An investigation of the mental health and psychological resilience of UK armed forces personnel following physical combat-related injury in Afghanistan (Operation Herrick) between 2009 and 2011.

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AN INVESTIGATION OF THE MENTAL HEALTH AND PSYCHOLOGICAL RESILIENCE OF U.K. ARMED FORCES PERSONNEL FOLLOWING PHYSICAL COMBAT-RELATED INJURY IN AFGHANISTAN (OP HERRICK) BETWEEN 2009 AND 2011

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ABSTRACT

Introduction: The relationship between traumatic injury and mental health diagnoses is still not well understood and mental health outcomes among military personnel with physical combat-related injuries remain poorly described. At present there are no studies describing the mental health morbidity of U.K. Armed Forces Personnel following physical combat-related injury. This unique study comprehensively explores post-traumatic stress disorder, common mental disorders and alcohol use disorder and assesses psychological resilience in that group.

Methods: This prospective study of 199 UKAF personnel admitted to the Defence Medical Rehabilitation Centre (DMRC) utilises a range of self-report measures to assess the prevalence of PTSD, CMD and AUD on admission in addition to reported levels of Hardiness and Psychological Resilience. Statistical analysis of this data, using Pearson's Chi-Square and Odds Ratio (OR) calculations was conducted to explore relationships between the primary outcome variables and a range of sociodemographic, military, physical (injury) and psychological factors.

Results: The study achieved an overall response rate of 56.28% (n=101). 11.9% (n=12) of participants met the criteria for PTSD, 66.7% (n=66) met the criteria CMD and 41.6% (n=37) met the criteria for hazardous drinking. Exploration of the relationships between the primary outcome variables and additional factors highlights a number of statistically significant associations for CMD, PTI, AUD and of hardiness and psychological resilience. Significantly higher levels of PTSD, CMD and AUD a high degree of comorbidity between PTSD and CMD were observed in this population when compared with the general U.K. Armed Forces population

Discussion: The long term management of the mental health of U.K Armed Forces Personnel following physical combat-related injury is complex and challenging. This important study provides a valuable insight into that group and presents a number of policy and clinical recommendations intended to facilitate positive outcomes in the longer term.

Keywords: Military, UK Armed Forces, Physical Combat-Related Injury, Post-traumatic Stress, Depression, Anxiety, Alcohol Use Disorder, Hardiness, Psychological Resilience.

DECLARATION

I declare that this thesis has been composed by myself and has not been presented for any other degree. All quotations are differentiated from my own work by quotation marks and all sources of information have been acknowledged.

Materials related to military operations and military capability have been sourced from materials in the public domain.

Lt Col Kevin J Forbes

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CHAPTER ONE: INTRODUCTION

The application of military power has evolved beyond the type of conflict characterised by the large-scale 'set piece' battle seen throughout the last century, and the contemporary view of warfare is now one centred upon the 'Spectrum of Conflict' (NATO, 2017). The changes in military doctrine seen in recent years reflect wider changes in global politics, military strategy and in military engagement (Champion *et al.,* 2003), and the Spectrum of Conflict encompasses a dynamic range of smaller-scale campaign themes including Civil-Military Cooperation (CIMIC), Humanitarian Assistance, Security Force Assistance (SFA) and Counterinsurgency Operation (COIN OP).

Increasingly, military operations involve conflicts between nations or groups with disparate military capabilities, *i.e.* asymmetric conflicts. Asymmetric conflicts characteristically involve small factional groups, proxy forces or non-state actors employing criminal or terrorist tactics against much larger forces or against nation states (NATO, 2017). Asymmetric conflicts are defined predominantly in relation to the nature of the adversaries, their ideals, objectives and by the mode of conflict they choose to employ. While it may appear that asymmetric conflicts, such as those seen in Iraq (OP TELIC[1]) and Afghanistan (OP HERRICK[2]), are the new model of warfare, future conflict might be very different, it may not begin with something "that goes bang" and will likely involve the exploitation of energy resources, bribery, corruption, cyber-attack, assassination, 'fake news' propaganda and military intimidation (Gen. Sir Nick Carter (CGS), RUSI Lecture[3], 22 Jan 2018).

