efficacy of included interventions in the HART programme by building on the neurobiological basis of the PR6 model (Rossouw & Rossouw, 2016) as well as recent models of prevention (Al Jowf et al., 2023).

Neurological model for prevention

Stress-related psychopathology is broadly linked to limbic brain structures (Al Jowf et al., 2023; Seo et al., 2019), including amygdala hyperactivity (Morey et al., 2012), and hippocampal (Tural et al., 2018) and hypothalamic-pituitary-adrenal axis changes (Bremner, 2006). Similarly, regulating neural structures are also affected, such as diminished Medial Prefrontal Cortex (MPFC) responses, reduced MPFC blood oxygenation, smaller Anterior Cingulate Cortical volume and decreased functioning (Etkin et al., 2011).

Pharmacological interventions such as glucocorticoid administration have identified the value of halting amygdala overshoot and hyperactivity in preventing and treating PTSD (Henckens et al., 2010). A neurofeedback investigation showed that non-pharmacological yet neuroscience-based strategies such as cognitive and relaxation exercises can reduce limbic reactivity and prevent stress-related psychopathology (Keynan et al., 2019). We summarise these concepts from a preventative perspective as LBR, wherein approaches that can reduce the reactivity of limbic structures such as the amygdala during stress and trauma exposure can prevent maladaptive alterations to neural structures.

Limbic brain reactivity connects with the Allostatic Load Theory by demonstrating the lasting neural changes caused by traumatic stress, such as altered cortisol and norepinephrine responses, altered HPA axis function, and structural changes in the hippocampus and amygdala (Guidi et al., 2021). Further alignment is noticed with Cognitive Appraisal Theory by emphasising the role of structures such as the MPFC and ACC in cognitive control, emotional regulation, and appraisal processes (Webb et al., 2012). Trauma-induced alterations in these structures can impair cognitive appraisal and emotional regulation, influencing an individual's response to stressors and coping strategies (McCammon et al., 1988).

Preventative interventions can play a significant role in mitigating the effects of stress and trauma on the brain. Comprehensive resilience training for HAOs can help establish and strengthen regulatory neural pathways that reduces LBR during exposure to stress or PTEs. The dual-process framework for emotion regulation highlights the need for comprehensiveness (Gyurak et al., 2011). This model shows that explicit regulation techniques provide one aspect of limbic brain regulation through ventrolateral and dorsolateral activation, connecting to reappraisal and breathing techniques included in the composure domain in the PR6 model. Implicit emotion regulation techniques

include those from the vision, tenacity, reasoning, and collaboration domains in the PR6 mode, providing a perspective on how Anterior Cingulate Cortex (ACC) and MPFC regulation of the limbic brain can be achieved.

We explore advanced proactive resilience training techniques in context of HAOs to achieve a reduction in LBR, offering a level of neural protection that decreases the risk of developing trauma-related mental health issues. In order to augment this search and build a comprehensive programme to equip individuals and organisations with the tools and strategies to protect mental well-being, we explore gaps and criticism of current programmes.

Gaps in resilience training for high adversity occupations

One review of preventative programme for first responders found 12 significant gaps in the knowledge base of programme for first responders and their families (McCreary, 2019). Among them was a lack of focus on families and veterans, and an overly restrictive focus on PTSD, PTEs, and individually oriented prevention programming. They also observe a significant lack of quality data; lacking quality evidence, methodology, a lack of gender differentiation in data, and lack of measurement assessing desired outcomes (instead, often measuring current processes or immediate outcomes) (McCreary, 2019, p. 9). The overly restrictive focus on PTSD mirrors a trend in the literature on loss and trauma, where trauma theorists have often focussed on PTSD interventions (Bonanno, 2004).

Decades of research on suicidal thoughts, feelings, and behaviours in military settings have extensively outlined the risk factors for suicide; however, further research is needed for resilience education preventatively and strategically delivered to the general military population as well as to those having experienced suicidal thoughts, feelings, and behaviours (Ringer et al., 2018). One review of programme for frontline workers calls for a larger focus on the integration of organisational training frameworks that include embedded individuals who act as leaders in implementation (Crane et al., 2021).

We observe the need to address the absence of interventions for organisational-level barriers and community resilience. Similarly, considering these gaps in the literature, we aim to implement a long-term, validated system of measurement that can assess outcomes over time. Our aim is to develop a comprehensive preventative resilience approach that can act as a protective mechanism against a wide range of mental and physical ill health effects.

The benefits of resilience training

Research has become more focussed on the benefits of resilience training (Joyce et al., 2018):

- Resilience is indicated to be bidirectionally linked with mental wellness (Joyce et al., 2018).

- Resilience training can play an important role in mental health and comprehensive wellness outcomes (Elisei et al., 2013; Horn & Feder, 2018).
- Resilience education has been found to be a protective factor against suicide risk (Sher, 2019).
- Resilient people are able to recover from stress faster and are able to return to sense of a physiological equilibrium from negative arousal quicker (Carver, 1998).
- Resilience acts as a buffer against negative health outcomes (Tugade et al., 2004), and is a causal mechanism for improved physical and mental health.

Research on developing resilience in first responders and HAOs concludes that targeted, ongoing training in resilience skills can build resilience capacity over time, acting as a protective factor against mental and physical health issues (Brassington & Lomas, 2020; Joyce et al., 2019). Studies show that resilience training lessens anxiety, stress and burnout in nurses (Deldar et al., 2018). Cai et al. (2017) found that in military settings, acute stress was mediated by cognitive emotion regulation, social support, and resilience education.

Current research indicates need for an integrated approach to suicide prevention and the promotion of personal and community resilience via education that incorporates biopsychosocial subjects in the areas of positive mental health behaviours and social relationships (Ivbijaro et al., 2019). The U.S. Department of Veterans Affairs found that a holistic, goal-focussed public health approach to suicide prevention is cost effective, results in high quality outcomes, increases veteran satisfaction, and even enhances the experience of the military healthcare provider (Kearney et al., 2020). A study on the U.S. Department of Veterans Affairs health coaching course found that it increased preparedness, self-efficacy, and use of health coaching skills (Collins et al., 2015).

Hoopsick et al. (2021) suggested that resilience factors should be focussed on for interventions to prevent deteriorating mental health in Army Reserve servicemembers, and that learned resilience skills are a significant protective factors for army soldiers who have never deployed. Cai et al. (2017) found that military acute stress was mediated by cognitive emotion regulation, social support, and resilience education.

Thus, purposeful and evidence-based resilience training for HAOs has significant support from researchers in this area (Thompson & Dobbins, 2018). Risk reduction through resilience training can be understood further through the neuromechanical perspective of LBR regulation, further highlighting the benefit of resilience as primary prevention.

Recognising the value of prevention

Preventative programme such as resilience are increasingly recognised (McDaid et al., 2019) as they address mental health challenges more effectively than treatment alone (Furber et al., 2015). These cost-effective solutions (McDaid et al., 2017) reduce the financial burden associated with

mental illness (Knapp et al., 2011), such as America's \$163.00 billion cost in 2013 (McDaid et al., 2019) and the global cost tripling between 2010 and 2030 (Bloom et al., 2012). Preventative interventions yield high returns, estimating a return of AUD\$2.30 per dollar of investment (Beyondblue & PwC, 2014; Knapp et al., 2011) and are considered most effective in tackling mental health issues.

