Buffering and Facilitative Factors for Posttraumatic Stress and Flourishing among New Zealand Defence Force Personnel: A Longitudinal Study

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ABSTRACT

Substantial heterogeneity exists in individual responses to trauma. Reactions to operational deployments by service personnel appear to be no exception. The present research has sought to explore the links that potentially traumatic deployment experiences (PTDEs) have with posttraumatic stress (PTS) and flourishing. Further, the impacts of adaptive health behaviours (physical activity, nutrition, and sleep) and social support (from close others or from military leadership) upon the relationships that PTDEs have with PTS and flourishing were explored. Surveys were conducted 3 years apart with 313 New Zealand Defence Force (NZDF) postdeployment personnel and reports were analysed. A positive relationship was found between PTDEs and PTS, and a nonsignificant relationship between PTDEs and flourishing. Significant associations were also found between 1) adaptive health behaviours, social support, and leadership support, and 2) PTS and flourishing, both cross-sectionally and longitudinally. Mixed support was found for the moderating effects of social support and adaptive health behaviours on the relationships that PTDEs had with PTS and flourishing. Finally, PTS was found to moderate the relationship between PTDEs and flourishing. Conclusions on how the present findings converge and build upon past research, and the unique contributions of leadership support, as well as the effects of PTS on the relationship between PTDEs with flourishing, are discussed.

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ABBREVIATIONS

DSM	Diagnostic and Statistical Manual
HPA	hypothalamic-pituitary-adrenal
NZDF	New Zealand Defence Force
PTDEs	potentially traumatic deployment event(s)
PTEs	potentially traumatic event(s)
PTG	posttraumatic growth
PTS	posttraumatic stress
PTSD	posttraumatic stress disorder
COL	colonel
LTCOL	lieutenant colonel
WGCDR	wing commander
WW1	World War 1
IED	improvised explosive device
ACC	anterior cingulate cortex
ACTH	adrenocorticotropic hormone
DIXS	Defence Information Exchange System

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

I started my fledgling first steps into adulthood as a medic in the New Zealand Army. Like most medics, I spent many a day treating coughs, colds, and injuries. Unique to the New Zealand Defence Force (NZDF), on other days my medical skills were applied in more extreme emergency environments: sometimes successfully, sometimes not. Many of my fellow medics had similar experiences in Aotearoa and while on operational deployments overseas. As the years march on since my service, I have noticed a range of differing responses to these experiences among my service-related friends. Some characterise their time in uniform as fundamentally making them a better person. Others report that their experiences have forever scarred them.

Every occupation comes with its own set of risks, with some occupations posing higher risks than others. In some circumstances, exposure to negative workplace events can have disastrous effects on wellbeing (Lee, Lee, et al., 2020; Skogstad et al., 2013). The military context is no exception. On operational deployments, military personnel may contend with a range of challenging experiences, many associated with the subsequent development of posttraumatic stress (PTS; Armistead-Jehl et al., 2011), a cluster of symptoms thought to be caused by exposure to traumatising events, that include features such as 'flash-backs' distressing memories, avoidance of trauma-related stimuli, and marked alterations in autonomic arousal. Comorbid with PTS are a range of health conditions including cardiovascular, metabolic, and musculoskeletal disorders sitting alongside alterations in the hypothalamic-pituitary-adrenal (HPA) axis, nervous system, and in inflammatory processes (Michopoulos, Powers, et al., 2016; Michopoulos, Vester, & Neigh, 2016; Ryder et al., 2018).

Early models of psychopathology positioned stress as having a direct and causative role in PTS (Rosenthal, 1966), and the common expectation is that following exposure to a traumatic event, an individual is likely to experience PTS (Bonanno, 2021). However, research into the relationship between traumatic events and PTS has yielded significantly heterogenous results, such that some individuals may indeed develop and maintain symptoms while the majority tend to show no symptoms at all (Galatzer-Levy et al., 2018). A range of models, such as the diathesis-stress (Meehl, 1962; Walker et al., 2008) and hormesis (Hill et al., 2024) models, have been created in attempts to make sense of these divergent findings on outcomes by explaining that some people may be more vulnerable to stressful traumatic events than others. Given the capacity for these events to provoke PTS or other pathogenic consequences in some, but not all individuals, the exposures to such events are considered in this thesis as potentially traumatic events (PTEs). Where those events occur as a

part of military deployment activities, they are described as potentially traumatic deployment events (PTDEs).

The exposure to PTEs also has implications for the development of positive experiences. Classically referred to as posttraumatic growth (PTG), there are reports that military personnel may grow in positive ways following deployment (Habib et al., 2018). However, as found in PTS research, the positive impacts of PTDEs are not universal, with research showing negative, positive, and no relationship with positive mental health outcomes (Mark et al., 2018). Whether a traumatic event may contribute to broader factors of positive mental wellbeing, such as flourishing, remains an area for research development (Middleton, 2016).

This research was conceived to help make sense of the range of responses by NZDF personnel after deployments, and to support better outcomes for my uniformed brethren. First, I found two postservice academic supervisors who could help me to find gaps in the posttraumatic and postdeployment literature. Next, we engaged in consultation with key military leaders who were in the position to both consult on supporting the health and wellbeing of current NZDF personnel, and subsequently take action on these findings. This research aim aligns with the aim to reduce pathological consequences and enable wellbeing among service personnel within the NZDF (C. Bennett, 2017; NZDF, 2018), and across our military partner countries (Armour et al., 2022; Fikretoglu et al., 2022; Forbes et al., 2019; Sadler et al., 2024). Grounded in these foundations and following a primarily positivist approach, the present investigation sought to answer a number of questions, such as, why is it that some military personnel develop PTS after deployment, and why some flourish? Further, what factors facilitate and buffer these effects? This is the main focus of this research. Such understandings of factors which influence the development of PTS, or facilitate positive experiences following trauma, may also have implications beyond the trauma-exposed military population.

A number of factors have been investigated to explain the risks for PTS and what facilitates positive growth following adversity. Social support and adaptive health behaviours are two such factors with implications for both PTS and flourishing. While these past investigations have yielded useful insights, a limited number have investigated the effects of these factors over time: even fewer, within the New Zealand military postdeployment population.

Overview of the Study

This study focused on the question of why some individuals develop PTS after being exposed to PTEs, why some do not, and why some individuals may flourish. This research tested the impacts of PTDEs on PTS and flourishing, and the effects of social support and adaptive health behaviours, with

a sample of NZDF personnel who had previously deployed on operations. The study added theoretical knowledge to this body of literature, providing information about risk factors and facilitating factors in individuals who are exposed to PTEs, and yielded useful insights to aid the New Zealand postdeployment population.

In the first half of this thesis, arguments for adaptive health behaviours, social support, and their roles as protective factors for PTS are presented, as well as discussions on factors which promote flourishing. Chapter 2 describes the impacts that PTEs and PTDEs can have upon PTS, including a range of psychological, neurological, and physiological changes. Chapter 3 presents the notion of posttraumatic flourishing through an exploration of the shared space and differences between PTG and flourishing and explores the impact of PTDEs on flourishing. Chapter 4 seeks to explore the roles of a range of adaptive health behaviours (exercise, nutrition, and sleep), and a range of social supports as buffering factors to PTS and facilitating factors to flourishing.

In the second half of this thesis, the current study is presented. Chapter 5 integrates past research findings into an analytic framework, outlining the research aims and hypotheses. Chapter 6 outlines the methodology and Chapter 7 the results. Lastly, Chapter 8 discusses the study, the implications of the observed results, and the limitations and strengths of this study.

CHAPTER 2

TRAUMATIC STRESS

There are a number of factors that need to be addressed in order to understand PTS following operational deployments. To this end, this chapter serves to examine the relationship between PTDEs and PTS. The first section seeks to describe PTS, including how this cluster of symptoms came to be understood, and the most observed symptom clusters. Next, the link between PTDEs and PTS is explored, covering the heterogeneity of PTS and the range of deployment-related experiences that have been associated with PTS. Finally, the psychological and physiological changes that occur as humans orient to stress and threat are discussed, both from a normative perspective and in relation to the deviations that are observed in PTS.

Posttraumatic Stress Symptoms

The first systematic discussions of combat-related stress date back to World War 1 (WWI), an era of warfighting marked by combat techniques that had not co-occurred before. Soldiers waiting within trenches were exposed to chronic threats such as gunfire, and perversely new lethal terrorisations such as poison gasses, mortar fire, armoured tanks, machine-gun fire, and land mines. Casualty rates were devastating, and fatality numbers horrific. Men, having watched their comrades die, were confronted with their own mortality daily. Out of this arose a new and unfamiliar type of syndrome, characterised by memory impairment, an exaggerated startle response, confusion, and challenges maintaining concentration (Andreasen, 2010). While developments in warfare have replaced the trench-based approaches of WWI with terrorism, guerrilla warfare, and improvised explosive devices, the more recent wars in Iraq, Afghanistan, and Ukraine have proven to be no exception to the rule, that a range of symptoms have been observed to follow combat (Fulton et al., 2015; Jawaid et al., 2022).

Thought to have arisen from exposure to explosive ordinance (Mott, 1917), the aforementioned syndrome acquired the name *shell shock*. Other names that were used to describe shell shock were combat stress and neurasthenia (Ahrenfeldt, 1958; Merskey, 1995). Such terms described a characteristic set of autonomic, cognitive, and emotional symptoms following extreme stress. The Diagnostic and Statistical Manual of Mental Disorders (DSM) listed criteria for this cluster of symptoms labelled Gross Stress Reaction following WWII, then Post Traumatic Stress Disorder (PTSD) following the Vietnam war (Andreasen, 2011). PTSD was introduced into the third iteration (DSM-III) and evolved across subsequent versions in response to evolving research (North et al., 2016) by fine tuning criteria, restructuring symptom clusters, and emphasising distress and impairment. In the most recent edition of the DSM (5th edition, text revision; DSM-5-TR), PTSD is

defined by four pronounced symptom clusters: reexperiencing of the traumatic event, avoidance of trauma-related stimuli, negative alterations to mood and cognitions, and hyperarousal (American Psychiatric Association, 2022).

While the identification of symptoms and subsequent diagnostic criteria have enabled leaps forward in the diagnosis and understanding of PTS (Fulton et al., 2015; Garfinkel & Liberson, 2009), this has not been without challenges. Since the introduction of the DSM, 5th edition (DSM-5), there has been a proliferation of factors describing the symptoms of PTS, including five-, six- and even seven-factor models (Armour et al., 2016). Within this explosion of models many issues have arisen, including effective factor identification and correlation between factors (Rasmussen et al., 2019). Furthermore, the latent structures of PTS symptoms investigated in taxometric analyses (Broman-Fulks et al., 2006; Ruscio et al., 2002) and the incidence of subthreshold PTS (Branchu et al., 2016) give compelling cases for PTS to be understood along heterogenous and continuous dimensions (ranging from mild to severe) rather than as a discrete disorder category (disordered or not). While PTSD is classically diagnosed by meeting the prescribed diagnostic criteria for the condition, it is crucial to understand that underlying this diagnosis exists a spectrum of symptomatology. For the purposes of clarity, PTS within the present document will be considered and discussed as a spectrum of symptomatology, rather than as a discrete disorder category.

Therefore, the wide spectrum of symptoms are termed posttraumatic stress (PTS) in this document, acknowledging the presence of symptoms characteristic of the four-cluster DSM-5-TR system (American Psychiatric Association, 2022), but independently from diagnostic criteria. This decision was made to honour the range of symptoms that occur following PTEs that may or may not be adequately captured by a diagnostic system. It was also made with consideration for the severe limitations in assessing the potential presence of a disorder solely from surveys, where only probabilities may be estimated, and ranges of cutoff scores are argued in the literature (Karstoft et al., 2013; McDonald & Calhoun, 2010).

Through the lens of the DSM-5-TR cluster system (American Psychiatric Association, 2022), the first cluster, reexperiencing, has been described as the most distressing feature of PTS, involving the reexperiencing of aspects of a traumatic event through flashbacks, or involuntary sensory images of the traumatic scene. These images are characterised by their vivid and detailed nature, lacking in temporal context, and often experienced as though the past traumatic event was happening in the present moment (Whalley et al., 2007). While frequent, intrusive memories of stressful events are found in many forms of psychopathology (Brewin et al., 2012), it is the reliving in the present with the sense of “nowness” which differentiates the intrusive memories experienced in PTS from other

remembered experiences (Birrer et al., 2007; Brewin, 2014). The intruding reexperience is also fundamentally distressing in nature and includes negative and arousing affect (Brewin et al., 2012), increases the heart rate (Chou et al., 2018), and is laden with sensory and emotive language (Hellawell & Brewin, 2002).

While normal episodic memory is thought to draw together objects, scenes, and time to encode a whole, contextualised memory (Treisman & Gelade, 1980), traumatic memories tend to be restricted to the elements specific to danger, creating fractured and poorly contextualised memories (Brewin, 2014; Cisler & Koster, 2010). It is this encoding of memory under acute stress which impairs the normal functioning of the ventral visual stream and medial temporal lobe structures, areas integral to the binding of objects, scenes, and time together to form contextualised, complete, and past-experienced imprints (Smith et al., 2015). Given their traumatically-encoded nature, both the traumatic experience itself and subsequent memory retrieval can also be associated with dissociative experiences (Rafiq et al., 2018; Vonderlin et al., 2018), such that an individual may lose partial or full awareness of their present surroundings (Armour et al., 2014; Beutler et al., 2022). Defence cascade (Lanius et al., 2018) and shutdown models (Schauer & Elbert, 2015) predict that peritraumatic dissociative experiences may interfere with the integration of fragmented memories, which in turn may predict future PTS symptoms (van der Hart et al., 2008; Van der Kolk & Fisler, 1995). This prediction is supported by some evidence (Aho et al., 2017; Benzakour et al., 2021; Cyniak-Cieciura et al., 2022; De Soir et al., 2015; Duncan et al., 2013; Gandubert et al., 2016; Hetzel-Riggin & Meads, 2016), but not all (Dancu et al., 1996; Elklit & Christiansen, 2010; Kate et al., 2020; Tiihonen Möller et al., 2014). Further, dissociative experiences have also been reported during stressful military training (Campbell, 2023; Dimoulas et al., 2007; Eid & Morgan, 2006; Taylor & Morgan, 2014; Taylor et al., 2007), pointing to a potential shared mechanism of detaching from PTEs or extreme stress as a protective mechanism (Dalenberg & Carlson, 2012; Lanius et al., 2012).

The second cluster refers to avoidance behaviour, describing the often great lengths to which people with PTS will go to avoid thinking about a traumatic event, or avoid any cues or situations that may serve as reminders (American Psychiatric Association, 2022). Avoidance-type symptoms appear to be the most reliable indicators for PTSD diagnosis (Nemeroff et al., 2006) and symptom severity (Boeschen et al., 2001; Marshall et al., 2006; Marx & Sloan, 2005). In and of themselves, avoidance behaviours are not inherently pathological as they serve to activate adaptive defensive motivational networks in the face of threats to improve protection or survival (Arnaudova et al., 2017; Beckers & Craske, 2017; LeDoux et al., 2017; Servatious, 2016). However, avoidance behaviours in PTS have been thought to gradually generalise to non-trauma-related stimuli (Rosenthal et al., 2005). Here, inappropriate fear responses become negatively reinforced as the aversive state of fear is decreased

following an enacted avoidance response (LeDoux et al., 2017). Further, this avoidance serves to maintain PTS by interfering with processing of the traumatic experience, and incorporate safety learning into current models of the world (Pittig et al., 2018). As individuals suffering from PTS show heightened fear generalisation (Jovanovic et al., 2010), this process can occur rapidly, serving to exacerbate and maintain PTS symptoms over time (Tull et al., 2004) and significantly and negatively impact quality of life (Kashdan et al., 2006).

While avoidance behaviours are often seen overtly, they can also occur covertly. One example of covert avoidance, thought suppression, has been shown to paradoxically produce a rebound increase in an avoided thought in individuals without PTS (Wenzlaff & Wagner, 2000). This effect is pronounced within populations who have experienced trauma, with an exacerbated rebound effect in trauma-related thoughts shown to follow periods of thought suppression (Shipherd & Beck, 2005). As such, the utilisation of thought suppression has been seen to both predict and contribute significantly to PTS symptom severity (Mayou et al., 2002; Steil & Ehlers, 2000). Similarly, another form of avoidance, responding to distressing stimuli through distraction, has been also found to be predictive of PTS symptomatology (Gil, 2005; Scarpa et al., 2006).

The third symptom cluster comprises experiences associated with hyperarousal. Here, trauma has been seen to initiate a cascade of neural adaptions resulting in a state of hyperawareness and hyperresponsivity to threat-related stimuli (Garfinkel & Liberson, 2009). This cascade, in turn, mediates many of the hyperarousal symptoms experienced by those suffering from PTS (Fani et al., 2012; Grupe et al., 2016; Lanius et al., 2017; Milad et al., 2009). Clinical features include sleep disturbances, exaggerated startle responses, irritability, depression, and hyper-vigilance. While a heightened vigilance and preparedness for fight or flight could be adaptive in the military theatre, continued vigilance within areas of safety can have devastating effects on health and wellbeing (Porges, 2011b; Williamson et al., 2013).

Finally, the negative alterations to mood and cognitions cluster comprise two symptoms: distorted cognitions regarding the causes or consequences of the traumatic event (e.g., inaccurate blame), and conflated negative beliefs regarding oneself, others, and/or the world. Given, that this is a newly defined cluster, research associated with this specific cluster is still emerging. However, difficulties with emotional acceptance and accessing effective emotional regulation strategies (O'Bryan et al., 2014) alongside dysfunctional cognitions (Kaczkurkin et al., 2017) have been uniquely associated with this cluster.

The Centrality of Stress and Sense of Danger as Normal Reactions to Abnormal Events

Some have argued that PTS is the result of normal stress responses interacting with extreme circumstances (Jakovljević et al., 2012). The purpose of this section is to describe frequently cited models of threat response. The next section then aims to describe the changes in threat perception and physiology that occur in PTS.

Threats, whether real or imagined, imminent or in the future, necessitate action. Thus, the detection of threats serves as a prelude to the fight-or-flight response, as first proposed by Cannon (1929) and later developed by Epstein (1972). The fight-or-flight response is a defensive emergency response that is activated in response to threats and mobilises an individual to survive a dangerous encounter (LeDoux, 2015). This inborn defensive strategy to respond effectively to threats involve a conditional selection from three options: an initial freeze, flee if possible, and fight if necessary (Blanchard & Blanchard, 1969; Bolles & Fanselow, 1980; Bouton & Bolles, 1980; Edmunds, 1974).

In early work on the fight-or-flight cascade (Brown & Fee, 2002; Gillispie, 1978), the autonomic nervous system's control over physiological responses to threat was explored. The traditional interpretation of the two branches of the autonomic nervous system represents the two time domains relevant to threat: (1) the sympathetic nervous system, which is responsible for the mobilisation of resources in response to threat, and (2) the parasympathetic nervous system, which is responsible for de-escalation and a return to homoeostasis after threat (Bernard, 1865/1957; Cannon, 1929; Langley, 1903). While more recent research has acknowledged that the two branches engage in a more complicated manner than was previously believed, this view is still widely held (Porges, 2011a).

Cannon (1970) believed that the activation of the sympathetic nervous system mobilised energy resources through a cascade of systems to support defensive physical actions and was therefore a particularly energy-intensive system. In line with such an assertion, activity in the sympathetic nervous system has been robustly associated with increases in respiration, oxidative pathways, and cardiac output, helping to transport oxygen towards muscles and waste products away (Porges, 1997). Through activation of the adrenal medulla, the sympathetic nervous system also impacts the release of adrenaline, which assists the liver in converting glycogen to glucose for muscle uptake (Porges, 2011a). Finally, blood supply is redirected away from the skin and intestines and into the muscles responsible for grossly defensive behaviour. This interplay between the adrenal glands and the sympathetic nervous system during fight-or-flight reactions is collectively referred to as the sympathoadrenal system.

The pituitary-adrenal axis is a second system that contributes to fight-or-flight responses, acting on a separate portion of the adrenal glands. Within this system, the pituitary gland stimulates the adrenal cortex to release cortisol, a steroid hormone which also helps to regulate energy availability. While the sympathoadrenal system responds to a threat within seconds, the pituitary-adrenal axis response is frequently not completely expressed until minutes or even hours later (Rodrigues et al., 2009). It is believed that these two complementary physiological axes regulate defensive responses to threat.

Both the sympathoadrenal and pituitary-adrenal systems respond to threat processing via the amygdala, the brain region responsible for detecting threats and activating defensive responses (LeDoux, 1998). Similarly, the amygdala and its associated defensive circuitry are critical for activating the brain's arousal system in reaction to a threat (LeDoux, 2015). Once activated by the amygdala, arousal processes contribute to threat detection by further attuning the brain to the sensory environment in search of potential threats, lowering the thresholds for protective responses, and suppressing other differently motivated behaviours (Luchicci et al., 2014; Nadim & Bucher, 2014; Sara & Bouret, 2012; Sears et al., 2013). Such a mechanism may understandably lead to a range of downstream changes. The next section characterises the physiological changes that occur within PTS, alongside their resultant burdens.

Threat Perception and Physiology: How the Body Reacts to PTS

Initial physiological responses to threat have been thought to support a state of energy availability that can promote a more efficient response to threat (Michopoulos, Powers, et al., 2016). However, the implications of alterations in threat processing also appear to have severe downstream consequential effects, particularly when stress responses are prolonged and especially intense (de Quervain et al., 2009; McEwen et al., 2002; McGaugh, 2000; Sapolsky, 1998). Indeed, PTS is associated with elevated risks for a wide range of cardiovascular, immunological, and metabolic disorders (Blessing et al., 2017; Levine et al., 2014; O'Donovan et al., 2015; Pacella et al., 2013). While lifestyle factors appear to play a role (Zen et al., 2012), a number of processes intrinsic to PTS have also been proposed as contributors to disease risk (Lohr et al., 2015; Michopoulos et al., 2015, Michopoulos, Vester, & Neigh, 2016; Su et al., 2008) and the subsequent perpetuation of PTS (Mellon, 2018). Thus, physiology has been identified as a key perpetuating factor and treatment target for PTS (McFarlane et al., 2017; Nijdam et al., 2023).

The first identified factor, inflammation, is thought to arise to protect and heal damaged tissues following trauma, and is generally effected by the immune system to increase the supply of blood flow and associated inflammatory mediators to the site of injury (Pierce & Pittet, 2014).

Inflammation has been identified as being elevated in PTS (Maes et al., 1999; Passos et al., 2015; Smith et al., 2011; Spivak et al., 1997) and correlates positively with PTS symptoms (Miller et al., 2001; von Kanel et al., 2007). Furthermore, inflammation has been associated with a range of deleterious neurobiological changes that facilitate PTS symptomatology (Kim et al., 2020; Michopoulos et al., 2015; Ravi et al., 2021; Rothaug et al., 2016). For example, inflammatory processes appear to disrupt hippocampal function (Loddick et al., 1998; Williamson, 2013), and impair contextual fear learning (Pugh et al., 1998) through disruptions to memory formation processes in the hippocampus (Burton & Johnson, 2012; Czerniawski et al., 2015; Gonzalez et al., 2013). Inflammatory processes also appear to disrupt amygdala function, impairing the acquisition and extinction of fear conditioning (Hao et al., 2014; Jing et al., 2015). As such, inflammation has been demonstrated to play a causal role in PTS (Dantzer et al., 2008; O'Donovan et al., 2013; Raison et al., 2006; Raison et al., 2013; Slavich et al., 2010). Similarly, inflammation also appears to serve as a risk factor for PTS, such that predeployment inflammation (Eraly et al., 2014; Schultebraucks et al., 2021) and inflammation measured in the hours and days after a PTEs (Bielas et al., 2018; Cohen et al., 2011; Pervanidou et al., 2007) have been associated with an increased risk of subsequent PTS. Therefore, arguments have been made that inflammation is a driving force in the aetiology and maintenance of PTS (Felger et al., 2016) and interventions that target inflammatory pathways may be effective treatment strategies for PTS (Michopoulos & Jovanovic, 2015).

The second identified factor, metabolic changes, is considered in nonpathological settings to facilitate a state of energy availability to promote an efficient response (Michopoulos, Vester, & Neigh, 2016). However, under persistent or extreme conditions of stress, both peripheral and central changes to metabolic functioning have been documented. In regard to peripheral changes, individuals with PTS are more likely to show peripheral increases in blood glucose, triglycerides, and HDL (Rosenbaum, Stubbs et al., 2015), with states of continuous energy availability being associated with insulin resistance (Blessing et al., 2017; Rao et al., 2014). For individuals with PTS, altered insulin and glucose responses following acute stress exposures have also been observed (Nowotny et al., 2010) and PTS has been shown to predict the subsequent likelihood of metabolic syndrome, but not vice versa (Wolf et al., 2016). In regard to central changes, glucose metabolism has also been shown to be significantly altered in the cortical structures of individuals with PTS, with disruptions shown in the hippocampus (Kim, 2012; Molina et al, 2010) and increased metabolism in the amygdala (Yehuda et al, 2009). It is thought that maladaptive metabolism may contribute to the core symptoms of PTS, given that fasting glucose levels and insulin resistance are both associated with damaging effects on the central nervous system (Heni et al., 2015; Reagan et al., 2008).

Given the threatening nature of military deployments, investigations have explored the link between PTDEs and PTS. The next section seeks to explore the research in this area, including the nature of the relationship that PTDEs have with PTS, and the specific experiences on deployment which may uniquely be associated with PTS.

The Link Between Deployment Experiences and PTS

Despite the extremes of human experience that occur on operational deployments, most veterans of modern deployments return without adverse mental health effects (Bonanno et al., 2012; Isacs et al., 2017; Pietrzak & Cook, 2013). Indeed, substantial heterogeneity has been observed within psychological functioning following traumatic exposure (Bliese et al., 2008; Bonanno, 2004; Branchu et al., 2016; Fulton et al., 2015). Exploring patterns of PTS, distinct and unique patterns of symptoms have emerged in response to military deployments (Bonanno et al., 2012; Galatzer-Levy et al., 2018). Here, some individuals show chronically elevated symptoms over time, some show an initial worsening then recovery, and others a chronic worsening over time, while the vast majority show no symptoms of PTS.

Some experiences on deployment appear to be more relevant than others to the later development of PTS. Combat exposure is one of the most obvious predictors of PTS during deployment (Able & Benedek, 2019). A dose-dependent relationship between combat exposure and PTS has been established (O'Toole et al., 1999), and combat exposure has emerged as a more accurate predictor of subsequent PTS than a variety of preexisting risk factors such as personal or family psychiatric history (Armistead-Jehle et al., 2011). In other research, PTS symptoms were only found to increase across the deployment cycle with high levels of trauma (Moore et al., 2017).

Different combat experiences also appear to have distinct associations with specific PTS symptom clusters. Combat has been linked to increased reexperiencing and numbing symptoms, proximity to death or injury to reexperiencing and hyperarousal symptoms, and exposure to an improvised explosive device (IED) to hyperarousal patterns (Osorio et al., 2018; Shea et al., 2017). General associations between combat exposure and avoidance, hyperarousal, and intrusive symptoms have also been established (Loncar et al., 2014). In other research on a variety of combat traumas, witnessing allies being injured or killed, being exposed to friendly fire, and being exposed to landmines were all linked to PTS (Pietrzak et al., 2011). The association between wartime atrocities and reexperiencing symptoms has been repeatedly established, with the degree of combat exposure being significantly correlated with the degree of reexperiencing symptoms (Beckham et al., 1998; Cox et al., 2017; Nye & Bell, 2007; Yehuda et al., 1992).

Individuals who are exposed to morally offensive events during deployment may experience significant emotional distress and functional impairments, known as moral injuries (Griffin et al., 2019). A range of potentially morally injurious events have been identified within the context of military deployment, including injuring or killing an enemy combatant, failing to prevent the suffering of civilians, or being betrayed by a leader or fellow service member in a position of authority. Exposure to potentially morally injurious events in the military context has been shown to be associated with PTS (Currier et al., 2015; Dennis et al., 2017; Jordan et al., 2017), even after controlling for sociodemographic characteristics (Wisco et al., 2017). However, there has been disagreement regarding which acts are considered transgressive and morally injurious, with some describing acts that could be justified in a war context (e.g., mortally wounding an enemy) as still morally injurious (Farnsworth et al., 2014; Litz et al., 2009), and others arguing for behaviours that fall outside the rules of engagement to prevent bracket creep (Frankfurt & Frazier, 2016). A further complicating factor is that moral injuries are generally believed to result from either perpetrating, witnessing, or experiencing actions that violate one's core beliefs (Litz et al., 2009; Shay, 2014), and are therefore defined according to an individual's own moral code and core beliefs. Given these factors, there has been a push in the literature to describe and characterise moral injury (Yeterian et al., 2019). Within the present research, moral injury is considered to have occurred when an individual has experienced an event which has both violated the individual's moral beliefs and lead to a pathogenic outcome.

An additional unique predictor of PTS is the occurrence of interpersonal trust transgressions (DePrince & Freyd, 2002). Interpersonal traumas, such as sexual, emotional, or physical abuse perpetrated by another individual, are believed to result in a loss of trust in others and the world (Ratcliffe et al., 2014), and have been linked to PTS following deployment (Godfrey et al., 2015; Katz et al., 2012; Kearns et al., 2016). Such relationships with PTS have been found to occur independent of combat exposure (Hahn et al., 2015) and compound with combat exposure to confer a higher risk of PTS (Godfrey et al., 2015). Moreover, it is believed that interpersonal traumas are exacerbated in military and deployment settings by continued exposure and involvement with the perpetrator (Yaegar et al., 2006).

In sum, while the majority of individuals exposed to traumatic events during deployment do not exhibit symptoms of PTS, a sizeable minority are affected, sometimes severely and persistently. There is evidence that certain deployment experiences, including combat exposure, moral injuries, and interpersonal transgressions, are uniquely associated with PTS. The next section explores the cognitive and perceptual changes in PTS and contextualises these changes within the military environment.

Cognitive and Perceptual Changes in PTS and the Deployment Context

PTS is characterised by marked deviations from what are assumed to be normal threat responses (Grupe & Nitschke, 2013). A number of researchers have sought to develop descriptive and explanatory models for these PTS-related deviations (Brewin et al., 1996; Brewin & Holmes, 2003; Clark & Ehlers, 2004; Dalgleish, 2004; Ehlers & Clark, 2000; Foa & Rothbaum, 2001; Hembree & Foa, 2004). Subsequent attempts to integrate these primarily cognitive models (Clark & Beck, 2011; Leahy, 2010) have emphasised that the union of traumatically-encoded memories and maladaptive changes in thoughts and perceptions culminate in the development and maintenance of PTS. It is believed that in cases of PTS, memories of the traumatic event encode in a manner that is fragmented and poorly contextualised (Clark & Ehlers, 2004; Ehlers & Clark, 2000), leading to memories that are retrieved in a disorganised and fragmented manner (Halligan et al., 2002; McKinnon et al., 2008; Meiser-Stedman et al., 2007) and contain highly salient elements of threat and danger (Dunmore et al., 1999, 2001; Halligan et al., 2003). The convergence of these factors appears to give rise to the hallmark symptoms of PTS of intrusion and reexperiencing (Marks et al., 2018).

It has been proposed that in PTS traumatic events also dramatically alter basic assumptions about the self, the world, and other people (Brewin et al., 1996; Ehlers & Clark, 2000; Foa & Rothbaum, 2001; Janoff-Bulman, 2006; Shipherd et al., 2006). These, in turn, lead to documented changes in perceptions that the world is dangerous, people are a threat, and the self as vulnerable (Dunmore et al., 1999, 2001; Field et al., 2008; Piotrkowski & Brannen, 2002). Seemingly due to the aforementioned fear-memory and perceptual changes, an automatic attentional bias toward potential threats appears to also eventuate (Beck et al., 2001; Bryant & Harvey, 1995; McNally et al., 1990; Paunovic et al., 2002; Pineles et al., 2007).

While the above factors provide models for describing and explaining automatic processes inherent in PTS, the way an individual responds to these automatic processes also appears to underpin and define PTS. As trauma-related thoughts, images, and intrusions arise, the subsequent appraisal of these intrusions as threatening or catastrophic are thought to drive further perceptions of ongoing and current threat (Ehlers & Clark, 2000; Ehlers & Steil, 1995; Falsetti et al., 2002), leading to the documented intensification and persistence of PTS (Dunmore et al., 1999; Steil & Ehlers, 2000). The use of cognitive strategies to prevent or terminate intrusive recollections or reminders are thought to be maladaptive (Ehlers & Clark, 2000), giving rise to documented intensification and increased persistence of PTS in the presence of thought suppression, rumination, and ongoing and persistent dissociation (Ehring et al., 2006; Laposa & Alden, 2003; Steil & Ehlers, 2000). Further, behavioural models of PTS (Mowrer, 1939; Wolpe, 1968) have predicted that the avoidance of trauma-related

cues will be associated with increases in subsequent PTS (Dunmore et al., 1999, 2001; Litz et al., 2000).

Perhaps unsurprisingly, the downstream impact of these cognitive and behavioural processes appears to give rise to a range of perceptual differences in PTS. These include increased attention to threat, deficiencies in the discrimination between threat and safety information, increased avoidance of possible threats, inflated estimates of threat likelihood and consequences, increased reactivity to threat uncertainty, and disrupted cognitive and behavioural control in the presence of threats (Grupe & Nitschke, 2013; Grupe et al., 2016; LeDoux, 2015). As such, the cacophony of mechanisms used to explain and understand the development, maintenance, and attenuation of PTS is best characterised as complex by nature.

While most research positions the person experiencing PTS as a victim of these aforementioned cognitive and behavioural processes, it is important to consider the unique role of the military deployment context. Military occupational models of mental health have been developed to make sense of the appropriateness of threat-related adaptions within the military deployment environment. From this view, the relationships between deployment demands and subsequent psychological adjustments are powerfully influenced by a range of organisationally relevant contextual factors (Adler & Castro, 2013; Bliese & Castro, 2003).

A unique contribution of these models includes that military personnel knowingly enter high-risk environments and thus develop sets of psychological and physiological adaptions that are PTS-like in presentation. Distinctly, however, these are appropriate to the deployment environment and have been fostered through rigorous training and experience (Castro & Adler, 2011; Hoge, 2011). For example, hypervigilance is an appropriate adaption to environments containing dangers such as IEDs, suicide bombers, and the presence of enemy combatants indistinguishably dressed as civilians. Similarly, difficulties sleeping are similarly appropriate within the context of multiday patrolling efforts, regular night missions, and intermittent attacks from mortar fire. Finally, the restricted experience of distressing memories, thoughts, and feelings is an understandable adaption to operating within a culture that emphasises suppressing emotions and conducting military operations with professionalism. However, it appears that for some veterans, many of the combat-related adaptions that were appropriate on deployment are not easy to deactivate outside of this context (Castro & Adler, 2011), potentially contributing to the findings that, for some veterans, PTS symptoms appear to increase over time (Galatzer-Levy et al., 2018).

Chapter Summary

In summary, PTS has been observed to occur in some postdeployment individuals, frequently identified through the four symptom clusters outlined for PTSD in the DSM-5-TR (American Psychiatric Association, 2022). There are unique PTEs that may occur on military deployments (PTDEs) which appear to contribute to PTS in unique ways which in turn give rise to a range of cognitive, perceptual, and physiological changes. While many of these changes appear to be adaptive for the deployment environment, challenges may arise when military personnel return from operations. While negative effects of exposure to potentially traumatic events are well documented, positive effects have also been observed. The concept of posttraumatic flourishing is explored in the next chapter.

CHAPTER 3

POSTTRAUMATIC GROWTH AND FLOURISHING

While the relationship between deployment experiences and PTS has been well popularised, the positive changes an individual may experience following adversity have received less attention. Typically termed posttraumatic growth (PTG), a host of reports have documented its occurrence in the postdeployment population (Benetato, 2011; Lee et al., 2010; Morgan & Desmarais, 2017; Morgan et al., 2017; Murphy et al., 2017; Palmer et al., 2016; Palmer et al., 2012). A newer conceptualisation of posttraumatic positive adaptions has also emerged through studies of the impacts of PTEs on subsequent flourishing. This chapter seeks to explore PTG and posttraumatic flourishing, positioning these two concepts as separable constructs and building a case for their respective roles in postdeployment positive adaptions.

Positive Changes Following Adversity

There is growing interest in determining whether traumatic life experiences can serve as drivers for positive life experiences. The term PTG was coined to describe the positive psychological improvements found in individuals coping with difficult life experiences (Cohen et al., 1998; Tedeschi & Calhoun, 1996). Numerous distinct conceptualisations describe the phenomena of positive adaptations following trauma (Tennen, 2013), such as benefit finding (Tomich & Helgeson, 2004), stress-related growth (Park et al., 1996), and even positive illusions (Taylor et al., 2000). In this section, the major conceptual frameworks of PTG are explored, including the model of growth as occurring in five domains of life (Tedeschi & Calhoun, 2004), PTG as increases in eudemonic wellbeing (Joseph & Linley, 2005), PTG as changes in individuals' life narratives (Pals & McAdams, 2004), and the action-focused growth model (Hobfoll et al., 2007).

Tedeschi and Calhoun's (2004) proposal is the predominant model in the PTG literature. In this approach, PTG is generally described as experiences of positive psychological transformation following difficult life situations. Individuals report having a deeper appreciation for life, more intimate social interactions, heightened senses of personal strength, increased involvement with spiritual topics, and the awareness of new possibilities in their lives. The development of PTG is thought to result in feelings of wisdom and, over time, significant increases in life satisfaction. Indeed, this perspective on PTG is unique in that growth is viewed as both an outcome and a process—it is both a desirable outcome in and of itself, and an ongoing process of coming to terms with trauma in a positive way. Thus, according to Tedeschi and Calhoun (2004), PTG occurs later in the adjustment process and is a worthwhile consequence regardless of whether it promotes better wellbeing in the short-term.