Historically, war has been viewed as a campaign against injustice or tyranny or as a struggle between good and evil. The 'heroic' view of war often promotes or entails a high degree of popular support, even patriotic fervour (think of the public response to the Argentinian invasion of the Falkland Islands in 1982). Soldiers do not 'make' war, they 'fight' it, and while it remains true that warfare is a political tool, and military force an instrument of national power, changes in the nature of conflict, in the role of the armed forces, and through the increased

[1] OP TELIC was the operational name given to the UK's involvement in Iraq. The U.S. used the operational name Operation Iraqi Freedom. OP TELIC began on 19 March 2003 and ended on 22 May 2011.

[2] OP HERRICK was the operational name given to the UK's involvement in Afghanistan. The U.S. used the operational name Operation Enduring Freedom. OP HERRICK began formally on 20 June 2002 and ended on 12 December 2014.

[3] https://rusi.org/event/dynamic-security-threats-and-british-army: Accessed 24 Jan 2018

accessibility of conflict through the media, have fundamentally changed public perceptions of warfare. Modern conflict is now often viewed by the public as selfish, arrogant and politically motivated and no longer enjoys uncritical popular support (Hines *et al.,* 2014a). Despite the perception that military operations are often politically motivated and unpopular, those fighting them, in the main, continue to enjoy the respect and support of the public as a whole (Hines *et al.,* 2014a), even though they themselves perhaps no longer have the sure and sound knowledge that they are fighting for a just cause or that what they are doing is right.

1.1. OP HERRICK

On the 11th of September 2001, Islamist militants from the terrorist group *Al-Qaeda*[4] hijacked four commercial passenger aircraft with the intention of crashing them into a number of high-profile targets in the United States of America. In all, nearly 3,000 people died in the attacks that have become known simply as '9/11'. Many more, experiencing or witnessing the attack that day, have been invisibly scarred by those events (Neria *et al.,* 2011).

The passage of the United Nations Security Council Resolution 1373 on the 28th of September 2001 and the invocation of Article 5 of the North Atlantic Treaty by the United States of America on the 2nd of October 2001 prompted the United Kingdom to announce its intention to participate in a military campaign mounted in support of a multinational effort against international terrorism centred in Afghanistan and against the supporting Taliban regime there. As part of a 1,700-man taskforce (TF JACANA), 45 Commando (Royal Marines) deployed in order to deny and destroy terrorist infrastructure and interdict the movement of Al-Qaeda in eastern Afghanistan. The Taliban regime collapsed within weeks of the commencement of operations and, in December 2001, the International Security Assistance Force (ISAF) was formed at the North Atlantic Treaty Organization (NATO) Conference in Bonn.

[4] While the American Federal Bureau of Investigation (FBI) managed to identify and link the 9/11 terrorists to Al-Qaeda as early as two weeks after the attacks, Al-Qaeda's leader, Osama bin Laden, did not formally claim responsibility for the attacks until the 29th of October 2004 during a videotaped statement broadcast on the Arabic news channel Al Jazeera.

The ISAF was mandated to support the new regime in Afghanistan and to prevent the country from returning to being an ungoverned space in which terrorist training could be conducted. Counterinsurgency operations began formally in 2001 (OP HERRICK 1), and, as part of an international coalition, United Kingdom Armed Forces (UKAF) personnel found themselves engaged on a daily basis against a Taliban centred insurgency. The ISAF operated in Afghanistan up until the 8th of December 2014 (OP HERRICK 20), when it formally 'cased its colours'. At their peak, combat operations in Afghanistan saw 137 U.K. bases and around 9,500 U.K. troops in Helmand Province.

1.2. Combat Injury – The OP HERRICK Perspective

Between April 2006 and April 2009[5], there were 11,158 attendances at the Emergency Department (ED) of the Role 2 (Enhanced) U.K. Field Hospital[6] at Camp Bastion in Helmand Province. While the total number of attendances during this period included troops from other (non-UKAF) coalition militaries, injured enemy combatants and 'entitled civilians', *i.e.* those employed by approved civilian contractors and treated according to the official 'eligibility matrix'[7], 59.7% (*n*=6666) of those attendances were made by UKAF personnel (Stalker, 2011).