Adverse psychological consequences for HAOs may stem from pre-employment experiences (Chamberlin & Green, 2010), emphasising the need for resilience training (Madden, 2015). Mental health stigma, affecting males more than females, persists throughout life (Eisenberg et al., 2009) and is prevalent in first responder jobs. Preventative interventions can address this stigma. It is noted that no evaluations were found that included samples of more diverse and non-binary gender classifications.

Potentially traumatic events can be exacerbated by clinical interventions like debriefing (Bonanno, 2004), yet they remain common. Implementing preventative measures can reduce the need for such treatments and improve overall wellbeing (Madden, 2015), consequently enhancing the quality-of-care HAOs provide (Aiken et al., 2013).

The high adversity resilience training programme

We conceptualise resilience practically as a set of skills and beliefs that act as protective mechanisms against adverse situations, and which enable growth through a strength-based approach (Rossouw et al., 2017).

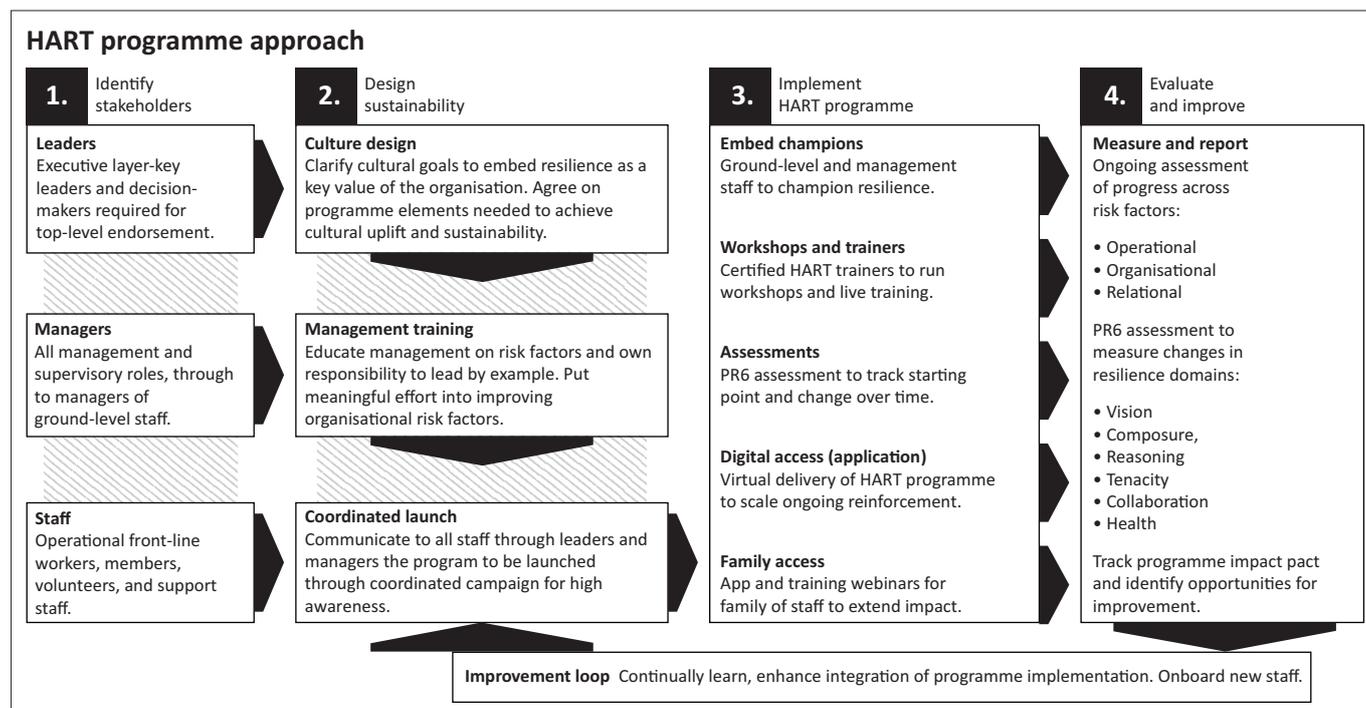
The idea of 'preventative interventions' has gained increasing popularity as solutions have been sought to the escalating mental health crisis (Knapp et al., 2011). Of note is the concept of 'microtrauma', which is the cumulative psychological burden accrued over time from regular, low-level stresses (Crastnopol, 2015) that may increase LBR and related risks over time. This programme aims to develop resilience as a protective mechanism both against larger traumatic experiences as well as experience of microtrauma through more effective LBR regulation.

High adversity resilience training approach

In order to take a comprehensive approach that includes mental and physical health aspects, the PR6 model is used as a foundation (Rossouw et al., 2019). The PR6 model provides a psychometric assessment that may further be used as method of assessing impact, across the resilience domains of vision, composure, reasoning, health, tenacity, and collaboration.

These six domains provide the framework to construct the broader programme, putting together proven skills in a repeatable process to embed the programme and integrate with other resilience training elements using the PR6 model, such as the Driven Resilience App, and Resilience First Aid programme.

High adversity resilience training targets the specific resilience challenges of HAOs through an integrative approach, working from current research to address gaps identified. The HART programme approach has four stages (Figure 2). These stages incorporate concept to work towards cultural change from



HART, High Adversity Resilience Training Approach.

Note: The approach developed starts by identifying relevant stakeholders, including those who affect the organisational risk factors. From there, a collaborative approach is taken to design sustainability into the programme. This is followed by implementing the HART programme as designed in the collaborative phase. The impact is evaluated for improvement, looping back to re-iterating the design and onboarding new staff.

FIGURE 2: High Adversity Resilience Training Approach. Aiming towards a broader cultural impact.

recent research (Al Jowf et al., 2023; Dell et al., 2022), aiming to address operational, organisational, and relational challenges:

Identify stakeholders

Key audiences are identified for specific roles, including leadership layer for executive sponsorship, management and supervisory participants, as well as the broader staffing audience

Design sustainability

A structured approach aims to clarify the cultural goals and programme components, train executives and managers on how to support staff, culminating in a coordinated launch with the broader audience

Implement

Selected programme components as designed for the broader programme are implemented, including embedding champions, creating internal trainers, hosting workshops, running assessments, providing digital resource access, and also reaching family members through the staffing layer

Evaluate

Assessments provide important insight to evaluate programme effectiveness, as well as establish where improvements need to be made, feeding into an improvement loop back to the design stage to redesign an improved programme.

This approach builds in flexibility given that high adversity organisations and agencies have unique cultures and features that will require adaptation and ongoing evaluation to achieve high impact over time.

High adversity resilience training programme, elements

High adversity resilience training responds to a need for an approach which targets the community over the individual (Deppa, 2015). One systematic review of resilience programme notes that the effectiveness of resilience training is strongly mediated by the comprehensiveness of the training in terms of its audience – including employers, management, families, and so on (Brassington & Lomas, 2020).

High adversity occupations do not encounter well-being individually, but must ‘negotiate complex social, political and culture systems’ (Hamling, 2018, p. 142) in order to develop long term resilience. The HART programme has thus focused on targeting culture and communities, instead of having an overly restrictive focus on individual-based training.

High adversity resilience training can start small and scale over time, using an integrated set of programme components:

Embed champions

Training ground-level personnel who understand resilience and can champion the programme is critical for engagement.

programme such as Resilience First Aid, that is designed for this purpose, train various levels of stakeholders on how to create an environment that enabled resilience.