PTG has also been seen as synonymous with psychological wellbeing (Joseph & Linley, 2005), due to the overlapping nature of the five dimensions of PTG established by Tedeschi and Calhoun (2004) and Ryff's (1989) concept of psychological wellbeing. Thus, it is believed that PTG occurs when an individual's traumatic experience results in expansion in the dimensions of psychological wellness—self-acceptance, purpose in life, environmental mastery, autonomy, and good relationships with others (Ryff, 1989; Ryff & Singer, 1998). Further, it is believed that traumatic events may make a person feel more competent in navigating their social environment and relationships, as well as freer to behave in line with their principles without fear of social rejection. According to this perspective, traumatic events are one of the avenues that might promote wellbeing. Further to this approach, differentiations are made between subjective/hedonic and eudemonic/psychological forms of wellbeing. Where subjective wellbeing relates to an individual's affect and satisfaction (Keyes et al., 2002), eudemonic wellbeing also includes concepts such as purpose, meaning, and autonomy (Jayawickreme et al., 2012). Here, the aftermath of trauma may have both negative effects, and increased understandings of what is important, alongside a stronger resolve to live in line with these understandings (Joseph & Linley, 2005).

PTG can be understood as a form of meaning-making during and after traumatic events (Park, 2010; Roepke et al., 2013; Wong et al., 2006). Pals and McAdams (2004) have contended that the rewriting of one's life story is a driver for people to make sense of traumatic events and a catalyst for the many cognitive and behavioural changes that comprise PTG. Thus, the revision of a person's life story is the process by which people rewrite their life tales in light of their awareness of how they have changed after the event.

Lastly, an action-focused growth paradigm has been advanced, identifying behavioural change as a measure of real (as opposed to perceived) growth after trauma (Hobfoll et al., 2007). Built upon the conceptualisations of Victor Frankl (1984), self-determination theory (Deci & Ryan, 2012), and models of behavioural activation (Martell et al., 2022), this perspective advocates that genuine and lasting growth is best indicated by changes in behaviour rather than cognitive and emotional shifts. Underpinning this model is the finding that while traumatic events may elicit reports of both distress and PTG, PTG was found to be protective against PTS and depression when an individual also took action in line with their own values (Hobfoll et al., 2007). Other research offers support for this model, finding lowered distress among individuals who enacted positive life changes (Frazier et al., 2001) and increases in reported PTG alongside increased behavioural change (Shakespeare-Finch & Barrington, 2012). However, other research has challenged the necessity of action to achieve PTG, citing instances where a lack of action also led to positive psychological outcomes (Bellizzi, 2004; Frazier & Kaler, 2006). Nevertheless, the action-focused approach has delivered an important

contribution to the PTG field, through discriminating between self-reported perceptions of growth and behavioural measures of growth (Jayawickreme, 2014; Seery et al., 2010; Zachry & Jayawickreme & Blackie, 2022). This divergence represents a challenge to the conceptualisation of PTG, and as such is discussed further in the proceeding sections.

Underpinning these conceptualisations is a common model of positive psychological growth after adversity (Cohen et al., 1998; Tedeschi & Calhoun, 1996). An individual is first faced with a PTE that precipitates a shattering of beliefs about the self and world (Foa et al., 1999; Janoff-Bulman, 2006), resulting in a period of psychological struggle (Weststrate & Glück, 2017). Other researchers have asserted that a PTE is not required to stimulate PTG (Jayawickreme & Infurna, 2021; Weststrate et al., 2022), as the psychological impact of an event is thought to be influenced by both subjective and objective factors (Boals, 2018). Nevertheless, the psychological struggle following a challenging event is thought to eventually give rise to a level of growth that exceeds both pretrauma levels (Tedeschi & Calhoun, 2004) and normative growth (Weststrate et al., 2022).

Deployment Experiences and PTG

In Tedeschi and Calhoun's (2004) original conceptualisation of perceived PTG, the psychological struggle that emerges during and following a traumatic event was thought to give rise to PTG. It was thus proposed that a positive relationship between trauma-related stress and growth would occur. Exposure to PTEs and a co-occurring elevation in stress were positioned as necessary initial steps in causing one to rethink and reorder priorities and rebuild values shattered by the trauma (Janoff-Bulman, 2006). Providing support for this conceptualisation, a recent systematic review described findings that military-related PTEs were associated with PTG (Mark et al., 2018). However, further examination of these findings revealed a diversity of relationships, in that combat exposure displayed positive associations (Bush et al., 2011; Gallaway et al., 2011; Mitchell et al., 2013; Park et al., 2017), a quadratic association (McLean et al., 2013), and non-significant relationships (Currier et al., 2013; Kaler et al., 2011; Marotta-Walters et al., 2015; Pietrzak, Goldstein, et al., 2010; Tsai et al., 2015) with PTG. Several characteristics relating to deployment have also been explored. Perceptions of threat have been positively related to perceived PTG (Kaler et al., 2011; Marotta-Walters et al., 2015). However, a number of other factors were also unrelated to PTG, including time since the traumatic event (Morgan & Desmarais, 2017; Tsai & Pietrzak, 2017), number of deployments (Mitchell et al., 2013), years served in the military (Tsai & Pietrzak, 2017), and the number of traumas suffered (Tsai & Pietrzak, 2017; Tsai et al., 2016). Given the heterogeneity of associations that are found between PTDEs and PTG, a closer examination of the methodological factors commonly used to determine these relationships is warranted. The next sections explore the challenges inherent in establishing positive growth after trauma.

Conceptual Issues in PTG

Researchers engaged in the study of PTG encounter a range of unique obstacles. To eliminate selection effects, researchers would ideally have access to samples of subjects picked prior to traumatic events. Typically, however, samples consist of those who have had severe life experiences who are asked to recall their perceived changes across time. In this section, the most prevalent strategies used by researchers to overcome these obstacles are explored.

Cross-sectional and retrospective evaluation of PTG using Tedeschi and Calhoun's (1996) PTG Inventory is one of the most used methodologies in the research of PTG (Helgeson et al., 2006; Jayawickreme et al., 2018). Participants are asked to retrospectively recall how their psychological wellness was before a PTE and to assess how much they have changed since and to what degree this difference can be attributed to the trauma alone. The emphasis on the possible therapeutic importance of self-reported PTG and the degree to which reported increases in the five dimensions measured by the PTG Inventory can be associated with better psychological and physical health, have been avenues of investigation that have depended primarily on the retrospective self-report approach. However, due to the retrospective nature of the measure, causal conclusions are understandably difficult to determine.

A handful of investigations have addressed the subject of PTG's long-term stability, and the consequences of this growth. This body of research has evaluated whether self-reported levels of PTG stay steady over time. Several investigations have shown the stability over time of reported posttraumatic benefits among fire victims (Thompson, 1985), heart attack sufferers (Affleck et al., 1987), and Israeli veterans (Dekel et al., 2012). In one study, both overall temporal stability and considerable individual variation were seen following experiences of sexual assault (Frazier et al., 2001). Here, some individuals reported increases in PTG levels, while others reported declines. Lastly, stable increases in PTG levels were observed in the weeks following hospitalisation for leukaemia therapy (Danhauer et al., 2013). These results indicate that although there seems to be some stability in perceived PTG, it is important to be cognisant of individual differences. Moreover, examination of the differences between individuals who experience more versus less PTG may yield useful findings to facilitate PTG in others.

While longitudinal studies are progressively emerging, the majority lack baseline data (Ai et al., 2013; Pollard & Kennedy, 2007). Prospective designs measuring actual changes at the time of PTEs are now recommended over retrospective designs (Jayawickreme & Blackie, 2014). As discussed in the next section, divergences between PTG and other concepts have surfaced when following these methods.

Perceived Versus Actual Growth

A body of research has emerged exploring the comparability of retrospective measures of PTG, and changes in measures of wellbeing taken before and after a traumatic event. To explore whether growth following adversity represented a significant and beneficial change (Cohen et al., 1998), a motivated positive illusion (Taylor & Armor, 1996), or a coping process (McMillen & Cook, 2003), one ground-breaking investigation sought to delineate between these constructs by comparing 1) a retrospective measure of PTG with 2) the change between ratings of present wellbeing before and after a traumatic event (Frazier et al., 2009). Termed actual growth, the difference between the pre- and posttraumatic measures was found to be unrelated to the retrospective rating of perceived growth. Subsequent research has replicated these findings, in that several prospective studies have found very small or nonsignificant correlations between perceptions of change and actual change in posttraumatic populations (Boals et al., 2019; Owenz & Fowers, 2019; Yanez et al., 2011).

A number of differences in the associations between concurrent variables further suggests that perceived and actual growth may represent two different processes. In the original study by Frazier et al. (2009), perceived growth was positively associated with both distress and positive reappraisal coping, but actual growth displayed a negative association with distress and was not significantly associated with positive reappraisal coping. In an effort to further elucidate these differences, a follow-up study (Gunty et al., 2011) revealed that there was a strong and positive relationship between perceived growth and actual growth when distress was low, but a nonsignificant relationship when distress was high. Frazier et al.'s (2009) finding that perceived growth was associated with distress and positive reappraisal coping has since been replicated with similar associations with positive reappraisal processes that were also unrelated to actual growth (Owenz & Fowers, 2019).

Given the concurrent significant associations that distress and positive reappraisal processes have with perceived growth, but not actual growth, these finding appear to support assertions that perceptions of growth may arise as a coping strategy to deal with distress (Kalisch et al., 2015; Linley & Joseph, 2004). In these views, perceptions of growth may have both constructive and illusory components (Gower et al., 2022; Zoeller & Maercker, 2006), given the concurrent associations with a range of positive mental health outcomes (Tedeschi et al., 2018) and also the number of cognitive distortions or self-defence mechanisms that have been also similarly associated with PTS (Cho & Park, 2013; Hall et al., 2009; Shakespeare-Finch & Lurie-Beck, 2014). While these reappraisal processes appear to alleviate emotional distress in the short term, overall they display deleterious outcomes in the longer term (Maercker & Zoellner, 2004; McFarland & Buehler, 2012). Offering

support for this conceptualisation, self-reported PTG at 5 months after deployment has been associated with worse PTS at 15 months postdeployment (Engelhard et al., 2015).

Given the documented divergences between perceptions of growth and actual growth, a natural evolution of this discussion is to explore how PTG might relate to other measures of positive wellbeing. The next section explores this topic through the lens of posttraumatic flourishing.

PTG and Posttraumatic Flourishing

Flourishing is a broad umbrella term that encompasses a variety of psychological theories of wellbeing (VanderWeele, 2017), and has been defined as the culmination of positive emotions, positive relationships, and purpose and meaning (Keyes, 2002). Over the years, several psychological theories of happiness have arisen (Cantril, 1965; Diener et al., 1985; Fordyce, 1988; Lyubomirsky & Lepper, 1999). Some of the most frequently used constructs pertain to either happiness as a pleasant affective state (hedonic happiness), or alternatively, total life satisfaction (National Research Council, 2013). Others have conceptualised flourishing as sitting along a spectrum of mental health, from languishing to flourishing (Keyes, 2002).

Owing to its broad definition, a range of composite measures for flourishing have been developed that incorporate a variety of dimensions of psychological wellbeing (Diener et al., 2010; Huppert & So, 2013; Hyde et al., 2003; Ryff, 1989; Su et al., 2014). Based on prior humanistic psychological theories (Ryan & Deci, 2000; Ryff, 1989; Ryff & Singer, 1998), these conceptions define wellbeing in relation to various fundamental human psychological needs, such as feelings of competence, relatedness, and self-acceptance (Diener et al., 2010). In addition to ideas from the humanistic tradition, conceptualisations of flourishing have also embraced a few additional concepts including social capital (Helliwell et al., 2009; Putnam, 2000), flow, interest, and engagement (Csikszentmihalyi, 1990), purpose and meaning (Ryff, 1989; Ryff & Singer, 1998; Seligman, 2002; Steger et al., 2008), optimism (Peterson et al., 1988; Schiere & Carver, 2003), and virtue and health (VanderWeele, 2017).

Given PTG's original hypothesis of positive growth after difficult experiences (Cohen et al., 1998; Tedeschi & Calhoun, 2004), flourishing has been identified as a related concept that could be similarly fostered through supported accommodation to trauma (Middleton, 2016). To verify this hypothesis, it would be essential to compare PTG and flourishing data recorded before, up to, and after a traumatic incident (Frazier et al., 2009). Perhaps unsurprisingly, capturing such information within an acceptable study design such as this one is difficult. Few prospective longitudinal designs of this sort exist, which raises the issue of whether PTG represents perceptual changes, as shown by perceptions of PTG, or true changes over time, as demonstrated by the contributions of PTDEs to

flourishing (Infurna & Jayawickreme, 2019). Clarifying this issue, early meta-analytic investigations have found PTG to be largely unrelated to a range of positive mental health outcomes (Helgeson et al., 2006). In more recent investigations, PTG was found to be unrelated to posttraumatic flourishing (Barrington & Shakespeare-Finch, 2013) or actual changes in flourishing (Davis et al., 2021) but in others, PTG was positively correlated with posttraumatic flourishing (García & Wlodarczyk, 2016; Greene & McGovern, 2017; Grier-Reed et al., 2022). Among these varied findings, no military or postdeployment samples were used.

Trauma and Flourishing

Compared to the wealth of PTG research, the direct impact of trauma exposure upon flourishing has been much less explored. In one sample of undergraduate students (Nolen, 2013), the number and severity of traumas experienced across lifetimes were not associated with scores on the flourishing scale. In one sample of adults who had experienced a parental death at an early age (under 18 years), individuals who had experienced very little trauma across their lifetimes experienced significantly higher levels of flourishing compared to those who reported extreme levels of adult trauma (Greene & McGovern, 2017). In an investigation comparing the associations between flourishing and experiences of events that met versus did not meet Criterion A events in the DSM-IV-TR criteria for PTSD, the number of traumatic events experienced that met Criterion A did not display a significant association with flourishing (Anders et al., 2012). Interestingly, non-Criterion A events and relational traumas showed negative associations. Moral injuries were found not to be associated with flourishing in a sample of individuals who had received a life-sentence of imprisonment (DeCaro et al., 2022). Cumulative exposure to traumatic events was also negatively associated with psychological wellbeing in a sample of individuals who had experienced loss, but not for those who had lost people in traumatic circumstances or suffered interpersonal violence (Folger, 2016). These findings indicate that the types of trauma may uniquely impact flourishing. The direct effect of military deployment trauma on flourishing, however, remains an area that has been neglected.

In investigations of similar constructs, combat exposure, deployment frequency, and vehicle crashes or blast exposure while on deployment have shown negative associations with life satisfaction (Barczak-Scarboro et al., 2021). In a sample of recently deployed Canadian Armed Forces members, exposure to potentially morally injurious events were associated with 37% less likelihood of meeting the flourishing criteria when compared to those who had not been exposed to potentially morally injurious events (Hansen et al., 2022). In an investigation with Korean and Vietnam war veterans (Lee, 2019), combat exposure, malevolent environments, perceived threat, and moral injury were not related to psychosocial wellbeing. In another investigation of Vietnam war veterans, combat

exposure, engagement in atrocities or episodes of extraordinarily abusive violence, experiences of harsh or malevolent environments, and perceived threat or anticipatory fear were negatively related to a measure of general life satisfaction (Vogt et al., 2004).

A Synthesis: PTDEs and Hormesis

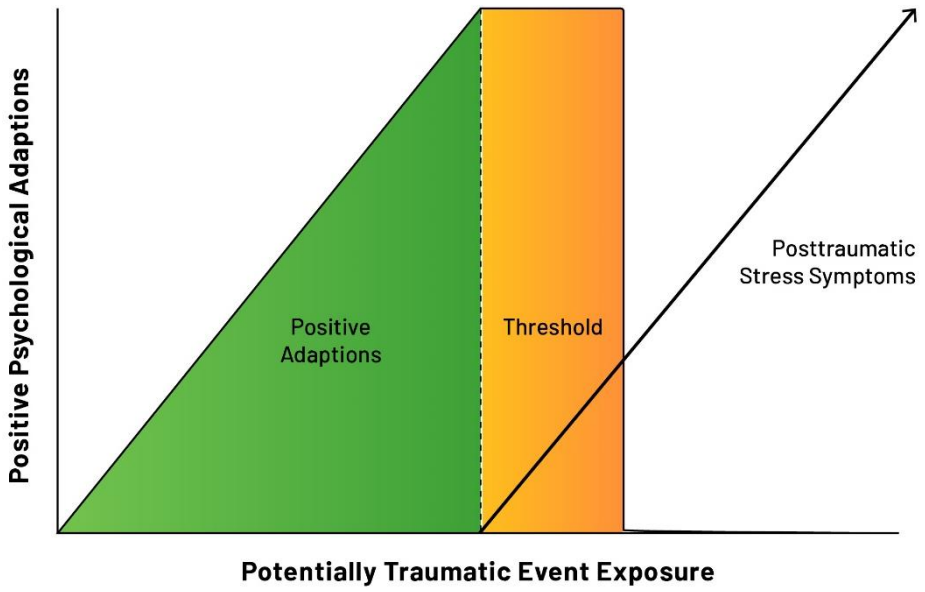
A recent model of adaption to stress has positioned hormesis as an explanatory factor for the link between PTEs and both positive and negative outcome variables (Hill et al., 2024). Building upon the diathesis-stress (Meehl, 1962) and Yerkes-Dodson (Yerkes & Dodson, 1908) models, hormesis explains that in the right doses and conditions, stressors may either enhance or strain an organism or system (Agathokleous et al., 2018; Calabrese, 1999, 2001, 2005a, 2005b; Calabrese & Baldwin, 2001; Calabrese & Blain, 2005, 2011). Applied to psychological outcomes, some adversity, but not too much, is thought to give rise to better psychological outcomes (Hill et al., 2024; Oshri, 2023; Voigt et al., 2024). Theories which predict similar effects include stress inoculation (Meicheribaum & Novaco, 1985), stress immunisation (Başoğlu et al., 1997), and steeling (Rutter, 2006, 2012). Past research into cumulative life adversity adds some support for this conceptualisation, finding that the experience of moderate levels of lifetime adversity predict better psychological outcomes than not only high aversity, but also no adversity (Dooley et al., 2017; Edge et al., 2009; Gunnar et al., 2009; Hagan et al., 2014; Oshri, 2023; Seery, 2011; Seery et al., 2010; Seery et al., 2013). Other research has similarly found that adversity may catalyse subsequent positive psychological outcomes in appropriate doses (Agathokleous & Calabrese, 2020; Infurna & Jayawickreme, 2019; Jayawickreme & Infurna, 2021; J. J. Liu et al., 2017; R. T. Liu, 2015). These results suggest that adversities may contribute to positive psychological outcomes when the adversity is neither too minor nor too major.

A difficulty with extrapolating these conceptualisations to the military context is that there is significant heterogeneity in responses to PTEs and PTDEs (Galatzer-Levy et al., 2018), suggesting that the optimal level of exposure to military stressors (e.g., PTDEs) to provoke subsequent positive outcomes (e.g., flourishing) may be dependent on an individual's capacity to adapt to stress, rather than any objective level of introduced PTE. Nevertheless, elements of the hormesis model appear to be supported within military samples. Combat exposure has been shown to have a positive linear association with PTG in some research (Bush et al., 2011; Gallaway et al., 2011; Mitchell et al., 2013; Park et al., 2017) and a curvilinear relationship in another investigation (McLean et al., 2013). However, nonsignificant relationships have also emerged (Currier et al., 2013; Kaler et al., 2011; Marotta-Walters et al., 2015; Pietrzak, Goldstein, et al., 2010).

It is important to note that, as outlined in the "Perceived Versus Actual Growth" section, there exist clear differences between retrospective measures of PTG and changes in positive psychological outcomes across time. One of the clear differences outlined was that distress arising as a result of a PTE appears to have a positive association with perceptions of PTG, but a negative association with a range of positive psychological outcomes. This suggests that the presence of distress may represent the crossing of a threshold, limiting an individual's ability to then adapt positively to adversity. In turn, increasing distress and adversity levels thereafter appear to lead to increasingly deleterious outcomes. PTS may also serve as a proxy variable for the "crossing of threshold" phenomenon. In support of this conceptualisation, actual growth (versus perceived PTG) relating to a singular PTE has been found to be negatively associated with distress (Frazier et al., 2009), and mental health has been found to mediate the relationship that childhood adversities have upon subsequent quality of life (Höltge et al., 2019). Together, these results suggest that an increasing presence of distress may represent the crossing of an individual's threshold of tolerance, which in turn has a deleterious effect on positive psychological outcomes. Figure 1 depicts this proposed relationship, such that positive psychological adaptions may increasingly occur at low to moderate levels of PTE exposures, but that these positive adaptions reverse, and PTS starts to emerge, after an individual's threshold for PTE is surpassed. However, this proposed model remains to be explored.

Figure 1

Positive Psychological Adjustment to Accumulating Potentially Traumatic Events



Chapter Summary

In sum, a range of mechanisms that lead to positive psychological adaptions after PTEs have been described and differentiated. Mixed results have been yielded from research investigating PTG following PTDEs. Conceptual issues exist regarding perceived versus actual PTG, with limited evidence suggesting that perceived PTG represents a buffering mechanism to distress while actual PTG represents broader overall positive psychological adaptions. Diverging from the commonly cited PTG literature, exploring the link between PTEs and posttraumatic flourishing may add constructively to this body of knowledge. However, only a small number of investigations have examined the association between PTEs and flourishing, with heterogenous results. Application to the military environment has been similarly impeded by limited research. Further, while research suggests that positive psychological adaptions occur in response to moderate levels of PTEs, increases beyond a threshold appear to be associated with both increases in distress and decreases in positive psychological outcomes. However, these findings are yet to be explored as they relate to PTS and flourishing. Several factors appear to be positioned to enable favourable outcomes for both PTS and posttraumatic flourishing. The next chapter explores this, by examining factors which may buffer PTS and facilitate flourishing.

CHAPTER 4

PATHWAYS TO HEALING: ADAPTIVE HEALTH BEHAVIOURS AND SOCIAL SUPPORT

The knowledge that PTS is not only a psychological disturbance, but also a whole-body adaption to threat and stress, is a key understanding. It is important knowledge, firstly for those individuals who wish to treat the state of PTS in an individual, and secondly, for those individuals who wish to develop prevention-enabling interventions. Implicit in the hormesis model of adaption are not only a dose-sensitive response to PTEs, as outlined in the previous chapter, but also contextual factors that may modify subsequent positive and negative responses (Den Hartigh et al., 2017; Hill et al., 2024). This suggests that a range of moderators may exert an effect on the relationships between PTDEs and both PTS and flourishing.

This chapter builds on Chapter 2's exploration of the psychological and physiological adaptions that occur in PTS and Chapter 3's exploration of the positive psychological effect of PTEs and explores the intervention points of adaptive health behaviours and social support. Specific factors described include exercise; nutrition; sleep; social support from family, friends, and significant others; and social supports from within the military framework. Further, this chapter also examines the role of adaptive health behaviours and social support in the facilitation of flourishing.

Adaptive Health Behaviours and Mental Health

There is increasing interest in the academic and clinical fields in a range of lifestyle factors that have previously been associated with physical health, but now also appear to relate to mental health (Firth et al., 2020). Termed adaptive health behaviours, patterns of physical activity, nutrition, and sleep, have amassed substantial cross-sectional evidence of association with a range of diagnosable disorders including schizophrenia, bipolar disorder, depression, anxiety, and stress-related disorders (Firth, Siddiqi, et al., 2019). As such, a range of regulatory bodies have positioned adaptive health behaviours as integral to effective treatment in mental health disorders. Notably the European Psychiatric Association has positioned exercise as a first-line treatment for depression and as an adjunctive therapy for improving recovery from severe mental illness (Stubbs et al., 2018). Further, the Royal Australian and New Zealand College of Psychiatrist's clinical practice guidelines for mood disorders list exercise, diet, and sleep as needing to be addressed before the implementation of pharmacotherapy or psychotherapy (Malhi et al., 2015).

Across the range of evidence, there appears to be support for the assertion that adaptive health behaviours are not only associated with lowered burdens of mental illness, but may also play a key causal role in the incidence and outcomes of disorders. Physical activity has been demonstrated to reduce the prospective risk of depression, anxiety, bipolar disorder, and psychosis (Brokmeier et al.,

2020; McDowell et al., 2019; Schuch et al., 2018; Sun et al., 2020). These findings are supported by research finding that cardiorespiratory fitness (Kandola et al., 2019; Schuch et al., 2016; Tacchi et al., 2019), muscular strength, and resistance training are protective against mental illness (Bennie et al., 2019; Gordon, McDowell, Hallgren et al., 2018; Gordon, McDowell, Lyons & Herring, 2017, 2019; Ortega et al., 2012). Similar findings in investigations of diet showed that healthy dietary patterns (operationalised as Mediterranean, DASH, and low-inflammatory diets) reduced the prospective risk for depressive symptoms (Lassale et al., 2019; Molendijk et al., 2018; Nicolaou et al., 2020; Tolkien et al., 2019). Similar prospective reductions in depression risk have been found with reductions in intake of sugar-sweetened beverages and increases in intake of polyunsaturated fatty acids, EPA and DHA, and fruit and vegetable (Grosso et al., 2016; Hu et al., 2019; Saghafian et al., 2018). Finally, sleep has also been found to play a prospectively role in mental health, including sleep quality (Bao et al., 2017; Hertenstein et al., 2019; Li et al., 2016), and quantity (Lee et al., 2019; Zhai et al., 2015), as well as key factors for the subsequent risk of depression, anxiety, and ADHD.

Potentially pointing to a shared explanatory factor, inflammation has been linked to a wide range of psychiatric disorders (Yuan et al., 2019). Inflammation is typically said to develop in response to injury and infection Lifestyle factors appear to play crucial roles in the regulation of both inflammation and psychopathology. For example, poor diet (Kiecolt-Glaser et al., 2017; O'Keefe et al., 2008; Salari-Moghaddam et al., 2019) and sleep (Hamer et al., 2009; Krysta et al., 2017), have been shown to both have proinflammatory effects and increase depressive symptoms. Conversely, the anti-inflammatory effects of exercise (Gleeson et al., 2011), diet (Kastorini et al., 2011), and improved sleep (Chen et al., 2011; Savin et al., 2023) have also been documented. However, there is some evidence that anti-inflammatory interventions may only exert protective effects among those individuals for whom inflammation is a contributing factor in their psychopathology. In one investigation, anti-inflammatory medication was only efficacious in reducing depression for individuals with high levels of circulating inflammatory markers (Raison et al., 2013). While speaking to the role of inflammation in depression, adaptive health behaviours may additionally exert their effects on mental health through other mechanisms, such as changes to neurohormones and cognitive structure and function (Ashdown-Franks et al., 2020). With adaptive health behaviours appearing to exert clear effects on mental health outcomes, the next sections explore their respective roles specifically in PTS.

Exercise

The Associations and Effects of Exercise with PTS

Although a variety of evidence-based psychological and pharmaceutical treatments are effective in addressing the symptoms of PTS (Lancaster et al., 2016), there are a number of hurdles to

treatment, such as stigma, motivation, affordability, and care access (Sayer et al., 2009). Furthermore, it has been argued that ignoring the biological components of PTS that may prevent the onset of PTS and/or alter its course over time may be detrimental to treatment paradigms (McFarlane et al., 2017). While exercise has its own limitations, it is a widely accessible, low-cost activity that avoids the negative connotations associated with conventional mental health care (Dickstein, Vogt, et al., 2010). As such, the idea that exercise and physical activity may be an effective treatment for postdeployment PTS is gaining traction in the scientific community (Caddick & Smith, 2017; Hall et al., 2015; McCash & Abraham, 2017; Sornborger et al., 2017; Vancampfort et al., 2017; Whitworth & Ciccolo, 2016).

Several observational studies indicate that exercise lowers PTS symptoms (Arnson et al., 2007; Bosch et al., 2017; Bourn et al., 2016; Davidson et al., 2013; Harte et al., 2015; Rosenbaum et al., 2016; Vujanovic et al., 2013; Whitworth et al., 2017). In a study of 38,883 American soldiers, those who reported engaging in intense exercise had considerably lower probabilities of acquiring new PTS symptoms or having chronic symptoms 3-5 years later (LeardMann et al., 2011). However, this risk reduction was not linked with mild or moderate intensities. Similarly, in a cross-sectional investigation of trauma-exposed civilians, vigorous-intensity exercise, but not low- or moderate-intensity exercise, was negatively correlated with PTS hyperarousal scores (Harte et al., 2015). This link between vigorous-intensity exercise and PTS was replicated in a longitudinal study with civilians (Whitworth et al., 2017), finding that vigorous-intensity exercise was associated with fewer avoidance/numbing and hyperarousal PTS symptoms 3 month later. A limitation of these investigations was that in one (LeardMann et al., 2011), only low levels of PTS were detected at baseline, and in the other (Harte et al., 2015) low levels of PTS were detected in general. This may suggest that individuals with low levels of PTS who participate in intense exercise may experience the most significant effects on hyperarousal symptoms, whereas correlational evidence implies that individuals with higher levels of PTS experience more widespread symptom relief. Alternatively, hyperarousal may have been a pertinent feature of PTS at low levels, and therefore represented a subconstruct that showed the most significant gains.

A cross-sectional study with an inpatient sample found that low-intensity exercise was negatively associated with PTS symptoms, while moderate- and vigorous-intensity exercise were not (Rosenbaum et al., 2016). However, other studies have failed to show a correlation between exercise and PTS symptoms (Arnson et al., 2007; Bosch et al., 2017; Davidson et al., 2013). Methodological constraints may account for these disparities. Studies that did not identify a significant link examined activity with a single-item variable, whereas studies that did detect a significant association employed validated, multiple-item exercise assessment measures. Given the

cross-sectional nature of many of these studies, it is not possible to conclude causation. Thus, the links found between exercise and PTS may suggest that those with lower levels of PTS may be more likely to engage in greater physical activity, as opposed to physical activity causing a reduction in PTS.

Looking to intervention research, exercise may be effective as a standalone treatment or as an adjunct to traditional PTS treatment (Babson et al., 2015; Diaz & Motta, 2008; Fetzner & Asmundsen, 2015; Goldstein et al., 2018; LeBouthillier et al., 2016; Manger & Motta, 2005; Newman & Motta, 2007; Powers et al., 2015; Rosenbaum, Vancampfort et al., 2015; Shivakumar et al., 2017). A variety of exercise-only therapies have shown significant decreases in PTS symptoms (Diaz & Motta, 2008; Manger & Motta, 2005; Newman & Motta, 2007; Shivakumar et al., 2017). In one intervention, hyperarousal symptoms were shown to decrease, but only in those with poor sleep quality at baseline (Babson et al., 2015). In a larger, randomised study (Fetzner & Asmundsen, 2015), aerobic exercise decreased PTS symptoms by reducing avoidance symptoms. In a follow-up study, it was discovered that persons with lower fitness levels at baseline saw bigger decreases in PTS symptoms compared to those with higher fitness levels (LeBouthillier et al., 2016). Lastly, a randomised intervention undertaken with a sample of veterans revealed that an exercise intervention resulted in larger decreases in PTS symptoms compared to waitlisted controls (Goldstein et al., 2018). However, hyperarousal symptoms were the only symptom cluster to substantially benefit from the exercise intervention.

In research analysing the effects of exercise alongside standard PTS treatment, the addition of exercise prior to treatment (Powers et al., 2015) and concurrent with treatment (Rosenbaum, Sherrington, & Tiedmann, 2015) produced greater improvements in PTS symptoms relative to groups participating only in therapy. These results converge to suggest that exercise may be combined with other forms of treatment to reduce PTS symptoms over and above standard treatment alone. To summarise more completely, both observational and intervention studies provide support for the notion that exercise exerts ameliorating effects on PTS symptoms. These results appear to be generalisable to the postdeployment context, as samples were drawn from both civilian and military populations. Based on this pattern of findings, potential mechanisms by which exercise may exert its effect on PTS are now discussed.

Exercise: Mechanisms of Action on PTS

One of the defining characteristics of PTS is hyperarousal, which frequently manifests as a heightened sensitivity to physiological arousal. Research indicates that exposure to these physiological signals during exercise, such as high heart and respiration rates, may promote

desensitisation to arousal cues (Anderson & Shivakuma, 2013; Asmundson et al., 2013; Broman-Fulks & Storey, 2008). Such a conceptualisation is compatible with the preceding section's findings, in that persons who engage in vigorous-intensity exercise had fewer hyperarousal symptoms of PTS (Babson et al., 2015; Harte et al., 2015; Whitworth et al., 2017). It is possible that exposure to the strong physiological arousal cues that are present during intense exercise may lower an individual's subsequent responsiveness to such cues. It has also been proposed that exposure to the strong physiological arousal inherent in exercise reduces catastrophic interpretations of normal physiological functioning (Broman-Fulks & Storey, 2008).

The presence and severity of PTS symptoms have been linked to alterations in brain structure and function, including reduced volumes in the anterior cingulate cortex (ACC), hippocampus, (Hayes, Hayes, & Miller, et al, 2017; Logue et al., 2018; O'Dohert, 2015), and prefrontal cortex (Karl et al., 2006; Shin et al., 2006). Further structural changes have been documented to co-occur with functional brain alterations in PTS including altered functioning and connectivity in the amygdala, hippocampus, orbitofrontal cortex, and ACC (Hayes et al, 2012; Miller et al., 2017; Sripada, King, Garfinkel et al., 2012; Sripada, King, Welsh et al., 2012). While there appears to be a dearth of exercise intervention studies in PTS that assess brain structure or function (Hegberg et al., 2019), there is considerable overlap between the neural correlates of PTS and the brain regions impacted by exercise (Hayes et al, 2013), indicating that exercise-induced brain changes may be one mechanism through which exercise exerts positive effects on PTS symptoms. For example, aerobic exercise training has been shown to increase volume in the prefrontal regions of the brain, including the ACC, relative to a nonaerobic stretching control (Colcombe et al., 2006). Other research has found that increases in physical exercise were associated with volume increases in the cingulate gyrus, frontal gyrus, medial prefrontal cortex, and other brain regions (Ruscheweyh et al., 2011). The hippocampus has also shown exercise-associated increases in volume (Erickson et al., 2011), which may in part be explained by increases in neurogenesis in this area (Firth et al., 2018; Pereira et al., 2007). Functional brain alterations have also been associated with aerobic fitness (Hayes, Hayes, Williams, et al., 2017; Prakash et al., 2011; Wong et al., 2015), and aerobic exercise has been shown to activate many of the same regions implicated in PTS (Hayes et al., 2013; Smith et al., 2013; Voss et al., 2010).

Normalisation of HPA-axis functioning may be another therapeutic target of exercise, based on its association with PTS symptom improvement (Childs & de Wit, 2014; Olff et al., 2007). Positive effects in the HPA axis that may promote normalisation and amelioration of PTS symptoms have been documented following acute bouts of exercise, and longer-term regular exercise. Acute exercise has been shown to induce the secretion of adrenocorticotropic hormone (ACTH; Galbo,

1986), which stimulates cortisol secretion and may address lowered basal levels of cortisol (Daskalakis et al., 2016). Acute moderate-, and vigorous-intensity exercise but not low-intensity exercise has been shown to increase levels of cortisol (Chatzinikolaou et al., 2010; Hill et al., 2008). Additionally, research also evidences that both acute and regular exercise improves stress-related activation of the HPA axis, including the commonly observed blunted cortisol response (Nabkasorn et al., 2006; Stranahan et al., 2008; Wunsch et al., 2017; Zscucke et al., 2015). It remains unclear whether these findings can be generalised as PTS-related HPA-axis alterations.

Overall, exercise has been demonstrated to reduce PTS symptomatology across a variety of populations, including the military, and as such is suggested to have utility as a form of treatment. There are multiple routes that may underpin exercise-induced improvements in PTS symptoms. However, additional investigations appear to be required to provide more definitive evidence for the attenuating mechanisms between exercise and PTS.

Nutrition

The association between nutritional intake and PTS is considerably less established than the relationship between physical activity and PTS. In one study, PTS symptoms were positively related with intake of fast food and drinks (Hirth et al., 2011; Vilija & Romualdas, 2014). In another, individuals with PTS were shown to consume fewer daily servings of fruit than those without PTS (Godfrey et al., 2013). It is plausible that the persistent psychological reactions associated with PTS may influence eating-related decision-making processes. In terms of eating behaviours, these processes include increased impulsivity and diminished emotional control, which can result in less nutritious food selection and less regulated food consumption (Mason et al., 2017; van den Berk-Clark et al., 2018). In support of such a conceptualisation, longitudinal research has revealed that increasing levels of PTS were linked with increasingly unhealthy diets over time (Gavrieli et al., 2015; Kim, 2021). However, there is a shortage of intervention-based studies pertaining to diet and PTS (Hall et al., 2015).

An additional method for investigating the association between nutrition and PTS is to examine the effects of micronutrient consumption (Kaplan et al., 2015). The brain requires a disproportionate amount of nutrients and energy compared to other organs (Leonard et al., 2003). To function, metabolism, or the transformation of one chemical into another, requires a variety of enzymes and cofactors. Without these cofactors, many metabolic processes are not possible (Karp, 2012; Lieberman, 2018). Therefore, the creation of energy is heavily dependent on nutritional availability. Several other metabolic processes essential to mental health, such as methylation and

gene expression (Stevens et al., 2018), as well as the regulation of reactive oxygen species (Kaplan et al., 2015), are also highly nutrient-dependent.

It is believed that chronic stress and specifically prolonged activation of the fight-or-flight response can result in chronic nutritional depletion (Rucklidge, Afzali, et al., 2021). Under such conditions, physiology has been shown to protect micronutrient-dependent short-term survival processes at the expense of longer-term functioning (McCann & Ames, 2009). Over time, and in the presence of persistent stress, this prioritisation of short-term survival may reduce or impair methylation processes, contribute to DNA damage and mitochondrial decay (Ames, 2010), and prevent longer-term resilience-building processes such as emotional processing after trauma (Rucklidge, Afzali, et al., 2021).

Supporting such claims, supplementation with B vitamins (Blampied et al., 2020; Long & Benton, 2013; Schlebusch et al., 2000; Stough, 2011; White et al., 2015; Young et al., 2019), and broad-spectrum multinutrient preparations has been shown to replenish nutrients and alleviate stress (Kaplan et al., 2015; Rucklidge et al., 2012; Young et al., 2019), as well as alleviate PTS symptoms following trauma (Rucklidge, Afzali et al., 2021). Further, biomarkers such as nutrient concentrations (Armborst et al., 2018; Camfield et al., 2013) have been shown to increase significantly in line with reductions in reported stress levels, and specific nutrient treatments have been demonstrated to have significant effects on mental health (Firth, Teasdale, et al., 2019), as have blood levels of individual nutrient factors (Friso et al., 2002; Webb, 2006), supporting the biochemical role nutrients play in improving mental health.