Emergency Department (ED) attendances at deployed U.K. Medical Treatment Facilities (MTFs) are categorised in the Operational Emergency Department Attendance Register (OpEDAR) database as being related to either 'injury' or to 'illness'. Attendances related to 'injury' encompass a wide range of cause and severity and extend from minor injury to major trauma. While a significant percentage of attendances related to 'injury' receive no further sub-classification by individual mechanisms of injury, the addition of a 'hostility marker' does allow for some further refining of injury into those related to 'Battle Injury' (BI) and those related to 'Non-Battle Injury' (NBI). 'Non-Battle Injury' and 'Illness and Disease' are collectively reported as 'Disease and Non-Battle Injury'

[5] These dates cover the period covered by operational deployments during OP HERRICK 6 through to OP HERRICK 9. Patients recruited to this study were injured on OP HERRICK 8 to OP HERRICK 11a.

[6] Joint Doctrine Publication 4-03 (JDP 4-03 3rd Edition) defines Role 2 (Enhanced) facilities as being "a basic secondary care facility built around primary surgery, intensive care unit and beds with nursing support; a R2E facility is able to stabilise post-surgical cases for evacuation to Role 4 without the need to put them through Role 3 first.

[7] Local civilians are treated by clinical need in cases where 'life, limb or eye' saving treatment is required even though they do not qualify for treatment under the conditions outlined in the current 'eligibility matrix'.

(DNBI) and are recorded as such on the U.K. Defence Medical Services Trauma Resuscitation Chart (JDP 4-03.1). As may be expected, attendances related to DNBI constituted the majority of U.K. Military attendances at the Role 2 (Enhanced) (R2E) MTF at Camp Bastion during the period between April 2006 and April 2009. Of those DNBI attendances, 38.8% *(n*=4,328) were recorded as NBI and 34.1% *(n*=3,800) were recorded as being related to illness or disease (Stalker *et al.,* 2011). While attendances related to BI constitute the minority of attendances at the ED during that period (23.3%, *n*=2,602), they continue to represent "the core focus of the hospital and culturally its main reason for existence" (Russell, 2007).

Whilst the OpEDAR database does not always allow for a full categorisation of the mechanism of injury, a number of discrete categories exist to further identify the nature and range of the type of injury. The largest of these discrete categories within the 'injury' grouping is Explosive Injuries (All), which accounts for 15.2% of all attendances, Gunshot Wound (GSW) including Negligent Discharge (ND), which accounts for 7.3% of all attendances and finally Motor Vehicle Collision (MVC), which accounts for 2.4% of the total number attending the ED. Those attendances categorised as general 'injury' account for a remaining 36.3% of attendances (Stalker *et al.,* 2011).

Closer examination of Explosive Injuries (All) indicates that Improvised Explosive Devices (IEDs) constituted the largest single category of Explosive Injuries (42.8%, *n*=782). The remaining sub-categories: Bomb; Grenade; Mine; Mortar; Other; Rocket and Rocket Propelled Grenade (RPG) making up the remaining 57.2% of the Explosive Injuries (All) category (Stalker *et al.,* 2011).

Between OP HERRICK 6 and OP HERRICK 9, 7.3% of all attendances at R2E MTF in Camp Bastion were related to GSW. While a small proportion of these injuries were the result of Negligent Discharge *(n*=31), 11.2% *(n*=91) of the total number of GSWs were fatal (Stalker *et al.,* 2011).

Expressed as a percentage of those attending with BI, rather than as a percentage of the total number of attendances during the period, explosive injuries account for approximately 65.3% *(n*=1699) of all battle injuries. The increased use of IED, anti-personnel mine, mortar, rocket and rocket propelled grenade (RPG), have led to the establishment of traumatic amputation and traumatic brain injury (TBI) as the signature injuries of asymmetric warfare (Shively and Perl, 2012). A comparison of these figures with those of other coalition partners demonstrates similar rates of casualties injured by explosive devices, ranging from 57% in Canadian Forces admitted to the Role 3 Multinational Medical Unit in Kandahar (Comstock *et al.,* 2011) to 71% in coalition forces admitted to the Spanish Role 2 in Herat (Navarro Suay *et al.,* 2011). Within the BI category, explosive injuries (All) accounted for 11.0% of all U.K. fatalities during the reviewed period (Stalker *et al.,* 2011). The IED is now recognised as having been the leading cause of death and injury in coalition troops in both Iraq and Afghanistan (Ramasamay, 2009a).