Workshops and trainers

Internal or external resilience coaches trained in the HART programme, can deliver ongoing live workshops to train individual skills, as well as help train managers and leaders on how to create an environment that supports resilience.

Assessments

The PR6 psychometric and other surveys provide important ongoing insight into programme impact and needs. Conducting twice yearly assessments can provide meaningful insight without overburdening staff.

Digital access Application (App)

- Variable training options help to reach audiences who prefer different learning styles. The Driven Resilience Application (App) also contains the HART programme, and further allows scalable training and ongoing reinforcement of learning through daily microtasks.

Family access

Through the staff themselves, training can also be provided to their family members (partners, children). This can include open webinars hosted by trainers and app access. This is important in helping to build a supportive and understanding social environment outside of the workplace (Deppa, 2015).

A key role for leadership and management is the understanding that resilience is not simply about individuals building resilience skills, but also about creating an environment that reduces organisational and relational risk factors. This requires management to put meaningful effort towards improving organisational risk factors (paperwork, shift arrangements, workplace conflict, lack of resources, etc.) as a clear indicator to HAO workers that there is a balance of individual and organisational investment in resilience.

This collaborative approach is necessary to create a culture of resilience that reduces stress and helps with limbic brain regulation. Taking a socially comprehensive approach is linked with greater resilience over time (Brassington & Lomas, 2020).

High adversity resilience training core curriculum

Our research identified commonalities between the gaps in the scientific literature and the PR6 resilience model, as well as neurological relationships with resilience building as a pathway to limbic brain downregulation during various modes of stress through high adversity work.

The upregulation of Neuropeptide Y (NPY) in the brain is associated with protection against adverse mental health effects, and appears to be inversely related to stress responses

(Zhou et al., 2008). It has a strong anxiolytic effect, making it a pivotal mediator for the stress response (Hirsch & Zukowska, 2012).

Additional conceptualisations are emerging to discuss the underlying pathways (e.g., mesostriatal reward and default mode networks) to resilience building, by focussing on interventions 'up-regulate the positive, down-regulate the negative, and transcend the self' (Tabibnia, 2020, p. 321). We theorise that training in the PR6 resilience domains can stimulate the upregulation of NPY and create epigenetic shifts contributing to an improved mediation of stress (Rossouw & Rossouw, 2016), which can provide not only learned improvement in LBR regulation and related risk reduction, but also lead to generational benefits through gene heredity.

High adversity resilience training encourages HAOs and other programme participants to better understand their brain, to build emotional composure in stressful situations, and to effectively empathise and manage the stress response of others. Neuroscience fundamentals is taught in relation to stress and the role of neuroplasticity. This section of the programme involves education on the limbic brain and the prefrontal cortex and encourages participants to reflect on the different ways they respond to stress.

Strategies identified through reviews take a strength-based approach and are grouped by PR6 domain for inclusion into the HART programme. While the domains act as separate constructs, each has a bidirectional effect on the other domains.

Vision

The domain of Vision encompasses a person's congruent sense of meaning, purpose, and personal vision for their lives. This domain guides the motivation and application for all the other domains (Rossouw & Rossouw, 2016).

The adverse effects of a distressing event can be significantly mitigated through the development of purpose – such as a commitment to developing meaningful life purpose, having an internal locus of control (i.e., believing you can change things), and believing that all events can be learned from (Bonanno, 2004).

A structured sense of meaning and purpose plays a significant role in developing resilient well-being in HAOs (Hamling, 2018; Jackson et al., 2007). Military service members with a sense of purpose have a lower incidence of suicidality (Trachik et al., 2021). A sense of meaning in the workplace is strongly linked to higher job satisfaction (Money et al., 2009), acting as a protective factor against burnout. The absence of a sense of meaning and purpose is linked with adverse mental and physical health outcomes, including suicide (Kleftaras & Psarra, 2012). Research on traumatic experiences shows that people can thrive if they can work towards their purpose in life (Tedeschi et al., 2018).

Connected purpose

A structured sense of purpose is presented in the concept of 'ikigai' or 'reason for being', which is a practical way of discussing and clarifying purpose using four fundamental pillars: passion, vocation, profession, and mission. Developing a sense of 'ikigai' is associated with lower all-cause mortality (Tanno et al., 2009).

This concept is included as developing a sense of 'Connected Purpose', providing modules to connect operational, organisational, and relational factors as part of the Vision domain. Connection facilitates an understanding of how all aspects of the work facilitates the achievement of a personal sense of purpose.

A sense of resilient purpose (setting a broader purpose such as 'to help others' rather than 'be a firefighter') can help manage crises of identity and reduce risk. High adversity occupation workers are at a risk of overidentifying with their occupation – meaning that job loss or retirement may result in a loss of purpose in life, increasing risk of mental illness and suicide (Blue, 2016).

Collaboration

The Collaboration domain spans support networks and relationships (Rossouw & Rossouw, 2016), recognising the importance of social connections for resilience (Cacioppo & Cacioppo, 2012).

McCreary (2019) notes that many programmes have an overly restrictive focus on the individual and exclude family and colleagues. However, the literature on networks of supportive relationships show that social support is crucial for holistic resilience (Mealer et al., 2012; Rippstein-Leuenberger et al., 2017). Studies of Canadian firefighters show that the lower their perception of social support, the higher their scores in depression and trauma (Chamberlin & Green, 2010; Regehr et al., 2003). Practices in seeking support from others is associated with a lower risk of PTSD (Chamberlin & Green, 2010; Regehr et al., 2003), and social isolation is fundamentally associated with suicide (Trout, 1980).

Connections in HAOs therefore includes individual training, as well as other programme elements such as embedding champions, training for superiors, and family members. Development of a shared language of resilience and understanding of techniques employed is necessary to facilitate stronger connections for the development of a culture of resilience (Henderson et al., 2016).

High adversity humour

Healthy co-worker connections foster relational resilience in the workplace (Jackson et al., 2007; Rippstein-Leuenberger et al., 2017; Stephens et al., 2012).

A common HAO strategy is using humour to deal with difficult circumstances, acting as a preventative mechanism

against developing adverse mental and physical health effects from exposure to traumatic events (Jackson et al., 2007). Being able to laugh with co-workers helps to foster and demonstrate a supportive collegial environment, and improve the enjoyment of the work day (Rippstein-Leuenberger et al., 2017).

'High Adversity Humour' training modules in the HART programme involves a short, informal assessment of the user's sense of humour at work and discusses a framework and usefulness of humour for high adversity situations. This training covers the mental and physical benefits of high adversity humour, as well as the types of humour that can be employed to enhance connection, as well as negative types of humour that may harm connection.

Grief and growth

The dual process model of grieving argues that adaptive coping comprises an oscillation between both confronting grief and avoiding it (Stroebe & Schut, 1999). The process of grief comes with the need for adaptation. Losing someone requires adaptation to their absence – which could include different routines, habits, and responsibilities.

Based on this research, the HART programme includes 'Grief and Growth' modules to educate participants on the general processes of grief, including adaptation and avoidance (Stroebe & Schut, 1999). This also includes discussion on supporting someone else's grief, using proactive, preventative actions (such as compartmenting and self-care), as well as reactive actions such as appropriate debriefing.