Sleep

Sleep disturbance is both a common occurrence in the postdeployment individual (Talbot et al., 2018), and fundamental to PTS (Lewis et al., 2009). Even in the absence of mental health challenges, sleep disturbances are extremely common in service members (Martindale et al., 2020; Plumb et al., 2014; Troxel et al., 2015), and are thought to arise, in part, as an artefact of the deployment environment, military training (e.g., irregular sleep-wake schedules), and culture (e.g., stigma; Martindale et al., 2021).

Though sleep disturbances are frequently considered a symptom or outcome, sleep is also a changeable health aspect that affects recovery and wellbeing (Martindale et al., 2021). Many PTS symptoms can stem from, and be exacerbated by, sleep disruptions (Richards et al., 2020). Moreover, the high prevalence of sleep disturbances and their associated problems have resulted in significant obstacles for reintegration and stabilisation into postdeployment life, as well as rehabilitation and quality of life (Ponsford et al., 2013; Troxel et al., 2015).

Although sleep has been strongly linked to PTS, the relationship between the two has been questioned (Spoormaker & Montgomery, 2008). According to the traditional perspective, traumatic events give rise to PTS, with sleep problems developing as part of standard PTS symptom clusters: reexperiencing symptoms such as flashbacks and nightmares, and insomnia as a subsymptom of hyperarousal. Here, insomnia and nightmares are regarded as subsequent symptoms of PTS. Nonetheless, a number of alternative hypotheses have arisen, including (1) disrupted sleep as a risk factor for PTS, (2) trauma-induced sleep disruptions leading to PTS and sleeping disorders, and (3) sleep disorders playing a mediating role in PTS (Spoormaker & Montgomery, 2008).

In early attempts to test the first model, difficulty sleeping appeared as a risk factor for the development of PTS (Harvey & Bryant, 1998; Koren et al., 2002; Mellman et al., 2001, Mellman, David, et al., 1995). Since this early research, prospective studies have convincingly demonstrated that sleep disturbances both before and after deployments serve as predictors of subsequent PTS development (Bramoweth & Germain, 2013; German et al., 2013; Wright et al., 2011). More data suggests a link between sleep disturbances and the development of PTS. It has been believed that REM sleep is essential for the emotional processing of information (Peever & Fuller, 2017). However, the amygdala hyperactivity and elevated noradrenaline levels that are seen in PTS have been linked to disruptions in REM sleep (Breslau et al., 2004 ; Kobayashi et al., 2007; Mellman et al., 2002, Mellman, Kulick-Bell, et al., 1995) and an increase in nightmares during REM sleep (Pagel & Helfter, 2003; Thompson & Pierce, 1999).

Cognitive and behavioural variables may also contribute to the development and maintenance of sleep disturbances in PTS. Nightmares following a traumatic incident are frequently experienced as a reenactment of the traumatic event, evoking levels of terror and/or shock similar to those that characterised the traumatic event (Wittmann et al., 2007). These nightmares disrupt sleep and lead to several behaviours that continue to disrupt sleep, such as getting out of bed, postponing the time for sleep, keeping lights on while sleeping, and several other behaviours (Krakow, 2000; Spoormaker et al., 2006; Wood & Bootzin, 1990), which is why nightmares seem to play a role in both the development of insomnia and PTS.

The “disturbed sleep as a secondary symptom” approach to PTS is challenged by the comparatively minor impact of PTS treatment on sleep disturbances (Bisson et al., 2007). Although primary mechanisms cannot be determined by the efficacy of a specific treatment, the inefficacy of a treatment indicates that the underlying hypothesis is most likely inaccurate (Salkovskis, 2002). While traumatic events may contribute to sleep disturbances, the involvement of disturbed sleep as a potential risk factor implies it is more than merely a consequence of PTS (Spoormaker &

Montgomery, 2008). Both psychological (Bisson et al., 2007; Zayfert & DeViva, 2004) and pharmacological (Davidson, Landerman, et al., 2002; Davidson, Rothbaum, et al., 2001; Meltzer-Brody, et al. 2000) treatment paradigms for PTS have low success rates for modifying sleeping issues. Conversely, therapy for disrupted sleep with individuals afflicted with PTS has been shown to considerably reduce PTS symptoms (Ho et al., 2016; Talbot et al., 2014).

How does the lack of restorative sleep associated with insomnia induce other psychological symptoms? The hypothesis that one of the functions of sleep is emotional regulation provides an answer (Palmer & Alfano, 2017). Preliminary investigations of sleep-dependent alterations in emotional memory support this role for sleep. For example, sleep has been shown to improve recall for emotionally important things (Payne et al., 2008). In this regard, it is believed that a lack of sleep in PTS patients could impede normal, sleep-dependent emotional memory processing and any related emotional regulation benefits (Wright et al., 2011). It is possible to hypothesise that insomnia patients would be at a higher risk for developing mood and anxiety disorders without these benefits.

When addressing uncomfortable emotional or psychiatric symptoms in combat veterans, sleep disruption may therefore be an ideal primary or secondary treatment focus. There are a number of advantages to treating sleep problems, including patient tolerance for therapy and a lesser degree of stigma in comparison to other mental health therapies (Kanady et al., 2018; Siebern & Manber, 2011). It has been demonstrated that therapies focusing on sleep are effective for individuals struggling with PTS. Several therapy options are available for sleep disorders, including both pharmaceutical and behavioural interventions. However, behavioural therapies have been proven to have greater long-term efficacy and fewer side effects than pharmacological approaches (Koffel et al., 2015).

A challenge in examining sleep-intervention outcomes lies in the fact that for a range of disorders, sleep is also a symptom of the core psychopathology. For example, sleeping difficulties are symptoms in both depression and PTS (American Psychiatric Association, 2022). Therefore, improvements in sleep may create spurious correlations with improvements in the sleep-related items of the psychopathology measure. While there appears to be a dearth of research investigating the role of sleep in psychopathology independent of sleep-related items, the scant research that does exist has shown that the effects are still valid when these items are controlled for (Müller et al., 2016). However, replication of this finding is clearly needed.

Interactive Effects of Adaptive Health Behaviours

There is evidence that nutrition, physical activity, and sleep habits may interact. Several nutritional stressors with far-reaching effects have been identified, such as energy deficit/low energy availability (Dipla et al., 2021; Elliott-Sale et al., 2018), macronutrient deficiencies (Elizabeth, 2019; Yan et al., 2018), and micronutrient deficiencies (Pervanidou & Chrousos, 2011; Wang et al., 2018). On the macronutrient front, deficits may contribute to sleeping problems (Vlahoyiannis et al., 2021). Dietary proteins and lipids, for instance, affect degrees of drowsiness and deep sleep (Vlahoyiannis et al., 2021). Further, while individuals on low-carbohydrate and low-energy diets frequently have insomnia and reduced REM sleep (Afaghi et al., 2008; Harvey et al., 2018), consuming rapidly digested, high-glycaemic carbs close to bedtime appears to aid sleep (Afaghi et al., 2008; Gratwicke et al., 2021; St-Onge et al., 2016). Emerging data also suggests that certain micronutrients can support enhanced sleep and, conversely, cause issues when deficient (Binks et al., 2020; Ji et al., 2017; Lothian et al., 2016; Zhao et al., 2019). For example, it has been demonstrated that correcting deficiencies in B vitamins, Vitamin D, iron, magnesium, and zinc improves sleep (Majid et al., 2018; Sanlier & Sabuncular, 2020).

Exercise also appears to alter the link between sleep and PTS. Exercise may be able to prevent some of the PTS-related physiological adaptations by stimulating the immune system and reducing inflammation. Immune and inflammatory abnormalities coexisting in PTS have been widely documented (Altemus et al., 2006; Groer et al., 2015; Michopoulos, Powers, et al., 2016; Platinga et al., 2013). However, regular aerobic exercise appears to provoke an anti-inflammatory effect (Archer et al., 2011; Gleeson, 2011; Kasapis & Thompson, 2005), which may partially explain the influence of exercise on sleep quality (Krueger et al., 2001; Rockstrom et al., 2018; Santos et al., 2007). Here, it has been demonstrated that changes in inflammation both moderate and mediate the relationship between exercise and PTS (Babson et al., 2015; Whitworth et al., 2017). The positive effects of exercise on inflammation and the role of inflammation in sleep regulation lend credence to the idea that exercise may be a useful treatment for PTS. However, additional research is required to directly evaluate this hypothesis (Hegberg et al., 2019).

Social Support

Social support has emerged as one of the most predictive factors for PTS (Brewin et al., 2000; Ozer et al., 2008) and mental illness more generally (Harandi et al., 2017). Social support, broadly defined, refers to social relationships that provide assistance to an individual and integrate them into a network of supportive social relationships (Kaniasty & Norris, 2009). Traditionally, social support is framed as having main or stress-buffering effects on psychological outcomes (Cohen et al., 2000). The main effects model suggests that social support directly supports positive outcomes, and the

stress-buffering model suggests that social support protects or buffers individuals from the pathogenic influence of trauma by boosting an individual's perceived ability to cope with trauma, reducing negative appraisals of trauma, and reducing damaging physiological responses (Cohen & Wills, 1985).

Social support has been regarded as an umbrella term that encompasses three facets: received social support, perceived social support, and social embeddedness, with each having different consequences for a variety of outcomes (Guilaran et al., 2018). It has been proposed that perceived social support affects psychological outcomes directly, whereas received social support modulates perceptions of support (Kaniasty & Norris, 2009). Both models are supported by a recent scoping study (Kaniasty et al., 2020) and a systematic review and meta-analysis (Guilaran et al., 2018).

Social support appears to improve a number of the physiological adaptions seen within PTS. High levels of social support have been shown to reduce inflammation and benefit the cardiovascular, endocrine, and immunological systems (Heard et al., 2011; Kiecolt-Glaser et al., 2010; Mezuk et al., 2010; Uchino et al., 1996). Two significant areas that perceived access to social support also appears to influence are stress reactivity and pain perceptions (Ditzen & Heinrichs, 2014; Uchino et al., 2011). Here, social support appears to directly buffer the physiological stress response (Cohen, 1988; Ditzen et al., 2008; Fontana et al., 1999; Heinrichs et al., 2003; Kamarck et al., 1995; Roberts et al., 2015; Thorsteinsson & James, 1999; Uchino, 2006) and to directly ameliorate pain perceptions (Krahé et al., 2013; Master et al., 2009). Through a variety of ameliorating physiological consequences, it is assumed that these are some of the buffering mechanisms of social support (Roberts et al., 2015).

Social support may be garnered from a range of different sources in the military setting and appears to show stronger buffering effects on PTS in military samples compared to nonmilitary (Wright et al., 2013; Xue et al., 2015; Zalta et al., 2021). Perceived support received from fellow unit members and leadership within a unit have been negatively correlated with (Pietrzak, Johnson, et al., 2010), and shown to prospectively buffer against PTS (Han et al., 2014). Unit cohesion, or the degree to which soldiers feel committed to and supported by their military units during deployment has been significantly negatively correlated with PTS (Armistead-Jehle et al., 2011; Brailey et al., 2007; Dickstein, McLean, et al., 2010; Pietrzak, Johnson, et al., 2010). It would appear this protective effect continues with service life, as postservice veterans are less likely to show resilient trajectories than active service members (Porter et al., 2017) and rates of resilience are nearly identical in single versus multiple deployers (Bonanno et al., 2012; Eekhout et al., 2016). Perhaps unsurprisingly, family

support and postdeployment social support have also been shown to buffer deployment-related stresses (Wright et al., 2013).

While evidence supports the assertion that social support performs as a particularly strong buffer against PTS in military service members (Zalta et al., 2021), a number of moderators of this relationship have emerged. The source of support plays one such moderating role. While supports from both military and nonmilitary sources have been shown to play important buffering roles on PTS (Wright et al., 2013; Xue et al., 2015), perceived support from nonmilitary sources appears to have a stronger effect than that from military sources, even after accounting for a range of covariates (Blais et al., 2021). Social support timing also appears to play a role. While previous research suggests that support received during deployment may enhance coping strategies and build resilience (Luciano & McDevitt-Murphy, 2017), support received outside of deployment by close others has displayed a larger effect on PTS relative to perceptions of social support received during deployment (Blais et al., 2021). These findings challenge the matching hypothesis of social support (Cohen & Wills, 1985), which suggests that support would be most beneficial when received from a similar other.

The types of social support received have also received research attention. Where types of social support, such as perceived, enacted, or structural, have been shown to moderate the relationship between social support and PTS in civilian populations (Finch et al., 1999; Zalta et al., 2021), this finding has not been replicated in the military context (Blais et al., 2021). Specifically, perceived social support has been shown to perform as a relatively stronger moderator in the nonmilitary population than enacted and structural support. However, in the military population there were no significant differences between support types. This suggests that military personnel may benefit from a range of social support sources.

Similar research has been conducted on another sort of social interaction: negative social reactions. Negative social reactions have been described as demonstrating negative affect, expressing negative judgments of an individual, or creating obstacles to the goals of an individual (Vinokur & van Ryn, 1993). Several studies have examined the influences of social support and negative social reactions as predictors of PTS (Brewin et al., 2000; Dworkin et al., 2019; Ozer et al., 2008; Shand et al., 2015; Wright et al., 2013; Xue et al., 2015). In fact, recent evidence supports the view that effects of negative support may be more punitive than the benefits of positive social support are rewarding (Zalta et al., 2021), due to the assumption that social support is desired and beneficial. When, however, social engagement falls into the negative dimension, its reception may be met with dissatisfaction and doubts about the relationship's utility (Pietromonaco & Brook, 1987).

Additionally, research has demonstrated a bidirectional association between PTS and social support within civilian samples (Platt et al., 2016; Ullman & Peter-Hagene, 2016). However, much of the research in this field has relied on an adapted model of social causality in which low levels of pretrauma social support are said to increase the likelihood of subsequent psychopathology (Johnson et al., 1999). In investigations that have explored this with military samples, social causation effects have failed to manifest, in that predeployment social support (Pollman et al., 2022) or unit support (Han et al., 2014; Polusny et al., 2011) failed to predict postdeployment PTS. Looking in the reverse direction, research provides evidence for a social selection model in which PTS may result in a decline in social support over time (Kaniasty & Norris, 2008). Here, the degree of PTS symptoms has been demonstrated to influence the level of social assistance military personnel subsequently experience (King, King, et al., 2006), and deteriorations in social support across the deployment cycle have been linked to an increased risk of PTS (Pollman et al., 2022).

Resource theories (Bakker & Demerouti, 2007; Hobfoll, 1989) have argued that social support provides the resources to manage work-related pressures more effectively. In support of these models, family support (Ciarleglio et al., 2018; Pietrzak, Johnson, et al., 2010; Polusny et al., 2011; Xue et al., 2015) and unit support during deployment (Han et al., 2014), and perceived social support postdeployment (Ciarleglio et al., 2018; Pietrzak, Johnson, et al., 2010; Polusny et al., 2011) are strongly and negatively associated with PTS.

In conclusion, a variety of adaptive health behaviours, including exercise, nutrition, and sleep, and social supports, from sources both within and outside military settings, show promise for protecting against the negative impacts of postdeployment PTS. In contrast to PTS, the following chapter examines the beneficial consequences that can result from traumatic situations and how adaptive health behaviours and social support may also enhance these positive adaptations.

THE FACILITATION OF FLOURISHING

Much like PTS, adaptive health behaviours and social supports appear to play important roles in facilitating flourishing among postdeployment military personnel. Outlined in this section are explorations into the roles that nutrition, physical activity, and sleep, and social support from sources such as leadership, an individual's unit, and their friends and family, play in bolstering flourishing.

Physical Activity

A growing body of research is consistently demonstrating the positive impact of regular exercise on flourishing and overall wellbeing. For example, physical activity levels have been associated with more optimal biomarkers of inflammation (Cole et al., 2015; Lee, Choi, et al., 2020), while flourishing

has been linked with a range of adaptive health behaviours (Keyes, 2007, Keyes et al., 2010; Keyes et al., 2012; Keyes & Simoes, 2012). Furthermore, individuals who engage in regular exercise have reported higher levels of emotional, social, and psychological wellbeing (Costigan et al., 2019; Ghrouz et al., 2019; Mascaro et al., 2022; Zhang & Chen, 2019).

In the literature, the relationship between physical exercise and many aspects of flourishing has been demonstrated. In one study, physical health, physical activity, and diet were connected with good emotional, psychological, and social wellness (Peter et al., 2011). Physical activity has been associated with life satisfaction and affect across a variety of populations, including workers (Edmunds, 1974), teenagers (Valois et al., 2004), young adults (Wickham et al., 2020), and cyclists (Lovretic et al., 2013). Positive emotions have also been linked to physical exercise (Mata et al., 2012). Finally, the link between physical activity and wellbeing appears to be bidirectional, as shown by research in which initial psychological wellbeing predicted future long-term physical activity outcomes (Kim et al., 2016).

However, other data connecting physical exercise and wellbeing have been conflicting. A variety of forms of physical activity, from walking to strenuous exercise, were unrelated to flourishing in a community-based study (Klussman et al., 2021); increased day-to-day activity levels, but not average activity levels, were connected to better subjective wellbeing (Maher et al., 2012); and physical exercise was likewise unrelated to life satisfaction among nursing students (Hawker, 2012). There have also been contradictory findings about the relationship between physical exercise and affect, with some studies finding no impact (Mata et al., 2012), while others show significant (Petruzzello et al., 1991), or mixed (Hogan et al., 2015), results.

Physical exercise has been positively linked with flourishing in a trauma-exposed population (Nolen, 2013). In this study, trauma exposure moderated the link between exercise and flourishing, such that at low and medium levels of trauma, there was a positive association between exercise and flourishing, however at high levels of trauma, the relationship became nonsignificant. Potentially reflecting previously identified difficulties in treating distress resulting from severe traumatic experiences (Armsworth & Holaday, 2001; Nemeroff, 2004), it is plausible that with high levels of trauma exposure, compulsive or other negative-coping engagements with exercise may inhibit flourishing. Some research partially supports this claim, in that trauma-exposed individuals have been found to engage with exercise more frequently than nontrauma exposed individuals (Sumner et al., 2015; Sumner et al., 2016), and individuals who are physically active tend to exercise more in the face of stress (Stults-Kolehmainen et al., 2014).

Nutrition

The positive effects of healthy eating have been observed both within healthy physiology (Davy & Davy, 2019) and different aspects of wellbeing (Buettner & Skemp, 2016; Hitchcott, 2018; López-Olivares et al., 2020; Moreno-Agostino et al., 2019). For example, fruit and vegetable consumption has been previously shown to predict psychological wellbeing (Blanchower et al., 2013; Conner, Brookie, Carr, et al., 2017; Hong & Pelzer, 2017; Mujcic & Oswald, 2016; Prendergast, Mackay, & Schofield, 2016; Prendergast, Schofield & Mackay, 2016), emotional wellbeing (Conner, Brookie, Richardson, & Pollack, 2015; White et al., 2013), and a composite measure of happiness, life satisfaction, and wellbeing (Mujic, 2016). However, it may be the case that flourishing is differentially affected by nutrition.

One piece of research used the World Health Organization's (WHO, 2005) definition of healthy eating; namely, eating five portions of fruit, vegetables, and legumes a day, as well as daily consumption of milk products, foods containing starch, and whole grains (Landefeld, 2021). This study found that healthy nutrition was associated with mental wellbeing but did not discriminate between individuals who were flourishing versus those who were not. Here, healthy nutrition was found to differentially effect some, but not all, aspects of mental wellbeing. Further, the different aspects of healthy nutrition displayed unique relationships with the various aspects of mental wellbeing. It was thus conceded that healthy nutrition may not positively affect all parts of wellbeing that comprise flourishing. It could therefore be considered here that if healthy nutrition supports some subdimensions of flourishing, but not others, the aggregate affect may not separate flourishers from nonflourishers (Keyes, 2002).

Other research has found a positive association between fruit and vegetable intake, and flourishing (Conner, Brookie, Carr., 2017; Conner, Brookie, Richardson, & Pollack, 2015). These findings mirror positive associations that fruit and vegetable intakes have with psychological wellbeing (Branchflower et al., 2013; Mujic, 2016). Such associations were not found in Landefeld's (2021) research which may point to the importance of methodological considerations. For example, four questions were used daily for 13 days in Connor's (2015) study, where Landefeld's investigation utilised a one-item assessment.

A range of biological processes may connect fruit and vegetable consumption to increased flourishing. Fruits and vegetables have been found to have higher concentrations of Vitamin C than other foods, which is an essential cofactor for the formation of dopamine (Girbe et al., 1994; Seitz et al., 1998), a neurotransmitter that underlies motivation and approach behaviours (Kringelbach & Berridge, 2009). Fruits and vegetables also include B vitamins and complex carbohydrates that

facilitate the production of mood-related neurotransmitters, including dopamine and serotonin (Rao et al., 2008; Rooney et al., 2013; Stough, 2011; Wurtman et al., 2003). Additionally, B vitamins serve an additional role in mitochondrial energy function, which may increase energy levels and motivation (Depeint et al., 2006). Finally, the antioxidants that are present in fruits and vegetables are known to reduce inflammation (McMartin et al., 2013), which has in turn been associated with increased eudemonic wellbeing (Friedman, 2007).

Sleep

Among modifiable individual-level health habits that influence wellbeing, sleep has been consistently shown to be one of the strongest predictors of improved wellbeing (Bassett et al, 2015; João et al., 2018; Pilcher et al., 1997; Wallace et al., 2017). Research into sleep also indicates that compared with those who get adequate sleep, those who do not develop more psychological, physical, and psychosocial difficulties (Wickham et al., 2020). Other research supports these findings, in that flourishing has been associated with more sleep (Capaldi & Gunnel, 2018; Venning et al., 2013) and decreases in sleep quality have been associated with decreased flourishing (Tsao et al., 2021; Wickham et al., 2020; Zaidlin et al., 2022). Further, curvilinear relationships between sleep quantity and flourishing have been observed, such that too little (< 8h) and too much sleep (> 12h) were associated with lower flourishing (Kaneita et al., 2007; Wickham et al., 2020). In research in the military population, sleeping difficulties have been negatively associated, cross-sectionally and longitudinally, with subjective wellbeing (Bergmann, 2014), and psychological wellbeing (Bergmann et al., 2019). Finally, decreased sleeping difficulties have been associated with increases in PTG at a later timepoint (Wealin et al., 2020). Here, it is thought that being able to sleep may provide trauma survivors with the reprieve needed to deliberately engage with traumatic memories (Tedeschi and Calhoun, 1996).

The Interrelationships between Adaptive Health Behaviours and Flourishing

While the literature review thus far has focused on the impacts and associations that adaptive health behaviours have on and with flourishing, some researchers have suggested bidirectional relationships may exist (Wickham et al., 2020). While it remains true that intervening in health behaviours results in improvements in mental health and wellbeing (Carr et al., 2013; Conner, Brookie, Richardson, & Pollack, 2017; Francis et al., 2019; Jacka et al., 2017), prior research has shown possible synergistic relationships between health behaviours in predicting wellbeing (Prendergast, Mackay, & Schofield, 2016; Prendergast, Schofield, & Mackay, 2016; Wickham et al., 2020).

One line of evidence supporting the bidirectional relationship between adaptive health behaviours and flourishing comes from research examining positive affect. Because positive affect has been shown to increase agency (Chang et al., 2017), it has been thought that positive affect may increase approach behaviours (Cameron et al., 2018; Salovey et al., 2000). Further, for those individuals who possess more personal resources to buffer the vicissitudes of daily life, such as the benefits of consistent engagement in adaptive health behaviours, life will be more enjoyable (Cohn et al., 2009). Some evidence supports this conceptualisation, such as fruit and vegetable intake predicting later positive affect, and vice versa (Fredrickson et al., 2021).

There also exists a body of research that shows that engagement in some adaptive health behaviours influences engagement in others, which may in turn further influence flourishing. Sleep duration and quality have been associated with diet quality and physical activity levels (Grandner et al., 2015; Kittle et al., 2016), fruit and vegetable intake (Ferranti et al., 2016) and the maintenance of adaptive health behaviour changes over time (Hui & Grandner, 2015). In turn, physical activity and fruit and vegetable intake have also been associated with increased sleep quality (Chan et al., 2015; Ferranti et al., 2016; McKnight-Eily et al., 2011). Further supporting such claims, the adoption of one adaptive health behaviour dramatically increases the likelihood of adopting other health behaviours (Bartonicek et al., 2020; Fleig et al., 2015; Geller et al., 2017; Lippke, 2014; Prendergast, Mackay, & Schofield, 2016; Tan et al., 2018), and each additional increase in the number of adaptive health behaviours engaged in has been shown to dramatically increase the likelihood of an individual being classified as flourishing (Prendergast, Mackay, & Schofield, 2016). Lastly, adaptive health behaviours may also compensate, in part, for deficits in other adaptive health behaviours (Tan et al., 2018; Wickham et al., 2020).

Social Support

According to the stress-buffering hypothesis, social relationships unquestionably function as buffers against the detrimental consequences of stress and hardship. However, social support may also be used to promote flourishing. Whether responding effectively to hardship or actively grasping opportunities for growth and development, social support may be seen as a context in which people can flourish (Feeney, 2015). This idea is supported by a significant amount of empirical research demonstrating that individuals who are more socially connected and who have more supportive and fulfilling interactions with others have better mental health, greater levels of subjective wellbeing, and lower rates of disease and death (Holt-Lunstad & Smith, 2012; Lakey & Orehek, 2011; Miller et al., 2009; Uchino et al., 2012).

Within the context of facilitating flourishing, social support has been thought to not only buffer stress and adversity, but to help an individual to emerge stronger than before (Collins & Feeney, 2000; Feeney, 2004; Feeney & Collins, 2004). Here, social support serves (1) to soothe and protect in times of hardship, (2) as a source of strength so that a person may be fortified to face adversity, and (3) as an aid to an individual in the reconstruction process in a manner that adds to growth (Feeney & Collins, 2015). This conceptualisation is congruent with research on social relationships as determinants of resilience to adversity, PTG, and benefit discovery (Dunn et al., 2011; Lelorain et al., 2012; Lepore & Kernan, 2009; Leung et al., 2010; Luszczynska et al., 2005; Morris et al., 2011; Powell et al., 2012; Prati & Pietrantoni, 2009; Scrignaro et al., 2011).

Social support also serves another function within the context of facilitating flourishing by supporting participation in life opportunities in the absence of adversity. Here supportive relationships may facilitate flourishing by promoting engagement in opportunities that broaden and build resources (Bowlby, 1988; Fredrickson, 2001), and help individuals find purpose and meaning (Ryff & Singer, 1998). This is accomplished not only by providing a secure base from which exploratory behaviour is more likely to occur (Crowell et al., 2002; Waters & Cummings, 2000), but also by serving as a relational catalyst to promote flourishing through life opportunities. These include (1) nurturing the desire to seize growth opportunities, (2) aiding in the perception of opportunities, (3) facilitating the preparation for engagement with opportunities, and (4) facilitating implementation (Feeney & Collins, 2015).

There are a number of places that an individual may find flourishing-supportive relationships within the military context; Leadership support is one such source. Leaders may inspire perceptions of support through a range of characteristics, including trustworthiness (Redman et al., 2011), through the facilitation of morale and job competency (Pflanz & Ogle, 2006), by providing ongoing motivational and instructional support (Bass et al., 2003), and by providing useful feedback (Bokti & Talib, 2009). Perceptions of leadership support have been positively associated with increased wellbeing and predicted occupational outcomes in a sample of US military (Dupré & Day, 2007), the buffering of stress and strain in the UK Royal Navy (Brasher et al., 2010; Bridger et al., 2009; Bridger et al., 2007), the facilitation of hardiness within military subordinates (Bartone, 2006), and flourishing in a sample of New Zealand military personnel (Hopkinson, 2021). Military leaders also appear to play integral roles in helping subordinates and their families navigate tough times (O'Neal et al., 2020); when unsupportive, they may be more strongly linked to PTS outcomes than combat exposure (Booth-Kewley et al., 2010).

Unit support is another source for social support inside the military framework. In this case, support may be derived from an individual's relationships with their colleagues within a unit, as well as from the unit's cohesiveness/sense of unity or bonds within the unit (King, King, et al., 2006). Support from other soldiers is distinctive in that it stems from shared experiences which provide a unique perspective for knowing how to effectively support other soldiers. Consequently, perceptions of support from other military personnel are related to life and career satisfaction (Limbert, 2004), positive adaptions by the soldier's family (O'Neal et al., 2020), and positive consequences for mental health above and beyond support provided by family members (Hinojosa & Hinojosa, 2011). Further, unit cohesiveness has been shown to lower stress (Mitchell et al., 2011; Pflanz & Ogle, 2006), be negatively associated with PTS (Armistead-Jehle et al., 2011; Dickstein, McLean, et al., 2010) and facilitate flourishing (Ujoatuonu et al., 2019).

Chapter Summary

In summary, a range of factors appears to facilitate positive and negative psychological adaptions following exposure to PTEs. These include adaptive health behaviours such as physical activity, nutrition, and sleep, as well as social supports such as support from close others, leadership, and unit members. Questions remain, however, as to whether exposure to PTDEs translate to meaningful gains in flourishing, and whether adaptive health behaviours, social supports, and PTS have roles in facilitating flourishing in this population. In the next chapter, the research aims and hypotheses of the current study are outlined.

CHAPTER 5

RESEARCH AIMS AND HYPOTHESES

Research Overview

In this chapter, the current study is detailed, including a summary of the research literature most pertinent to the proposed exploratory analyses and hypotheses. Specifically, examinations of the relationships that potentially traumatic deployment events (PTDEs) have with posttraumatic stress (PTS) and flourishing and the associations that social support and adaptive health behaviours have with PTS and flourishing, as well as moderating effects, are discussed. In addition, the hypotheses of the predictive effects of social support and adaptive health behaviours across a longitudinal period are outlined. In the scope of the current study, "social support" refers to perceived support from both close relations (i.e., family, friends, and significant others) and people in leadership within the NZDF. The term "adaptive health behaviours" is utilised as a catchall to refer to physical activity, nutrition, and sleep.

Derived from the extant research, the current study was informed by five research objectives; namely to investigate:

1) The relationship that exposure to PTDEs have with PTS and flourishing;
2) The relationship that social support and adaptive health behaviours have with PTS and flourishing;
3) The moderating effects that social support and adaptive health behaviours have upon the relationships that PTDEs have with PTS and flourishing;
4) The predictive associations that adaptive health behaviours and social support have with PTS and flourishing across time;
5) The moderating influence of PTS on the relationship between PTDEs and flourishing.

Exposure to Potentially Traumatic Deployment Experiences

Past research supports the proposition that there is a relationship between PTDEs and PTS, albeit only appearing among some but not all military personnel (Galatzer-Levy et al., 2018). A range of common experiences on military operational deployments have been associated with PTS, including engaging in combat, witnessing the aftermath of conflict, moral injuries, and interpersonal traumas (Godfrey et al., 2015; Jordan et al., 2017; Pietrzak et al., 2011). Such events have been shown to be both significant predictors of subsequent PTS (Vuksic-Mihaljevic et al., 2004) and to have a dose-dependent connection with PTS (O'Toole et al., 1999). Further, additional exposures to PTDEs have been associated with increasingly deleterious trajectories of symptoms over time (Bonanno et al.,

2012). These results suggest a positive relationship between PTDEs and PTS. Therefore, a positive relationship between PTDEs and PTS is hypothesised.

The relationship between PTDEs and flourishing has been less explored within the literature. In some research, the number and severity of potentially traumatic events (PTEs) have shown a nonsignificant association with flourishing (Nolen, 2013), and negative association in others (Greene & McGovern, 2017). Exposure to morally injurious events has also been associated with a reduced likelihood of being classified as flourishing (Hansen et al., 2022). Given the limited investigations and heterogeneous findings in this area, this section of analysis remains exploratory and therefore no hypotheses were made for the relationship between PTDEs and flourishing.

Adaptive Health Behaviours and Social Support

It is important to note that while PTDEs are predicted to have a positive relationship with PTS there exists significant heterogeneity in individual responses to trauma. Indeed, the majority of trauma-afflicted individuals do not experience PTS, while for others, symptoms intensify or decrease, over time (Bonanno et al., 2012; Galatzer-Levy et al., 2018). Similarly, there exists heterogeneity in changes to flourishing in response to trauma. In investigations assessing pretrauma to posttrauma changes, some individuals experienced increases in wellbeing, some no change, and others experienced decreases (Frazier et al., 2009; Gunty et al., 2011; Yanez et al., 2011). The main argument of this research is that for individuals with elevated levels of adaptive health behaviours and social support, decreases in PTS and increases in flourishing are more likely to occur in the aftermath of deployments.

To test this theory, this research has investigated the relationships between PTDEs, adaptive health behaviours, and perceived social supports and outcome variables (PTS and flourishing). A range of research has suggested negative relationships between PTS and adaptive health behaviours (Gavrieli et al., 2015; Kim et al., 2021), and social support (Brewin et al., 2000; Ozer et al., 2008). Similarly, research has suggested positive relationships between flourishing and adaptive health behaviours (Bartonicek et al., 2020; Nolen, 2013; Peter et al., 2011), and perceived social support (Elsayed et al., 2018; Grier-Reed et al., 2022; Imran et al., 2020; Li et al., 2020). Further, it was hypothesised that adaptive health behaviours and perceived social support moderate the relationships that PTDE has with PTS and flourishing and predict their trajectories over time.

PTDEs, PTS, and Flourishing, and their Interrelationships

The present investigation has also sought to investigate the influence of PTS on the relationship between PTDEs and flourishing. In classic conceptualisations of posttraumatic growth (PTG), PTE

exposure and co-occurring elevations in stress have been viewed as necessary preconditions for positive psychological adaptions to occur (Janoff-Bulman, 2006; Tedeschi & Calhoun, 2004). From this view, PTS may signal that the distress following a PTE is of a sufficient dose to drive PTG. A systematic review of military samples found mixed support for this, showing a range of relationships between PTDEs and PTG, and PTS and PTG (Mark et al., 2018).

In other models, exposure to adversity itself is similarly thought to predict positive psychological adaptions, with appropriate doses (Hill et al., 2024). This conceptualisation is built upon findings that individuals with too few or too many lifetime experiences of adversity display deleterious outcomes (Seery, 2011; Seery et al., 2010; Seery et al., 2013), and that exposures to some adversity can trigger the development of long-term positive adaptions (Agathokleous & Calabrese, 2020; Infurna & Jayawickreme, 2019; Jayawickreme & Infurna, 2021; J. J Liu et al., 2017; R. T. Liu, 2015). However, longitudinal research measuring positive psychological outcomes before and after PTEs has found that improvements in positive psychological adaptions were associated with lowered distress (Frazier et al., 2009; Gunty et al., 2011; Owenz & Fowers, 2019). It is therefore proposed that the presence of distress or PTS may signal that an individual's threshold for positively adapting to PTEs has been exceeded.

Central to both models is the positioning of adversity as a precursor to subsequent positive psychological adaptions. However, whether this adversity is within the exposure to PTEs, or within the PTS which follows, remains subject to examination. Thus, the current investigation provided an opportunity to explore two hypotheses simultaneously:

(1) PTS will positively facilitate flourishing after PTDEs, or

(2) PTS will have negative effects on flourishing after PTDEs.

To test these hypotheses, a series of moderation analyses were conducted. It was hypothesised that PTS would weaken the relationship that PTDEs have with flourishing.

Research Hypotheses

The research hypotheses for the current study were as follows:

1. Greater exposure to PTDEs will be related to higher PTS.
2. Social support (close relations and leadership) and adaptive health behaviours (physical activity, nutrition, and sleep) will be negatively related to PTS, and positively related to flourishing.

3. With higher levels of social support and adaptive health behaviours (compared with lower levels), the relationship between PTDEs and PTS will be weaker, and the relationship between PTDEs and flourishing will be stronger.
4. Perceived social support, from both close and leadership sources, and adaptive health behaviours will be negatively associated with subsequent PTS, and positively associated with subsequent flourishing.
5. At higher levels of PTS (compared with lower levels), the relationship between PTDEs and flourishing will be weaker.

CHAPTER 6

METHOD

This chapter details the methodologies used to examine PTDE, PTS, flourishing, social support, and adaptive health behaviours in a sample of NZDF personnel returned from deployment. This chapter contains sections on the study design, data collection methods, ethical considerations in the research design, selected measures, analysis plan, and a description of the study's sample.

Research Design

The present investigation was designed as a 2-wave longitudinal study, where responses were linked from the first to the second collection points, allowing for both cross-sectional and longitudinal analyses. To sufficiently explore the hypotheses outlined in Chapter 5, a number of factors were considered, including the research questions, the recruitment of a suitable sample of participants, the number of participants required to generate valid results, the generalisability of results, and the research methods used previously (Coolican, 2018). These factors influenced the type of research design that was selected. The question at the heart of this research was how do various adaptive health behaviours and sources of social support influence PTS and flourishing, and their trajectories in the aftermath of traumatic experiences while on operational deployments. While personnel in many occupations are exposed to occupational trauma in New Zealand, including police, fire-fighters, and ambulance personnel (de Terte et al., 2014; Guilaran et al., 2018; Reti et al., 2022), a range of unique stressors exist in the military deployment environment (Pietrzak et al., 2011). Therefore, a sample of postdeployment military personnel was deemed essential.

The choice of the study approach was also intended to build upon past research conducted with the NZDF population and to offer actionable results for leaders in the NZDF and both uniformed and non-uniformed clinicians supporting individuals returning from future operational deployments. Past research has explored the effects of peacekeeping activities on mental health, physical health, and stress among NZDF personnel and the veteran community (Long et al., 1992; MacDonald et al., 1997; MacDonald et al., 1999; McBride et al., 2022; Vincent et al., 1994). Other studies have examined the grounds for medical discharge (Iremonger et al., 2015) and help-seeking behaviours (Hom et al., 2020). In alignment with the NZDF's emphasis on not only mitigating pathological consequences but also enabling (Bennett, 2017; NZDF, 2018), it was deemed vital to adopt a design that gathered measurements of both pathological outcomes and good mental health. Furthermore, the prevalence of cross-sectional research has prompted calls for longitudinal designs (Hom et al., 2020). Finally, a prolonged period of consultation with various NZDF stakeholders was conducted throughout the study's design phase to enhance the subsequent utility of the investigation's findings. An

opportunity was extended to evaluate social support, adaptive health behaviours, and positive and negative psychological outcomes within a sample of NZDF personnel who had completed a survey on health and wellbeing at two timepoints, a subset of which represented the postdeployment population. A decision was made to utilise the dataset for this research. Following the conclusion of the research, results were shared with key NZDF stakeholders, and presented at the 2023 NZDF Psychology Conference.