Between October 2001 and March 2012 UKAF and civilian casualties in Afghanistan saw a year-on-year rise and this upward trend in attendance, related predominantly to explosive injury and to GSW, peaked between April and September 2008 during OP HERRICK 8 (Stalker *et al.,* 2011). While OpEDAR reflects neither the number of troops deployed within the operational environment nor the contemporaneous tempo of combat operations, it is highly likely that an increase in either, or both, of these factors resulted in a corresponding rise in the numbers of those at risk of, or sustaining, injury by explosive devices.

Casualty figures peaked again in 2010 during the period of OP MOSTARAK, a coalition-wide operation intended to expand security and Afghan Government influence in the areas previously identified as Taliban 'strongholds' (Chah-E Anjir, Western Babaji, Trikh Nawar, and, most significantly, Marjah). The first of the two operational phases saw sustained interface between coalition troops and Taliban insurgents and while it is beyond the scope of this work to assess the operation effectiveness of OP MOSHTARAK, casualty figures and MTF admissions reported in the years following the operation fell to their pre-2008 levels (DASA, 2012).

In all, 315 fatalities (including pre-hospital deaths) were recorded in the OpEDAR database across all sites over the period between OP HERRICK 6 and OP HERRICK 9 and, of this number, 90.2% (*n*=284) were associated with BI. For all attendees (*n*=11,158) at the ED, survivability was assessed at 97.2% although this rate is skewed by DNBI attendees (Stalker *et al.,* 2011). Of the total number of Battle Injuries (*n*=2,602) presenting at the ED, survivability was closer to 90% (10.9% fatality rate). Given the overwhelming nature of physical combat-related injury (from IED in particular) and the higher rates of survival achieved through improvements in military medical provision many of those personnel surviving have done so with very high levels of physical disability.

In all, between 1st January 2006 and 31st December 2014 when OP HERRICK ended, 5,255 UKAF and civilian personnel were admitted to U.K. MTFs with DNBI, a further 2,188 UKAF and civilian personnel were admitted to U.K. MTFs for damage control surgery, acute management and stabilisation prior to onward movement and Aeromedical Evacuation (AE). A total of 7,400 aeromedical evacuations were conducted for UKAF and civilian personnel by dedicated Critical Care Air Support Team (CCAST) or Deployable Aeromedical Response Team Squadron (DARTS) capabilities (MoD, 2015). Following AE back to the United Kingdom, injured UKAF personnel were transferred to, and received definitive treatment at the Royal Centre for Defence Medicine (RCDM) at the Queen Elizabeth Hospital in Birmingham. On discharge, the rehabilitation of those UKAF personnel injured on military operations was conducted at the Defence Medical Rehabilitation Centre (DMRC) at Headley Court near Leatherhead in Surrey.

1.3. Combat Injury – The Mental Health Legacy

While it has long been clear that military personnel deployed on combat operations are regularly exposed to traumatic events likely to significantly compromise their mental health and psychological well-being (Greenberg *et al.,* 2008a; Walker *et al.,* 2010), it has been suggested that the relationship between traumatic injury and subsequent mental health diagnoses is still not well understood (Walker et al., 2021) and mental health outcomes among veterans who have sustained physical combat-related injuries remain poorly described (Chin and Zeber, 2020).

While much of the research on military mental health over the last 20-30 years has focused on the general service population or on operational exposure to traumatic events, evidence supporting the hypothesis that physical combat-related injury may be a risk factor for the development of common mental health disorder (CMD) and post-traumatic illness (PTI) (Kulka et al., 1990; Michael et al., 1999; Koren et al., 2005; Forbes et al., 2012, Alexander, Klein and Forbes, 2013) has been slow to emerge. In more recent times, large scale, retrospective studies of US Military cohorts have suggested a high incidence of mental health conditions in critically injured combat casualties with traumatic amputation and TBI while other mental health outcomes among veterans who sustained critical combat injuries have not been described (Chin and Zeber, 2020) and the growing body of evidence confirms that, when compared to non-injured service personnel, those with physical combat-related injury have higher observed incidence of PTSD, depression and anxiety (Walker et al., 2021). Evidence supporting the hypothesis that physical combat-related injury is, itself, a risk factor/predictor for PTSD, CMD and AUD will be discussed in Chapter Two.