High quality connections

Taking a context-aware approach to fostering closer connections within the organisation is an important aspect of improving the Collaboration domain of resilience. This can be achieved through building strong workplace relations, which involves Cognitive (other-awareness, impressions of others, perspective-taking), Emotional (positive emotions, emotional contagion, empathy), and Behavioural (respectful engagement, task enabling, play) mechanisms (Stephens et al., 2012). High adversity resilience training includes this as the High Quality Connection training module.

Strong relationships

Perceived support has a stronger positive effect on mental health than received support for HAOs (Prati & Pietrantoni, 2010). Investing in family and other external relationships is included as a strategy to improve perceived support proactively, using Active Constructive Responding which is used extensively in the U.S. Army's Master Resilience Training programme (Reivich et al., 2011).

Composure

Composure is the domain of emotion management, focussing on limbic brain regulation strategies (Rossouw & Rossouw, 2016).

Research has shown that firefighters who are likely to engage in negative appraisals are at a higher risk of PTSD (Bryant & Guthrie, 2007). People in high adversity occupations who have a negative interpretation bias are six times more likely to show symptoms of depression, while positive reappraisal strategies are associated with lower distress in rescue workers (Chamberlin & Green, 2010). Positive emotions are strongly linked with psychological resilience (Fredrickson, 2001, 2003; Horn & Feder, 2018). Traumatic events can be mitigated and be used for growth given a strong presence of purpose and meaning; however, a person needs to first return to a standard level of emotional affect before meaning-making can become effective (Maitlis, 2020).

High adversity reappraisal

Cognitive reappraisal is established as a technique for first responders to manage the emotional impact of high adversity events, as well as being a broader emotion regulation strategy (Shepherd & Wild, 2014). Reappraisal involves examining the way a person has interpreted an event, and considering whether there is a more beneficial and realistic interpretation available (Shepherd & Wild, 2014). The HART programme includes reappraisal in a high adversity context as a strategy that builds on emotional awareness through to practical application in the context. Further Composure skills are available in the broader Driven Resilience training programme, including breathing and mindfulness techniques.

Tenacity

The Tenacity domain is about developing persistence, learning from errors, and being able to develop realistic optimism for situations (Rossouw & Rossouw, 2016). High adversity resilience training includes validated Tenacity skills focussed on HAO effectiveness to enhance motivation and overcome unique occupational challenges.

Three good things

An established HAO technique in positive psychology is 'Three Good Things'. The technique is designed to develop mindfulness of positive events.

In one study on the efficacy of this strategy, healthcare professionals reported a reduction in depressive symptoms even 6 months later (Rippstein-Leuenberger et al., 2017).

Positive emotions are at their most effective in HAOs when presented as modest and consistent flow of emotion, instead of a large spike (Fredrickson, 2001, 2003). This technique works from this principle, helping to cultivate positive emotion for long term resilience (Tugade & Fredrickson, 2007), and developing the skill of optimism, which is linked with high resilience (Jackson et al., 2007; Mealer et al., 2012).

Mental load management

Research shows that people in high adversity occupations benefit from mental load management, which is a strategy of developing resilience against trauma (Horn & Feder, 2018).

This HART module includes training focussed on common HAO risks such as burnout, compassion fatigue, vicarious trauma, and trauma exposure.

Two strategies of the Mental Load Management module are preventative, and strength based. These strategies stimulate the production of NPY, which is inversely related to anxiety (Zhou et al., 2008). In studies on the military, NPY was associated with a stronger resilient response as well as a lower risk of experiencing ongoing negative emotional effect, such as trauma (Morgan III et al., 2002).

Reasoning

The PR6 domain of Reasoning considers executive functioning involving problem solving, resourcefulness, and active adaptation to change (Rossouw & Rossouw, 2016). High adversity occupations can benefit from active cognitive strategies to use proactively for managing the unique challenges of high adversity work.

Concrete versus abstract processing

Following exposure to a potentially traumatic event, HAO workers may process what happened in an abstract way – posing ‘unanswerable’ questions such as ‘Why did this happen?’, leading to unhelpful rumination. Studies suggest that abstract processing is associated with higher rates of mental ill health (White et al., 2016). Concrete processing differs, in that a person asks ‘How?’ questions – i.e., questions that consider the logical and concrete steps of the event, such as who was involved, where was it located, and what were the sequence of events.

Concrete processing is associated with reduced flashbacks, stronger resilience and improved mental health outcomes, acting as a protective factor (White et al., 2016). Furthermore, research indicates that training in this thinking style is best developed preventatively to reduce intrusive thoughts and flashbacks (Ehring et al., 2009). Therefore, the HART programme has developed modules that train HAOs in concrete processing as a preventative skill.

Sustainable compartmenting

High adversity occupation workers face higher workload and emotional workload can curb the risk of burnout and stress through practising psychological detachment (Sonnetag et al., 2010). In order to develop this skill, the HART programme includes Sustainable Compartmenting modules, providing a framework to manage different aspects of life in a manner that enables focussed performance when needed, alongside strategies to prevent avoidance of accumulating trauma exposure.

This strategy is differentiated from commonly found unhealthy compartmenting, enhancing the strategy to become a sustainable system that facilitates improved communication with close connections and family members.

Thoughts and behaviours

Cognitive Behavioural Therapy psychoeducation includes training on thought distortions and biases as a pathway to improve thoughts and behaviours that result from beliefs. Proactive training on these thought distortions and biases can therefore provide a preventative approach to guard against causative factors of mental illness, and is strongly correlated with increased resilience (Jackson et al., 2007). High adversity resilience training includes a module on this as a proactive and strength-based approach to explore biases and take action proactively to enhance belief systems and related thoughts and behaviours.

Health

Health has often gone overlooked as an aspect of resilience. However, research shows that health is a foundational domain of holistic resilience (Rossouw & Rossouw, 2016; Rossouw et al., 2017). Brain-derived neurotrophic factor (BDNF) acts as a significant moderator of neuroplasticity allowing for adaptability. Brain-derived neurotrophic factor is generated through key physical health factors such as regular exercise, healthy nutrition, and quality sleep. Research is conclusive that sleep quality is intertwined with emotional and physical regulation (Monteiro et al., 2017).

High adversity occupations are at a higher risk of physical issues (Hamling, 2018). These issues can affect work performance and mental health, and lead to burnout (Horn & Feder, 2018). Research identified work hours, sleep, nutrition and exercise, as well as social connections, as key elements of health that affect HAOs (Crane et al., 2021) with shift work and irregular work hours being a major contributor (Knutsson, 2003).

Work hours

An indicator of burnout is the management of work hours, with longer hours contributing to reduced resilience (Knutsson, 2003), impacting HAO workers’ ability to maintain healthy dietary habits, reduce ability to exercise regularly, disrupt sleep schedules, as well as impact relationships with others working alternate schedules.

High adversity resilience training includes modules on practical strategies to manage the specific challenges of shift work and working irregular hours, focussing on managing a schedule, sleep strategies, nutrition and exercise, and social connections in the context of long hours and shift work.

Discussion

The HART programme represents a significant advancement in addressing the psychological and physiological challenges faced by individuals in HAOs. Drawing from the expansive review of current literature and the integration of the PR6 model, our study underscores the critical need for a holistic approach to resilience training that transcends traditional, individual-centric methods.