Data Collection

Data were collected as a part of an internal "NZDF Health and Wellbeing Survey," conducted in 2016 (*N* = 4,511) and 2019 (*N* = 4,092). Subsets of this data were drawn from for this research, including from sections on "Life Experiences and Wellbeing" (Section 2), "Your Job" (Section 4), "Physical Health and Health Behaviours" (Section 5), and "Demographic Characteristics" (Section 7). Survey collection procedures and the present analysis were approved following ethical review through internal NZDF processes, as well as Massey University's Ethical Review processes.

The "NZDF Health and Wellbeing Survey" (Appendix A) was developed for a range of objectives, including to better understand the current health and wellbeing of NZDF personnel, to identify areas of need and opportunities for improvement, and to inform decisions aimed at improving NZDF personnel health and wellbeing. The primary method used for collecting data was a web-based questionnaire. Participants were provided with an anonymous link to a secure web-based survey via Qualtrics. The Director of Defence Health invited all NZDF personnel including all civilian, reserve, contractor, and regular force personnel, via email to complete the survey. Recruits in training and currently deployed personnel were not included. Individuals who had limited or no access to the internet or the Defence Information Exchange System (DIXS) were invited to complete a paper version of the same survey. Survey completion time ranged from 15 to 60 minutes.

The opening pages of the survey offered an overview of the survey, including information about the purpose and requirements, and privacy assurances emphasising that the survey would be anonymous, that raw data would be protected and securely held for longitudinal research purposes, and that the data would be used for internal and external research projects approved by the NZDF. Survey completion was voluntary and anonymous, and no survey questions were compulsory. This information was presented in the opening pages, and again in the demographic section, where participants were advised they could skip items which they believed could compromise their anonymity. Upon completion, a list of internal and external sources of support were provided, and feedback on select items were given to self-identified individuals at risk (e.g., their scoring on K10 psychological wellbeing measure, and AUDIT alcohol use guide), who were then encouraged to

access the supports provided. Those who completed the online version of the survey received automated messages tailored to their score range, and paper surveys included score information for self-interpretation. Finally, participants were invited to a future follow-up survey, and anonymous research codes were employed to compare individual responses across surveys.

Sponsored by the dataset owner, the NZDF Director of Integrated Wellness, an application to the NZDF Research Ethics Committee was submitted. Following the approval of the proposed design, the dataset was released to the research team.

Ethics

A low-risk notification for the current investigation was sent to the Massey University Human Ethics Committee in August 2021, as the project involved access to previously collected data. Ethical approval from the NZDF Research Ethics Committee was confirmed in April 2022. As a part of the application process for the NZDF Research Ethics Committee, a Health and Disability Ethics Committee (Ministry of Health) "out of scope" review was sought and notification obtained. The research design was additionally reviewed by the research's sponsor (COL Clare Bennett), the NZDF research supervisor (WGCDR Carolyn Pezaro), and peer reviewed by a researcher external to the research team (Dr Veronica Hopner, School of Psychology, Massey University).

The first ethical consideration for this research was cultural sensitivity within the design. To support this aspiration, supervision was sought from Kaimātai Hinengaro Matua and Māori researcher Dr Simon Bennett, Massey University School of Psychology. It was recommended that each of the study's measures be first considered through the lens of culture. As outlined in the control variables section, social support was one identified consideration, in that the ways in which different cultures mobilise, access, and use social support have been shown to vary across cultures (Chen & Tang, 2021; Kaniasty & Norris, 2000; Kwok et al., 2019). Positioning the present research with sensitivity to Te Tiriti o Waitangi was also considered in the design of the present investigation. As stipulated by the Health Research Council of New Zealand (HRCNZ, 2010), a key mechanism for meeting the implicit obligations of the Treaty of Waitangi when conducting research involving Māori is producing knowledge that contributes to Māori health development. Māori have been shown to experience clinically significant PTS following deployment involving complex interrelationships between combat exposure, rank, and combat roles in some research (MacDonald et al., 1997), but not others (Morrison, 2018). Given these considerations, the inclusion of ethnicity data was deemed as essential to incorporate into the demographic information of the research and incorporated as an important control variable. From this view, cross-cultural mechanisms for identifying postdeployment support mechanisms may then emerge, particularly those relevant to Māori.

The second ethical consideration was to ensure that the information given by respondents remained confidential. The present research involved data collection from employees of the NZDF by the NZDF. As such, risks associated with possible reprisals may exist from the expression of negative experiences. Such risks were mitigated by the original data collection team by anonymising the data at its initial collection. Furthermore, the data to be accessed by the research team was also anonymised. To further protect this sensitive information, data security was also considered. This was addressed by storing anonymised data only on a password-protected and encrypted USB stick which was placed within a locked safe at the researcher's private residence when not in use. Data analysis project files were similarly stored on the same USB stick, where they will held for a period of 5 years, then destroyed by the primary researcher.

Finally, the third ethical consideration was for the psychological vulnerability of the participants. The survey involved the collection of information about previous PTDEs, various factors associated with wellbeing and mental state, which heightened awareness of these factors in the minds of respondents. A subset of the present investigation's sample population was also considered likely to score highly on measures of distress. On light of the ethics of this, the original data collection team included a number of procedures to measure and mitigate this risk. Participants were first given feedback for their scores on selected scales and encouraged to seek help if their scores indicated that they may be at risk. Electronic versions of the survey accomplished this by sending automated messages tailored to their score ranges. Paper versions of the survey accomplished this by providing self-score information. In both scenarios, support resources were then provided to all respondents (see Appendix A). The present research accessed the data provided from this process and did not involve the collection of new data; as such it was considered as not introducing new risk. Therefore, the identification of at-risk individuals and provision of support resources within the bounds of maintaining anonymity were judged an appropriate response to this risk.

Measures

Consideration was given for which measures would represent the constructs described in earlier chapters. Further, to adequately assess longitudinal changes, the continuity of measures was also considered. Below are outlined the measures that were utilised in the present research.

Deployment experiences. Serving as an independent variable in the present study, this investigation included an 18-item measure (2016) and a 22-item (2019) measure of various stressors commonly experienced on military deployments. Participants were asked to rate the number of times across all deployments they had encountered a situation described in each item (e.g., "Experienced an IED/EOD detonation, suicide bombing, or landmine strike," "Handled or seen dead

bodies"), on a 5-point Likert scale ranging from 1 (Never) to 5 (10+ times). Higher scores on this scale reflected more deployment-related stressors. The 18 items in the 2016 survey had identical corresponding items in the 2019 survey. For the purposes of having comparable measures across time, analyses performed on the 2019 dataset were confined to items which also appeared in the 2016 dataset. The difficulties and advantages of checklists in research have been described and systematically analysed, including the challenges of psychometric validity (Ilgen et al., 2015). The items of this measure showed good face validity, and represented a range of experiences previously identified as essential to represent deployment-related trauma (King et al., 2003). However, as a novel measure that did not undergo a process of statistically robust measure development, it remains unclear whether each items loads equally and meaningfully upon the construct of PTDEs. To ensure the measure would remain comparable to other research similarly utilising this measure, the measure was therefore not altered. Internal consistency estimates of the present research revealed a Cronbach's α of .89 for 2016, and .89 for 2019, representing sound measures of reliability (Field, 2017).

PTSD Checklist for Civilians (PCL-C). Serving as an outcome metric in the 2016 dataset, the PCL-C represents a measure of PTS. This measure is a self-report survey consisting of 17 items corresponding directly to the DSM-IV conceptualisation of PTSD (Weathers et al., 1991). Items are rated on a 5-point Likert scale from 0 (Not at All) to 4 (Extremely) over the past month to reflect the severity of each symptom. A summed score for each symptom cluster and a total severity score are produced, with higher scores indicating greater PTSD symptom severity. PCL-C test scores have previously demonstrated internal consistency levels (α) in the mid to high .90s (Keen et al., 2008), good test–retest reliability (r = .96) and convergent validity within the military population (Keen et al., 2008; Weathers et al., 1993). A Cronbach's α of .93 was found for this measure in the present investigation.

PTSD Checklist for DSM-5 (PCL-5). Serving as an outcome metric in the 2019 dataset, PCL-5 represents a measure of PTS. This measure is a self-report survey consisting of 20 items corresponding directly to the DSM-5 conceptualisation of PTSD (Weathers et al., 2013). Items are rated on a five-point Likert scale from 0 (Not at All) to 4 (Extremely) over the past month to reflect the severity of each symptom. A summed score for each symptom cluster and a total severity score are produced, with higher scores indicating greater PTSD symptom severity. The PCL-5 test scores have demonstrated good internal consistency (α = .96), test–retest reliability (r = .84), and convergent and discriminant validity within the military population (Wortmann et al., 2016). A Cronbach's α of .95 was found for this measure in the present investigation.

It is important to note that while a PCL measure was used at both timepoints, the 2016 collection utilised PCL-C (Weathers et al., 1991) and the 2019 collection used PCL-5 (Weathers et al., 2013). Strong correlations between PCL-C and PCL-5 (r = .95) have been found (Moshier et al., 2019; Wortmann et al., 2016). Similarly, nearly identical relationships with comorbid conditions (Hoge et al., 2014), and no significant differences in prevalence rates (Hoge et al., 2014; LeardMann et al., 2021) have been found. However, there are notable differences between instruments. PCL-5 includes 3 additional items, and the wording of 13 items have been modified to reflect updates to the DSM-5 criteria for PTS (Pai et al., 2017). When individual items from the PCL-C and PCL-5 were compared, substantial agreements were found between equivalent items ($\kappa > 0.6$ for 16 of 17 symptoms; Hoge et al., 2014; LeardMann et al., 2021), representing overall agreement rates comparable to or better than test-retest studies of the original PCL-C (McDonald & Calhoun, 2010; Terhakopian et al., 2008). For the purposes of measuring changes in how items were scored between timepoints, rather than changes in test construction, the three additional items present in the PCL-5 were excluded from analyses.

A cutoff value for the PCL-C measure (Weathers et al., 1991) was sought from the literature to detect the probable presence of PTS in the present research. There has been some debate in the literature regarding appropriate cutoff scores and related prevalence rates of PTS derived from the PCL (Karstoft et al., 2013). A cutoff score of 50 has previously been used in military research (Hoge et al., 2004; Smith et al., 2009). While this cutoff has been identified to display high specificity by correctly excluding those without PTS, this cutoff has also been observed to display low sensitivity by incorrectly excluding a significant proportion of individuals who display PTS symptoms (McDonald & Calhoun, 2010). In attempts to increase the diagnostic efficiency of the test by balancing specificity and sensitivity, a range of 30-34 has been demonstrated as more appropriate within military samples (Bliese et al., 2008; Nicholson, 2006). The more recent PCL-5 (Weathers et al., 2013) recommends a similar cutoff of 30-33, which has been confirmed by a recent systematic review of 64 studies as an optimal cutoff score (Forkus et al., 2023). As 3 items were removed from the PCL-5 in the present research to produce comparable results between measures (PCL-C and PCL-5), a cutoff of 30 was selected to produce optimal sensitivity across both measures.

Flourishing Scale (FS). Also included as a primary outcome variable, the FS serves as a measure of psychological flourishing. An abbreviated 2-item version of the 8-item flourishing scale (Diener et al., 2010) was collected in the 2016 dataset, and all 8 items were collected in the 2019 dataset. Participants in both surveys were asked to rate the degree to which they agreed with the following two statements: “I lead a purposeful and meaningful life” and “My social relationships are supportive and rewarding” on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). These items

were selected by the survey-collection team to enhance the coverage of the wellbeing measures in the battery. Summed scores for the two items can range from 2 to 10, with higher scores indicating greater psychological flourishing. The FS has demonstrated good internal consistency (α = .87), strong convergent validity with other similar scales (Diener et al., 2010), and a strong correlation between items (r = .60, p < .01) in the abbreviated version (Hom et al., 2020). For the purposes of having comparable measures across time, analyses performed in the 2019 dataset were confined to items which also appeared in the 2016 dataset. A Cronbach's α of .71 in 2016 and .75 in 2019 were found for this measure in the present investigation, representing reliability for psychological research (Kline, 1999). While displaying good reliability statistics, it is also noted that because the Flourishing Scale measures a multidimensional construct, the elimination of six of eight items from the scale also represents a likely loss, in part, of construct and convergent validity with the original 8-item measure.

Adaptive Health Behaviours. To assess adaptive health behaviours in both covariate and moderating roles, this investigation included seven items reflecting a range of health behaviours, with four items relating to nutrition, two to physical activity, and one to sleep. Participants were asked a series of questions relating to each health behaviour area with corresponding answers given on a 5-point Likert-like scale ranging from 1 to 5 (e.g., 0 = I Don't Eat These, 4 = 4 or More Servings Per Day). Nutrition items included "On average, how many servings of vegetables did you eat per day over the past 7 days?", "On average, how many servings of fruit did you eat per day over the past 7 days?", "On average, how often during the working week do you eat breakfast (negatively coded)?", "How often do you usually drink sugary beverages (negatively coded)?". Physical activity items included "On average, how often do you do light exercise of 20 minutes or more each week?" and "On average, how often do you do moderate or vigorous aerobic exercise of 20 minutes or more duration each week?" Finally, the sleep item asked, "On average, how many hours do you sleep each day/night?". Scores for each item were summed and a single score given. Higher scores indicated increased health behaviours.

These items were selected by the survey design team to enhance the coverage of wellbeing processes measured by the battery in a concise manner which did not overly contribute to participant burden. A Cronbach's α of .51 in 2016 and .54 in 2019 were found for this measure in the present investigation. While these were considered low (Coolican, 2018; Hayes, 2017), it is important to note that this is a multidimensional and composite measure, which therefore may give diluted results in tests of validity (Tavakol & Dennick, 2011). Therefore, a follow-up reliability analysis was completed using McDonald's omega, revealing an ω of .61 for 2016 scores, and .65 for 2019, representing good reliability for a multidimensional measure with multiple separate but

interrelated constructs (Graham, 2006; C. E. Lance et al., 2006; J. F. Lance, 2005). Small-item, self-rated measures of health behaviours are widespread and have been shown to be valid and reliable (Davies & Ware, 1981; Mossey & Shapiro, 1982), and health behaviour research has shown health behaviours to be more helpfully understood in conjunction with one another (Prendergast, Mackay, & Schofield, 2016; Tan et al., 2018). Therefore, this measure was determined to be appropriate for the present investigation's purposes.

Multidimensional Scale of Perceived Social Support (MSPSS). A 4-item version of the 12-item MSPSS (Zimet et al., 1988) was used in the 2016 survey to measure perceived social support from family, friends, and significant others. Participants rated the degree to which they agreed with a series of statements (e.g., "There is a special person who is around when I am in need" and "I can talk about my problems with my family"), rating each item on a 7-point Likert scale, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). The full MSPSS has shown excellent test-retest reliability (r = .96), and high internal consistency (α = .94). The abbreviated version of the MSPSS has also displayed excellent internal consistency (α = .94), and almost no loss in construct validity in the military population (Porter et al., 2020). The present investigation revealed a Cronbach's α of .80.

Leadership Support. This investigation included a 4-item measure to investigate perceptions of social support that an individual receives from their direct manager/leader. Participants rate the degree to which they agree with a series of statements (e.g., "My direct manager/leader treats me with dignity and respect.") on a 5-point Likert-like scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These questions were developed for internal use by the NZDF. Responses are summed, generating a single score. Higher scores indicate higher levels of leadership support. Previous research has shown good internal consistency (α = .93; Hopkinson, 2021), and the present investigation revealed a Cronbach's α of .71 in 2016 and .75 in 2019.

Analysis Plan

This section outlines the analysis plan to address the research aims. Data were analysed using the Statistical Package for the Social Sciences (SPSS), version 29.0.0.0 (241), and the PROCESS macro (Hayes, 2009). Descriptive statistics were employed to describe the sampled participant's demographic and service-related characteristics, as well as the presence of PTS, flourishing, and support factors (social support, adaptive health behaviours). Independent sample t-tests were employed to assess the statistical significance of differences between the aforementioned variables across demographic variables and datasets and differences above and below PTS cutoff scores. Bivariate correlations were utilised to analyse the predicted and exploratory relationships.

A series of hierarchical multiple regressions was employed to assess the predictive hypotheses, and a number of considerations were made in selecting the appropriate regression model. A common approach to analysing ordinal data is to employ an ordinal regression model. However, this approach has been debated (Donneau et al., 2014; Norris et al., 2006; Robitzsch, 2020; Thomas, 2023). Instead, a linear regression was employed for the present research. This approach was implemented to yield an easily interpretable β coefficient, that could be utilized for comparison to other research in the area and included in future reviews. A limitation to this approach is that linear models assume that each step between ordinal variables are equal, which is an incorrect assumption for the present research's variables. While arguments have been made that clinical and statistical interpretations from this type of analysis may still yet proceed with this limitation (Donneau et al., 2014; Norris et al., 2006; Robitzsch, 2020; Thomas, 2023), an associated variance statistic (change in r^2) was also included to support the interpretation of the impact of the independent variables on the dependent variables in this series of regressions. A second limitation to this approach is that linear regressions of ordinal data may produce significant but clinically meaningless findings (Norris et al., 2006). Therefore, comparative analyses of study variables at above and below the cutoff for PTS were also produced (Table 5).

The PROCESS macro for SPSS was utilised to explore the moderation analyses. A moderation analysis identifies circumstances in which the relationship between the independent variable and the dependent variable varies as a consequence of varying scores for a third, moderating variable. In Hypothesis 3, the independent variable was PTDE, the outcome variables were PTS and flourishing, and the moderating variables were social support, leadership support, and/or adaptive health behaviours. If the relationship between deployment experiences and outcome variables (PTS and flourishing) changed as a function of level of perceived social support, leadership support, or adaptive health behaviours, then a moderating effect was said to exist (Field, 2017; Tabachnick & Fidell, 2018). Therefore, using a linear model of prediction for PTS and flourishing, a significant interaction between traumatic deployment experiences and the moderators in question (perceived social support from close others, leadership support, and adaptive health behaviours) would provide support for Hypothesis 3. Moderating variables were compared at high versus low levels, which were selected to be at the 84th and 16th percentiles for these analyses. For Hypothesis 5, a mediation analysis was conducted to assess the effect of PTS on the relationship between PTDEs and flourishing.

Sample Description

The present research aimed to identify postdeployment risk and facilitating factors across time using several variables. As such, only participants who had (1) previously been deployed in 2016, (2)

completed both surveys using their respective unique anonymised code, and (3) completed the measures of interest, were included in the analysis (*N* = 315). These criteria enabled a longitudinal examination of the same participants, rather than comparing two groups of potentially novel participants. Two participants were excluded due to missing data (see "Data Screening" section in Chapter 7). Therefore, 313 participants in the sample met the inclusion criteria. A number of demographic variables were collected, including age, gender, and ethnicity. Further, military service characteristics were also collected. Both the demographic and the military characteristics captured in 2019 are given in Table 1; except for age, they were assumed to be consistent across the datasets. Where an individual identified themselves as belonging to multiple ethnic groups, the survey also requested a primary ethnic group to be identified. This self-identified primary ethnic group was used to populate the sample's ethnic groups.

Table 1

Participant Demographic and Military Service Characteristics (N = 313)

	n	**Valid %**
Gender		
Male	247	79.2
Female	62	19.9
Other	3	1.0
Missing	1	-
Age (T2)		
20-24 years*	4	1.3
25-29 years	33	10.6
30-39 years	86	27.7
40-49 years	118	38.1
50-59 years	60	19.4
60 years and over	9	2.9
Missing	3	-
Ethnic Group		
New Zealand European/Pākeha	234	75.5
Māori	31	10.0
Pacific Islander	8	2.6
Asian	2	0.6
Other European	10	3.2
Other	25	8.0
Missing	3	-
Military Status		
Regular Force	280	90.0%
Reserve Force	4	1.3%
Civilian	27	8.6%
Missing	2	-
Military Service		
Navy	85	30.0
Army	105	37.1
Airforce	93	32.9

	n	Valid %
Missing or Civilian	30	-
Years of NZDF Service (T2)		
4 - 5 years	14	4.9
6 – 10 years	42	14.8
11 – 15 years	46	16.3
16 – 20 years	47	16.6
21 – 25 years	41	14.5
26 or more years	93	32.9
Missing	30	-

Note. *A minimum age of 18 years is required by the NZDF for uniformed staff prior to the completion of their respective recruit course training. The "Other" specification for Gender represented an option for self-identify that was not captured by the Male or Female options. The "Other" grouping for Ethnicity represented an option that was not adequately captured by the given Ethnicity options.

The sample included 79% male, and 20% females, numbers which are nearly identical to other research in military populations (Hom et al., 2020), and in the wider NZDF population (NZDF, 2023). With respect to participant ethnicity, 76% identified as New Zealand European/Pākeha, 10% as Māori, 3% as Pacific Island, 1% as Asian, and 8% as other. A significant portion identified with multiple ethnicities. While the rank order of proportions in the sample was the same as in other research in the wider NZDF population (nondeployed individuals included), the individual percentages diverged (Hom et al., 2020). However, in the cited research those individuals who identified with multiple ethnicities were grouped separately, and in the present research these participants were grouped according to the ethnicity they most identified with. Nonetheless, the proportions found were similar to those in other research in the New Zealand postdeployment population (Morrison, 2018). The vast majority of participants were Regular Forces (90%) with Army (37%) representing slightly more than Navy (30%) or Air Force (33%). Aligned with past research (Back et al., 2019; Goldstein et al., 2017; Ryan et al., 2015), 13% of participants in 2016 and 7% in 2019 reported they had never experienced any of the listed PTDEs. The remaining participants reported experiencing each of the listed PTDEs an average of 1-2 times. Regarding deployment characteristics, participants had on average deployed for a total of 12-24 months in their entire career, across 2-3 deployments.

PTDEs

This section describes the various PTDEs that the participants had reported experiencing and compares this data across time. Participants were asked to think across all of their operational deployments and note how often they had experienced a range of PTDEs. Scoring for each item was as follows: 1 = Never, 2 = Once, 3 = 2-4 times, 4 = 5-9 times, and 5 = 10+ times. Table 2 lists the percentages and numbers of individuals who reported experiencing a given experience at least once.

Table 2

Percentages and Numbers of Participants Exposed to Specific Deployment Experiences

Deployment Experience	2016	2019
• Seriously fear you would encounter an IED	49.8% (*n* = 156)	51.1% (*n* = 160)
• Go on combat patrols/missions or participate in support convoys	55.6% (*n* = 174)	56.5% (*n* = 177)
• Concerned about yourself or others (including allies) having an unauthorised discharge of a weapon	47.9% (*n* = 150)	49.8% (*n* = 156)
• Clear/search buildings, caves, vessels or other areas	25.6% (*n* = 80)	27.2% (*n* = 85)
• Come under fire	33.2% (*n* = 104)	35.5% (*n* = 111)*
• Experience an IED/EOD detonation, suicide bombing, or landmine strike	10.9% (*n* = 34)	10.5% (*n* = 33)
• In danger of being killed or injured	46.3% (*n* = 145)	49.8% (*n* = 156)*
• Have casualties among people close to you	33.2% (*n* = 104)	36.4% (*n* = 114)*
• Handle or see dead bodies	39.3% (*n* = 123)	41.5% (*n* = 130)
• Experience a threatening situation where you were unable to respond due to the rules of engagement	16% (*n* = 50)	18.2% (*n* = 57)*
• Witness human degradation and misery on a large scale?	42.2% (*n* = 132)	42.2% (*n* = 132)
• Discharge your weapon in direct combat	4.2% (*n* = 13)	4.5% (*n* = 14)
• Believe your action or inaction resulted in someone being seriously injured or killed	5.8% (*n* = 18)	7.3% (*n* = 23)*
• Exposed to smoke and/or dust, fumes, fuels, or chemicals?	59.7% (*n* = 187)	61.7% (*n* = 193)
• Exposed to hazardous materials	16.6% (*n* = 52)	16.9% (*n* = 53)
• See something that you considered to be morally unacceptable	30.1% (*n* =113)	31.5% (*n* = 130)*
• Confronted with an ethical dilemma where there was seemingly no “best” answer	24.6% (*n* = 77)	25.2% (*n* =79)
• Placed in a situation where you felt compelled to make an uncomfortable ethical decision	20.8% (*n* =65)	19.8% (*n* = 62)

Note. * = Using paired sample *t*-tests, a significant difference between 2016 and 2019 values was identified. % = percentage of sample who had experienced the given PTDE at least once. *n* = number in sample who had experienced the given PTDE at least once.

Significant increases in the proportion of personnel reporting a subset of traumatic deployment experiences were seen between the 2016 and 2019 results. The average frequency for each experience ranged from “Never” in some items, to “2-4 times”, with reported frequencies significantly rising between 2016 and 2019 across a minority of variables.

Control Variables

Care was taken to select control variables that had clear mechanistic implications for the hypothesised and observed findings, as suggested by leaders in the field in this area (Spector & Brannick, 2011). The following are the considered control variables, and their specified roles.

Gender Differences

A consistent result in PTS research is a 2:1 female-to-male ratio in prevalence, which has been reproduced across a variety of industrialised nations and diagnostic criteria iterations (Tolin & Foa, 2006). However, within the military population, the research on gender differences in PTS is limited and mixed (Crum-Cianflone & Jacobson, 2014; Street et al., 2009). In some postdeployment research, women reported elevated PTS symptoms compared to men (Luxton et al., 2010; Polusny et al., 2014), and in other research, no significant differences have been found (Eisen et al., 2012; Lapierre et al., 2007; Maguen et al., 2012).

It is unclear whether these gender differences may be attributed to combat exposure. While men tend to experience more exposure to combat than women, women are more likely to experience sexual trauma and are equally likely to report exposure to the aftermath of battle (Maguen et al., 2012; Polusny et al., 2014). However, when adjusted for combat, women have reported significantly more PTS than men (Skopp et al., 2011), and the relationship between combat exposure and PTS was stronger for women compared to men at higher levels of exposure (Luxton et al., 2010). This is not a universal finding, however. Combat exposure and PTS have also been found to be more strongly associated in men than women in some research (Hourani et al., 2016), and equivalent in other research (Jacobson et al., 2015; Vogt et al., 2011).

A clearer picture is garnered when examining the chronicity and persistence of PTS across genders. Women exhibit higher rates of new-onset PTS than men following deployment (Smith et al., 2008), a finding that was stronger among combat deployers (LeardMann et al., 2009). Over time, however, greater improvements in PTS symptoms have been associated with women compared to men (Maguen et al., 2017), and a greater persistence in symptoms has been associated with men compared to women (Kelber et al., 2021).

Several cognitive, emotional, and neurobiological processes have been explored in efforts to explain why women initially experience greater levels of PTS, although males maintain PTS for longer durations. Gender differences in a range of factors implicated in the expression of PTS have been identified, including negative emotion sensitivity and tolerance (Miles et al., 2016; Vujanovic et al., 2016), levels of self-blame, negative beliefs, and rumination in response to PTS (Cox et al., 2014; Johnson & Whisman, 2013), and in several neurobiological factors (Bangasser & Valentino, 2014).

With respect to the persistence of symptoms, women are more likely to seek treatment than men, and utilise treatment earlier than men (Hines et al., 2014; Hom et al., 2017; McKibben et al., 2013). Help-seeking attitudes and behaviours are an important consideration for the present research, as previous research conducted with the same dataset as the present research found that help-seeking behaviours and attitudes influence flourishing and mental health (Hom et al., 2020). To control for the effects of gender over time, gender was included as a control variable.

Ethnicity Differences

A range of ethnicities were present in the sample population, including New Zealand European, Māori, Pacific Island, and Asian cultures. Differences in prevalence rates have been observed across these ethnicities for PTS (Hom et al., 2020; MacDonald et al., 1997; Tsai & Kong, 2012; Whealin et al., 2013), and PTG (Morrison, 2018). There is evidence to suggest that ethnicity and cultural variables influence the dynamics of support mobilisation, utilisation, and effectiveness (Chen & Tang, 2021; Hansford & Jobson, 2022; Kaniasty & Norris, 2000; Kwok et al., 2019). As the influence of social support on the relationship between deployment experiences and outcome variables was one of the subjects of examination in the present research, ethnicity was also selected as a control variable.

Age and Deployment Characteristics

While the consideration of appropriate controls is essential to quality research, leaders in the field also emphasise the importance of consideration for the inappropriate use of controls (Breaugh, 2008; Spector & Brannick, 2011). Generally, the inclusion of control variables aims to clarify and confirm observed relationships between variables of interest by removing any possible contaminations and distortions by other influential factors. However, control variables may also serve as proxies for constructs of interest, and therefore dilute or suppress real existing relationships. It has therefore been argued that the inappropriate use of controls may move research results further from the truth, not closer (Breaugh, 2008; Spector & Brannick, 2011). With this view in mind, critical consideration was given to a commonly incorporated demographic control variable in postdeployment PTS research: age.

Postdeployment PTS rates have been observed to be higher among younger individuals compared to older individuals (Seal et al., 2007; Seal et al., 2009; West & Weeks, 2006), and age has been found to be a significant discriminating factor in the improvement of PTS over time (Bonanno et al., 2012). However, a recent meta-analysis of 32 investigations into military PTS found that age was not a predictor for combat-related PTS (Xue et al., 2015). Similarly, a meta-analysis of 33 studies of PTS rates among individuals with traumatic brain injuries found that age was not a significant discriminating factor (Loignon et al., 2020). Pointing to a potential mechanism, other reviews of 29

(Ramchand et al., 2010) and 37 (Blais et al., 2021) military PTS studies found that associations between age and PTS became nonsignificant after a range of covariates were adjusted for. One of the covariates in these models was combat exposure. From this view, soldiers who are exposed to combat tend to be younger (Sollinger et al., 2008), and as a result may exhibit higher levels of PTS. Adding support to this view, age has failed to discriminate between trajectories of PTS over time when combat exposure was considered (Dickstein, Suvak, et al., 2010; Orcutt et al., 2004). As such, age has been explained to serve as a potential proxy variable for a range of deployment characteristics, including combat exposure (Konnert & Wong, 2015; Seal et al., 2007).

Returning to the proper consideration of controls, it is important to note that many of the analyses in the present investigation explored the relationships between deployment experiences (including combat experiences) and outcome variables (including PTS). These not only included the effects of the exposure to combat and other PTDEs, but also the effect of increasing and accumulated amounts of exposure to these events. As outlined above, age appears to serve as a proxy variable for combat exposure, and thus its presence as a control variable may obfuscate the presence of a real relationship between PTDEs and outcome variables (Becker, 2005; Breaugh, 2008; Spector & Brannick, 2011). Therefore, age was excluded as a control variable.

CHAPTER 7

RESULTS

This chapter presents the results of the present research, including the data-screening methods implemented, a summary of the study measures, and the hypothesis tests. At the beginning of each hypothesis test, the hypothesis is reintroduced and how it was tested is detailed. Table 7 includes a summary of Pearson's correlations for all research measures.

This chapter is divided into the following sections: (1) data screening, (2) sample description, (3) study measures results summary, (4) the relationship between PTDEs and outcomes, (5) the effects of adaptive health behaviours and social support on outcomes, and (6) moderation of the relationship between PTDEs and outcomes. The main statistical methods that were utilised to analyse the relationships between the various constructs were Pearson's correlation coefficients, hierarchical regressions, and moderation analyses. These statistical analyses were completed using the statistical package SPSS, version 29.0.0.0 (241), and the PROCESS macro (Hayes, 2009).

Data Screening

Prior to beginning statistical analysis of the data, it was necessary to evaluate a number of factors. These problems included missing data, outliers, and data normality (Field, 2017; Tabachnick & Fidell, 2018).

Missing Data

The term "missing data" refers to responses on variables that were unavailable for analysis. In the present collection, missing data may have occurred through participants electing not to answer questions on the survey or missing them accidentally. Using the SPSS statistical package, analysis of the missing data was performed by running missing values analysis. While there are currently no established cutoffs in the literature regarding acceptable percentages of missing data in a dataset (Dong & Peng, 2013), missingness tolerances for valid statistical inferences have been suggested. For example, it has been suggested that missing data rates lower than 5% are inconsequential (Schafer, 1999), while missing data rates higher than 10% generate bias (D. A. Bennett, 2001; Hair et al., 2009). More than 5% missing data in a completed survey was used as a cutoff mark for exclusion in the present investigation. Two individual surveys had completion rates of under 95% and were removed from the dataset (N = 313 remaining). All other surveys had 97-100% completion rates and were retained.

Missing data mechanisms and patterns have been posited to impact research results more significantly than missing data proportions (Tabachnick & Fidell, 2012). Therefore, missing data patterns were also tested using Little's MCAR chi-square through iterations of expectation-

maximisation (EM) algorithms, where no significant pattern was found (χ^2 = 5250.11, p = .85). This indicates that data were missing completely at random (Howell, 2007). Missing data were treated using the multiple imputation-Markov chain Monte Carlo method (Schafer, 1997). To ensure the preservation of statistical power, five imputations were generated (Graham et al., 2007). Imputation was performed at the item level.

Outliers

An outlier is a score that is significantly different from the rest of the data and has the potential to distort parameter estimations and the accompanying error range (Field, 2017). All variables were analysed on a univariate basis to see if the data included any extreme values. Values were converted to standard scores, and scores 3 standard deviations above or below the mean were identified as outliers (Field, 2017; Osborne & Overbay, 2004). Twenty-six outliers were found from nine variables with one in each of the 2016 adaptive health behaviours and 2019 flourishing variables. Two outliers were found in the 2016 leadership support, 2016 flourishing, 2019 deployment experiences, and 2019 social support variables. Three outliers were found in the 2019 leadership support and 2016 PTDE variables. Four outliers were found in the 2019 PTS variable, and seven in the 2016 PTS variable. Several considerations were made about these outliers, including whether the data was submitted accurately, and if a subset of participants contributed disproportionately to the number of outliers (Field, 2017; Tabachnick & Fidell, 2018). Further consideration was given to whether the presence of outliers was typical of the sampled population (Field, 2017; Osborne & Overbay, 2004; Wiggins, 2000).

Due to the modest number of outliers and the belief that the scores were indicative of the population of trauma-exposed NZDF personnel, it was decided to retain the outliers. Particularly in the case of PTS, the variable with the highest number of outliers, previous research has found that only a small number of trauma-exposed individuals in the postdeployment population proceed to develop PTS (Bonanno et al., 2012; Galatzer-Levy et al., 2018). In addition, it has been shown that outliers owing to extreme responses produce little statistical bias, in that excluding data due to extreme responses has been shown to not have a discernible effect on validity coefficients (Zijlstra et al., 2011). Whenever there were multiple predictor variables, multivariate outlier studies using the Mahalanobis distance test were conducted (Field, 2017; Tabachnick & Fidell, 2018). When the suggested p value of.001 was used (Tabachnick & Fidell, 2018), and when sample-size-by-predictor-number interaction limitations were attempted (Barnett & Lewis, 1994; Field, 2017), no significant outlier association was identified. Thus, subsequent analyses were thought to be reliable with the outliers retained.

Normality of Data

The normality of the data distribution was a further factor for detecting the effect of possible bias. All variables were examined visually using box and whisker plots, frequency histograms, and P-P plots for this purpose. Within the graphical representations, nonnormal distributions were found in scores for both 2016 and 2019 variables for PTDEs, PTS, flourishing, social support, and leadership. Using the significance thresholds on Z-scores for skewness and kurtosis of the data (Field, 2017; Hair et al., 2009; Tabachnick & Fidell, 2018), it was determined that PTDEs, PTS, flourishing, social support, and leadership support were skewed in both datasets. The PTDEs variable was not expected to exhibit normality due to the heterogenous nature of experiences on deployment. It has been proposed that skewness is unacceptable if the mean and median differ by more than half a standard deviation (Coolican, 2018). Accordingly, none of these factors were deemed excessively skewed.

PTS and leadership-support variables for 2016 and 2019 exhibited significant kurtosis. Tests of kurtosis shape are not considered as detrimental to statistical analyses as data that is skewed (Coolican, 2018). Further, arguments have been made that with larger sample sizes (i.e., over 100), the impacts of variance on statistical analyses become negligible (Tabachnick & Fidell, 2018), and tests of data shape such as skewness and kurtosis do not affect significance tests (Field, 2017). Although there were irregularities in the data, they were deemed acceptable, and no data alterations were performed. Moreover, data transformations have been regarded as undesirable for a number of reasons; they may not adequately address assumptions of normality for statistical inference, they can alter the generalisability of findings to the original dataset, they do not adequately deal with outliers, and they confound possible interpretations; thus, a variety of researchers do not recommend it (Erceg & Mirosevich, 2008; Games, 1984; Glass et al., 1972; Grayson, 2004; Norris & Aroian, 2004; Pek et al., 2017; Wilcox, 2017). Finally, the data in this study seemed to be representative of both the sampled group and the postdeployment military population. PTS factors in the current study exhibited positive skew and kurtosis values, showing a propensity for postdeployment participants to report reduced levels of PTS, with a smaller minority reporting symptomatology markedly higher compared to their similarly trauma-exposed counterparts. This finding has been robustly replicated by supporting research, in that only a small number of trauma-exposed individuals in the postdeployment population have been found to subsequently develop PTS (Bonanno et al., 2012; Galatzer-Levy et al., 2018). For instance, using a recommended screening score cutoff of 30 for military populations (Bliese et al., 2008; Nicholson, 2006), 20% of individuals in the 2016 dataset, and 21% in the 2019 dataset, met criteria for PTS. This is consistent with other studies of PTS prevalence in postdeployment military personnel. For example, Searle and colleagues (2015) found a prevalence rate of 15% for PTS in a sample of

Australian military personnel. Further, data samples of the postdeployment military population have shown similar positive skew (Andrews et al., 2009; Pitts et al., 2014).

Multiple Regression Analysis Considerations

Multicollinearity tests, centring of moderating factors, and ratios of cases are additional assumptions for multiple regression analysis. By comparing the independent variables included in the regression analyses, multicollinearity was investigated. Multicollinearity is believed to exist if there is a correlation between the independent variables of above .90, or if the variance inflation factor is substantially above 1 (Bowerman & O'Connell, 1990; Field, 2017; Hair et al., 2009). No combination of variables met these criteria, and therefore there was no evidence of multicollinearity. When moderation analyses were performed, all moderating factors were centred to further minimise the possibility of multicollinearity (Echambadi & Hess, 2007) and to account for the impacts of predictors across the spectrum of other predictors (Field, 2017). The sample size was the final factor considered for the multiple regression analysis. In the present research, 240 participants were needed to obtain statistically significant and generalisable findings, satisfy requirements for normalcy if the dependent variable data were skewed, and guarantee that no data transformations were necessary (Tabachnick & Fidell, 2018). Thus, given the sample size of this study, multiple regression analysis was considered an appropriate statistical method.