While there is certainly evidence to support the hypothesis that there is a relationship between physical combat-related injury and mental health outcomes, there are, currently, no prospective studies of the mental health or mental health morbidity of UKAF personnel following physical combat-related injury to be found in the literature. In an attempt to bridge that gap, this study offers a valuable insight into the mental health and mental health morbidity of UKAF personnel following physical combat-related injury sustained on military operations in Afghanistan. This study, therefore, significantly contributes to the body of knowledge by offering a unique prospective perspective on the mental health and mental health morbidity of a group of UKAF personnel admitted to the Defence Medical Rehabilitation Centre at Headley Court for ongoing treatment following discharge from the Royal Centre for Defence Medicine (RCDM) at the Queen Elizabeth Hospital in Birmingham.

1.4. Barriers to Positive Mental Health

The majority (up to 80%) of UKAF personnel with a perceived mental health problems seek some sort of support (Iversen *et al.,* 2010). While many seek support informally, less than one quarter of those with identified mental health problems access professional medical help (Iversen *et al.,* 2010).

Investigation of care seeking behaviour suggests a number of well-established barriers to care (Samele, 2013) and many of these are related to long-standing negative beliefs about mental illness within the military population (Langston *et al.,* 2010). Stigma and label avoidance consistently emerge as barriers to care seeking and service participation (Ben-Zeev *et al.,* 2012). The impact of internal stigma (Langston *et al.,* 2010) and lack of trust or confidence in providers of mental health services (Britt, 2000; Greene-Shortridge *et al.,* 2007) remain significant barriers to positive mental health in military populations.

Strong masculine norms among military personnel who are required to be physically and psychologically resilient during times of adversity (Rona *et al.,* 2004) make it difficult to report or seek help for a psychological problem (Britt, 2000; Langston *et al.,* 2007) and many service personnel choose to 'suffer in silence'. These difficulties are often related to the fear of being seen as 'weak' by comrades or by seniors and of the negative impact that a psychiatric diagnosis may have on the individual's service career. Where there are practical barriers to care (Iversen *et al.,* 2011), *i.e.* where military personnel are unsure about how to access care, it would appear that these practical considerations are still, in part, due to long standing negative beliefs about mental illness and perceived stigma may itself be predictive of mental health symptoms (Britt *et al.,* 2008).

While it is likely that those UKAF personnel with physical combat-related injury have good access to mental health services and despite the development of an integrated rehabilitation network and enhanced service provision within the UK Armed Forces there remains sufficient evidence to suggest that many of the positive gains achieved by rehabilitation services, military and civilian alike, are frequently short-term (Fletcher, 2007).

1.5. The Headley Court Trust Project (HCTP)

As a consequence of increased numbers of UKAF personnel discharged from the RCDM requiring rehabilitation at Headley Court during military operations in Iraq and Afghanistan, the DMRC saw an overall rise of 23% in its staffing establishment, 83% in its ward bed provision and in 2010 a further expansion of rehabilitation services through the building of a rehabilitation-focused sports complex (funded by the charity Help for Heroes). The expansion of the DMRC was supported by a Defence wide expansion of rehabilitation services and the establishment of Regional Rehabilitation Units (RRUs) across the United Kingdom and Germany in order to address capacity issues and ensure the continuation of a high standard of care for UKAF personnel.

In recognition of the need to support the mental health and well-being of UKAF personnel following physical combat-related injury at Headley Court the Centre for Mental and Cognitive Health (CMCH) at DMRC was expanded and offered a comprehensive mental health service for inpatients (including Eye Movement Desensitisation and Reprocessing (EMDR) and trauma-focused

Cognitive Behavioural Therapies (CBT)). Between December 2012 and December 2013, the combined Tri-service and civilian team at the CMCH at Headley Court treated 166 patients (43%, *n*=72, with a diagnosis of PTSD or Post-Traumatic Symptoms) (Ashton, 2018).