Main findings

Our findings indicate that the HART programme, with a neurological grounding in reducing LBR and enhancing resilience at an individual and cultural level, offers a comprehensive framework that is significantly beneficial for individuals in HAOs. By focussing on both individual resilience skills and creating supportive organisational and social environments, the HART programme addresses the multifaceted nature of adversity these workers face. This dual approach is critical, as it acknowledges that resilience is not solely an individual's responsibility but is also heavily influenced by their working conditions and social support systems.

Implications for practice and policy

The implementation of the HART programme within HAOs has implications for organisational practices and policies. Firstly, organisations must recognise the importance of adopting systemic changes that foster resilience, such as improving communication, reducing bureaucratic obstacles, and providing adequate resources. Leadership training should also incorporate elements of resilience training, enabling leaders to better support their teams and mitigate stressors.

Further, the explicit focus on reducing LBR through resilience training suggests that mental health interventions in HAOs should include practices that promote emotional regulation, stress inoculation, and cognitive flexibility. Policies should therefore support ongoing resilience training as part of professional development, rather than as a one-time intervention.

Theoretical contributions

This study contributes to the theoretical understanding of resilience in HAOs by highlighting the role of LBR in stress and trauma response. By integrating neurobiological insights with resilience training, the HART programme offers a novel perspective on mitigating the impact of high-adversity work environments. This aligns with and expands upon existing theories of occupational stress and resilience, providing a comprehensive model that can be adapted across various high-adversity settings.

Limitations

The primary focus of the research was on development of the foundational aspects of the HART programme design. Therefore, empirical evaluation of practical implementation would enable validation of the combined concept, regardless of the existing evidence supporting individual strategies. The overall programme is generalised from a broad representation of existing research, in contrast to specific situational deployments where there may exist extensive cultural and organisational differences. Implementation of the HART programme would therefore benefit from tailored deployments in order to translate concepts to suit the environment where it is utilised.

Directions for future research

While the current study provides a foundational framework for the HART programme, future research should aim to empirically test its effectiveness across different HAO settings. Longitudinal studies are needed to assess the sustained impact of the programme on improving mental health outcomes. Additionally, research should explore the scalability of the programme, including digital and self-led training options, to increase accessibility for a wider range of HAO workers.

Exploring the differential impacts of various components of the HART programme can also provide insights into the most effective strategies for building resilience. This would allow for the refinement of the programme, ensuring it meets the specific needs of different HAO populations.

Conclusion

The HART programme, represents a practical approach to implement a paradigm shift in resilience training for HAOs, emphasising the need for comprehensiveness that addresses both individual and systemic cultural factors. By focussing on reducing LBR and fostering a supportive work environment, HART has the potential to significantly improve the well-being of individuals facing high levels of adversity in their professional roles. As we continue to develop and refine resilience training programmes, it is crucial that we adopt a holistic perspective that recognises the complex interplay between individual, organisational, and social factors in promoting resilience.

Acknowledgements

The authors would like to thank Mike Taigman, Rhonda Kelly, and Paul Koning for their expertise in emergency services fields and contributing their knowledge to assist with developing a programme that meets the practical needs of these organisations.

Competing interests

J.G.R., is an employee of Hello Driven, and J.H., is an investor in the same company. As such, both may have a potential financial conflict of interest, as Hello Driven could potentially benefit from the research findings through further development and implementation of the programme being studied. Regardless of this affiliation, J.G.R. and J.H. affirm their commitment to the strictest scientific and ethical standards in conducting the research. All data analysis and interpretations have been conducted impartially, independent of Hello Driven's influence. J.G.R. and J.H. sincerely believe that our results and conclusions have not been compromised by these competing interests.

Authors' contributions

All authors listed on the article have significantly contributed to the research project and preparation of the article. J.G.R.,

took the lead and developed the outline, methodology, and overall structure of the research project. J.G.R. was also responsible for the initial literature research, creating visualisations, compiling the final draft, and managing the research project as a whole. C.E., as a research assistant, made significant contributions to developing the initial draft and conducting extensive literature research. C.E.'s efforts have been pivotal in shaping the direction and content of the research. J.H. and D.G. acted as reviewers, providing crucial insights, constructive critique, and supervision for the research project. Their expertise helped to refine the article and contributed to the completion of the final draft. J.G.R., C.E., J.H. and D.G. approved the final version of the article for submission and agreed to be accountable for all aspects of the work.

Ethical considerations

This article followed all ethical standards for research without direct contact with human participants.

Funding information

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the private company, Hello Driven. There were no specific grants or other external funding sources from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability

This article is the result of a literature review and conceptual research, it did not generate any primary datasets or raw data. All data utilised in this research are derived from previously published studies, and these are accordingly cited within the text. Readers can access the original sources referenced for further inspection. There are no restrictions on data availability.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors, or the publisher.