Study Measures Results Summary

This section includes a summary of the descriptive statistics for the measures used in the current study, the differences in these statistics between those who met and those who did not meet the criteria for PTS and estimates of the internal consistency and rest-retest reliability for study measures. Table 3 provides a summary of the descriptive statistics for the measures used in the current investigation, including measures of the key outcomes (PTS and flourishing) and the potentially influencing variables (social support and adaptive health behaviours). Significant differences were discovered between the 2016 and 2019 scores on the Flourishing Scale, and Adaptive Health Behaviours. Conversely, PTS levels were found to be relatively stable across time in the sampled population, such that paired sample *t*-tests revealed no significant differences (p = .11) in average PTS scores between 2016 and 2019 (See Table 3). Past research has employed the use of descriptors to represent the degree for which PTS symptoms diverge from the normative mean (Bovin, 2016). 'Normal' range is considered to occur at scores below 25, 'Mild' at 25-33, 'Moderate' at 34-50, 'Severe' at 51-65, and 'Extremely Severe' at over 65. Using these descriptors, the average PTS symptom severity was identified to be in the 'Normal' range.

Table 3

Study Measures Results Summary

	2016 Data			2019 Data		
Variable	*M*	*SD*	*Range*	*M*	*SD*	*Range*
PCL	23.86	8.95	16-62	24.52	10.34	16-77
Flourishing Scale	8.34	1.50	3-10	8.14*	1.73	2-10
MSPSS	16.30	3.27	4-20	-	-	-
Leadership Support	17.30	3.30	4-20	17.62	3.44	4-20
Adaptive Health Behaviours	17.59	3.60	7-25	17.39*	3.43	8-26

Note. * = using paired sample *t*-tests, a significant difference between 2016 and 2019 values was identified. PCL = PTSD Checklist (PCL-C in 2016, PCL-5 in 2019). MSPSS = Multidimensional Scale of Perceived Social Support (not measured in 2019).

A comparison of the present research's PTS prevalence rates with previous literature is difficult, as the exact cutoff scores for the PCL and PTS prevalence rates have been debated (Karstoft et al., 2013). As described in Table 4, a commonly used cutoff score of 50 revealed that 3.5% of participants met criteria for PTS in 2016, and 4.2% in 2019. Other research using a cutoff score of 50 to detect PTS in the postdeployment population found a comparable 3.7% (Smith et al., 2009): lower than the 11-17% found for combat-specific deployments in other research (Hoge et al., 2004). The use of a score of 50, however, has been observed to have a high specificity but lower sensitivity, potentially underestimating the prevalence and increasing the number of false negatives for PTS in the trauma-exposed military population (McDonald & Calhoun, 2010).

Table 4

PTS Prevalence Rates Across PCL Cutoff Scores

	PTS Prevalence Rates	
PCL Cutoff Score	2016	2019
30	20.1%	21.1%
50	3.5%	4.2%

Conversely, PCL-5 recommends a cutoff of 30-33 (Weathers et al., 2013). Further, this cutoff has also been observed to be an appropriate cutoff score on the PCL-C for military samples (Bliese et al., 2008; Nicholson, 2006). Due to these factors, 30 was selected as the primary cutoff in the present research as an indicator the probable presence of PTS. As depicted in Table 4, a cutoff value of 30 led to 20.13% of participants meeting criteria in 2016, and 21.10% in 2019, which was lower than 31%

prevalence rate found in an American female veteran population (Lang et al., 2003), but higher than the 6% found in another postdeployment population (Bliese et al., 2008). Despite *t*-tests not finding a significant difference between 2016 and 2019 values using either cutoff, there was not an equal division between individuals experiencing worsening versus ameliorating PTS. A worsening of PTS across time was reported by 34.82% of participants, while 65.18% of participants reported an amelioration of PTS.

Turning to the second outcome measure in this research, flourishing, an average rating of 8.34 was found in 2016, and 8.14 in 2016. These results were comparable to the 7.76-8.08 found in two other surveys of New Zealand Defence Force personnel (Hom et al., 2020; Hopkinson, 2021) but lower than the 12.24 found in a sample of trauma-exposed college students (Nolen, 2013). A significant difference was found in the flourishing scores between the 2016 and 2019 datasets, albeit by a relatively inconsequential amount (8.34 vs 8.14; p = .02). A bias toward participants reporting deteriorations versus increases in flourishing was found upon examination of the internal distribution of scores. Where 29.7% of participants reported increases in flourishing scores, 70.3% reported deteriorations. This finding is similar to other research in which 25% of individuals displayed improvements in life satisfaction (Frazier et al., 2009), but diverges from the 52% showing increases in scores on the Posttraumatic Growth Inventory (PTGI; Yanez et al., 2011) following traumatic events.

In Table 5, the average score for each of the measures used in the current study is compared for individuals who scored above vs below the suggested cutoff on the PCL. As described in the measures section of Chapter 6, a cutoff of 30 has been described as an appropriate cutoff for both the PCL-5 and PCL-C (Bliese et al., 2008; Nicholson, 2006), and is used in the present research as an indicator of probable PTS. To compare the possible differences among covariates for those individuals who scored above versus below this cutoff, independent sample *t*-tests were undertaken to see whether the scores varied substantially from one another. These was conducted to compare the rates of PTDEs, flourishing, adaptive health behaviours, and perceptions of social support from close others and leadership for individuals who were above versus below the cutoff for PTS. As shown in Table 5, individuals who met criteria for probable PTS reported significantly elevated levels of PTDEs, lower levels of flourishing, less frequent adaptive health behaviours, and lower perceived social support from close others and leadership.

Table 5

Average Results for Individuals with Scores of ≤29 vs ≥30 on the PTSD Checklist

	2016		2019	
Study Measures	≤29 (*n* = 243)	≥30 (*n* = 70)	≤29 (*n* = 247)	≥30 (*n* = 66)
PTDE	29.70	34.48*	30.57	34.25*
Flourishing Scale	8.63	7.31*	8.50	6.77*
Adaptive Health Behaviours	21.83	19.46*	21.35	19.44*
Leadership Support	17.71	15.83*	17.98	16.28*
MSPSS	16.78	14.61*	-	-

Note. * = independent sample *t*-tests showed significant differences between individuals who scored ≤29 vs ≥30 on the PTSD Checklist (PCL; PCL-C in 2016, PCL-5 in 2019). PTDE = potentially traumatic deployment experiences. MSPSS = Multidimensional Scale of Perceived Social Support (not measured in 2019).

Table 6 describes the relevant internal consistency and test-retest reliability estimates for all study measures. Internal consistency refers to the extent to which items within a scale correlate well with one another (Field, 2017). A score of 0.7 to 0.8 or higher is generally regarded as an acceptable value for Cronbach's α to represent a reliable measure (Kline, 1999), which was reached for the PTDE, PCL, MSPSS, and LS measures. Affordances for values as low as 0.5 have been recommended for new measures (Nunnally, 1978), particularly when there is diversity in the constructs within the measure (Kline, 1999). As the adaptive health behaviour measure was a newly constructed variable and containing three different constructs, this α level was determined to fall within acceptable parameters. In addition, since the chosen adaptive health behaviours have been proven to be behaviourally and physiologically interrelated (Prendergast, Mackay, & Schofield., 2016), and partially mitigate the deficiencies of one another (Tan et al., 2018; Wickham et al., 2020), it was deemed suitable to continue with the grouped variable. Finally, arguments have been made that Cronbach's α must be supported with a Spearman-Brown statistic to appropriately test reliability for 2-item measures (Eisinga et al., 2013) such as the flourishing scale. Both the Cronbach's α and Spearman-Brown statistic returned identical statistics and met the cutoff of 0.7 for measures with a diversity of constructs (Allen et al., 2018; Eisinga et al., 2013). Given these statistics, it was deemed appropriate to proceed with hypothesis testing.

Table 6

Internal Consistency and Test-Retest Reliability Estimates for Study Measures

	2016	2019	Test-Retest
PTDE	.89	.89	.70*
PCL	.93	.95	.47*
MSPSS	.80	-	-
Leadership Support	.90	.91	.18*
Adaptive Health Behaviours	.51	.54	.78*
Flourishing Scale	.71	.75	.54*

Note. * = correlation was significant at the .01 level. The Flourishing Scale's reliability was measured through correlations between both items. All other internal reliability estimates were measured using Cronbach's α, and Test-retest measures with Pearson's correlation coefficients. PTDE = Potentially Traumatic Deployment Experiences. PCL = PTSD Checklist (PCL-C in 2016, PCL-5 in 2019). MSPSS = Multidimensional Scale of Perceived Social Support (not measured in 2019).

In addition to the Cronbach's α analyses, Pearson's correlation coefficients were employed to assess for test-retest reliability between 2016 and 2019 values of the Flourishing Scale. This analysis found that 2016 and 2019 values were positively and significantly correlated with one another (see Table 6). Ranges have been proposed to describe the strength of correlations, such that 0-.30 is described as weak, .31-.60 moderate, .61-.80 strong, and .81-1.00 very strong (Coolican, 2018). As such, flourishing displayed moderate correlation. While test-retest reliability analyses are frequently used to determine the reliability of the measure being used, they are subject to influence by factors occurring in the intervening time period between measures (Field, 2017). For the variables at the heart of the present research, it was expected that a range of factors would both change across time and influence the trajectories of PTS and flourishing over time (Galatzer-Levy et al., 2018). Therefore, the stronger these influences, the weaker the relevant test-retest estimates would subsequently be. It was also expected that changes in adaptive health behaviours, perceived social support, and leadership support would occur across time, further diluting test-retest correlations. As with all other measures, the Flourishing Scale's reliability characteristics were thus judged to be within acceptable parameters.

The Relationship Between PTDEs, Psychological Outcomes, and Influencing Variables

In this section, the stated hypotheses and exploratory analyses are each restated, alongside their corresponding results.

Hypothesis 1 and Exploratory Analysis

For Hypothesis 1, PTDEs were predicted to be positively related to PTS. Further, an exploratory analysis of the relationship between PTDEs and flourishing was also undertaken. Correlation analyses were completed in relation to PTDEs and the outcome variables. There were significant positive correlations between PTDE and PTS in both the 2016 and 2019 datasets (see Table 7). Thus, Hypothesis 1 was fully supported. A nonsignificant relationship emerged between PTDE and flourishing in both datasets.

Hypothesis 2

Hypothesis 2 stated that perceived social support, leadership support, and adaptive health behaviours would be negatively related to PTS, and positively related to flourishing. To test this hypothesis, correlation analyses were completed for all variables. In the 2016 dataset, perceived social support, leadership support, and adaptive health behaviours were negatively related to PTS, and positively related to flourishing. In the 2019 dataset, leadership support, and adaptive health behaviours were negatively related to PTS, and positively related to flourishing (see Table 7). Thus, Hypothesis 2 was fully supported.

Table 7

Correlation Table of Study Variables

	PTDE	**PCL**	**FS**	**MSPSS**	**LEAD**	**AHB**
PTDE	-	.14*	-.01	x	-.05	.07
PCL	.14*	-	-.45**	x	-.22**	-.32**
FS	-.02	-.37**	-	x	.27**	.22*
MSPSS	.00	-.30**	.54**	-	x	x
LEAD	-.09	-.23**	.27**	.26**	-	.10
AHB	.08	-.34**	.23**	.16**	.16*	-

Note: PTDE = Traumatic Deployment Experiences, PCL = PTSD Checklist (2016 = Civilian Version, 2010 = DSM5 Version), FS = Flourishing Scale, MSPSS = Multidimensional Scale of Perceived Social Support (only collected in 2016), LEAD = Leadership Support, AHB = Adaptive Health Behaviours. ** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level. AHB x PCL correlation is without sleep items in the PCL, where all other correlations include sleep items in PCL. 2016 data below the line, and 2019 data above.

Hypothesis 3

Hypothesis 3 stated that the relationships between PTDEs and both PTS and flourishing would be moderated by perceived social support, leadership support, and adaptive health behaviours. The moderation analyses were each conducted individually. The findings are summarised below then described in detail. Perceived social support from close others and leadership support, but not adaptive health behaviours, significantly moderated the relationship between PTDE and PTS in 2016. Conversely, adaptive health behaviours, but not perceived leadership support, moderated the relationship between PTDE and PTS in 2019. Adaptive health behaviours, but not perceived social support from close others or leadership, moderated the relationship between PTDE and flourishing in 2016. Perceived leadership support and adaptive health behaviours moderated the relationship between PTDE and flourishing in 2019. Thus, Hypothesis 3 was partially supported.

PTDE and PTS in 2016: Moderation analyses of the relationship between PTDE and PTS in 2016 revealed a significant moderating effect for perceived social support from close others (b = -.13, t = -5.31, p = .00), and perceived leadership support (b = -.08, t = -3.65, p = .00). A nonsignificant effect was found for adaptive health behaviours (b = -.00, t = -.19, p = .85; sleep-sensitive items omitted from PCL), indicating these variables did not display moderating effects (Field, 2017).

Table 8 describes the moderating effect of perceived social support from close others on the relationship between traumatic deployment experiences and PTS. Figure 2 depicts the simple slope equations for predicted PTS at low and high values of PTDEs and social support (Jose, 2013). The moderation analyses revealed:

1. When perceived social support from close others was low (16th percentile), there was a significant and positive relationship between deployment experiences and PTS (b = .24, 95% CI [.19, .30], t = 8.08, p = .00).
2. When perceived social support from close others was high (84th percentile), there was a nonsignificant relationship between deployment experiences and PTS (b = .01, 95% CI [-.05, .07], t = .34, p = .72).

Table 8

Linear Model of 2016 Predictors of PTS: Perceived Social Support

	b	*SE B*	*t*	*p*
Constant	1.35	.19	7.09	.00
	[.98, 1.72]			
Deployment Experiences	.68	.11	6.36	.00
	[.47, .89]			
Social Support	.00	.05	.07	.95
	[-.09, .09]			
Deployment Experiences x Perceived	-.13	.03	-5.31	.00
Social Support Close Others	[-.18, -.09]			

Note. R^2 = .14.

Figure 2

Simple Slope Equations of the Regression of Deployment Experiences on PTS at High and Low Levels of Perceived Social Support from Close Others

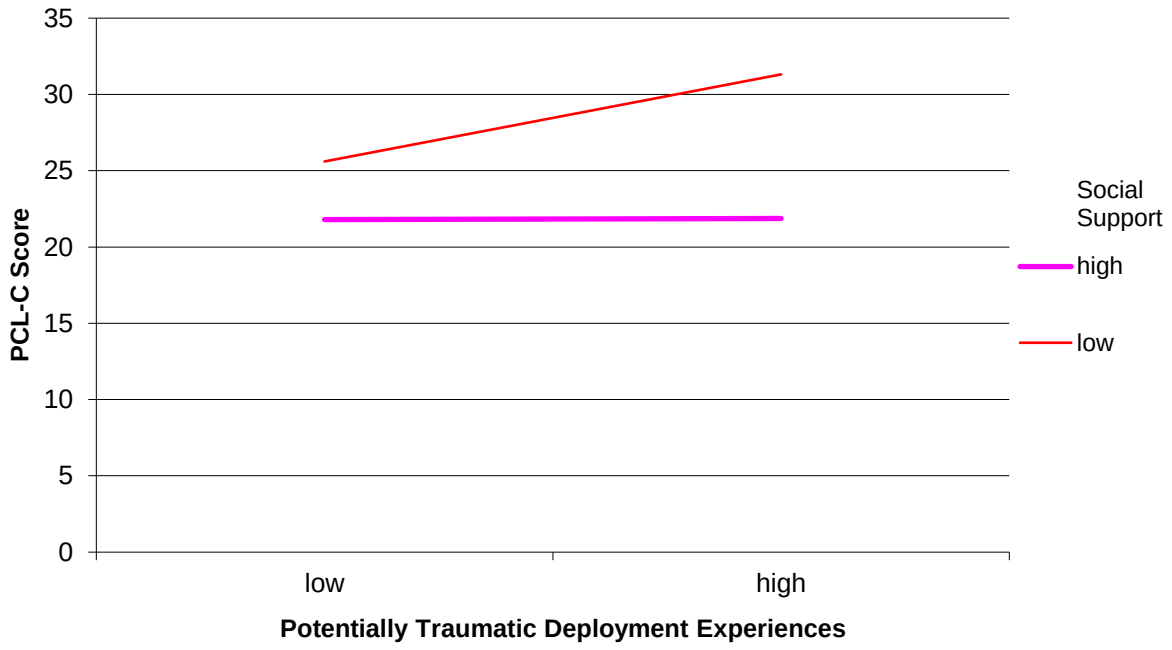


Table 9 describes the moderating effect of leadership support on the relationship between traumatic deployment experiences and PTS. Figure 3 depicts the simple slope equations for predicted PTS for low and high scores for PTDEs and leadership support (Jose, 2013). The moderation analyses revealed:

- When leadership support was low (16th percentile), there was a significant and positive relationship between deployment experiences and PTS (*b* = .15, 95% CI [.11, .20], *t* = 6.23, *p* = .00).

  When leadership support was high (84th percentile), there was a nonsignificant relationship between deployment experiences and PTS (*b* = .04, 95% CI [-.01, .09], *t* = 1.50, *p* = .13).

-

Table 9

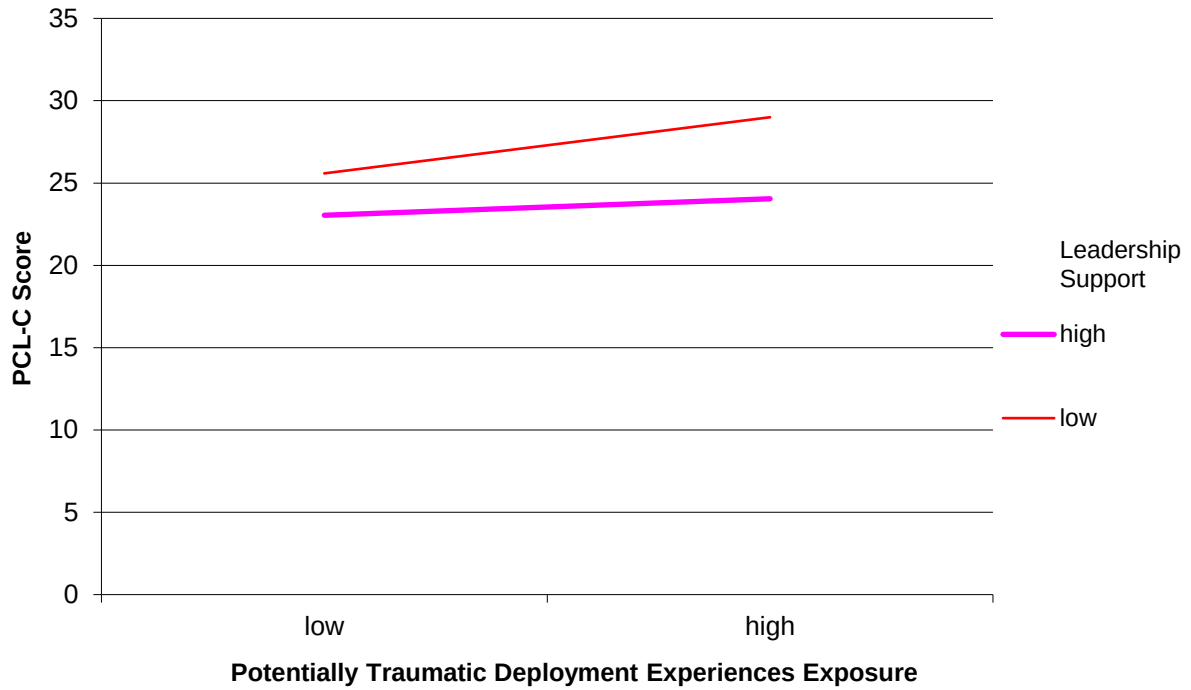
Linear Model of 2016 Predictors of PTS: Leadership Support

	b	*SE B*	*t*	*p*
Constant	1.52	.18	8.50	.00
	[1.17, 1.88]			
Deployment Experiences	.42	.09	4.70	.00
	[.24, .60]			
Leadership Support	-.02	.04	-.53	.60
	[-.10, .06]			
Deployment Experiences x Leadership Support	-.08	.02	-3.65	.00
	[-.12, -.04]			

Note. R^2 = .08.

Figure 3

Simple Slope Equations of the Regression of Deployment Experiences on PTS at High and Low Levels of Leadership Support



PTDE and PTS in 2019: Moderation analyses of the relationship between PTDE and PTS in 2019 revealed a significant moderating effect for adaptive health behaviours (b = -.03, t = -2.57, p = .01). A nonsignificant effect was found for leadership support (b = .01, t = .39, p = .70), indicating that this variable did not display a moderating effect (Field, 2017).

Table 10 describes the moderating effect of adaptive health behaviours on the relationship between traumatic deployment experiences and PTS. Figure 4 depicts the simple slope equations for predicted PTS at low, and high scores for PTDEs and adaptive health behaviours (Jose, 2013). The moderation analyses revealed:

1. When adaptive health behaviours were low (16th percentile), there was a significant and positive relationship between deployment experiences and PTS (b = .22, 95% CI [.16, .28], t = 7.31, p = .00).
2. When adaptive health behaviours were high (84th percentile), there was a significant and positive relationship between deployment experiences and PTS (b = .11, 95% CI [.05, .17], t = 3.46, p = .00).

Table 10

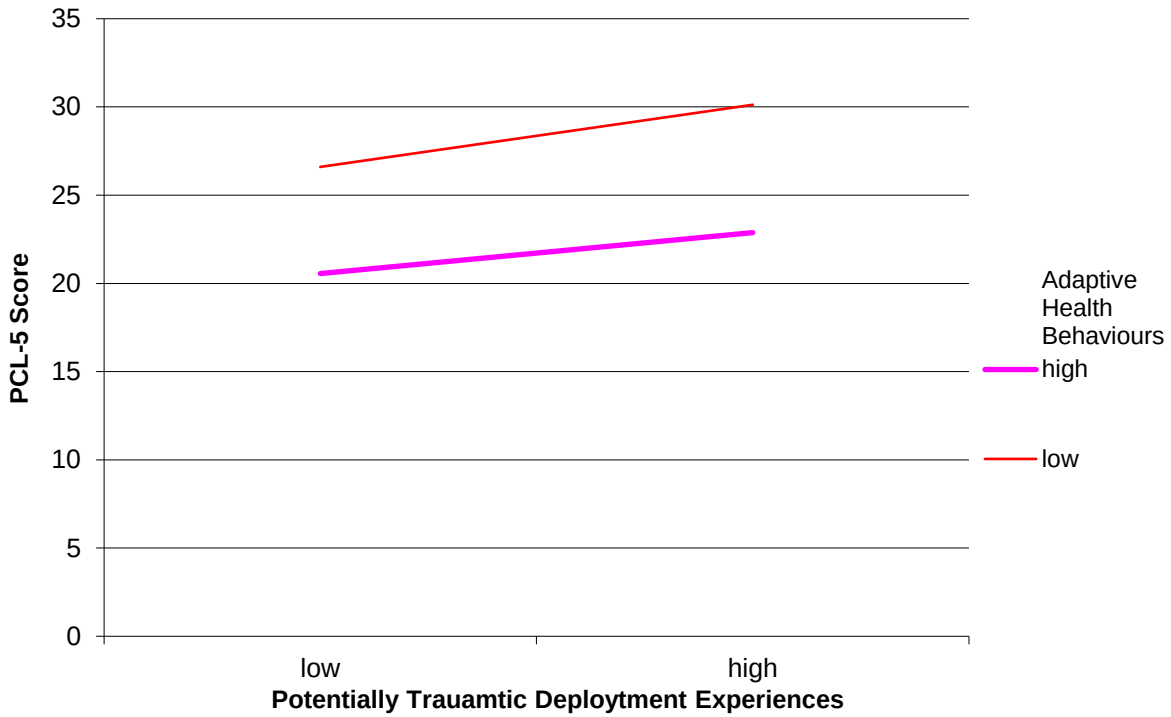
Linear Model of 2019 Predictors of PTS: Adaptive Health Behaviours

	b	*SE B*	*t*	*p*
Constant	1.85	.23	8.09	.00
	[1.40, 2.30]			
Deployment Experiences	.37	.11	3.33	.00
	[.15, .59]			
Adaptive Health Behaviours	-.11	.06	-1.68	.09
	[-.24, .02]			
Deployment Experiences x	-.03	.01	-2.57	.01
Adaptive Health Behaviours	[-.06, -.01]			

Note. R^2 = .13.

Figure 4

Simple Slope Equations of the Regression of Deployment Experiences on PTS at High and Low Levels of Adaptive Health Behaviours



PTDE and Flourishing in 2016*:* Moderation analyses of the relationship between traumatic deployment experiences and flourishing in the 2016 dataset revealed a significant moderating effect for adaptive health behaviours (*b* = .04, *t* = 2.61, *p* = .01). Nonsignificant effects were found for social support (*b* = .04, *t* = 1.57, *p* = .12), and leadership support (*b* = .01, *t* = .25, *p* = .80), indicating these variables did not display moderating effects (Field, 2017).

Table 11 describes the moderating effect of adaptive health behaviours on the relationship between traumatic deployment experiences and flourishing. Figure 5 depicts the simple slope equations for predicted flourishing at low, and high scores for PTDEs and adaptive health behaviours (Jose, 2013). The moderation analysis revealed:

1. When adaptive health behaviours were low (16th percentile), there was a significant and negative relationship between deployment experiences and flourishing (*b* = -.12, 95% CI [-.19, .04], *t* = -3.01, *p* = .00).
2. When adaptive health behaviours were high (84th percentile), there was a nonsignificant relationship between deployment experiences and flourishing (*b* = .03, 95% CI [-.04, .10], *t* = .75, *p* = .46).

Table 11

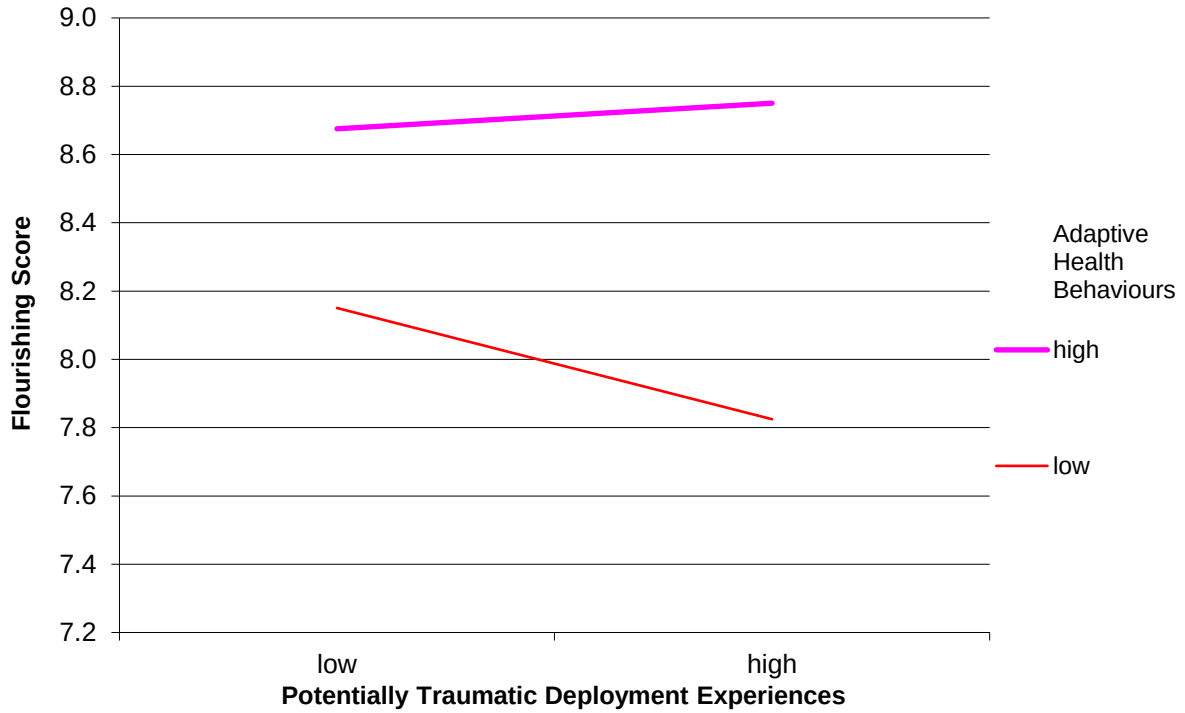
Linear Model of 2016 Predictors of Flourishing: Adaptive Health Behaviours

	b	*SE B*	*t*	*p*
Constant	3.97	.27	14.88	.00
	[3.45, 4.50]			
Deployment Experiences	-.42	.15	-2.84	.00
	[-.70, -.13]			
Adaptive Health Behaviours	.03	.03	1.08	.28
	[-.02, .08]			
Deployment Experiences x	.04	.01	2.60	.01
Adaptive Health Behaviours	[.01, .07]			

Note. R^2 = .06.

Figure 5

Simple Slope Equations of the Regression of Deployment Experiences on Flourishing at High and Low Levels of Adaptive Health Behaviours



PTDE and Flourishing in 2019: Moderation analyses of the relationship between traumatic deployment experiences and flourishing in the 2019 dataset revealed a significant moderating effect for leadership support (b = .03, t = 4.65, p = .00), and adaptive health behaviours (b = .08, t = 4.25, p = .00).

Table 12 describes the moderating effect of adaptive health behaviours on the relationship between traumatic deployment experiences and flourishing. Figure 6 depicts the simple slope equations for predicted flourishing at low, and high scores for PTDEs and adaptive health behaviours (Jose, 2013). The moderation analyses revealed:

1. When adaptive health behaviours were low (16th percentile), there was a significant and negative relationship between deployment experiences and flourishing (b = -.17, 95% CI [-.25, -.08], t = -4.02, p = .00).
2. When adaptive health behaviours were high (84th percentile), there was a significant and positive relationship between deployment experiences and flourishing (b = .09, 95% CI [.00, .17], t = 2.06, p = .04).

Table 12

Linear Model of 2016 Predictors of Flourishing: Adaptive Health Behaviours

	b	*SE B*	*t*	*p*
Constant	4.37	.32	13.76	.00
	[3.74, 4.99]			
Deployment Experiences	-.77	.17	-4.44	.00
	[-1.11, -.43]			
Adaptive Health Behaviours	.03	.03	-.70	.48
	[-.09, .04]			
Deployment Experiences x	.08	.02	4.25	.00
Adaptive Health Behaviours	[.04, .11]			

Note. R^2 = .06.

Figure 6

Simple Slope Equations of the Regression of Deployment Experiences on Flourishing at High and Low Levels of Adaptive Health Behaviours

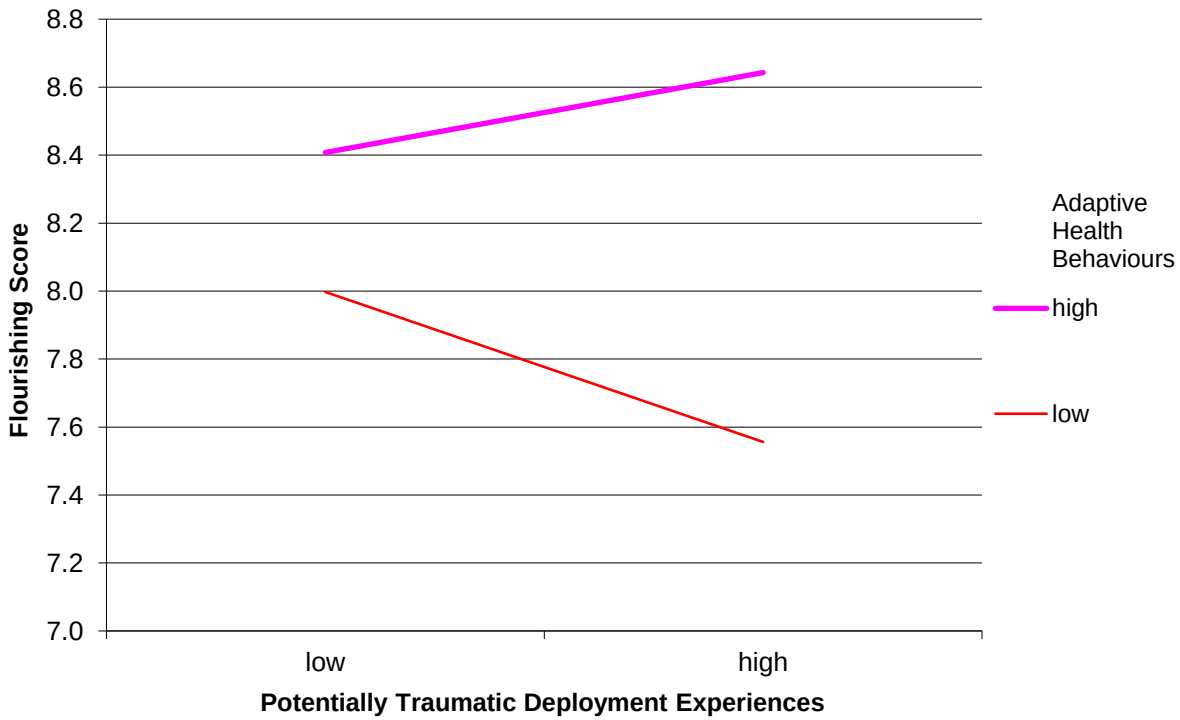


Table 13 describes the moderating effect of leadership support on the relationship between traumatic deployment experiences and flourishing. Figure 7 depicts the simple slope equations for predicted flourishing at low, and high scores for PTDEs and leadership support (Jose, 2013). The moderation analyses revealed:

1. When leadership support was low (16th percentile), there was a significant and negative relationship between deployment experiences and flourishing (*b* = -.07, 95% CI [-.14, -.01], *t* = -2.25, *p* = .02).

When leadership support was high (84th percentile), there was a significant and positive relationship between deployment experiences and flourishing (*b* = .11, 95% CI [.03, .18], *t* = 2.86, *p* = .00).

2.

Table 13

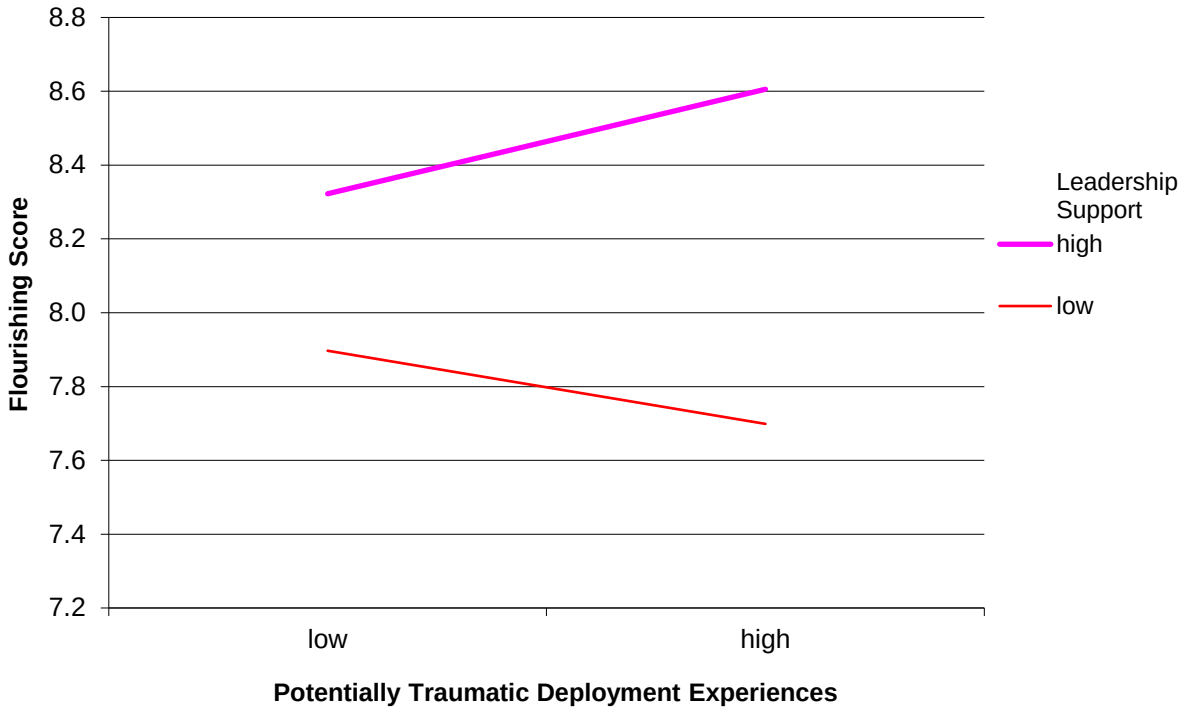
Linear Model of 2016 Predictors of Flourishing: Leadership Support

	b	*SE B*	*t*	*p*
Constant	4.00	.27	15.07	.00
	[3.48, 4.52]			
Deployment Experiences	-.62	.14	-4.55	.00
	[-.88, -.35]			
Leadership Support	.01	.06	.16	.87
	[-.11, .13]			
Deployment Experiences x Leadership Support	.14	.14	4.65	.00
	[.08, .21]			

Note. R^2 = .08.

Figure 7

Simple Slope Equations of the Regression of Deployment Experiences on Flourishing at High and Low Levels of Leadership Support



Hypothesis 4

For Hypothesis 4, it was anticipated that perceived social support, leadership support, and adaptive health behaviours in 2016 would negatively predict PTS, but positively predict flourishing in 2019. To test this hypothesis, a series of hierarchical multiple regressions were conducted. At Step 1, the control variables were entered (both sex and ethnicity, and either PTS or Flourishing from the 2016 dataset). At Step 2, perceived social support, leadership support, and adaptive health behaviours were entered, one variable for each regression analysis. PTS or flourishing from the 2019 dataset were selected as corresponding dependent variables.