In 2009, the Aberdeen Centre for Trauma Research (ACTR) at the Robert Gordon University in Aberdeen was approached by the Board of Trustees of the civilian charity The Headley Court Trust (registered charity 256382) and commissioned to undertake a three-year research project intended to identify the:

1. durability of psychiatric and psychosocial gains from rehabilitation following combat-related injury, and the;
2. impact of combat-related injury on the partner of military personnel in terms of mental health, psychosocial adjustment, and relationships.

In order to address these aims the HCTP sought to address three linked research questions with respect to both military personnel admitted to the DMRC (RQ1 & RQ2) and in relation to their partners (RQ3):

- RQ1: What are the long-term effects of rehabilitation of combat-injured personnel following admission to the Defence Medical Rehabilitation Centre, Headley Court?
- RQ2: What factors either compromise or facilitate the durability of therapeutic gain?
- RQ3: What is the association between the durability of therapeutic gain and the 'Ripple Effect' of trauma?

The Headley Court Trust Project incorporated the linked and parallel study of two groups of UKAF personnel admitted to the care of the complex-trauma team at the DMRC (prospective group (*n*=224) and retrospective group (*n*=126)) and their partners (prospective group (*n*=107) and retrospective group (*n*=14)). The health and well-being of participants was assessed on admission to the DMRC at baseline, at six months and again at twelve months (at six months and at twelve months assessments were conducted by postal questionnaire). Despite mixed initial recruitment (Patient Study: Prospective Group (PG), *n*=199, Retrospective Group (RG), *n*=20: Partner Study: Prospective Group (PG), *n*=27, Retrospective Group (RG), *n*=3) and poor response rates at follow up, the study (Alexander *et al*.,

2013) reported a number of key findings in relation to the stated research questions:

1.In relation to RQ1:

a. Changes in reported prevalence of PTSD in both patient and partner studies were consistent with existing studies that report delayed onset of symptoms (Hoge et al, 2004). Prevalence of PTSD in the patient study increased at six months to 20% from a baseline of 10% and decreased to 18% at twelve months. Within the partner study prevalence at baseline was 7%, 33% at six months, and 10% at twelve months.

b. Within the prospective patient group, the prevalence of common mental health disorders was estimated as being approximately 67% at baseline, 57% at six months and 52% at twelve months. Within the partner group, the prevalence of common mental health disorders was, approximately 65% at baseline, 67% at six months and 56% at 12 months. The study concluded that high levels of common mental health disorder identified in both patient and partner participant groups further demonstrates that comorbidity is the norm rather than the exception in patients with PTSD (O'Donnell et al, 2004).

c. Levels of dispositional resilience (Hardiness) measured at baseline suggested that coping with physical combat-related injuries in the short-term had a detrimental effect on overall resilience.

d. Levels of resilience measured across the twelve-month follow up indicated that levels of resilience declined from baseline (Mean=31.33, n=109) to six months (Mean=28.72, n=29) but stabilised between six months and 12 months (Mean=23, n=23). These results indicate a statistically significant worsening of resilience at six months.

2. In relation to RQ2:

a. There is no evidence to suggest that either post-traumatic or common mental health variables (PCL-C and GHQ-12) or resilience variables (DRS-15 and CD-RIS-10) can be used to predict outcome in terms of future levels of PTSD or common mental health disorder.

b. Both the measurement of psychological resilience using the CD-RIS-10 scale and the measurement of psychiatric caseness using the GHQ-12 provide an indication concurrent of levels of PTSD in participants.

3. In relation to RQ3 qualitative data suggested that:

a. Partner participants report a positive experience of the care at the DMRC and that the level of care provided made it 'easier' or 'much easier' to care for their partner at home. Partner satisfaction was consistent across the twelve-month follow up period.

b. Partner participants consistently report a less positive experience in relation to the provision of information regarding the care of their partner, his or her recovery, the psychological impact of his or her injury and their involvement in their partner's care.

c. The relationship between the Defence Medical Rehabilitation Centre (DMRC) and the partners may be contributing to partner distress.

Following these key findings, the HCTP recommended that the DMRC should:

1. Extend the provision of care to the 'wider' family, *e.g.* to the partners of those with combat-injuries, in order to further strengthen mutual social support and to minimise the impact of those injuries on partner health.

2. Develop strategies designed to improve the longer-term employability of patients following their discharge from the Defence Medical Rehabilitation Centre (DMRC) and/or medical discharge from the Armed Forces.