References

- Aiken, L.H., Sloane, D.M., Bruyneel, L., Van den Heede, K., Sermeus, W., & Consortium, R.C. (2013). Nurses' reports of working conditions and hospital quality of care in 12 countries in Europe. *International Journal of Nursing Studies*, 50(2), 143–153. <https://doi.org/10.1016/j.ijnurstu.2012.11.009>
- Al Jowf, G.I., Ahmed, Z.T., An, N., Reijnders, R.A., Ambrosino, E., Rutten, B.P., De Nijs, L., & Eijssen, L.M. (2022). A public health perspective of post-traumatic stress disorder. *International Journal of Environmental Research and Public Health*, 19(11), 6474. <https://doi.org/10.3390/ijerph19116474>
- Al Jowf, G.I., Ahmed, Z.T., Reijnders, R.A., De Nijs, L., & Eijssen, L.M. (2023). To predict, prevent, and manage Post-Traumatic Stress Disorder (PTSD): A review of pathophysiology, treatment, and biomarkers. *International Journal of Molecular Sciences*, 24(6), 5238. <https://doi.org/10.3390/ijms24065238>
- Baird, K., & Kracen, A.C. (2006). Vicarious traumatization and secondary traumatic stress: A research synthesis. *Counselling Psychology Quarterly*, 19(2), 181–188. <https://doi.org/10.1080/09515070600811899>
- Beyondblue, & PWC. (2014). *Creating a mentally healthy workplace: Return on investment analysis [Industry report]*. Retrieved from https://www.headsup.org.au/docs/default-source/resources/beyondblue_workplaceroi_finalreport_may-2014.pdf
- Bloom, D. E., Cafiero, E., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., ... & Weiss, J. (2012). *The global economic burden of noncommunicable diseases* (No. 8712). Program on the Global Demography of Aging.
- Blue, B. (2016). *Good practice framework for mental health and wellbeing in first responder organisations*. Beyond Blue.
- Bonanno, G.A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events?. *American Psychologist*, 59(1), 20. <https://doi.org/10.1037/0003-066X.59.1.20>
- Boscarino, J.A., Figley, C.R., & Adams, R.E. (2004). Compassion fatigue following the September 11 terrorist attacks: A study of secondary trauma among New York City social workers. *International Journal of Emergency Mental Health*, 6(2), 57.
- Brassington, K., & Lomas, T. (2020). Can resilience training improve well-being for people in high-risk occupations? A systematic review through a multidimensional lens. *The Journal of Positive Psychology*, 16(5), 1–20. <https://doi.org/10.1080/17439760.2020.1752783>
- Bremner, J.D. (2006). Traumatic stress: Effects on the brain. *Dialogues in Clinical Neuroscience*, 8(4), 445–461.
- Bryant, R.A., & Guthrie, R.M. (2007). Maladaptive self-appraisals before trauma exposure predict posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*, 75(5), 812. <https://doi.org/10.1037/0022-006X.75.5.812>
- Cacioppo, S., & Cacioppo, J.T. (2012). Decoding the invisible forces of social connections. *Frontiers in Integrative Neuroscience*, 6, 51. <https://doi.org/10.3389/fnint.2012.00051>
- Cai, W.-p., Pan, Y., Zhang, S.-m., Wei, C., Dong, W., & Deng, G.-h. (2017). Relationship between cognitive emotion regulation, social support, resilience and acute stress responses in Chinese soldiers: Exploring multiple mediation model. *Psychiatry Research*, 256, 71–78. <https://doi.org/10.1016/j.psychres.2017.06.018>
- Carver, C.S. (1998). Resilience and thriving: Issues, models, and linkages. *Journal of Social Issues*, 54(2), 245–266. <https://doi.org/10.1111/j.1540-4560.1998.tb01217.x>
- Chamberlin, M.J., & Green, H.J. (2010). Stress and coping strategies among firefighters and recruits. *Journal of Loss and Trauma*, 15(6), 548–560. <https://doi.org/10.1080/015325024.2010.519275>
- Collins, D.A., Shamblen, S.R., Atwood, K.A., Rychener, D.L., Scarbrough, W.H., Abadi, M.H., & Simmons, L.A. (2015). Evaluation of a health coaching course for providers and staff in veterans health affairs medical facilities. *Journal of Primary Care & Community Health*, 6(4), 250–255. <https://doi.org/10.1177/2150131915591154>
- Crane, M.F., Falon, S.L., Kho, M., Moss, A., & Adler, A.B. (2021). Developing resilience in first responders: Strategies for enhancing psychoeducational service delivery. *Psychological Services*, 19(suppl 2), 17–27. <https://doi.org/10.1037/ser0000439>
- Crastopol, M. (2015). *Micro-trauma: A psychoanalytic understanding of cumulative psychic injury* (Vol. 25). Routledge.
- Deldar, K., Froutan, R., Dalvand, S., Gheshlagh, R.G., & Mazloum, S.R. (2018). The relationship between resilience and burnout in Iranian nurses: A systematic review and meta-analysis. *Open access Macedonian Journal of Medical Sciences*, 6(11), 2250. <https://doi.org/10.3889/oamjms.2018.428>
- Dell, L., Madden, K., & Jones, K. (2022). *Wellness action through checking health: WATCH project report. Report prepared for Department of Defence*. Phoenix Australia – Centre for Posttraumatic Mental Health.
- Deppa, K.F. (2015). *Resilience training for firefighters: A proposed approach*. Dissertations & Theses, University of Pennsylvania, United States.
- DSPO, D.o.D.S.P.O. (2020). *Department of Defense (DoD) Quarterly Suicide Report (QSR) 4th Quarter*. Retrieved from <https://www.dspo.mil/qs/>
- Ehring, T., Szeimies, A.-K., & Schaffrick, C. (2009). An experimental analogue study into the role of abstract thinking in trauma-related rumination. *Behaviour Research and Therapy*, 47(4), 285–293. <https://doi.org/10.1016/j.brat.2008.12.011>
- Eidelson, R., & Soldz, S. (2012). Does comprehensive soldier fitness work: CSF research fails the test. *Coalition for an Ethical Psychology*, 1(5), 1–12.
- Eisenberg, D., Downs, M.F., Golberstein, E., & Zivin, K. (2009). Stigma and help seeking for mental health among college students. *Medical Care Research and Review*, 66(5), 522–541. <https://doi.org/10.1177/1077558709335173>
- Etkin, A., Egner, T., & Kalisch, R. (2011). Emotional processing in anterior cingulate and medial prefrontal cortex. *Trends in Cognitive Sciences*, 15(2), 85–93. <https://doi.org/10.1016/j.tics.2010.11.004>
- Elisei, S., Sciarra, T., Verdolini, N., & Anastasi, S. (2013). Resilience and depressive disorders. *Psychiatria Danubina*, 25(suppl 2), S263–S267.
- Figley, C.R. (1995). *Compassion fatigue: Toward a new understanding of the costs of caring*. Routledge
- Fisher, P.M., & Abrahamson, K. (2002). *When working hurts: Stress, burnout & trauma in human, emergency, and health services*. Spectrum Press.
- Fredrickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218. <https://doi.org/10.1037/0003-066X.56.3.218>
- Fredrickson, B.L. (2003). The value of positive emotions: The emerging science of positive psychology is coming to understand why it's good to feel good. *American Scientist*, 91(4), 330–335. <https://doi.org/10.1511/2003.26.330>