Hierarchical regression analyses revealed that adaptive health behaviours in 2016 (b = -.08, p = <.01, Δr^2 = .04; see Table 14), leadership support (b = -.13, p = <.01, Δr^2 = .03; see Table 15), and perceived social support (b = -.05, p = <.01, Δr^2 = .003; see Table 16) contributed predictive variance towards PTS in 2019. Further, hierarchical regression analyses also revealed that adaptive health behaviours (b = .06, p = <.01, Δr^2 = .01; see Table 17), leadership support (b = .20, p = <.01, Δr^2 = .04; see Table 18), and perceived social support in 2016 (b = .13, p = <.01, Δr^2 = .01; Table 19) contributed predictive variance towards flourishing in 2019.

Table 14 *Hierarchical Regression Analysis Effects of Adaptive Health Behaviours on PTS in 2019* (*n* = 313)

	Model 1		
Variables	*b*	*SEB*	*p*
Gender	-.07	.03	.05
Ethnicity	-.08	.03	.01
Past PTS	.52	.02	.01
r	.48		
r^2	.24		
	Model 2		
Gender	-.03	.03	.39
Ethnicity	-.07	.03	.03
Past PTS	.46	.02	<.01
AHP	-.08	.01	<.01
r	.53		
r^2	.28		
Δr^2	.04		

Note. Past PTS = Posttraumatic stress in 2016. AHB = adaptive health behaviours. Gender Control variable measured as: male=0, other=1. Ethnicity control variable measured as: NZ-Euro=0, other=1.

Table 15 *Hierarchical Regression Analysis of Effects of Leadership Support on PTS in 2019* (*n* = 313)

	Model 1		
Variables	*b*	*SEB*	*p*
Gender	-.06	.03	.06
Ethnicity	-.08	.03	.01
Past PTS	.52	.02	<.01
r	.48		
r^2	.23		
	Model 2		
Gender	-.06	.03	.09
Ethnicity	-.06	.03	.03
Past PTS	.50	.02	<.01
Leadership	-.13	.02	<.01
r	.51		
r^2	.26		
Δr^2	.03		

Note. Past PTS = Posttraumatic stress in 2016. Gender Control variable measured as: male=0, other=1. Ethnicity control variable measured as: NZ-Euro=0, other=1.

Table 16 *Hierarchical Regression Analysis of Effects of Perceived Social Support on PTS in 2019* (*n* = 313)

	Model 1		
Variables	*b*	*SEB*	*p*
Gender	-.06	.03	.06
Ethnicity	-.08	.03	.01
Past PTS	.52	.02	<.01
r	.48		
r^2	.23		
	Model 2		
Gender	-.07	.03	.05
Ethnicity	-.08	.03	.01
Past PTS	.50	.02	<.01
Social Support	-.05	.02	. <.01
r	.49		
r^2	.24		
Δr^2	.003		

Note. Past PTS = Posttraumatic stress in 2016. Gender Control variable measured as: male=0, other=1. Ethnicity control variable measured as: NZ-Euro=0, other=1.

Table 17 *Hierarchical Regression Analysis of Effects of Adaptive Health Behaviours on Flourishing in 2019* (*n* = 313)

	Model 1		
Variable	*b*	*SEB*	*p*
Gender	.06	.04	.16
Ethnicity	.05	.04	.17
Past FL	.63	.02	<.01
r	.54		
r^2	.29		
	Model 2		
Gender	.04	.04	.42
Ethnicity	.05	.04	.23
Past FL	.61	.02	<.01
AHP	.06	.01	<.01
r	.55		
r^2	.31		
Δr^2	.01		

Note. Past FL = flourishing in 2016. AHB = adaptive health behaviours. Gender Control variable measured as: male = 0, other = 1. Ethnicity control variable measured as: NZ-Euro = 0, other = 1.

Table 18 *Hierarchical Regression Analysis of Effects of Leadership Support on Flourishing in 2019* (*n* = 313)

	Model 1		
Variable	*b*	*SEB*	*p*
Gender	.06	.04	.19
Ethnicity	.06	.04	.16
Past FL	.63	.02	<.01
r	.54		
r^2	.29		
	Model 2		
Gender	.05	.04	.27
Ethnicity	.04	.04	.36
Past FL	.60	.02	<.01
Leadership	.20	.02	<.01
r	.58		
r^2	.33		
Δr^2	.04		

Note. Past FL = flourishing in 2016. Gender Control variable measured as: male = 0, other = 1. Ethnicity control variable measured as: NZ-Euro = 0, other = 1.

Table 19 *Hierarchical Regression Analysis of Effects of Perceived Social Support on Flourishing in 2019* (*n* = 313)

	Model 1		
Variable	*b*	*SEB*	*p*
Gender	.06	.04	.19
Ethnicity	.06	.04	.16
Past FL	.63	.02	<.01
r	.54		
r^2	.29		
	Model 2		
Gender	.06	.04	.14
Ethnicity	.06	.04	.14
Past FL	.56	.03	<.01
Social Support	.13	.02	<.01
r	.55		
r^2	.31		
Δr^2	.01		

Note. Past FL = flourishing in 2016. Gender Control variable measured as: male = 0, other = 1. Ethnicity control variable measured as: NZ-Euro = 0, other = 1.

Hypothesis 5

Hypothesis 5 predicted that PTS would moderate the relationship that PTDEs had with flourishing. A nonsignificant moderating effect was found in the 2016 dataset (b = -.01, t = -.14, p = .89). Conversely, a significant effect was found for PTS in the 2019 dataset (b = -.21, t = -5.38, p = <.000). Table 20 describes the moderating effect of PTS on the relationship between PTDEs and flourishing in 2019. Figure 8 depicts the simple slope equations for predicted flourishing at low and high scores of PTDEs and PTS (Jose, 2013). The moderation analysis revealed:

1. When PTS was low, there was a significant and positive relationship between deployment experiences and flourishing (b = .19, 95% CI [.12, .26], t = 5.38, p = .00).
2. When PTS was high, there was a nonsignificant relationship between deployment experiences and flourishing (b = 2.06, 95% CI [-.10, .03], t = -1.03, p = .30).

Table 20

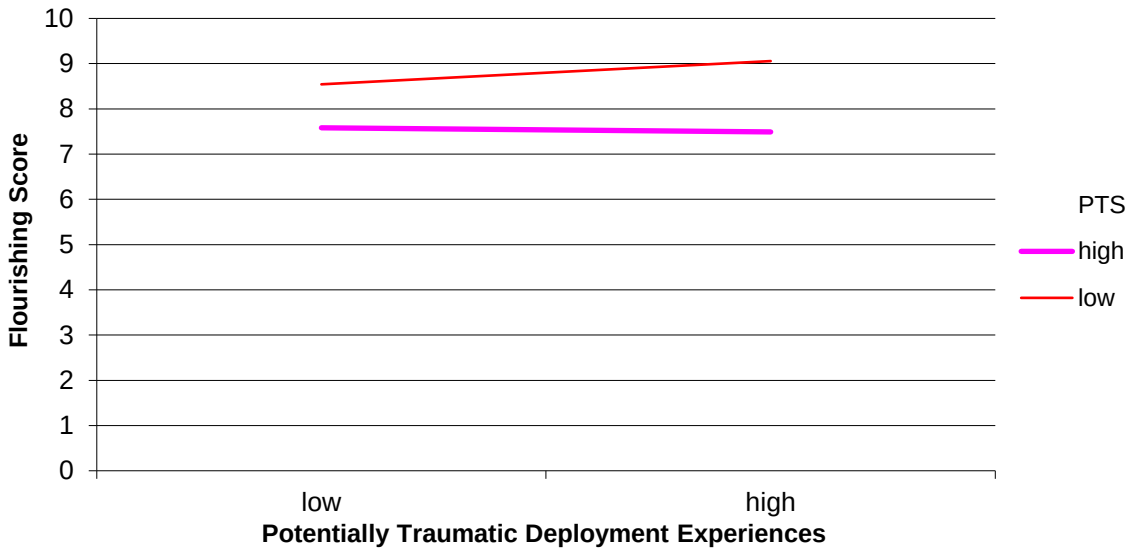
Linear Model of 2019 Predictors of Flourishing

	b	***SE B***	***t***	***p***
Constant	4.27	.13	32.69	.00
PTDE	.41	.07	5.92	.00
PTS	-.22	.08	-2.71	.01
PTDE x PTS	-.21	.04	-5.38	.00

Note. R^2 = .22. PTDE = Potentially Traumatic Deployment Experiences. PTS = Posttraumatic Stress.

Figure 8

Moderating Effect of PTS on the Relationship between PTDEs and Flourishing in 2019



CHAPTER 8

DISCUSSION

The present investigation sought to build upon the emerging body of research into buffering factors for PTS, and facilitative factors for flourishing, in the postdeployment New Zealand military population. While past research has identified the link between PTDEs and PTS within the New Zealand military population (Long et al., 1992; Macdonald, 1999; Vincent et al., 1994), the present research has sought to add to this body of knowledge by investigating flourishing. Responding to calls for longitudinal research (Hom et al., 2020; Hopkinson, 2021), the study also found evidence for the interplay between PTDEs, adaptive health behaviours, social support, PTS, and flourishing both cross-sectionally and over time.

This chapter discusses the results of hypothesis testing and exploratory investigations, situating these findings in relation to the relevant literature. Considerations for the buffering and facilitative roles of adaptive health behaviours and social support, as well as the potentially limiting role of PTS in the development of flourishing, are discussed and contextualised within current understandings of the New Zealand military. Finally, the limitations and implications of this research project are discussed, and future research recommendations made.

RESULTS IN RELATION TO RESEARCH AIMS AND HYPOTHESES

Potentially Traumatic Events

While the majority of reported types of PTDEs did not change in frequency from 2016 to 2019, a minority of experiences increased. As a sample of active-duty service members, it is possible that a subset of the sampled population was redeployed between survey collection dates, and that this contributed to the increased reports of PTDEs. Research has also described a number of recall biases that have been observed in trauma recollection, including propensities for higher frequencies of reported exposures at follow-up than at postdeployment, and an increased salience of memories with life-threatening content (Burns et al., 2014; Krayem et al., 2021). These finding align with the present research's findings, in that the increased reported experiences predominantly comprised life-threatening experiences, including coming under fire, being in danger of being killed or injured, having casualties among people close to you, and believing your action resulted in someone being seriously injured or killed.

Outcomes

Utilising a cutoff score of 30 on the PCL (Bliese et al., 2008; Nicholson, 2006; Searle et al., 2015), 20% of participants exceeded the cutoff for probable PTS in 2016, and 21% in 2019. A number of

difficulties have been identified when comparing prevalence rates between countries, including differences in sampling strategies, methods and cutoffs, existing mental health support and infrastructure, and the consideration of other concurrent risk factors (Yehuda et al., 2014). Therefore, comparisons with other countries must be made with caution. The 20-21% probable PTS prevalence rate observed in the present research appears lower than the 31% prevalence rate observed in an American female veteran population (Lang et al., 2003), but higher than the 15% found in a similar Australian Defence Force wellbeing survey (Searle et al., 2015), which similarly utilised a cutoff score of 30 on the PCL. This suggests that NZDF PTS prevalence rates are generally comparable to other military samples. However, comparable literature using a cutoff variable of 30 on the PCL is extremely limited. More generally, this rate also suggests at a clear need for mental health infrastructure for returning soldiers.

The present investigation tracked the same participants over time, enabling a longitudinal comparison of within-person PTS values. Despite *t*-tests not finding a significant difference between 2016 and 2019 cutoff values, there was an unequal division between individuals whose symptoms worsened versus ameliorated. Of all participants, 34.82% reported a worsening of PTS across time, while 65.18% of participants reported an amelioration of PTS. Similar rates of worsening vs. improving have been found in a review of 54 trajectory studies (44% worsening versus 66% ameliorating; Galatzer-Levy et al., 2018). The same review also found that military samples were more likely to not display any PTS over time, compared to nonmilitary samples. Together, these results suggest that being situated within a military context is beneficial, potentially due to the extensive predeployment preparation and training, and postdeployment and ongoing support that is offered to military personnel (Bonanno et al., 2012; Mobbs & Bonanno, 2018). Described as the healthy soldier effect (McLaughlin et al., 2008), an alternative explanation may be that healthier individuals tend to get selected for military service and additionally for deployment, and therefore are at a lowered prospective risk for subsequent PTS.

A recent systematic review found a number of factors to be more strongly associated with worsening trajectories over time in the postdeployment population, including increased combat exposure, lowered social support, more alcohol and tobacco use, impaired sleep, and poorer physical health (Pavlacic et al., 2022). This suggests that for those with more trauma exposure and less support, trajectories across time tend to be more dire. Partial support for this conceptualisation was found in the present research, where it was found that participants who exceeded the cutoff score of 30 on the PCL experienced more PTDEs, engaged in significantly less adaptive health behaviours, and perceived less social support from close others and leadership. It may be the case

that while social support and adaptive health behaviours may effectively buffer PTS, the absence of these ameliorating factors may lead to a precipitous worsening of symptoms.

Flourishing displayed a reduction between 2016 and 2019, albeit at a relatively inconsequential amount (8.34 versus 8.14), potentially pointing to the sustained flourishing of this sample in the face of PTDEs. These rates were comparable to a sample of veterans (Greenleaf et al., 2019), and higher than a sample of students exposed to armed conflict (Saleem et al., 2023) and a military sample of individuals with spinal cord injuries (Meade & Trumpower, 2015). Due to the longitudinal design involving the same participants, the present investigation was able to compare within-person flourishing values over time. A bias towards participants reporting deteriorations in flourishing was found, such that only 30% of participants reported an improvement in flourishing across time. This finding was comparable with other research showing that 25% of individuals reported improvements in life satisfaction following traumatic events (Frazier et al., 2001). It may be the case that, for most individuals, flourishing remained largely unaffected following PTDEs and only a subset of the population responded meaningfully to PTDEs, as found in the PTS literature. While there remains a dearth of research on postdeployment flourishing, other research has similarly reflected that flourishing remains remarkably constant across time (de la Fuente et al., 2023), potentially reflecting that life circumstances also tend to stay relatively constant (Diener et al., 2018), or return to a "set-point" following initial reactions to positive and negative events (Diener et al., 2009). Thus, true contributions to flourishing might only occur within specific circumstances.

PTDEs' Relationships with PTS and Flourishing

This study investigated the relationship that PTDEs had with both PTS and flourishing. Reflecting past findings internationally (Nordstrand et al., 2020; Vasterling et al., 2010) and within the NZ postdeployment context (Morrison, 2018), a positive relationship between PTDEs and PTS was found in the present investigation. No significant relationships between PTDEs and flourishing were found. While there remains a paucity of research on the relationship between PTDEs and flourishing, particularly within the military context, other research has found negative (Greene & McGovern, 2017; Prizmić-Larsen et al., 2020), and nonsignificant relationships (Nolen, 2013) between trauma exposure and flourishing. As such, the current findings contribute to the idea of a net null relationship between PTEs and flourishing. As discussed below, there exists nuance to this relationship.

A potential explanation for the finding that PTDEs were not associated with flourishing might be found in explorations of the resilience construct. The construct of resilience is not without controversy, which includes a lack of agreement on definition and discrepancies between trait

versus dynamic conceptualisations (Denckla et al., 2020). Nevertheless, high levels of resilience have been shown to reduce sensitivity to, and opportunities for, traumatic events to contribute positively to poor mental health outcomes (Crespi, 2015). In this view, individuals who are more resilient are thought to be less challenged by adversity and engage less in reflective and meaning-making behaviours that could have contributed to positive outcomes in terms of PTG (Westphal & Bonanno, 2007). Some support for this conceptualisation might be found within the posttraumatic growth (PTG) literature, where higher levels of resilience were associated with lower levels of PTG in trauma-exposed individuals (Garrido-Hernansaiz et al., 2017; Levine et al., 2009). Military personnel have been found to rate higher on measures of resilience than their civilian counterparts (Sanborn et al., 2022), and exhibit lower rates of probable PTS (Galatzer-Levy et al., 2018). Taken together, it is plausible that the increased resilience of military personnel may lower opportunities for PTDEs to contribute positively to flourishing.

Associations of Adaptive Health Behaviours and Social Support with PTS

Within the present cross-sectional investigations, social support from close others, leadership support, and adaptive health behaviours (sleep, physical activity, and nutrition) were found to be associated negatively with PTS, and positively with flourishing. This would suggest that people engaging in more adaptive health behaviours, and with higher levels of social support from close others and leadership, experience lower levels of PTS and higher levels of flourishing. This is congruent with past research (Bartonicek et al., 2020; Grier-Reed et al., 2022; Kim et al., 2021; Ozer et al., 2008). These associations also held longitudinally, in that higher levels of adaptive health behaviours, leadership support, and social support predicted lower PTS and higher flourishing 3 years later, an effect that persisted when past PTS and flourishing levels were controlled for. These findings suggest that increases in adaptive health behaviours, leadership support, and social support may not only be associated with current levels of PTS and flourishing, but that they may support improved trajectories across time. However, given the weak effect sizes yielded by the longitudinal analyses, caution must be applied not to overinterpret these predictive results.

While effect sizes ranged from medium to large within cross-sectional analyses of the present investigation, small effects were found longitudinally (Peterson & Foley, 2021). This is congruent with other work in the field of predicting psychopathology from potentially traumatic events, where small effect sizes appear to be the norm rather than the exception (Southwick et al., 2014). As a result, research in this area tends to be modelled as a network of many small but significant contributing factors that aggregate in a cumulative manner to support an individual, each adding or subtracting from an overall vulnerability (Bonanno, 2021). The medium-to-large effect sizes cross-sectionally, and small effect sizes longitudinally, also suggest that while buffering factors might

aggregate to shape the trajectory of symptoms across time, the relationship between adaptive health behaviour and PTS might be more usefully discussed through cross-sectional and buffering lenses. This finding might make sense, considering the day-to-day life of soldiering. In the time between samples, many of the selected variables may have changed dramatically for participants. For example, changes in nutrition, physical activity, and sleep occur while military personnel are on exercise versus when they are on camp. It is also common for military personnel to change units and locations every 2 to 3 years, based on NZDF requirements. Such moves may include changes in leadership support, unit support, and sometimes family and friend support if the person is residing apart from their family. Despite these ever-evolving changes in buffering factors, adaptive health behaviours, leadership support, and social support nevertheless emerged to have significant relationships with PTS and flourishing 3 years later, albeit at a weak level, suggesting that these factors may play an additive and aggregating role. Research into the trajectory of PTS symptoms supports such a conclusion, finding that different support factors are differentially associated with symptom trajectory paths (Galatzer-Levy et al., 2018).

There were, however, some suggestions that buffers may have more impact at different points across time. With respect to PTS, perceived social support and leadership support, but not adaptive health behaviours, moderated the relationship between PTDE and PTS in 2016. Conversely, adaptive health behaviours, but not leadership support, moderated the relationship between PTDE and PTS in 2019. Social support from close others was not measured in 2019. It is seemingly plausible therefore that social support from close relations and leadership may have more impact closer to the time of traumatic exposure, and adaptive health behaviours may have more impact further away from the time of traumatic exposure with respect to PTS. As discussed further below, while social support has been shown to exert well-documented buffering effects (Wang et al., 2021), some evidence suggests that the effects of adaptive health behaviours on negative psychological outcomes appear to emerge across time. Nevertheless, the uncontrolled time lapse between PTDE exposure and data collection inherent in the present research's design limits definitive commentary in this area.

Supporting both stress-buffering (Cohen et al., 2000) and social causation models (Johnson et al., 1999) of social support, the present research found that the social support from close others and from leadership both moderated PTS symptoms at the first data collection point, and predicted PTS levels at the second collection point. This aligns with research in the general (Wang et al., 2021) and military populations (Blais et al., 2021). While the social support of close relationships was not measured at the second data collection point, perceived social support from leadership was unexpectedly not found to moderate the relationship between PTDEs and PTS. The following sections examine the implications of these longitudinal findings.

Regarding the longitudinal associations between perceived social support and psychopathology, a range of assumptions about the directionality of effects exist. In line with social causation models (Johnson et al., 1999), most studies assume a direction of movement from higher perceived social support to subsequently lower psychological symptoms (Wang et al., 2021; Zalta et al., 2021). However, in line with social selection models (Johnson et al., 1999), evidence also exists for movement in the opposite direction, such that high PTS symptomatology predicts subsequent lower social support (Kaniasty & Norris, 2008; Lui et al., 2009; Platt et al., 2016; Ullman & Peter-Hagene, 2016). Across the range of investigations, directionality appears to be heterogenous; in some investigations, PTS symptoms were found to predict perceived social support, but not vice versa (Freedman et al., 2015; King, Taft, et al., 2006; Nickerson et al., 2017; Price et al., 2014), while others have revealed bidirectional associations (Kaniasty & Norris, 2008; Platt et al., 2016; Shallcross et al., 2016).

Time appears to be an important variable for explaining heterogeneity in findings. A recent meta-analysis of longitudinal studies found that increases in time between data collection were associated with weakening effects of social support on PTS (Wang et al., 2021). Another investigation found bidirectionality from 12 to 18 months after a traumatic effect, but only social selection mechanisms seemed to operate after 18 months (Kaniasty & Norris, 2008). Several social factors associated with PTS might explain this erosion effect across time. One possibility is that PTS symptoms themselves involve withdrawal from positive interpersonal relationships (Gutner et al., 2006; Hofmann et al., 2003; Shallcross et al., 2014). Further, the ways that distress is experienced and expressed by trauma survivors (e.g., impulsivity and irritability) may also lead close others to withdraw from relationships (Guay et al., 2006). It has also been discussed that trauma may distort an individual's perception of support, leading to a lessened receptivity of others' help (King, Taft, et al., 2006). In support, differences in offered versus perceived support have been observed in trauma-exposed populations (Hofmann et al., 2003; Hyman et al., 2003). Increases in work stress and depression have similarly been found to modify leadership support perceptions (Pflanz & Ogle, 2006).

A number of distortions in social information processing may underly changes in perceptions of support in the PTS population. These changes include the maladaptive processing of socially relevant information (Couette et al., 2020), the reporting of more distressing social emotions and associated maladaptive social cognitions (Brondolo et al., 2018; Gäbler & Maercker, 2011; McIlveen et al., 2020; Schoenleber et al., 2022), problems regarding emotional self-disclosure (Bolton et al., 2003), and decreased reward-oriented social behaviour (Weaver et al., 2020). Together, these processes may lead individuals with PTS to perceive lower social support from those around them (Evans et al., 2013). Given these factors, the progression of time may lead to a reduced buffering effect for close

or leadership support, as was the case for leadership support in the present investigation. Future research may investigate if the buffering effect of social support from close others similarly reduces in strength across time.

Cross-sectional results in the present investigation revealed that nonmilitary social support (significant others, friends, family) had stronger relationships with PTS and flourishing compared to military sources (leadership support). This is congruent with findings that while support from both military and nonmilitary sources has shown to play an important buffering role on PTS (Wright et al., 2013; Xue et al., 2015), perceived support from nonmilitary sources appears to have a stronger effect on military personnel (Blais et al., 2021). Conversely, longitudinal results found that leadership support had a stronger relationship with PTS and flourishing. Nevertheless, effect sizes were ultimately similar, and suggest that support from both close others and from military sources is important for PTS outcomes.

The unique effect of leadership support on PTS remains an emergent research area. In a recent literature review of nondeployment factors affecting psychological wellbeing, leadership support was identified as likely to be important due to the highly structured environment (Brooks & Greenberg, 2018). Perceived leadership support has also been shown to predict a range of positive military occupational and psychological outcomes (Brasher et al., 2010; Bridger et al., 2009; Bridger et al., 2007; Dupré & Day, 2007), problems with leadership have been positively associated with PTS (Booth-Kewley et al., 2010). Low leader support is one of the most consistent predictors of workplace distress (Finne et al., 2014; Nielsen et al., 2013). Similarly, unit support, a variable that includes leadership support, has been shown to have a negative association with PTS (Armistead-Jehle et al., 2011; Brailey et al., 2007; Han et al., 2014; Pietrzak, Johnson, et al., 2010). This might suggest that while perceptions of close support are more closely related to immediate perceptions of PTS and flourishing, leadership support may be more important to trajectories over time. However, a potential confound in comparing cross-sectional to longitudinal results lies in the influence of present-day mood upon ratings of perceptions and events, where mood has been shown to affect recollections and reporting of past PTEs and present wellbeing (Schraedley et al., 2002; Zerach & Levi-Belz, 2022).

In consideration of the moderating role of adaptive health behaviours on PTS symptoms, past research has shown that physical activity, nutrition, and sleep were associated with a range of psychopathology (Firth, Siddiqi, et al., 2019). Several mechanisms have been identified. Regarding physical activity, the related factors of cardiorespiratory fitness and muscular strength have been identified as protective against psychopathology (Bennie et al., 2019; Gordon McDowell, Hallgren et

al., 2018; Gordon McDowell, Lyons & Herring, 2017, 2019; Kandola et al., 2019; Ortega et al., 2012; Schuch et al., 2016; Tacchi et al., 2019). It has been further hypothesised that exposure to the interoceptive physiological signals that arise during exercise may also serve to desensitise individuals to PTS-related arousal symptoms and reduce catastrophic interpretations of normal physiological functioning (Hegberg et al., 2019). Exercise has been shown to enhance the structures and functions of key brain areas and circuits that have been maladaptively associated with PTS (Hayes et al., 2012; Miller et al., 2017; Sripada, King, Garfinkel et al., 2012; Sripada, King, Welsh et al., 2012). Exercise appears to also improve stress-related activation of the HPA axis (Nabkasorn et al., 2006; Stranahan et al., 2008; Wunsch et al., 2017; Zscucke, 2015), which has similarly been shown to be maladaptively altered in PTS. Finally, exercise appears to ameliorate inflammatory processes (Metsios et al., 2020), which have been shown to play a precipitating and perpetuating role in PTS (Michopoulos & Jovanovic, 2015; Quinones et al., 2020). This diversity of mechanisms suggests that physical activity plays a buffering and protective role for PTS, a position that is supported by the present research's findings that adaptive health behaviours both moderated the relationship between PTDEs and PTS, and predicted later PTS.

The adaptive health behaviours variable also included several questions on nutrition, suggesting that nutrition habits may help to buffer PTS symptoms. A number of mechanisms have been described in the literature which speak to the role of nutrition impacting PTS. One mechanism is through the provisions of vital micronutrients (Du et al., 2016; Rucklidge, Afzali, et al., 2021; Rucklidge, Johnstone, et al., 2021), which have been shown to be required in far larger amounts during times of increased stress (Kaplan et al., 2015). A decrease in inflammation and subsequent oxidative stress is another mechanism (Mukherjee et al., 2023), which has been shown to be an important precipitating and perpetuating factor in PTS (Michopoulos, Powers, et al., 2016). While these mechanisms suggest an effect of nutrition on PTS, arguments for the reverse direction have also been made. Supporting this view, increases in PTS symptoms have been associated with less nutritious food selection and less regulated eating behaviours (Escarfulleri et al., 2021; Gavrieli et al., 2015; Godfrey et al., 2013; Hirth et al., 2011; Kim et al., 2021; Mason et al., 2017; van den Berk-Clark et al., 2018; Vilija & Romualdas, 2014). While both directional mechanisms have supporting evidence, the scant intervention research that exists has found that changes in nutritional habits have led to beneficial ameliorations in PTS symptoms and related biomarkers (Arcan et al., 2024; Murray & Holton, 2024; Zodkoy, 2014). From these results, together with the present research's findings of negative cross-sectional and longitudinal relationships between adaptive health behaviours and PTS symptoms, as well as the buffering impacts of adaptive health behaviours on the relationship between PTDEs and PTS, it appears that a focus on improving nutrition habits in the

PTDE-exposed population may lead to better PTS outcomes. Conversely, it also may be the case that increases in PTS correspondingly increase the likelihoods of less nutritious food selections and poor eating behaviours, which in turn may further intensify PTS symptoms.

The final adaptive health behaviour explored, sleep, has also been shown to have important impacts on the presentation of PTS. Similar to nutrition's relationship with PTS, the directionality of sleep's relationship with PTS has been critically discussed in the literature (Spoormaker & Montgomery, 2008). For example, sleep quality both before and after deployments serves as a predictor of subsequent PTS development (Bramoweth & Germain, 2013; German et al., 2013; Wright et al., 2011). Difficulties sleeping are also a core diagnostic feature of PTS (American Psychiatric Association, 2022). Conversely, the onset of PTS may also increase the occurrence of behaviours which interfere with sleep (e.g., postponing sleep to avoid nightmares), which in turn disrupt sleep quality (Krakow et al., 2000; Spoormaker et al., 2006; Wood & Bootzin, 1990). These findings suggest that PTS and sleep quality are both bidirectionally and inextricably linked. Intervention research serves to add nuance to these identified relationships. Psychological therapy targeting sleep has been shown to ameliorate PTS symptoms (Ho et al., 2016; Talbot et al., 2014), but PTS-focused therapies have a low success rate for modifying sleep issues (Bisson et al., 2007; Davidson, Landerman, et al., 2002; Davidson, Rothbaum, et al., 2001; Meltzer-Brody, et al., 2000; Zayfert & DeViva, 2004), indicating sleep may be an independent but modifiable variable in PTS. Together, these past investigations suggest that intervening to improve poor sleep may be helpful for those with PTS. Additionally, the present research suggests that improvements in sleep may buffer PTS symptoms, plausibly through moderating the relationship that PTDEs have with PTS. Weak evidence has been found for the longitudinal impacts of adaptive health behaviours on PTS over time. While many interventions appear to remain in the hands of clinicians (e.g., psychological therapy, pharmacological interventions), some behavioural interventions that are more accessible to consumers have also shown to be efficacious, including introducing exercise and sleep hygiene practices (Maher et al., 2021).

Overall, the present findings align with past models suggesting that psychological, biological, and behavioural factors within PTS may powerfully influence one another over time (Schnurr et al., 2004; Zen et al., 2012). These lend support to recommendations that posttraumatic exposure care may be improved by adding screening and, where appropriate, interventions for adaptive health behaviours, such as sleep (Spoormaker & Montgomery, 2008), nutrition (Davison et al., 2021; Mueller et al., 2011), physical activity (Hegberg et al., 2019), and social support from close others and leadership (Agtarap et al., 2018; Yalnız Dilcen et al., 2021), where possible. This is explored further in the applications section.

Associations of Adaptive Health Behaviours and Social Support with Flourishing

Adaptive health behaviours, social support, and leadership support were found to have positive relationships with flourishing, both cross-sectionally and longitudinally. This is congruent with past research (du Plooy et al., 2019; Hopkinson, 2021; Li et al., 2020; Wickham et al., 2020; Zhou & Huo, 2022). However, varying buffering effects were found between data collection points. Adaptive health behaviours moderated the relationship between PTDE and flourishing in 2016, and both leadership support and adaptive health behaviours moderated the relationship between PTDE and flourishing in 2019. These findings add support for treatment guidelines to consider the effects of chronicity and patterns of presentation when choosing interventions for patients following traumatic exposure (McFarlane et al., 2017; Nijdam et al., 2023). This is considered further in the applications section.

In the present research, adaptive health behaviours were found to moderate the relationship that PTDEs had with flourishing at both timepoints. Other New Zealand researchers have found similar beneficial effects from adaptive health behaviours, finding a positive association between adaptive health behaviours and flourishing (Bartonicek et al., 2020; Conner, Brookie, Carr, et al., 2017; Conner, Brookie, Richardson, & Pollack, 2015; Wickham et al., 2020). Supporting assertions that adaptive health behaviours are modifiable behaviours that promote flourishing (Wickham et al., 2020), intervening to change such behaviours has also been shown to improve subsequent mental health and wellbeing (Carr et al., 2013; Conner, Brookie, Carr et al., 2017; Francis et al., 2019; Jacka et al., 2017). Together with the present research's findings, the positive psychological effects of adaptive health behaviours appear to also be relevant in the postdeployment population.

The finding that adaptive health behaviours moderated the relationship between PTDEs and flourishing at both timepoints stood in contrast to their effects on PTS, where a moderating effect was found only at the second timepoint. Further examination of the literature revealed similar differential effects of adaptive health behaviours on positive versus negative psychological outcomes. Notably, adaptive health behaviours appear to have stronger effects upon positive mental health indices compared to negative mental health indices. For example, fruit and vegetable consumption has been associated more strongly with positive affect and eudaemonia (two components under the flourishing umbrella) than negative affect (Conner, Brookie, Richardson, & Pollack, 2015; White et al., 2013), depressive symptoms, anxiety, or mood (Conner, Brookie, Carr, 2017). Physical activity has found similar differential associations (Mack et al., 2012). Time may be one factor that explains these differential effects. Dietary patterns have been found to have a cumulative effect on negative mental health outcomes over time (Kim et al., 2021; Lai et al., 2014), seemingly due to their relationships with physical health and physiological parameters (Berk et al.,

2013); therefore, the effects of adaptive health behaviours appear to be delayed rather than immediate. Contrastingly, diet and physical activity appear to have a rapid (Conner, Brookie, Carr, 2017; Connor, Brookie, Richardson, & Pollack, 2015) and direct effect on flourishing, despite controlling for a range of potential mediators, such as physical health, stress, and social support (Boehm et al., 2013; Branchflower et al., 2013; Wu et al., 2023). Therefore, the effects that adaptive health behaviours have upon flourishing may eventuate earlier and more directly than the effects on PTS.

Additionally, a range of interrelationships have been observed between adaptive health behaviours and flourishing in related literature. For example, the present research found that adaptive health behaviours predicted later flourishing, a finding that is supported in other research (Conner, Brookie, Carr, et al., 2017; Conner, Brookie, Richardson, & Pollack, 2015; Nolen, 2013). The broaden-and-build theory of wellbeing (Fredrickson, 2001), describes how change in the reverse direction might also occur. This theory states that when people feel positive emotions, they broaden their perspective, experiences, actions, and resources. Further extending this theory, it has been suggested that increases in positive feelings may create feed-forward loops for sustained participation in health behaviours (Segar & Richardson, 2014). Adding support for such a conceptualisation, positive moods have been shown to increase the likelihood of individuals making healthier subsequent food choices (Gardner et al., 2014). Similarly, flourishing has been shown to predict future activity levels (O'Rourke et al., 2023). These conceptualisations suggest that the positive association that flourishing has with adaptive health behaviours in the present research may be due to underlying bidirectional relationships.

In the present research, social support from both close others and leadership sources was found to be positively associated with flourishing and to predict later flourishing. Leadership support was also found to moderate the relationship that PTDEs had with flourishing in 2019. Social support has been conceptualised as facilitating flourishing through a range of mechanisms, including responding constructively to life adversities and actively pursuing opportunities for growth and development (Feeney & Collins, 2015). Within the context of perceived social support from close others and posttraumatic flourishing, social resources are thought to increase perceptions of stressful conditions (e.g., trauma) as challenging and a source of potential for growth, mastery, and gain (Lazarus, 2006; Lazarus & Folkman, 1984). Supporting this conceptualisation, perceived social support from close others has been found to have positive relationships with flourishing (Abdollahi et al., 2018; Allaire et al., 2022; Flórez-Rodríguez & Sánchez-Aragón, 2021; Li et al., 2020; Yıldırım & Green, 2023), and related constructs (Arslan, 2018; Fuller-Iglesias, 2015). It is thought that leadership support may offer similar benefits through facilitating positive mental wellbeing by

building resource reserves within the individual (Hobfoll et al., 1990). This conceptualisation is supported by findings that supportive leadership helps to build employees' affective and social resources (Stein et al., 2021), that leadership support is positively associated with positive mental outcomes (Halbesleben, 2010), and that interventions focusing on improving the supportive capacities of leaders similarly improve dimensions of flourishing in employees (Stein et al., 2021). Taking this evidence together, it appears that social support from both close others and leadership sources acts to facilitate flourishing in the postdeployment population.

Moderating Effect of PTS on PTDEs' Relationship with Flourishing

The present research investigated the moderating role of PTS on the relationship that PTDEs had with flourishing, finding mixed results. While the 2016 dataset yielded a nonsignificant moderating effect, the 2019 dataset found a significant interaction, such that PTDEs held a positive relationship with flourishing at low levels of PTS, and a nonsignificant relationship at high levels of PTS. The hormesis model (Hill et al., 2024; Hill et al., 2020; Rush et al., 2024; Voigt et al., 2024), which states that exposure to stressors may contribute to positive outcomes (Agathokleous et al., 2018; Calabrese, 1999, 2001, 2005a, 2005b; Calabrese & Baldwin, 2001; Calabrese & Blain, 2005, 2011) served to predict this relationship. Recent evolutions of the hormetic models have been applied to psychological outcomes, to explain how some exposure to adversity leads to better psychological outcomes than both too little or too much adversity (Hill et al., 2024; Oshri, 2023; Voigt et al., 2024). This view is gathering support in the literature (Dooley et al., 2017; Edge et al., 2009; Gunnar et al., 2009; Hagan et al., 2014; Oshri, 2023; Seery, 2011; Seery et al., 2010; Seery et al., 2013). The present research adds to this body of knowledge, describing how, in the absence of PTS, flourishing tends to increase alongside PTDE exposure.

The hormesis model further identifies that there are individual differences in capacities to tolerate and grow positively from stressors, a finding supported by outcome research showing substantial heterogeneity in responses to PTEs and PTDEs (Galatzer-Levy et al., 2018). Given the findings that positive psychological adaptions following PTEs appear to be negatively related to distress (Frazier et al., 2009; Yanez et al., 2011), the present investigation suggests that while adversity (e.g., PTDEs) may contribute positively to psychological outcomes (e.g., flourishing), the presence of PTS might represent the crossing of the threshold of an individual's ability to positively adapt to adversity. Partial support for this conceptualisation was found, in that PTS displayed a negative correlation with flourishing (see Table 7), a finding replicated in other literature (Hom et al., 2020). Furthermore, PTS was found to moderate the relationship that PTDEs had with flourishing, rendering the relationship nonsignificant at higher levels of PTS.

It is notable that “high” values for PTS in the moderation analysis were representative of high relative scores within the sample, but not high absolute scores for PTS. “High” scores were represented by a score of 37, meeting the criteria of probable PTS presence (Bliese et al., 2008; Forkus et al., 2023; Nicholson, 2006; Weathers et al., 2013), but meeting the descriptors for only a “moderate” level of PTS (Bovin et al., 2016). Kurtosis analysis of PTS values showed a positive skewness in the sample, indicating that an asymmetric portion of the sample reported low-to-no symptoms of PTS. While this was deemed to be representative of the sample, as most individuals exposed to PTEs and PTDEs show little-to-no symptomatology (Galatzer-Levy et al., 2018), it is important to emphasise that high absolute levels of PTS present in the investigation. Mixed effects of distress on PTE-driven positive psychological adaptions have been described in the extant literature, finding that distress has been negatively related to actual growth in some research (Frazier et al., 2009), and not significantly related in other research (Owenz & Fowers, 2019). The present investigation showed the presence of PTS having a negative impact on the relationship between PTDEs and flourishing. This might be interpreted as a reduction of this relationship to nonsignificant levels, as was found in the present investigation. It is also possible that this “negative effect” could be interpreted as PTS affecting the relationship between PTDEs and flourishing in a negative direction at high absolute levels of PTS. As the high values in the moderation analyses represented moderate absolute values of PTS, this remains to be investigated. Interestingly, at “medium” levels of PTS in the moderation analysis a positive relationship between PTDEs and flourishing remained. This “medium” level was represented by a score of 23, which sits below the cutoff for probable PTS presence. Therefore, the present investigation suggests that at levels approximating and above the probable presence of PTS the relationship between PTDEs and flourishing appears to be non-significant.

The finding of a positive relationship between PTDEs and flourishing at low-to-moderate levels of PTS contrasts strongly with other New Zealand research which showed that PTS mediated the relationship between PTDEs and PTG in a positive direction (Morrison, 2018), suggesting that positive contributions to PTG are made through increases in PTS. The divergence between these two findings is explained by findings in research investigating the differences between actual versus perceived positive changes following trauma (Frazier et al., 2009; Gunty et al., 2011; Jayawickreme & Infurna, 2021). In this view, while traumatic exposures are positively associated with PTS, PTS is simultaneously associated with increases in perceptions of growth (i.e., retrospective measures of PTG) but decreases in actual growth (i.e., positive changes in flourishing or wellbeing from before to after traumatic exposure). Building on this finding, several prospective studies have found very small or nonsignificant correlations between perceptions of change and actual change in posttraumatic

populations (Boals et al., 2019; Frazier et al., 2009; Owenz & Fowers, 2019; Yanez et al., 2011), indicating that the two constructs are likely unrelated.

The divergence between perceptions of psychological growth and actual growth has led researchers to describe PTG as having both constructive and illusory components (Gower et al., 2022; Zoeller & Maercker, 2006). This is owing to the range of positive mental health outcomes associated with PTG (Tedeschi et al., 2018), and the range of cognitive distortions or self-defence mechanisms that are associated with high levels of both PTG and PTS (Cho & Park, 2013; Hall et al., 2009; Shakespeare-Finch & Lurie-Beck, 2014) which appear to alleviate emotional distress in the short term but display deleterious outcomes in the longer term (Maercker & Zoellner, 2004; McFarland & Buehler, 2012). These findings suggest that while respondents might rate themselves as having experienced positive growth following trauma, these effects may be related to self-illusory processes relating to PTS, which in turn has a negative effect on flourishing. Support for this conceptualisation can be found in an investigation that explored the moderating role of distress on the relationship between perceived and actual growth, where a strong correlation between the two variables was found at low levels of distress, and a nonsignificant association at higher levels of distress (Gunty et al., 2011). This would suggest that while PTG is associated with distress as a strategy for coping with posttraumatic distress, as predicted by Tedeschi and Calhoun's "break and then grow" model (Tedeschi et al., 2018), both trauma exposure and PTG may only contribute to flourishing where distress is low. Further support may be found in the present investigation, where positive relationships between PTDEs and flourishing were only found at low levels of PTS.

The present research adds further to this divergent discussion. Both cross-sectionally and longitudinally, social support and adaptive health behaviours were positively related with flourishing and negatively with PTS. From a longitudinal perspective, PTS may deleteriously affect buffering variables, which in turn may prevent the subsequent facilitation of flourishing. For example, increased emotional health, physical health, and social connectedness have been associated with subsequent increased flourishing (Chen et al., 2022; de la Fuente et al., 2023) and psychological wellbeing (Boehm et al., 2020; Steca et al., 2013). Psychological wellbeing, in turn, may also facilitate subsequent physical heath (Boehm & Kubzansky, 2012; Sin, 2016), possibly by influencing neurobiological, health-behavioural, or other psychosocial pathways that facilitate health or buffer stress (Kubzansky et al., 2018). In this view, an "upward spiral" of positive mental health which influences social support and adaptive health behaviours which in turn facilitate flourishing may occur (Fredrickson & Joiner, 2002).

Conversely, PTS has been associated with subsequent reductions in social support (Kaniasty & Norris, 2008; Platt et al., 2016; Shallcross et al., 2016) and health behaviour engagement independent of traumatic exposure (Lee & Park, 2018). This in turn, has been thought to erode the resources necessary for PTEs to contribute to flourishing (Feeney & Collins, 2015). Furthermore, there is some evidence to suggest that PTS may directly and negatively affect flourishing, such that PTS symptoms negatively predict subsequent psychological wellbeing (Richardson, 2023), and PTS symptoms have been seen to lower in tandem with increases in subjective wellbeing during treatment (Berle et al., 2018; Rapaport et al., 2002). Given that PTS is characterised in part by distortions in perceptions of the self, the world, and the future (Foa et al., 1999), it is perhaps unsurprising that improvements in PTS may be associated with changes in perceptions of personal wellbeing. Taken together, social support and adaptive health behaviours may facilitate posttraumatic flourishing after PTDE exposure when PTS is not present, and conversely PTS may erode the factors necessary for the facilitation of flourishing.

The New Zealand Military Context

An objective of the present investigation was to add to the New Zealand postdeployment body of research. Past New Zealand research has established a link between PTDEs and PTS within the postdeployment population (Long et al., 1992; Macdonald et al., 1999; MacDonald et al., 1998; Vincent et al., 1994), which was replicated in the present investigation.

In one recent investigation, the risk and protective factors associated with PTS were examined in a New Zealand veteran sample (Richardson et al., 2020). Several considerations were made when comparing the present investigation's findings with Richardson's study. The present research found a noticeably lower incidence of PTS, in that using a similar cutoff of 30 in the PCL yielded a 20-21% prevalence rate of PTS in the present research, compared to 30% in the Richarson study. A likely contributor to this difference lies in the sampled populations. In Richardson's investigation, invitations were extended to both currently serving military personnel (but only those with an Operational Service Medal—bestowed on individuals who have deployed on a qualifying military deployment), and to postservice veterans with or without qualifying service. Thus, 15% of the sampled population had not deployed previously. Postservice veterans are less likely to show resilient trajectories than active service members (Porter et al., 2017), and despite the link established between PTDEs and PTS, individuals who deploy display lowered likelihoods of PTS, and rates of resilience are nearly identical in single versus multiple deployers (Bonanno et al., 2012; Eekhout et al., 2016). These findings suggest that continued service has a protective effect, potentially due to extensive preparatory predeployment training and considerable posttraumatic support (Bonanno et al., 2012; Mobbs & Bonanno, 2018). These differences might also be addressed

by considering the healthy solider effect (Larson et al., 2008; McLaughlin et al., 2008), where due to the health and fitness requirements for service, with additional requirements for deployment, individuals who serve in the military and on deployment tend to be healthier, more resilient, and less likely to be afflicted with psychopathology before traumatic exposure. Taken together, the difference in these prevalence rates may lie in the samples, given the present study only investigated active service personnel, who tend to be a healthier and more resilient population when compared to the nondeployed and nonactive service personnel sampled in Richardson and colleagues' study.

Richardson and colleagues (2020) also found a relationship between PTEs and PTS in the military population, such that higher rates of trauma exposure were reported among those who met criteria for PTS and lower rates among those with lower PTS. A similarly larger number of PTDEs was observed among those displaying PTS in the present investigation. The Brief Trauma Questionnaire (Schnurr et al., 1999) was employed by Richardson and colleagues to measure the occurrences of life-threatening events across the entirety of the respondents' lifetimes. This stood in contrast with the narrower range of PTDEs, including non-life-threatening events, that were examined in the present study. Caution is therefore needed when comparing direct results, as deployments come with a number of unique stressors that are further associated with PTS. For example, elevated risk for PTS has been found with non-life-threatening moral injuries (Henderson, 2022), prolonged periods of low activity on deployment (Jones et al., 2006; McKenzie et al., 2004; Roux et al., 2003), and from non-combat stressors on deployment, such as being away from family, interpersonal relationships, and workload levels (Morrison, 2018). Nevertheless, similarly to Richardson's and colleagues' investigation, the present investigation adds convergent support for the relationship between PTEs and PTS in the New Zealand military population.

Similarly to the present study, Richardson's and colleagues' investigation also found that social support was associated with lower risk of PTS. However, Richardson's and colleagues' found that social support's negative association was rendered nonsignificant after a number of control variables were included, including age and rank. Past research has shown that age and rank serve as confounding proxy variables for combat exposure (Dickstein, Suvak, et al., 2010; Friedman, 2005; Orcutt et al., 2004; Ramchand et al., 2010; Sollinger et al., 2008; West & Weeks, 2006), and therefore may serve as inappropriate control variables that may dilute or cloud the real relationships (Becker, 2005; Breaugh, 2008; Shadish et al., 2002; Spector & Brannick, 2011). As a recent review has shown that social support is especially effective in the combat-exposed (versus other trauma types) and veteran (versus civilian) populations (Zalta et al., 2021), the introduction of age and rank as control variables may have obfuscated existing relationships between social support and PTS.

A similar negative association between sleep and PTS was found in Richardson's and colleagues' study, which was congruent with the negative association that was found between adaptive health behaviours (which incorporated sleep) and PTS in the present study. However, sleep disturbance is not only a commonly reported problem in military PTS (Saguin et al., 2021), but also a part of the criteria for PTS (American Psychiatric Association, 2022). Therefore, it is unclear whether the significant correlations found would still be significant if the sleep-related PTS criteria were controlled for. For example, the present study found significant longitudinal associations and moderation effects in the second data collection point (2019), but not in the first (2016), when sleep-specific items in the PTS measure were controlled for.

A number of factors have been identified in other New Zealand postdeployment investigations as buffering factors to PTS, and facilitative factors for flourishing, many of which converged with the present research's findings. In one investigation with a sample of deployed and nondeployed personnel it was identified that perceptions of support from leadership and close others had direct and positive relationships with flourishing, and moderated the relationship between nondeployment work stressors and psychological distress (Hopkinson, 2021). Interestingly, a 1-item version of the MSPSS was utilised, nevertheless yielding a significant effect. Replicating these moderation findings, the present investigation similarly found that social support from both close others and leadership support moderated the relationship that PTDEs had with flourishing. Additionally, responding to calls for longitudinal research (Hom et al., 2020; Hopkinson, 2021), the present investigation also revealed that social support from both close others and leadership support also served as predictors of subsequent PTS and flourishing.

Other New Zealand postdeployment research has investigated the role of social support from close others, by examining the role of intimate partners. In one investigation, measured immediately after deployment and six months after returning home, not being in a relationship was identified as a risk factor for increased PTS symptoms (Morrison, 2018). Another investigation similarly described a negative relationship between perceived relationship warmth and both psychological distress and mental health concerns (Henderson, 2022). These findings aligned with the present research's findings that support from close others correlated negatively with PTS and weakly predicted PTS 3 years later.

While these findings lend convergent support to the present investigation's findings, a methodological limitation in the New Zealand military body of research needs to be considered. It is important to note that a number of the investigations with New Zealand military personnel have also employed designs which accessed the NZDF Health and Wellbeing Survey datasets, including

both the 2016 and 2019 datasets examined in the present research (Henderson, 2022; Hom et al., 2020; Hopkinson, 2021). While different data analysis and sample exclusion strategies were employed, nevertheless the underlying sampled dataset remains the same. Arguments have been made that where a dataset is large enough to be divided into multiple discrete reports, each with their own clear and unique contribution, then research may ethically proceed (Altay & Kocak, 2021; Beaufils & Karlsson, 2013). As the original dataset was large in size (2016 *n* = 4,511, 2019 *n* = 4,092), and each investigation examined a different aspect of the dataset, the present investigation's additions to the New Zealand body of literature, including the novel analyses and unique theoretical implications, were deemed appropriate. However, it is important to stress that some of the comparative findings listed above may not constitute a convergent weight of evidence in the general body of literature, owing to the shared original dataset, but may nevertheless contribute to theoretical knowledge (Altay & Kocak, 2021). This research was therefore considered to have contributed to novel understandings of this previously investigated sample.

Looking to research outside of the NZDF Health and Wellbeing Survey datasets, a recent publication and related thesis found a direct association between combat exposure and PTS, both cross-sectionally and longitudinally (Morrison, 2018; Morrison & Jose, 2023). Similar findings were established in the present investigation. Uniquely, Morrison's 2018 investigation sampled a deployment contingent that had recently returned from overseas operations, and then sampled them once again 6 months later. Bivariate correlations described a linear longitudinal relationship and follow-up analysis revealed a quadratic relationship, such that as combat exposure increased, a nonlinear acceleration in PTS symptoms was also exhibited. As there were two collection points, it remains unclear what levels symptoms might have increased to, over what time period. Meta-analytic investigations have confirmed that a ceiling effect does eventually occur with a range of subsequent trajectories (Galatzer-Levy et al., 2018), including persistently elevated and ameliorating levels over time. Together, these findings suggest that combat exposure may be significantly associated with PTS not only in the months after NZDF deployments, as found in Morrison and Jose's investigation, but for years afterward, as found in the present investigation. Morrisons's investigation also found that while combat experiences were predictive of subsequent PTS, previous deployment experience was not, possibly indicating that deployments themselves are not inherently traumatic, but instead represent environments where PTEs may occur. This explanation aligns with the finding that not all deployment experiences that were measured in the present research had a significant relationship with PTS.

Clinical and Organisational Applications

The choice of the study approach was made to provide actionable results for the NZDF and clinicians supporting future veterans. The findings were presented to the 2023 NZDF Psychology Conference, and an executive summary was produced (Appendix B) for further dissemination. In the present research, adaptive health behaviours and social support from both leadership and close others were found to provide buffering, facilitative, and predictive functions. These findings suggest that supports in these areas are important considerations for psychological outcomes in the postdeployment population in the short term, and for years after deployment. Given these considerations, screening initiatives by mental health professionals and military support structures may be enhanced by including assessment of these key areas.

Regarding adaptive health behaviours, the combination of sleep, nutrition, and physical activity was found in the present research to be related to better psychological outcomes. Difficulties sleeping have been previously identified as risk, perpetuating, and exacerbating factors for PTS and as such has been recommended as a screening consideration (Spoormaker & Montgomery, 2008). Screening may include investigations of sleep quality (Buysse et al., 1989; Fabbri et al., 2021), daytime sleepiness (Johns, 1991; Klingman et al., 2017), insomnia (Ali et al., 2020; Bastien et al., 2001), nightmares (Krakow et al., 2002), or sleep apnoea (Amra et al., 2018). Clinicians can also use more in-depth assessment procedures which systematically investigate a range of factors which interfere with beneficial sleep (Klingman et al., 2017; Roth et al., 2002; Spoormaker et al., 2005). A wide range of tools might similarly screen for nutritional deficits, which in turn may prompt further assessment by a qualified specialist such as a dietitian (Correia, 2018; Guaitoli et al., 2014; Mueller et al., 2011). Finally, screening for physical activity levels is indicated, including the volume, intensity, and types of exercise, as well as daily nonexercise activity levels (Björkman & Ekblom, 2022; Hegberg et al., 2019). While the adoption of adaptive health behaviours generally increases the likelihood of adopting other behaviours (Bartonicek et al., 2020; Fleig et al., 2015; Geller et al., 2017; Lippke, 2014; Prendergast, Mackay, & Schofield, 2016; Tan et al., 2018), research has also found that engagement with some adaptive health behaviours may also buffer deficits in other areas (Tan et al., 2018; Wickham et al., 2020). Finally, the addition of adaptive health behaviour interventions to PTS treatment programmes has shown promise (Hegberg et al., 2019; Kaplan et al., 2015; Maher et al., 2021; Rucklidge, Afzali, et al., 2021). Therefore, comprehensive screening may be required to assess an individual's overall risk and inform treatment approaches thereafter.

The present investigation also shed light on the risk, buffering, and facilitative factors for PTS and flourishing that social support from both close others and leadership play in the postdeployment population, and as such are important considerations for mental health support staff. While

leadership variables generally lie outside clinician's and client's abilities to modify, social support from close others may instead become a treatment target were it deemed insufficient, for example, by encouraging clients to access available supports, or facilitating access to support groups where appropriate. Interventions which target relationship dynamics have similarly been shown to ameliorate PTS symptoms (Howard, 2021; Monson et al., 2008; Pukay-Martin et al., 2015; Snyder & Monson, 2012). Perceptions of social support, which have been shown to change during PTS (Evans et al., 2013), may also become a cognitive treatment target for clinicians.

Through an organisational lens, the present research also emphasises the importance of effective leadership as it relates to perceptions of support. Therefore, the engendering of team environments which create sources of social support is encouraged. Past research echoes these recommendations, finding that perceived support by fellow unit members and leadership have been negatively correlated with (Pietrzak, Johnson, et al., 2010) and prospectively buffer against PTS (Han et al., 2014).

Limitations and Future Directions

The present research is not without limitations. First, while small-item measures of health behaviours are widespread and have been shown to be valid and reliable (Davies & Ware, 1981; Mossey & Shapiro, 1982), there exists evidence that multi-item measures reveal significant effects that were found to be nonsignificant in single item research. For example, in a review of exercise interventions for PTS, only studies that utilised validated, multiple-item exercise assessment measures were found to yield significant effects for exercise in relation to PTS (Hegberg et al., 2019). The present research used a number of single-item (e.g., sleep hours, exercise frequency) and small-item (e.g., nutrition) measures that constituted the adaptive health behaviour variable. While the present research found significant effects for adaptive health behaviours across the majority of hypothesis tests, health behaviours tend to show more accurate predictive effects when modelled together rather than as unitary constructs (Prendergast, 2016a; Tan et al., 2018), and a stronger effect may have been observed if multi-item and previously validated measures were utilised. Similarly, a number of abbreviated measures were employed in the original surveys in order to reduce the participants' burden of survey completion. Future research may benefit from replicating this study utilising more robust indices (e.g., for flourishing and leadership support). In particular, the Flourishing Scale likely lost construct and convergent validity in its change from at 8-item to 2-item measure, owing to Flourishing's multiple underlying constructs. To limit further construct validity loss, the 2-item measure was preserved during all analyses. This created a limitation in interpretability of the relationships between the Flourishing Scale and the MSPSS, due to social relationship's contribution to the flourishing construct. Caution must therefore be applied when

considering the stated relationships between Flourishing and Social Support, and proposed mechanisms, as the significant relationships discovered may represent similarities in measures, and not necessarily between constructs.

Secondly, a number of mechanisms were proposed to explain the impacts of adaptive health behaviours on PTS and flourishing. These included inflammation, stress-related nutrient deficiencies (Kaplan et al., 2015; Rucklidge, Afzali et al., 2021), interoceptive exposure and desensitisation, and brain structure and function (Hegberg et al., 2019). However, these mechanisms were not directly nor concurrently tested. For this reason, while the present research demonstrated that adaptive health behaviours and social support were important factors in the experiences of PTS and flourishing, why these effects occurred remains open for future research to explore.

Looking at the social support variables, evidence was found to support some models of social support but other models were left unexplored. For example, both perceived social support and leadership support were found to have direct relationships with PTS and flourishing, as well as moderating the relationship that PTDEs had with PTS and flourishing. These add support to direct-effect and buffering models of social support (Cohen et al., 2000), and relational support acting to facilitate flourishing (Feeney & Collins, 2015). However, other social support dynamics have previously been found to influence wellbeing after traumatic events (Kaniasty, 2020), including those in social causation models, where low levels of pretrauma social support are a risk factor for subsequent psychopathology (Johnson et al., 1999), and social selection models, where elevated levels of PTS may result in declines in social support over time (Kaniasty & Norris, 2008). While the present research found a negative association between social support variables and PTS, both cross-sectionally and over time, this finding does not provide adequate evidence to speak to the variety of social support models, or the directionality of their effects. As such, future research could explore the mechanisms by which social supports exert their positive effects within the postdeployment population, particularly as they relate to flourishing.

A significant limitation of the present research lies in the uncontrolled nature of the length of time since the PTDEs occurred. While this research primarily sought to investigate influences on the trajectories of PTS and flourishing, past research has shown that the passage of time reveals different trajectories for PTS (Bonanno, 2021; Galatzer-Levy et al., 2018), sometimes as long as 10 years later and likely longer (van der Wal et al., 2020). Moderators of PTS, including psychological (Cole et al., 2022), physiological (Weems & Carrion, 2007), and social support (Wang et al., 2021) variables, have also been shown to change over time. A wide distribution of service years existed within the sample population (4-26+ years of service), and as such the time lag between an

individual's last deployment and the present data capture would likely have varied significantly across participants. Recall bias effects may have therefore occurred, where some participants might not have remembered events as vividly as they could have, or they have since reappraised the situation differently as a part of their healing journey. Future research is recommended to explore the role of time since trauma as an important contributing variable. This research may benefit from sampling strategies that do not rely on recall over substantial time periods (e.g., ecological momentary analysis).

The present research collected data via a voluntary survey, of the health and wellbeing of NZDF personnel, which comes with a range of limitations, the first of which is a sampling strategy that was nonrepresentative, and therefore generalisability may be limited. It has been documented that surveys of New Zealand Defence Force personnel postdeployment exhibit low response rates, particularly from those who exhibit high levels of PTS (Brounéus et al., 2015). Therefore, individuals suffering from elevated PTS may have been less likely to volunteer for these surveys, which may have given rise to an artificially lowered prevalence estimate of PTS. Other research approaches might be employed in future to ensure a representative sample, such as approaching prospective participants in veteran treatment programmes (LoSavio et al., 2023), or examining results from compulsory postdeployment screening (Searle et al., 2015).

Social desirability may have also played a role in participants' choice to respond to the questionnaires, or provide accurate reports of their experiences, in that participants may be hesitant to disclose information because others may perceive them negatively (Paulhus & Trapnell, 2008). Such effects have been demonstrated within military culture, where divergences between objective and self-reports (Adler et al., 2005), and self- and other-reports (Foster et al., 2018), have yielded positive self-biases. Similar effects have been found to create barriers to help-seeking behaviours, and perceived stigma has been associated with decreased help-seeking behaviours (Boyd, 2017; Hom et al., 2020) when military personnel take the view that they should handle their distress on their own (Pietrzak et al., 2009), that seeking help is associated with weakness and embarrassment (Hom et al., 2017), and seeking help might negatively impact on their career and deployability status (Stecker et al., 2007). While these results were found in the help-seeking population, they speak to a culture that is sensitive to social desirability factors which may have arisen in reporting strategies in the surveys used in the present research. The survey designs sought to reduce these effects by offering an anonymity, in light of past research showing that military personnel are more likely to respond honestly when completing questionnaires anonymously (Warner et al., 2011). However, other research has found that concerns that research said to be anonymous may not be truly anonymous can change response patterns, particularly with the possibility of undesirable

repercussions from truthful disclosures (Johnson & Richter, 2004). Other collection methods such as compulsory postdeployment screenings that include the full sampled population (Morrison, 2018), or where participants are recruited directly, as is the case in veteran-specific treatment programmes in other countries (Biddle et al., 2002; Calhoun et al., 2000) may increase response rates in future. However, social desirability factors may similarly affect response patterns in these approaches.

Conclusion

This research contributes to the body of knowledge on postdeployment PTS and flourishing among the NZDF population. This was achieved by exploring the buffering and facilitating factors which were shown to contribute to improved outcomes for this population who are frequently exposed to potentially traumatic events. Most past research in this area has examined PTS in a correlative fashion, leaving investigations of flourishing and longitudinal studies overwhelmingly absent. In response to these research gaps, the current research examined the unique roles of social support from both close others and leadership, as well as adaptive health behaviours, and how these factors might shape the trajectories of both PTS and flourishing longitudinally.

This study makes important contributions to research with military personnel by demonstrating that, for a sample of postdeployment personnel, PTDEs may shape the trajectories of their emotional wellbeing for years after deployment. While the potentially traumatic events this population experienced on deployment showed a relationship with PTS, social support (from close others and leadership) and adaptive health behaviours (sleep, exercise, and nutrition) were demonstrated to play roles in buffering PTS and facilitating posttraumatic flourishing. Standing in contrast to the body of literature on posttraumatic growth, this research uniquely demonstrated that while deployment experiences may sometimes positively contribute to flourishing, PTS tended to have an overshadowing and deleterious effect when it was present.

The NZDF have demonstrated a commitment to serving their personnel over the years by supporting research of this nature. Nevertheless, gaps remain in in this body of knowledge. Explorations of these areas could serve to further enhance the support provided for this brave and committed population. It has been a pleasure to play a role in furthering this important area of research.

Health & Wellbeing
Survey / 23 Sep – 6 Oct

New Zealand DEFENCE FORCE
Te Ope Kātua O Aotearoa

What is this survey about?
The health and wellbeing of NZDF members is an important part of how we perform as a team, and an organisation. The aim of this survey is to get a picture of the current health and wellbeing of our people so that we may better understand and identify any areas of need. This is a key step in helping keep our people safe and well. We invite all members of the Regular Force, civilians and contractors to complete the survey.

What is involved in the survey?
The survey will take most people between 15–30 minutes to complete. Your participation is voluntary. There is an additional section on deployments that will require a little extra time if you have been deployed.

The survey is **anonymous** and no attempt will be made to identify you. This is because we ask some sensitive questions and it is important you feel comfortable answering these honestly and without worrying about being identified. However, because the survey is anonymous we do ask that you provide some basic demographic information at the end of the survey to help us understand patterns of health and wellbeing across different groups.

What questions will be asked?
There are six sections in the survey – these ask about your overall wellbeing; life experiences; resilience, spiritual and social health; your job; physical health; and, attitudes about help seeking. The job section includes questions about deployments that you can skip if you have never been deployed. We also invite your feedback about what we can be doing as an organisation to support you. You can find feedback about how you are doing in two areas of wellbeing at the end of the survey.

Some questions are of a personal nature so remember that all questions are voluntary and you do not have to answer any question if you do not want to. If you find involvement in this survey distressing, or if you have concerns about your health and wellbeing or that of someone else, information about a range of support options available is provided at the beginning and end of this survey.

What do we do with the information?
The data will be collected, collated and reported at an aggregated level. No personally identifying data will be reported. The information collected in the survey will be used for internal and external research projects approved by the NZDF and may also form the basis of reports and academic publications. A summary of the results of the survey and any key areas for action identified will be communicated by the end of the year.
A summary of findings will be also be released externally in early 2020. If you would like to be sent a summary of the results, please email healthcheck@nzdf.mil.nz

How will we maintain your privacy?
This research is being conducted in accordance with the Privacy Act (1993) and DFO 3 14[5] Authority to Conduct Personnel Research and has been approved by CDF. Data from paper copies of the survey will be entered into a database and then the copies will be destroyed. Your personal data will not be identifiable. The full database will be securely, electronically stored and will only be accessible by the Defence Health research team. The database will be retained as part of a longitudinal research study. By completing this survey you are giving your consent for your personal information to be used for the purpose and in the manner described above.

Why should I participate?
Your contribution is important to helping build a current and accurate picture of health and wellbeing across the NZDF and to inform decisions that aim to improve health and wellbeing for all NZDF staff. Nevertheless the survey is voluntary and you may decide not to take part or withdraw from the study at any time without any disadvantage to yourself of any kind.

Please complete all sections by following the instructions at the beginning of each question.

Note:
The information collected in this survey is Unclassified and while the survey is anonymous, you must not disclose sensitive or classified information. Some questions may seem a little repetitive, but this is necessary due to the questions being grouped into scales.

The term ***'organisation'*** is used throughout the survey and refers to the unit that you are currently employed with.

For more information about the study, contact:
Col Clare Bennett, Chief Mental Health Officer,
Health Directorate, HQ NZDF clare.bennett@nzdf.mil.nz
or healthcheck@nzdf.mil.nz

If at any point you are concerned about your wellbeing you can find a list of contacts and resources on the last page or contact 0800 NZDF4U (0800 693348), or a Defence Health Centre.

INSTRUCTIONS

- ✓ Read the instructions that correspond to each section of this survey
- ✓ Use a dark pencil or pen
- ✓ Draw a line through the circle to indicate your response

If you want to change your response, ERASE or CROSS OUT your initial response and draw a line in the desired circle.

Section 1. Overall Wellbeing

The following section asks some general questions about how you have been feeling recently.

Wellbeing is important in different areas of your life. Please rate your average levels of wellbeing during the past 4 weeks in the following four areas.										
1.	**Taha tinana (physical health)** *Physical fitness and overall body wellbeing*									
Very Low	○	○	○	○	○	○	○	○	○	Very High ○
2.	**Taha wairua (spiritual health)** *Identity, self awareness, faith, compassion, connection to land and ancestors, joy, and fulfillment*									
Very Low	○	○	○	○	○	○	○	○	○	Very High ○
3.	**Taha whānau (family health)** *Social and family connectedness and support*									
Very Low	○	○	○	○	○	○	○	○	○	Very High ○
4.	**Taha hinengaro (mental health)** *Thoughts, feelings and emotions*									
Very Low	○	○	○	○	○	○	○	○	○	Very High ○

Life events and circumstances can have an impact on our overall wellbeing.
How much have each of the areas below been of a concern for you over the last 4 weeks?

		Not at all	A little	Somewhat	Quite a lot	A great degree
1.	Relationship issues	○	○	○	○	○
2.	Loneliness / Isolation	○	○	○	○	○
3.	The wellbeing of a friend or family member	○	○	○	○	○
4.	Loss or grief	○	○	○	○	○
5.	Conflict with others	○	○	○	○	○
6.	Personal experience of discrimination	○	○	○	○	○
7.	Personal experience of bullying	○	○	○	○	○
8.	Personal experience of sexual harassment	○	○	○	○	○
9.	Problems with your boss	○	○	○	○	○
10.	Lack of job satisfaction	○	○	○	○	○
11.	Workload	○	○	○	○	○
12.	Finances	○	○	○	○	○
13.	Alcohol consumption	○	○	○	○	○
14.	Drug use	○	○	○	○	○
15.	Prior stressful/traumatic experiences	○	○	○	○	○
16.	Difficulty sleeping	○	○	○	○	○
17.	Chronic pain	○	○	○	○	○
18.	Physical injury	○	○	○	○	○
19.	Overall physical health	○	○	○	○	○
20.	Parenting problems / difficulty with children	○	○	○	○	○
21.	Anger Management	○	○	○	○	○
22.	Eating habits	○	○	○	○	○
23.	Caregiver / welfare responsibilities other than parenting	○	○	○	○	○
24.	Subject to racist/ageist/non inclusive behaviours at work	○	○	○	○	○
25.	Dysfunctional team / departmental dynamics	○	○	○	○	○
26.	Other (Please specify) _____	○	○	○	○	○

The following questions ask about how you have been feeling during the last month (4 weeks). Please read each question carefully and then indicate the response that best describes how you have been feeling.

		None of the time 1	A little of the time 2	Some of the time 3	Most of the time 4	All of the time 5
1.	How often did you feel tired for no good reason?	○	○	○	○	○
2.	How often did you feel nervous?	○	○	○	○	○
3.	How often did you feel so nervous that nothing could calm you down?	○	○	○	○	○
4.	How often did you feel hopeless?	○	○	○	○	○
5.	How often did you feel restless or fidgety?	○	○	○	○	○
6.	How often did you feel so restless that you could not sit still?	○	○	○	○	○
7.	How often did you feel depressed?	○	○	○	○	○
8.	How often did you feel that everything was an effort?	○	○	○	○	○
9.	How often did you feel so sad that nothing could cheer you up?	○	○	○	○	○
10.	How often did you feel worthless?	○	○	○	○	○

If you would like an indication about how you are going, add up the scores from items 1 – 10. The scores for each item is equal to the number in the header column you selected. (e.g. none of the time = 1, all of the time = 5). ***Check out how you are going at the end of this survey.***

Score = _____

Section 2: Life Experiences and Wellbeing

The next questions are about life experiences, including traumatic experiences and sexual assault. By answering these questions you are helping NZDF build a better understanding about a range of sensitive issues our people may have experienced or be dealing with.

The survey is anonymous so we will not be able to identify you but please skip any question if you find it confronting, or difficult to deal with, and use the contact information provided if you would like support or advice.

		No	**Yes**		**No**	**Yes**
1.	Have you ever experienced a situation that was extremely stressful and / or where you feared for your life (eg. accident, natural disaster, personal attack, deployment experience, combat)?	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○
2.	Did someone very close to you die unexpectedly; for example, they were killed in an accident, murdered, committed suicide, or had a fatal heart attack at a young age?	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○
3.	In the last 12 months have you been systematically **verbally sexually harassed**? *(e.g., consistent sexual jokes made towards you, repeated comments made about your private life, repeated sexually offensive comments)*	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○
4.	Have you ever been **physically assaulted?** *(e.g., subject to an intentional or a threatened act of either direct or indirect interpersonal violence)*	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○
5.	Have you ever been **indecently assaulted** *(e.g., subject to unwelcome physical contact such as touching, pinching, and / or massage in circumstances that are indecent)*	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○

6.	Have you ever been **sexually violated**? *(e.g., rape or unlawful sexual connection)*	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○
7.	Has anyone ever made or pressured you into having some type of **unwanted sexual contact?**	○	○	If yes, did this happen as a result of or in relationship to your work in NZDF?	○	○

Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, and then rate how much you have been bothered by that problem in the past month (4 weeks). Remember, confidential support is available if you find any of these questions distressing (0800 693348).

		Not at all	A little bit	Moderately	Quite a bit	Extremely
1.	Repeated, disturbing and unwanted memories, of a stressful experience?	○	○	○	○	○
2.	Repeated, disturbing dreams of a stressful experience?	○	○	○	○	○
3.	Suddenly acting or feeling as if the stressful experience were happening again (as if you were reliving it)?	○	○	○	○	○
4.	Feeling very upset when something reminded you of the stressful experience?	○	○	○	○	○
5.	Having a physical reaction (e.g., heart pounding, trouble breathing, sweating) when something reminded you of the stressful experience?	○	○	○	○	○
6.	Avoiding memories, thoughts or feelings related to the stressful experience?	○	○	○	○	○
7.	Avoiding external reminders of the stressful experience (eg. people, places, conversations, activities, objects or situations)?	○	○	○	○	○
8.	Trouble remembering important parts of the stressful experience?	○	○	○	○	○
9.	Having strong negative beliefs about yourself, other people, or the world (e.g., having thoughts such as: I am bad, there is something seriously wrong with me, no one can be completely trusted, the world is completely dangerous)?	○	○	○	○	○
10.	Blaming yourself or someone else for the stressful experience?	○	○	○	○	○
11.	Having strong negative feelings such as fear, horror, anger, guilt, or shame?	○	○	○	○	○
12.	Loss of interest in activities that you used to enjoy?	○	○	○	○	○
13.	Feeling distant or cut off from other people?	○	○	○	○	○
14.	Trouble experiencing positive feelings (e.g., being unable to feel happiness or have loving feelings for those close to you)?	○	○	○	○	○
15.	Irritable behavior, angry outbursts, or acting aggressively?	○	○	○	○	○
16.	Taking too many risks or doing things that could cause you harm?	○	○	○	○	○
17.	Being 'super alert; or watchful or on guard?	○	○	○	○	○
18.	Feeling jumpy or easily startled?	○	○	○	○	○
19.	Having difficulty concentrating?	○	○	○	○	○
20.	Trouble falling or staying asleep?	○	○	○	○	○

Sometimes people have thoughts or intentions to hurt themselves. The following 6 questions concern such feelings. Over the past year did you:			
		No	Yes
1.	Think that you would be better off dead or wish you were dead?	○	○
2.	Want to harm yourself?	○	○
3.	Think about suicide?	○	○
4.	Have a suicide plan?	○	○
5.	Attempt suicide?	○	○
6.	Deliberately harmed or injured yourself in the past month (e.g. cut, burned or scratched) when not feeling suicidal?	○	○

If you answered yes to any of these questions, you are strongly encouraged to seek help. A list of help resources is provided at the end of this survey. Remember, seeking help is not a sign of weakness, it is a sign of strength. Sometimes you can't go it alone and seeking help is a positive step your recovery.

Section 3: Resilience

The following section asks about positive experiences and support in your life.

Please indicate how much you agree or disagree with the statements:

		Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
1.	I tend to bounce back quickly after hard times	○	○	○	○	○
2.	I have a hard time making it through stressful events	○	○	○	○	○
3.	It does not take me long to recover from a stressful event	○	○	○	○	○
4.	It is hard for me to snap back when something bad happens	○	○	○	○	○
5.	I usually come through difficult times with little trouble	○	○	○	○	○
6.	I tend to take a long time to get over set-backs in my life	○	○	○	○	○
7.	I lead a purposeful and meaningful life	○	○	○	○	○
8.	My social relationships are supportive and rewarding	○	○	○	○	○
9.	I am engaged and interested in my daily activities	○	○	○	○	○
10.	I actively contribute to the happiness and wellbeing of others	○	○	○	○	○
11.	I am competent and capable in the activities that are important to me	○	○	○	○	○
12.	I am a good person and live a good life	○	○	○	○	○
13.	I am optimistic about my future	○	○	○	○	○
14.	People respect me	○	○	○	○	○
15.	I have a clear sense of my own identity	○	○	○	○	○
16.	I feel connected to my culture	○	○	○	○	○
17.	Religion or spiritual faith is an important factor that guides me	○	○	○	○	○
18.	I am able to live a life that is aligned to my values	○	○	○	○	○
19.	I can find forgiveness when carrying a sense of guilt	○	○	○	○	○

20. How do you feel about your life as a whole, taking into account what has happened in the last year and what you expect to happen in the future? (please choose one response only)									
Very Unhappy									Very Happy
○	○	○	○	○	○	○	○	○	○

RELATIONSHIPS AND SUPPORT

Often we have people in our lives who help us with our problems. Please indicate how much you agree or disagree with the statements:

		Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
1.	If I have a problem there is someone I trust that I can talk to about it	○	○	○	○	○

The following questions are directed at those who have a partner/spouse. If these questions do not apply to you please leave them blank.