- Furber, G., Segal, L., Leach, M., Turnbull, C., Procter, N., Diamond, M., Miller, S., & McGorry, P. (2015). Preventing mental illness: Closing the evidence-practice gap through workforce and services planning. *BMC Health Services Research*, 15(1), 1–14. <https://doi.org/10.1186/s12913-015-0954-5>
- Guidi, J., Lucente, M., Sonino, N., & Fava, G.A. (2021). Allostatic load and its impact on health: A systematic review. *Psychotherapy and Psychosomatics*, 90(1), 11–27. <https://doi.org/10.1159/000510696>
- Gyurak, A., Gross, J.J., & Etkin, A. (2011). Explicit and implicit emotion regulation: A dual-process framework. *Cognition and Emotion*, 25(3), 400–412. <https://doi.org/10.1080/02699931.2010.544160>
- Hamling, K. (2018). *Wellbeing across occupations and in the emergency services: A mixed methods study*. Auckland University of Technology.
- Henckens, M.J., Van Wingen, G.A., Joëls, M., & Fernández, G. (2010). Time-dependent effects of corticosteroids on human amygdala processing. *Journal of Neuroscience*, 30(38), 12725–12732. <https://doi.org/10.1523/JNEUROSCI.3112-10.2010>
- Henderson, S.N., Van Hasselt, V.B., LeDuc, T.J., & Couwels, J. (2016). Firefighter suicide: Understanding cultural challenges for mental health professionals. *Professional Psychology: Research and Practice*, 47(3), 224. <https://doi.org/10.1037/pro0000072>
- Hirsch, D., & Zukowska, Z. (2012). NPY and stress 30 years later: The peripheral view. *Cellular and Molecular Neurobiology*, 32(5), 645–659. <https://doi.org/10.1007/s10571-011-9793-z>
- Hoopsick, R.A., Homish, D.L., Collins, R.L., Nochajski, T.H., Read, J.P., Bartone, P.T., & Homish, G.G. (2021). Resilience to mental health problems and the role of deployment status among US Army Reserve and National Guard Soldiers. *Social Psychiatry and Psychiatric Epidemiology*, 56(7), 1299–1310. <https://doi.org/10.1007/s00127-020-01899-5>
- Horn, S.R., & Feder, A. (2018). Understanding resilience and preventing and treating PTSD. *Harvard Review of Psychiatry*, 26(3), 158–174. <https://doi.org/10.1097/HRP.0000000000000194>
- Ivbijaro, G., Kolkiewicz, L., Goldberg, D., Riba, M.B., N'jie, I.N., Geller, J., Kallivayalil, R., Javed, A., Svab, I., Summergrad, P., Laher, S., Enum, Y. (2019). Preventing suicide, promoting resilience: Is this achievable from a global perspective?. *Asia-Pacific Psychiatry*, 11(4), e12371. <https://doi.org/10.1111/appy.12371>
- Jackson, D., Firtko, A., & Edenborough, M. (2007). Personal resilience as a strategy for surviving and thriving in the face of workplace adversity: A literature review. *Journal of Advanced Nursing*, 60(1), 1–9. <https://doi.org/10.1111/j.1365-2648.2007.04412.x>
- Jakel, P., Kenney, J., Ludan, N., Miller, P.S., McNair, N., & Matesic, E. (2016). Effects of the use of the provider resilience mobile application in reducing compassion fatigue in oncology nursing. *Clinical Journal of Oncology Nursing*, 20(6), 611–616. <https://doi.org/10.1188/16.CJON.611-616>
- Joyce, S., Shand, F., Lal, T.J., Mott, B., Bryant, R.A., & Harvey, S.B. (2019). Resilience@ work mindfulness program: Results from a cluster randomized controlled trial with first responders. *Journal of Medical Internet Research*, 21(2), e12894. <https://doi.org/10.2196/12894>
- Joyce, S., Shand, F., Tighe, J., Laurent, S.J., Bryant, R.A., & Harvey, S.B. (2018). Road to resilience: A systematic review and meta-analysis of resilience training programs and interventions. *BMJ Open*, 8(6), e017858. <https://doi.org/10.1136/bmjopen-2017-017858>
- Kearney, L.K., Smith, C.A., & Miller, M.A. (2020). Critical foundations for implementing the VA's public health approach to suicide prevention. *Psychiatric Services*, 71(12), 1306–1307. <https://doi.org/10.1176/appi.ps.202000190>
- Keynan, J.N., Cohen, A., Jackont, G., Green, N., Goldway, N., Davidov, A., Meir-Hasson, Y., Raz, G., Intrator, N., Fruchter, E., Ginat, K., Laska, E., Cavazza, M., & Hendlar, T. (2019). Electrical fingerprint of the amygdala guides neurofeedback training for stress resilience. *Nature Human Behaviour*, 3(1), 63–73. <https://doi.org/10.1038/s41562-018-0484-3>
- Kleffaras, G., & Psarra, E. (2012). Meaning in life, psychological well-being and depressive symptomatology: A comparative study. *Psychology*, 3(04), 337. <https://doi.org/10.4236/psych.2012.34048>
- Knapp, M., McDaid, D., & Parsonage, M. (2011). *Mental health promotion and mental illness prevention: The economic case*. Department of Health. Retrieved from https://eprints.lse.ac.uk/29953/1/Mental_health_promotion_and_mental_illness_prevention%28author%29.pdf
- Knutsson, A. (2003). Health disorders of shift workers. *Occupational Medicine*, 53(2), 103–108. <https://doi.org/10.1093/ocmed/kqg048>
- Madden, M. (2015). *Evaluating the impact of preventative health services on improving general well-being*. Yale University.
- Maitlis, S. (2020). Posttraumatic growth at work. *Annual Review of Organizational Psychology and Organizational Behavior*, 7, 395–419. <https://doi.org/10.1146/annurev-orgpsych-012119-044932>
- McAlearney, A.S., Gaughan, A.A., MacEwan, S.R., Gregory, M.E., Rush, L.J., Volney, J., & Panchal, A.R. (2022). Pandemic experience of first responders: Fear, frustration, and stress. *International Journal of Environmental Research and Public Health*, 19(8), 4693. <https://doi.org/10.3390/ijerph19084693>
- McCammom, S., Durham, T.W., Jackson Allison, Jr, E., & Williamson, J.E. (1988). Emergency workers' cognitive appraisal and coping with traumatic events. *Journal of Traumatic Stress*, 1(3), 353–372. <https://doi.org/10.1002/jts.2490010307>
- McCreary, D. (2019). *Veteran and first responder mental ill health and suicide prevention: A scoping review of prevention and early intervention programs used in Canada, Australia, New Zealand, Ireland, and the United Kingdom*. Donald McCreary Scientific Consulting.
- McDaid, D., Park, A.-L., Knapp, M., Wilson, E., Rosen, B., & Beecham, J. (2017). *Commissioning cost-effective services for promotion of mental health and wellbeing and prevention of mental ill-health*. Public Health England. Retrieved from https://eprints.lse.ac.uk/85944/1/McDaid_Commissioning%20cost-effect-give%20services_2017.pdf
- McDaid, D., Park, A.-L., & Wahlbeck, K. (2019). The economic case for the prevention of mental illness. *Annual Review of Public Health*, 40, 373–389. <https://doi.org/10.1146/annurev-publhealth-040617-013629>
- Mealer, M., Jones, J., & Moss, M. (2012). A qualitative study of resilience and posttraumatic stress disorder in United States ICU nurses. *Intensive Care Medicine*, 38(9), 1445–1451. <https://doi.org/10.1007/s00134-012-2600-6>
- Money, K., Hillenbrand, C., & Da Camara, N. (2009). Putting positive psychology to work in organisations. *Journal of General Management*, 34(3), 31–36. <https://doi.org/10.1177/030630700903400302>
- Monteiro, B.C., Monteiro, S., Candida, M., Adler, N., Paes, F., Rocha, N., Nardi, A.E., Murillo-Rodríguez, E., & Machado, S. (2017). Relationship between brain-derived neurotrophic factor (Bdnf) and sleep on depression: A critical review. *Clinical Practice and Epidemiology in Mental Health: CP & EMH*, 13, 213. <https://doi.org/10.2174/1745017901713010213>
- Morey, R.A., Gold, A.L., LaBar, K.S., Beall, S.K., Brown, V.M., Haswell, C.C., Nasser, J., Wagner, H.R., & McCarthy, G. (2012). Amygdala volume changes in posttraumatic stress disorder in a large case-controlled veterans group. *Archives of General Psychiatry*, 69(11), 1169–1178. <https://doi.org/10.1001/archgenpsychiatry.2012.50>
- Morgan III, C.A., Rasmusson, A.M., Wang, S., Hoyt, G., Hauger, R.L., & Hazlett, G. (2002). Neuropeptide-Y, cortisol, and subjective distress in humans exposed to acute stress: Replication and extension of previous report. *Biological Psychiatry*, 52(2), 136–142. [https://doi.org/10.1016/S0006-3223\(02\)01319-7](https://doi.org/10.1016/S0006-3223(02)01319-7)
- Ponder, W.N., Walters, K., Simons, J.S., Simons, R.M., Jetelina, K.K., & Carbajal, J. (2023). Network analysis of distress, suicidality, and resilience in a treatment seeking sample of first responders. *Journal of Affective Disorders*, 320, 742–750. <https://doi.org/10.1016/j.jad.2022.09.097>
- Prati, G., & Pietrantoni, L. (2010). The relation of perceived and received social support to mental health among first responders: A meta-analytic review. *Journal of Community Psychology*, 38(3), 403–417.
- Regehr, C., Hill, J., Knott, T., & Sault, B. (2003). Social support, self-efficacy and trauma in new recruits and experienced firefighters. *Stress and Health*, 19(4), 189–193. <https://doi.org/10.1002/smi.974>
- Reivich, K.J., Seligman, M.E., & McBride, S. (2011). Master resilience training in the US Army. *American Psychologist*, 66(1), 25.
- Ringer, F.B., Soberay, K.A., Rogers, M.L., Hagan, C.R., Chu, C., Schneider, M., Podlogar, M.C., Witte, T., Holm-Denoma, J., Plant, E.A., Gutierrez, P.M., & Joiner, T.E. (2018). Initial validation of brief measures of suicide risk factors: Common data elements used by the military suicide research consortium. *Psychological Assessment*, 30(6), 767–778. <https://doi.org/10.1037/pas0000519>
- Rippstein-Leuenberger, K., Mauthner, O., Sexton, J.B., & Schwendimann, R. (2017). A qualitative analysis of the three good things intervention in healthcare workers. *BMJ Open*, 7(5), e015826. <https://doi.org/10.1136/bmjopen-2017-015826>
- Rossouw, J.G., Eriean, C.L., & Beeson, E.T. (2019). Building resilience through a virtual coach called Driven: Longitudinal pilot study and the neuroscience of small, frequent learning tasks. *International Journal of Neuropsychotherapy*, 7(2), 23–41. <https://doi.org/10.12744/ijnpt.2019.023-041>
- Rossouw, J.G., Rossouw, P.J., Paynter, C., Ward, A., & Khnana, P. (2017). Predictive 6 factor resilience scale—domains of resilience and their role as enablers of job satisfaction. *International Journal of Neuropsychotherapy*, 2(1), 24–40. <https://doi.org/10.12744/ijnpt.2017.1.0025-0040>
- Rossouw, P.J., & Rossouw, J.G. (2016). The predictive 6-factor resilience scale: Neurobiological fundamentals and organizational application. *International Journal of Neuropsychotherapy*, 4(1), 31–45.
- Shepherd, L., & Wild, J. (2014). Cognitive appraisals, objectivity and coping in ambulance workers: A pilot study. *Emergency Medicine Journal*, 31(1), 41–44. <https://doi.org/10.1136/emered-2011-200511>
- Sher, L. (2019). Resilience as a focus of suicide research and prevention. *Acta Psychiatrica Scandinavica*, 140(2), 169–180. <https://doi.org/10.1111/acps.13059>
- Skeffington, P.M., Rees, C.S., Mazzucchelli, T.G., & Kane, R.T. (2016). The primary prevention of PTSD in firefighters: Preliminary results of an RCT with 12-month follow-up. *PLoS One*, 11(7), e0155873. <https://doi.org/10.1371/journal.pone.0155873>
- Sonnentag, S., Kuttler, I., & Fritz, C. (2010). Job stressors, emotional exhaustion, and need for recovery: A multi-source study on the benefits of psychological detachment. *Journal of Vocational Behavior*, 76(3), 355–365. <https://doi.org/10.1016/j.jvb.2009.06.005>
- Stephens, J.P., Heaphy, E., & Dutton, J.E. (2012). High-quality connections. In K.S. Cameron & G.M. Spreitzer (eds.), *The Oxford handbook of positive organizational scholarship* (pp. 385–399). Oxford University Press.
- Stevelling, S., Pernet, D., Dregan, A., Davis, K., Walker-Bone, K., Fear, N., & Hotopf, M. (2020). The mental health of emergency services personnel in the UK Biobank: A comparison with the working population. *European Journal of Psychotraumatology*, 11(1), 1799477. <https://doi.org/10.1080/20008198.2020.1799477>
- Stroebe, M., & Schut, H. (1999). The dual process model of coping with bereavement: Rationale and description. *Death studies*, 23(3), 197–224. <https://doi.org/10.1080/074811899201046>
- Tabibnia, G. (2020). An affective neuroscience model of boosting resilience in adults. *Neuroscience & Biobehavioral Reviews*, 115, 321–350. <https://doi.org/10.1016/j.neubiorev.2020.05.005>