1.	Are you currently in a relationship? *If you answered no please skip to Section 4 Your Job*	No	Yes
		○	○

		Never	Not very often	Sometimes	Often	Very often
2.	How often do you let each other know you really care about each other?	○	○	○	○	○
3.	How often do you act in a supportive and understanding way towards one another?	○	○	○	○	○
4.	How often do arguments result in you feeling put down or bad about yourself?	○	○	○	○	○
5.	How often do arguments result in you or your partner breaking or throwing things?	○	○	○	○	○
6.	How often do arguments result in either you or your partner hitting, kicking or pushing one another?	○	○	○	○	○
7.	Is there any abuse (physical, sexual, psychological, financial) in your relationship now?	Yes	○	No	○	

Section 4. Your Job

The next section asks about your current and past work experiences at NZDF including previous deployments.

1.	On average how many hours did you work each week, over the last four weeks (average over 1 week)? If you have been on leave during this time, please record your usual average work hours	Less than 15 hours	15-30 hours	31-40 hours	41-50 hours	51-59 hours	60+ hours
		○	○	○	○	○	○

2.	Approximately how many days have you spent away from home overnight as part of your work? (eg. operations, exercises, training courses, conferences, meetings, or in a commuter relationship etc) over the last 12 months?	Less than 2 weeks	Between 2 and 4 weeks	Between 4 and 8 weeks	Between 8 and 16 weeks	Between 4 and 6 months	Between 6 and 8 months	More than 8 months
		○	○	○	○	○	○	○

3.	Does your job involve regular shift work, including working at night?	No ○	Yes ○

The following statements are about how you feel about your job. Please read each statement carefully and decide how much you agree with each of the following statements.

		Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
4.	I am enthusiastic about my job	○	○	○	○	○
5.	I am clear about what is expected of me at work	○	○	○	○	○
6.	I get appropriate recognition for the work I do	○	○	○	○	○
7.	My workload is manageable	○	○	○	○	○
8.	If I have a problem at work I can talk to my boss about it	○	○	○	○	○
9.	The demands of my work interfere with my home and family life	○	○	○	○	○
10.	The level of work related stress I experience is acceptable	○	○	○	○	○
11.	I can cope with the pressure of my work	○	○	○	○	○
12.	My colleagues treat me with dignity and respect	○	○	○	○	○
13.	Members of my team are able to bring up problems and discuss tough issues	○	○	○	○	○
14.	From a safety perspective, I feel supported / enabled to do my job	○	○	○	○	○
15.	I am; or I feel, excluded by my work colleagues	○	○	○	○	○
16.	I intend to leave NZDF within the next 12 months	○	○	○	○	○

The following statements are about your relationships with your direct manager/leader.

		Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
1.	My direct manager/leader treats everyone fairly	○	○	○	○	○
2.	My direct manager/leader is approachable	○	○	○	○	○
3.	My direct manager/leader treats me with dignity and respect	○	○	○	○	○
4.	My direct manager/leader refrains from improper remarks or comments	○	○	○	○	○
5.	My direct manager/leader demonstrates command courage if work circumstances require it	○	○	○	○	○

The following statements are about your relationships with all of the people you work with. How often have the following things happened as part of your work either by a work colleague or by your superiors?

		Never	Rarely	Occasionally	Frequently	Very Often
1.	I have been verbally abused	○	○	○	○	○
2.	I have been threatened with violence	○	○	○	○	○
3.	I have been singled out for discipline or criticism in an unfair way	○	○	○	○	○
4.	Offensive remarks or jokes have been made about me	○	○	○	○	○

5.	Who normally engages in these types of behaviours?	N/A	Colleagues	Superiors	Both
		○	○	○	○

Deployment

1.	Have you ever been deployed on either an operational mission that would be qualifying service for the Operational Service Medal or other overseas activities (excluding courses or permanent established postings)? **Note: for Navy** this might include non-operational deployments (e.g OP CALYPSO, OP APEC ASSIST, OP KAUWAE etc.), or operational deployments. **Note: For Air Force** this includes any overseas aircraft operations (e.g., NORPATs, TROPIC ASTRA, PITCH BLACK, HADRs, etc).	No	Yes				
		○	○				
If you answered **no** to the previous question, please leave the following section blank and skip forward to the section on Physical Health. (Page 12)							
2.	In total how long have you spent on deployments while serving with the NZDF?	Less than 3 months	3 – 6 months	7 – 12 months	Between 12 – 24 months	3 – 4 years	5 or more years
		○	○	○	○	○	○
3.	What is the longest continuous period you have deployed on any one deployment?	Less than 3 months	3 – 6 months	7 – 12 months	More than 12 months		
		○	○	○	○		
4.	How many times have you been deployed?	Once	2 – 3 times	4 or more times			
		○	○	○			
5.	How do you rate the level of support has been provided by NZDF to you during your deployment(s)?	Poor	Adequate	Good			
		○	○	○			
6.	How do you rate the level of support that has been provided by NZDF to your family during your deployments?	○	○	○			
7.	Please add any comments about your deployment support experiences, including what we could do better below: **Pre:** **During:** **Post:**						

Thinking of ALL your deployments during your military career, how often did you/were you?						
		Never	Once	2-4 times	5-9 times	10+ times
1.	Seriously fear you would encounter an IED?	○	○	○	○	○
2.	Go on combat patrols/missions or participate in support convoys or armed RHIB patrols	○	○	○	○	○
3.	Concerned about yourself or others (including allies) having an unauthorised discharge of a weapon?	○	○	○	○	○
4.	Clear/search buildings, caves, vessels or other areas?	○	○	○	○	○
5.	Come under fire (i.e. small arms or anti-aircraft fire, guided or directed mortar/artillery fire or missile attack), in-direct fire (e.g. rocket attack), or small arms fire from an unknown enemy combatant?	○	○	○	○	○
6.	Experience an IED/EOD detonation, suicide bombing, or landmine strike?	○	○	○	○	○

7.	In danger of being killed or injured?	○	○	○	○	○
8.	Have casualties among people close to you (i.e. were present or heard of a close friend, co-worker or loved one who had been injured or killed)?	○	○	○	○	○
9.	Handle or see dead bodies?	○	○	○	○	○
10.	Experience a threatening situation where you were unable to respond due to the rules of engagement?	○	○	○	○	○
11.	Witness human degradation and misery on a large scale?	○	○	○	○	○
12.	Discharge your weapon in direct combat?	○	○	○	○	○
13.	Believe your action or inaction resulted in someone being seriously injured or killed?	○	○	○	○	○
14.	Exposed to smoke and/or dust, fumes or fuels, or chemicals	○	○	○	○	○
15.	Exposed to hazardous materials (i.e. non-iodising radiation, contact with chemical or biological weapons, contact with depleted uranium shells, exposed to ionising radiation or radioactive shells, use of NBS suit [not for training])?	○	○	○	○	○
16.	See something that you considered to be morally unacceptable?	○	○	○	○	○
17.	Confronted with an ethical dilemma where there was seemingly no 'best' answer?	○	○	○	○	○
18.	Placed in a situation where you felt compelled to make an uncomfortable ethical decision?	○	○	○	○	○
19.	Left with feeling a sense of guilt or shame about something that had happened.	○	○	○	○	○
20.	Left with feeling anger about something that had happened.	○	○	○	○	○
21.	Experienced hostile reactions from civilians e.g. boarding parties, supply runs, being mugged.	○	○	○	○	○
22.	Experiencing a no duff/safeguard/or not for exercise incident not already mentioned e.g. fire, flood, emergency landing, aircraft/vessel locked onto by enemy weapons	○	○	○	○	○

		No	Yes
1.	Do you have any concerns about how you are going now as a consequence of your deployments?	○	○
2.	Has a family member or someone close to you expressed any concerns about how you are going now as a consequence of your deployments?	○	○
3.	In what year did you last return from deployment?	More than 4 years ago	In last 4 years
		○ **Please go to Section 5 on Page 12.**	○ **Please go Question 4 below**

4.	Select from the options below the deployment that was the most challenging deployment/overseas activity you've had in the last four years (2016-2019):

- ○ Deployment (qualifying for OSM)
- ○ Non-operational overseas deployment (e.g. OP CALYPSO, OP APEC ASSIST, OP NORPAT)
- ○ Domestic deployment (e.g. OP DEANS, OP WESTLAND, OP AWHINA)
- ○ Operational exercise in Australia (e.g. Talisman Sabre, Pitch Black)
- ○ Operational exercise overseas but not in Australia (e.g. CROIX DE SUD, TROPIC TWILIGHT)
- ○ HADR (E.g. TG Winston)
- ○ Other _____

5.	What made this particular deployment/overseas activity so challenging? *(Mark all that apply)*

- ◯ First overseas activity with the NZDF
- ◯ Lack of preparation for the job itself
- ◯ Being away from friends and family
- ◯ Leadership on the deployment/overseas activity
- ◯ Significant events happening back home
- ◯ Interpersonal issues within the NZDF team
- ◯ Discrimination, harassment or bullying
- ◯ Exposure to trauma
- ◯ Living conditions
- ◯ Environmental conditions
- ◯ Uncertainty over amount of time away
- ◯ Work tempo before or after the overseas activity
- ◯ Being in an isolated role without much support
- ◯ Frustration with systems and processes
- ◯ Boredom
- ◯ Overwork
- ◯ Lack of respite / on duty all the time
- ◯ Nothing was difficult
- ◯ Other (please specify) _____

For each period please rate the **level of support from your unit/ship** for this particular deployment/overseas activity:

		Poor	Adequate	Good
6.	Prior to the deployment/overseas activity	◯	◯	◯
7.	During the deployment/overseas activity	◯	◯	◯
8.	After the deployment/overseas activity	◯	◯	◯

For each period please rate the **level of support** from **NZDF Psychology** for this particular deployment/overseas activity:

		Poor	Adequate	Good
9.	Prior to the deployment/overseas activity	◯	◯	◯
10.	During the deployment/overseas activity	◯	◯	◯
11.	After the deployment/overseas activity	◯	◯	◯

For each period please rate the **level of support** from **wider NZDF** for this particular deployment/overseas activity:

		Poor	Adequate	Good
12.	Prior to the deployment/overseas activity	◯	◯	◯
13.	During the deployment/overseas activity	◯	◯	◯
14.	After the deployment/overseas activity	◯	◯	◯

Section 5 Physical Health and Health Behaviours

The next section asks about your physical health, as well questions about your behaviours such as alcohol consumption, nutrition, sleep, and physical activity.

		No	Yes
1.	Are you on any prescription medication for a physical health related illness?	○	○
2.	Are you on any prescription medication for a mental health related illness?	○	○
3.	Do you have any concerns about your physical health?	○	○
4.	If you answered **yes to qn 3**, have you sought help for these concerns?	○	○
5.	Do you have a long-term illness?	○	○
6.	Do you have a chronic injury or chronic pain?	○	○
7.	Do you consider yourself to be impaired or disabled in any way?	○	○

8. If yes, please state your disability

Hearing	Vision	Mobility	Agility	Intellectual	Psychological	Other: Specify
○	○	○	○	○	○	

		No	Yes
9.	Do you use electronic cigarettes / vape?	○	○

		Never	I used to but not now	Yes, socially on occasion	Yes, regularly
10.	Do you currently smoke tobacco?	○	○	○	○

		No	Maybe	Yes
11.	If you answered **Yes** to Qn 9 would you like to stop smoking?	○	○	○

12. If you do smoke and would like to stop, what are the things making this difficult for you? (Mark all that apply)

- ○ I enjoy smoking
- ○ Others around me smoking
- ○ It's the norm in my social group
- ○ Having a drink makes me want to smoke
- ○ Smoking gives me something to do when I am bored
- ○ Smoking relaxes me
- ○ Craving or addiction
- ○ Other, please list_____

Supplements: How often do you use the following supplements?

		Never	Less than once a month	Monthly	Weekly	Daily or almost daily
1.	Body building supplements (such as amino acids, wait gain products, creatine etc.)?	○	○	○	○	○
2.	Energy supplements (such as energy drinks, pills or energy enhancing herbs)?	○	○	○	○	○
3.	Weight loss supplements?	○	○	○	○	○

Drugs: Do any of the following apply to you or have in the past?

		Never	Yes, but not since joining the NZDF	Yes, and this has been since I joined the NZDF but not in the last year	Yes, and in last year
1.	Used medication in a way that was not prescribed or used someone else's medication? (A reminder, this survey is anonymous)	○	○	○	○
2.	Used recreational drugs or drugs other than those required for medical reasons?	○	○	○	○
3.	Have a problem with gambling?	○	○	○	○
4.	What would you do if a colleague told you they were struggling with their drinking? (Mark all that apply)	○ Don't know ○ Nothing ○ Make a joke or make light of it ○ Tell them to get a grip / harden up ○ Listen and support ○ Encourage them to get help ○ Speak to someone else for advice about what to do ○ Other			
5.	What would you do if a colleague disclosed a mental health problem to you? (Mark all that apply)	○ Don't know ○ Nothing ○ Make a joke or make light of it ○ Tell them to get a grip / harden up ○ Listen and support ○ Encourage them to get help ○ Speak to someone else for advice ○ Other			

Alcohol Use

The questions below ask about your alcohol use. When answering the following questions use the guidelines below regarding the size of a standard drink. A standard drink measures the amount of alcohol, not the amount of liquid you are drinking.

1.	How often do you have a drink containing alcohol? ***If you never drink please answer 'never' then skip to the next section.***	Never	1 per month or less	2-4 times per month	2-3 times per week	4 or more time per week
		○	○	○	○	○
2.	How many standard drinks do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10+
		○	○	○	○	○

Thinking of your alcohol consumption:

	Scoring	***0***	***1***	***2***	***3***	***4***
		Never	Occasionally	Monthly	Weekly	Twice a week or more
3.	How often do you have six or more standard drinks on one occasion?	○	○	○	○	○
4.	How often during the last year have you found that you were not able to stop drinking once you had started?	○	○	○	○	○
5.	How often during the last year have you failed to do what was normally expected from you because of drinking?	○	○	○	○	○
6.	How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	○	○	○	○	○
7.	How often during the last year have you had a feeling of guilt or remorse after drinking?	○	○	○	○	○
8.	How often during the last year have you been unable to remember what happened the night before because you had been drinking?	○	○	○	○	○
9.	Have you or someone else been injured because of your drinking?	No ***Score [0]***		Yes, but not in the last year ***[2]***		Yes, during the last year ***[4]***
		○		○		○
10.	Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No ***Score [0]***		Yes, but not in the last year ***[2]***		Yes, during the last year ***[4]***
		○		○		○
If you would like to assess your current levels of alcohol risk add up the scores from items 3-10. The score of each item is equal to the number in the circle that you selected (e.g., for items 3-8, never = 0, twice a week or more = 4). See how your rate on the last page of this survey.					**Score=_____**	

What do you eat?

1.	On average, how many servings of VEGETABLES (fresh, frozen, canned) did you eat per day over the past 7 days? *Do not include vegetable juices. A 'serving' = 1 medium potato/kumara or 1 cup cooked vegetables or 1 cup of salad vegetables)*	I don't eat these	Less than 1 serving a day	1 serving per day	2 or 3 servings per day	4 or more servings per day
		○	○	○	○	○
2.	On average, how many servings of FRUIT (fresh, frozen, canned or stewed) did you eat per day over the past 7 days? *Do not include fruit juice or dried fruit. A 'serving' = 1 medium piece or 2 small pieces of fruit or 1 cup of stewed fruit.*	I don't eat these	Less than 1 serving a day	1 serving per day	2 or 3 servings per day	4 or more servings per day
		○	○	○	○	○

3.	On average, how often during the working week do you eat breakfast? Breakfast is defined as consuming food or a liquid meal replacement before 10 am. *Exclude coffee and tea.*	Never ○	1 – 2 days per week ○	2 – 4 days per week ○	Daily ○

4.	How often do you usually drink sugary beverages? *Include energy drinks, carbonated drinks, fruit juice or cordial. Exclude diet drinks.*	Never ○	Less than 1 per week ○	1 – 2 per week ○	3 - 5 per week ○	6+ per week ○

Physical Activity

The next questions ask about your physical activity and exercise on average each week.

1.	On average, how often do you do light exercise of 20 minutes or more duration each week, such as riding a bike to work or going for a lunchtime walk?	Never ○	Once or twice a week ○	3-4 days a week ○	Most days ○	Daily ○
2.	On average, how often do you do moderate or vigorous aerobic exercise of 20 minutes or more duration each week, such as a gym workout, PT, a sports game, running, cycling or swimming?	Never ○	Once or twice a week ○	3-4 days a week ○	Most days ○	Daily ○

Sleep

1.	On average how many hours do you sleep each day/ night?	Less than 5 ○	5 Hrs ○	6 Hrs ○	7 Hrs ○	8 Hrs ○	9+ Hrs ○

		None	Mild	Moderate	Severe	Very Severe
2.	During the past TWO WEEKS how much difficulty have you had falling asleep and staying asleep	○	○	○	○	○
		Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
3.	In the past TWO WEEKS how satisfied / dissatisfied are you with your current sleep pattern?	○	○	○	○	○
		Not at all interfering	A little	Somewhat	Much	Very much interfering
4.	In the past TWO WEEKS to what extent do you consider your sleep pattern to INTERFERE with your daily functioning (for example: daytime fatigue, ability to function at work / daily chores, concentration, memory, mood etc.)	○	○	○	○	○

Use of Personal Electronic Devices

		Less than 1 hr	2-4 Hrs	4-6 Hrs	More than 6 Hrs
5.	On average how many hours a day do you spend using electronic devices (mobile phone, laptop, Ipad, desktop PC etc.) required for your job?	○	○	○	○
6.	On average how many hours a day do you spend using electronic devices (mobile phone, laptop, Ipad, desktop PC, TV etc.) for leisure?	○	○	○	○
7.	How many hours on average daily do you spend playing video games?	○	○	○	○
8.	How many hours on average daily do you spend on social media?	○	○	○	○

Maintaining Balance

1.	What sort of things do you do to help you to maintain or increase health and balance in your life?

Section 6: Help Seeking

Every New Zealander can potentially suffer from problems with their mental health and wellbeing. Members of the NZDF are no exception to this. The next section ask about your previous experiences and current attitudes towards seeking help with mental health and wellbeing issues.

1.	Do you have any current concerns about your mental health and wellbeing?	No	Yes
		○	○

2. Which of the following are you concerned about? (Please tick all that apply)

- ○ Alcohol or drug abuse or dependency
- ○ Work related issues
- ○ Anxiety or stress
- ○ Depression
- ○ Post Traumatic Stress
- ○ Anger Management
- ○ Other psychological condition
- ○ Gambling
- ○ Chronic pain or injury
- ○ Relationship issues
- ○ Sleep
- ○ Physical Health
- ○ Other (please specify): _____

3.	Has there been a time in the last 12 months you felt you needed help to manage these concerns?	No	Yes
		○	○
4.	If yes, did you seek help?	○	○

5.	If yes, and it was since you joined the NZDF, did you seek help inside or outside the organisation?	Inside NZDF	Outside NZDF	Both	N/A
		○	○	○	○

6. If you did not get help, why didn't you? *(Mark all that apply)*

- ○ I preferred to manage issues myself
- ○ I didn't think anything could help
- ○ I didn't know where to get help
- ○ I was afraid to ask for help, or of what others would think of me
- ○ I couldn't afford it
- ○ I could still function effectively
- ○ I was worried about career impacts
- ○ Other (please specify) _____

7.	How likely is it you would seek help if you had a mental health problem in the near future?	Extremely unlikely						Extremely likely
		○	○	○	○	○	○	○

8.	If you had concerns about your mental health in the future where would you seek help?	Inside NZDF	Outside NZDF	Both if I need to	I would not seek help
		○	○	○	○

9. Who would you approach within NZDF? *(Mark all that apply)*

- ○ I would not seek help within NZDF
- ○ Boss or supervisor
- ○ Colleague
- ○ Would contact NZDF4U Wellbeing Support for external confidential support (Call or text)
- ○ NZDF Psychologist
- ○ NZDF Medical Officer
- ○ NZDF Chaplain
- ○ NZDF Support Officer (DCF, DSO, DCC, NCO)
- ○ NZDF Social Worker
- ○ HR Advisor
- ○ Vitae (Employee Assistance Programme)
- ○ Cultural Advisor
- ○ Nurse
- ○ Medic
- ○ SAPRA
- ○ AHA (Anti-Harassment Advisor)
- ○ Other (please specify) _____

10. Who would you approach for help externally? *(Mark all that apply)*

- ○ I would not seek help outside NZDF
- ○ Partner
- ○ A friend
- ○ Other family member
- ○ Counsellor
- ○ Psychologist
- ○ GP /Doctor
- ○ Kaumatua
- ○ Chaplain
- ○ Alternative medical provider/ healer
- ○ A confidential support line (e.g., Healthline, Youthline)
- ○ Online channels or social media
- ○ Other (please specify) _____

If you were concerned about a mental health problem and did NOT seek help it would be because :

		Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
11.	I don't know where to get help	○	○	○	○	○
12.	There would be difficulty getting time off work to get help	○	○	○	○	○
13.	It would be difficult to get an appointment	○	○	○	○	○
14.	My unit leadership / manager might treat me differently	○	○	○	○	○
15.	I would be seen as weak	○	○	○	○	○
16.	People might have less confidence in me	○	○	○	○	○
17.	It would stop me from being deployed	○	○	○	○	○
18.	I don't trust mental health professionals	○	○	○	○	○
19.	It would harm my career	○	○	○	○	○
20.	My visit would not remain confidential	○	○	○	○	○
21.	It would be too embarrassing	○	○	○	○	○
22.	I prefer to manage issues myself	○	○	○	○	○

If you are not military please go to Question 28

		Extremely dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Extremely satisfied	N/A
23.	If you are **military**, how satisfied are you with the access you get to **medical health** support services?	○	○	○	○	○	○
24.	If you are not satisfied with access to these services why is this?	Please describe: ○ Reluctance to attend / Don't feel comfortable attending ○ Can't get time off ○ The time it takes to travel ○ Difficulty getting appointment ○ Waiting time for an appointment ○ No reminders ○ Other (please list): _____					○
25.	If you are **military**, how satisfied are you with the access you get **to oral health** support services?	○	○	○	○	○	○
26.	If you are not satisfied why is this?	Please describe: ○ Reluctance to attend / Don't feel comfortable attending ○ Can't get time off ○ The time it takes to travel ○ Difficulty getting appointment ○ Waiting time for an appointment ○ No reminders ○ Other (please list):_____					○
27.	If you are **military**, how satisfied are you with the level of support provided to your family?	○	○	○	○	○	○

28.	What could we do differently or better as an organisation to support you (or others)?	Please describe:	○

Are you aware of the following:

		No	Yes
29.	Who you can speak to if you or someone you know has been subject to inappropriate, unacceptable or harmful behaviours? *(e.g. bullying, sexual harassment etc.)*	○	○
30.	Are you aware of NZDF4U Wellbeing Support services (0800 NZDF4U helpline service, text 8881 and EAP face to face support)?	○	○
31.	Are you aware of the Defence Health internet website?	○	○

Have you ever used the following resources:

		No	Yes (but didn't find it useful)	Yes (and found it helpful)
32.	The NZDF4U services (0800 NZDF4U helpline service, Text 8881 or EAP face to face support), prior to April 2019?	○	○	○
33.	The 0800 NZDF4U helpline/ text service since April 2019?	○	○	○
34.	The EAP / face to face counselling service since April 2019?	○	○	○

		Unlikely	Unsure	Likely
35.	How likely is it that you would you use these services in the future if you needed a helping hand?	○	○	○

		By Phone 0800 NZDF4U	Face to face	Text (8881)	Webchat (coming soon)
36.	If you would use the NZDF4U Wellbeing Support service, how would you prefer to engage?	◯	◯	◯	◯

	Where do you / would you prefer to access information on health and wellbeing? (Mark all that apply)
37.	◯ Face to face with a professional ◯ Booklets and posters ◯ Forums and training sessions ◯ NZDF Intranet ◯ Internet ◯ Social media ◯ An APP on mobile device ◯ Wānanga / Hui ◯ Other (please specify) _____

		No	Yes
38.	Have you attended NZDF resilience training?	◯	◯

		Not at all	Somewhat	Very
39.	If yes, how useful has this training been for you?	◯	◯	◯

40.	If NZDF offered health / wellbeing sessions, what areas would you be interested in attending? (Mark all that apply) ◯ I am not interested in attending ◯ Resilience ◯ Healthy Families ◯ Managing Finances ◯ Sleeping Well ◯ Managing stress ◯ Alcohol and drug education ◯ Maintaining peak performance ◯ Pilates / Yoga ◯ Looking after wellbeing from a holistic perspective - Te Whare Tapa Whā ◯ Relationships ◯ Mindfulness ◯ Other (please specify) _____
41.	What would you like to see the NZDF do differently with regard to supporting the health and wellbeing of our people?

Section 7: Demographic Characteristics

The following information will be used to view differences between groups, such as rank groups or units. Feel free to skip questions that you are not comfortable answering or that you believe may compromise your anonymity.

1. What is your gender?

Male	Female	Other
○	○	○

2. What is your age?

Less than 20 years	20- 24 years	25- 29 years	30 – 39 years	40 – 49 years	50 – 59 years	60 years and over
○	○	○	○	○	○	○

3. Which ethnic groups do you identify with? *(Mark all that apply)*

- ○ New Zealand European/Pakeha
- ○ Māori
- ○ Pacific Islander
- ○ Asian
- ○ Other European
- ○ Other (please specify)_____

4. If you selected more than 1 ethnicity, which do you most identify with? (Please select one)

- ○ New Zealand European/Pakeha
- ○ Māori
- ○ Pacific Islander
- ○ Asian
- ○ Other European
- ○ Other (please specify)_____

5. If you are Māori and you know your Iwi affiliation please enter it here_____

6. Which of the following options best describes how you think of yourself?

- ○ Heterosexual or Straight
- ○ Gay or Lesbian
- ○ Bisexual
- ○ Don't Know
- ○ I prefer not to answer
- ○ Other (please state)_____

7. Which of the following best describes your status?

Regular Force	Reserve	Civilian	Civilian ex-mil	Contractor
○	○	○	○	○

8. If you are **military**, what service do you belong to?

Navy	Army	Airforce
○	○	○

9. If you are **military**, which trade/corps do you belong to?

Navy		Army		Air	
○	Chef	○	New Zealand Corps of Officer Cadets	○	Air Engineer Officer
○	Combat System Specialist	○	Royal Regiment of New Zealand Artillery	○	Air Loadmaster Officer
○	Communication Warfare Specialist	○	Royal New Zealand Armoured Corps	○	Air Warfare Officer
○	Communications Technician	○	The Corps of Royal New Zealand Engineers	○	Helicopter Loadmaster Officer
○	Diver	○	Royal New Zealand Corps of Signals	○	Parachute Instructor
○	Electronic Technician	○	Royal New Zealand Infantry Regiment	○	Pilot
○	Electronic Warfare Specialist	○	The New Zealand Special Air Service	○	Engineering
○	Helicopter Loadmaster	○	New Zealand Intelligence Corps	○	Supply Officer
○	Hydrographic Survey Technician	○	Royal New Zealand Army Logistic Regiment (The Duke of York's Own)	○	Chaplain
○	Marine Technician	○	Royal New Zealand Army Medical Corps	○	Communications And Information Systems Officer
○	Medic	○	Royal New Zealand Dental Corps	○	Intelligence Officer
○	Military Police	○	Royal New Zealand Chaplains Department	○	Learning And Development Officer
○	Musician	○	New Zealand Army Legal Service	○	Legal
○	Physical Training Instructor	○	The Corps of Royal New Zealand Military Police	○	Medical Officer
○	Seaman Combat Specialist	○	Royal New Zealand Army Education Corps	○	Operational Support Officer
○	Steward	○	New Zealand Army Physical Training Corps	○	Other Specialist
○	Logistics Supply Specialist	○	Royal New Zealand Nursing Corps	○	Psychologist
○	Weapon Technician	○	Other	○	Physical Fitness Officer
○	Writer			○	Security Forces Officer
○	Youth Development Instructor			○	Works Officer
○	Branch List Officer			○	Other
○	Chaplain				
○	General List - Engineering - Marine Engineering				
○	General List - Engineering - Weapon Engineering				
○	General List Ops Support				
○	General List – Aviation				
○	General List - Seaman				
○	General List - Supply				
○	Medical Officer				
○	Other				

10.	How many years service have you completed with the NZDF?	Less than 1	1 – 3	4 -5	6 - 10	11 - 15	16 - 20	21 - 25	26 or more
		○	○	○	○	○	○	○	○

11. What is your current rank? *Please mark one:*

- ○ Pte-Cpl / Ord–LH / LAC-Cpl (E)
- ○ Sgt-WO1 / PO–WO / Sgt-WO (E)
- ○ Ocdt-Capt / Mid–LT / PO-FLTLT (E)
- ○ Maj / LTCDR / SqnIdr (E)
- ○ LtCol/CDR/WG CDR (E)
- ○ Col (E) & Above
- ○ Not applicable

12. Select the home situation that best describes you. *Please mark one:*

- ○ Married or de-facto
- ○ Married or de-facto with dependents (children or elderly adults)
- ○ Single (never married)
- ○ Single (divorced, widowed, separated)
- ○ Single (including divorced, widowed, separated) with dependents (children or elderly adults)
- ○ Other

13.	How many children do you have who are under the age of 5?	None	1 – 2	3 or more
		○	○	○
14.	How many children do you have who are aged 5-16 years, or older if still financially dependent on you?	○	○	○

14.	Are you currently in a commuting relationship? (your partner lives in a different geographic location to where you work)	No	Yes
		○	○

15.	If yes, how long have you been doing this?	0-3 months	4-6 months	7-12 months	12 months+
		○	○	○	○

16. In which region do you work?

- ○ Whangarei
- ○ Auckland
- ○ Tauranga
- ○ New Plymouth
- ○ Gisborne
- ○ Waiouru
- ○ Napier
- ○ Palmerston North
- ○ Ohakea
- ○ Wanganui
- ○ Upper Hutt – (JF NZ)
- ○ Upper Hutt (Trentham)
- ○ Wellington (HQ NZDF)
- ○ Wellington (Other)
- ○ Nelson
- ○ Woodbourne
- ○ Christchurch
- ○ Dunedin
- ○ Invercargill
- ○ Other (please specify)_____

Thank you for completing this survey.

We appreciate you having taken the time to do this survey, and for your honesty in answering the range of questions asked of you. We acknowledge it has taken time away from doing other things but your contributions will help ensure we have an accurate picture of how we are going and respond to any areas of need. We'll let you know the results as soon as we can.

Over the page you can check out how you are going based on how you scored yourself in two areas in the survey.

A list of health support resources is provided on the next page. Please detach and retain these pages if you would like to.

Future research and Anonymous Research Code

Finally, we invite you to select an anonymous research code. It is proposed to undertake a follow-up study in 2-3 years time to monitor changes in the health of our people over time, and the impact of events, support programmes and initiatives introduced across NZDF during this time.

Selecting an Anonymous Research Code will allow anonymity to be protected while permitting your survey response to be *compared across surveys.*

If you completed the 2016 survey please use the same ARC as you used for that survey. This is so we can monitor trends in risk and protective factors and how people are tracking over time.

Anonymous Research Code (ARC)

Your ARC will allow us to compare your responses from this survey with your responses on past/future surveys, while still respecting your anonymity. By using the ARC, you will be the only one who knows what your anonymous code is.

Spaces 1 & 2: **First two** letters of your mother's maiden name (e.g., For Smith, you would write S / M)
Spaces 3 & 4: The numbers corresponding to the **month your mother** was born (e.g., For April, you would write 0 / 4)
Spaces 5 & 6: The **first two** letters of your father's first name (e.g., For John, you would write J / O)

e.g., S / M / 0 / 4 / J / O

Enter your ARC: ___ / ___ / ___ / ___ / ___ / ___
1 2 3 4 5 6

e.g. *S / M / 0 / 4 / J / O* … you would enter *SM04JO* as your ARC

Please insert your ARC below (without spaces or slashes between the characters)

Anonymous Research Code: X X X X X X

Paper copies of the survey should be returned via the internal mail system to:

Health Check
Directorate of Health
Reserve Bank
Level 5
HQNZDF
Wellington

How Are You Doing? (Please detach and retain this page)

Below you can find information about how you scored on two of the health screens used in this survey. **Please use this information as a guide, no matter what your score, if you have any concerns about how you are going, seek help.**

K10 Psychological Wellbeing (page 4)

Please use this information as a guide, no matter what your score, if you have any concerns about how you are going, seek help. Scores can sometimes be influenced by particular life events, such as a recent change in circumstances (e.g. financial pressures, birth of a child, relationship breakdown), or a busy work period. These feelings may only last a short period of time, however if you are experiencing signs of distress that have endured over the last four weeks you are strongly encouraged to seek help. Seeking help will enable an earlier recovery and reduce the likelihood of longer term issues developing.

10-14 Low

Your score falls into the low range. This means you're doing pretty well! It's important to remember that this result is not a diagnosis. If you feel down, sad, stressed or anxious, you might want to speak to someone (eg. doctor or other health professional).

15-19 Moderate

Your score falls into the moderate range. Some people who score in this range have mild depression and/or anxiety. We encourage you to see your doctor or health professional for a more personalised assessment.

20+ High

Your score falls into the high range. Many people who score in this range are experiencing depression and/or anxiety. We strongly recommend that you see your doctor or health professional for a more personalised assessment.

AUDIT Alcohol Use (Page 13)

Score	Risk	Action
0-7	Low risk	This is the healthiest level of drinking, but check the additional risks below to make sure you are not at elevated levels of risk taking.
8-15	Medium	Your drinking has the potential to cause harm, consider low risk drinking, and try the tips below for change.
16 and above	High risk	This level of risk indicates that you are likely damaging your health and wellbeing with your drinking. Seriously consider changing these behaviours. Talk to your doctor or health professional for additional advice.

Low risk guidelines

Low-risk drinking to reduce the lifetime risk of harm from disease or injury for healthy men and women is:

- on any day no more than 2 standard drinks.

Low risk drinking to reduce the harm of injury or death on any one occasion of drinking is:

- no more than 4 standard drinks on any one day (on a special occasion, not regular drinking) – these drinks should be spread out over several hours;
- having regular alcohol-free days.

For women who are planning to become pregnant, or who are pregnant or breastfeeding, no alcohol is the safest option.

Additional risks

Caution:

- Do you have a health condition made worse by alcohol i.e. diabetes, hepatitis, pancreatitis etc.?
- Do you have heart disease, high blood pressure or are gaining weight?
- Are you on medication?
- Do you suffer from depression, anxiety, or PTSD?
- Do you experience mood swings or irritability?
- Do you have trouble sleeping?
- Are you over 65?

Even if you are in the low risk category you may need to drink less if you are in one of the above groups that are more susceptible to the effects of alcohol. Talk to your doctor or other health professional.

Appendix B: Executive Summary

Introduction

Substantial heterogeneity exists in individual responses to trauma. Reactions to operational deployments by service personnel appear to be no exception. The present research sought to explore the link that potentially traumatic deployment experiences (PTDEs) have with posttraumatic stress (PTS) and flourishing. Further, the impacts of adaptive health behaviours (physical activity, nutrition, and sleep) and social support (from close others or from military leadership) on the relationships that PTDEs have with PTS and flourishing were explored. The present research also sought to add to the New Zealand military body of literature.

Method

Surveys were conducted 3 years apart (2016, 2019) with 313 New Zealand Defence Force (NZDF) postdeployment personnel and reports analysed. A series of correlational, moderation, and regression analyses were completed to explore hypothesised relationships.

Findings

Hypothesis 1 predicted that a positive relationship between PTDEs and PTS would emerge, which was fully supported. Additionally, the relationship between PTDEs and flourishing was explored, revealing a nonsignificant correlational relationship.

Hypothesis 2 predicted that social support from close others, from leadership, and adaptive health behaviours would have a negative relationship with PTS, but a positive relationship with flourishing. This hypothesis was fully supported.

Hypothesis 3 predicted that higher levels of social support from close others, from leadership, and adaptive health behaviours (compared to lower levels) would weaken the relationship that PTDEs had with PTS but strengthen the relationship that PTDEs had with flourishing. Moderation analyses investigating this hypothesis yielded mixed results.

For Hypothesis 4, it was anticipated that social support from close others, leadership support, and adaptive health behaviours would predict PTS and flourishing 3 years later. Regression analyses provided full support for this hypothesis, albeit at relatively weak levels (Δr^2 = .003-.04).

Finally, Hypothesis 5 predicted that PTS would moderate the relationship that PTDEs had with flourishing. Moderation analyses found partial support for this hypothesis, in that the relationship

between PTDEs and flourishing was nonsignificant at high levels of PTS, and positive at low levels of PTS within the 2019 dataset. A nonsignificant moderation effect in the 2016 dataset was found.

Clinical and Organisational Implications

The present research found that among New Zealand military personnel exposed to PTDEs, the majority did not show signs of PTS. This was congruent with past research (Galatzer-Levy et al., 2018). Further, it was found that experiences on operational deployments may positively contribute to military personnel's overall flourishing levels, where PTS is at sufficiently low levels. Adaptive health behaviours and social support from both leadership and close others were also found to provide buffering, facilitative, and predictive functions. These findings suggest that support in these areas are important considerations for psychological outcomes in the postdeployment population in the short term, and for years after deployment.

Given these considerations several recommendations apply. Screening initiatives by mental health professionals and military support structures may be enhanced by including assessment of these key areas. The addition of adaptive health behaviours interventions to PTS treatment programmes has shown promise and is additionally recommended (Hegberg et al., 2019; Kaplan et al., 2015; Maher et al., 2021; Rucklidge, Afzali et al., 2021). Similarly, interventions which improve perceptions of social support are recommended. For example, interventions which target relationship dynamics have been shown to ameliorate PTS symptoms (Howard, 2021; Monson et al., 2008; Pukay-Martin et al., 2015; Snyder & Monson, 2012). Through an organisational lens, the present research also emphasises the importance of leadership effectiveness as it relates to perceptions of support and psychological outcomes. Therefore, the engendering of leadership qualities and team environments which create sources of social support is encouraged. Past research echoes these recommendations, finding that perceived support by fellow unit members and leadership have been negatively correlated with (Pietrzak, Johnson, et al., 2010) and prospectively buffer against PTS (Han et al., 2014).

Limitations and Future Directions

A number of limitations were identified, and recommendations made. The present research utilised several single, small-item, and nonvalidated measures. Future research is recommended to utilise multi-item and validated measures. Several mechanisms were proposed but not measured to explain the research outcomes. Future concurrent investigations of mechanisms are therefore recommended. Future research is additionally recommended to employ collection strategies that target individuals with high PTS levels, explore directionality of effects, and control for time since deployment.

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