- Tanno, K., Sakata, K., Ohsawa, M., Onoda, T., Itai, K., Yaegashi, Y., Tamakoshi, A., & Group, J.S. (2009). Associations of ikigai as a positive psychological factor with all-cause mortality and cause-specific mortality among middle-aged and elderly Japanese people: Findings from the Japan Collaborative Cohort Study. *Journal of Psychosomatic Research*, *67*(1), 67–75. <https://doi.org/10.1016/j.jpsychores.2008.10.018>
- Tedeschi, R.G., Shakespeare-Finch, J., Taku, K., & Calhoun, L.G. (2018). *Posttraumatic growth: Theory, research, and applications*. Routledge.
- Thompson, S.R., & Dobbins, S. (2018). The applicability of resilience training to the mitigation of trauma-related mental illness in military personnel. *Journal of the American Psychiatric Nurses Association*, *24*(1), 23–34. <https://doi.org/10.1177/1078390317739957>
- Trachik, B., Oakey-Frost, N., Ganulin, M.L., Adler, A.B., Dretsch, M.N., Cabrera, O.A., & Tucker, R.P. (2021). Military suicide prevention: The importance of leadership behaviors as an upstream suicide prevention target. *Suicide & Life-Threatening Behavior*, *51*(2), 316–324. <https://doi.org/10.1111/sltb.12707>
- Trout, D.L. (1980). The role of social isolation in suicide. *Suicide and Life-Threatening Behavior*, *10*(1), 10–23. <https://doi.org/10.1111/j.1943-278X.1980.tb00693.x>
- Tugade, M.M., & Fredrickson, B.L. (2007). Regulation of positive emotions: Emotion regulation strategies that promote resilience. *Journal of Happiness Studies*, *8*(3), 311–333. <https://doi.org/10.1007/s10902-006-9015-4>
- Tugade, M.M., Fredrickson, B.L., & Feldman Barrett, L. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of Personality*, *72*(6), 1161–1190. <https://doi.org/10.1111/j.1467-6494.2004.00294.x>
- Tural, Ü., Aker, A.T., Önder, E., Sodan, H.T., Ünver, H., & Akansel, G. (2018). Neurotrophic factors and hippocampal activity in PTSD. *PLoS One*, *13*(5), e0197889.
- Webb, T.L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin*, *138*(4), 775. <https://doi.org/10.1037/a0027600>
- White, R., & Wild, J. (2016). ‘Why’ or ‘how’: The effect of concrete versus abstract processing on intrusive memories following analogue trauma. *Behavior Therapy*, *47*(3), 404–415. <https://doi.org/10.1016/j.beth.2016.02.004>
- Wild, J., Greenberg, N., Moulds, M.L., Sharp, M.-L., Fear, N., Harvey, S., Wessely, S., & Bryant, R.A. (2020). Pre-incident training to build resilience in first responders: Recommendations on what to and what not to do. *Psychiatry*, *83*(2), 128–142. <https://doi.org/10.1080/00332747.2020.1750215>
- Zhou, Z., Zhu, G., Hariri, A.R., Enoch, M.-A., Scott, D., Sinha, R., Virkkunen, M., Mash, D.C., Lipsky, R.H., Hu, X.-Z., Hodgkinson, C.A., Xu, K., Buzas, B., Yuan, Q., Shen, P.H., Ferrell, R.E., Manuck, S.B., Brown, S.M., Hauger, R.L., Stohler, C.S., Zubieta, J.-K., & Goldman, D. (2008). Genetic variation in human NPY expression affects stress response and emotion. *Nature*, *452*(7190), 997–1001. <https://doi.org/10.1038/nature06858>