3. Enhance the participation of partners of those with combat-injuries in the delivery of their care, *i.e.* participation in consultation, direct care delivery and through a more effective passage of information.

4. Develop and implement best-practice strategies designed to promote the psychological resilience of those with combat-injuries in order to minimise the risk of post-traumatic stress and common mental health disorders.

5. Identify and implement strategies designed to monitor alcohol consumption and identify hazardous or harmful alcohol use by those with combat-injuries during each period of inpatient admission at the DMRC.

While the HCTP report (Alexander, Klein and Forbes., 2013), make a number of general observations regarding socio-demographic factors, post-traumatic stress, common mental health disorders and psychological resilience, the specific investigation of potential predictors of common mental health disorder (CMD), post-traumatic illness (PTI), Alcohol Use Disorder (AUD) and psychological resilience in UKAF personnel following physical combat-related injury was not explored. This doctoral study therefore, seeks to more fully explore the mental health and mental health morbidity of the prospective patient participants, to identify a range or potential predictors of common mental health disorder (CMD), post-traumatic illness (PTI), Alcohol Use Disorder (AUD) and psychological resilience and to explore the relationships between these and both the mental health and resilience outcomes.

1.6. Summary

One of the enduring legacies of OP HERRICK is the establishment of traumatic amputation and traumatic brain injury (TBI) as the signature injuries of asymmetric warfare (Shively and Perl, 2012). During military operations in Afghanistan explosive injuries accounted for 65.3% of all battle injuries in UKAF personnel (n=1699). In recent years, as a result of improved force protection measures and improved medical management of combat casualties both on the battle field and in deployed healthcare, unprecedented numbers of UKAF personnel have sustained what would previously have been described as un-survivable, 'life and ambition changing' injuries (Etherington et al., 2016 and Ashton, 2018), and 'unexpected survival' has rapidly becoming the 'norm' within combat casualty care (Hodgetts and Mahoney, 2009). These physical combat-related injuries carry a significant burden in terms of physical disability and a growing body of evidence supports the hypothesis that physical combat-related injuries also carry with them an increased risk of CMD, PTI and AUD (Kulka *et al.,* 1990; Michael *et al.,* 1999; Koren *et al.,* 2005, Forbes *et al.,* 2012 and Alexander, Klein and Forbes, 2013). While there are now a number of large U.S. based retrospective studies that appear to confirm, when compared to non-injured service personnel, that those with physical combat-related injury have higher observed incidence of PTSD, depression and anxiety (Walker et al., 2021) there are, as yet, no prospective studies of the mental health and mental health morbidity of UKAF personnel following physical combat-related injury.

While there has been considerable investment in military rehabilitation in recent years it is also recognised that rehabilitative gains are often short term (Fletcher, 2007). Additionally, it has been suggested that those leaving military service early (often within the first five years of their service) are at increased risk of post-traumatic stress disorder (PTSD), common mental disorders, fatigue and multiple physical symptoms (Buckman *et al.*, 2013). It seems likely that those discharged from military service, early in their service careers following physical combat-injury may face similar prospects.

Building on the earlier work of the Headley Court Trust Project (Alexander, Klein and Forbes, 2013) this doctoral thesis seeks to further explore the relationships between physical combat-related injury, mental health, mental health morbidity and psychological resilience in a prospective sample of UKAF personnel admitted to the DMRC.

1.7. Study Aim and Objectives

This doctoral study has, as its primary focus, the promotion of positive mental health and psychological wellbeing in military personnel following physical combat-related injury.

1.7.1. Study Aim

The primary aim of this doctoral study is to investigate mental health and mental health morbidity in a prospective sample of United Kingdom Armed Forces (UKAF) personnel following physical combat-related injury, and to explore the relationships between potential risk factors and predictors and subsequent mental health disorder (CMD), post-traumatic illness (PTI), Alcohol Use Disorder (AUD) and psychological resilience.

1.7.2. Study Objectives

In order to address the primary aim of this doctoral study the following chapters will:

1. Present a review of the contemporary challenges to mental health and psychological well-being in military personnel and the role of psychological resilience in promoting positive mental health (Chapter Two).
2. Undertake a systematic review of published literature in order to identify potential risk factors associated with the development of post-traumatic Illness (PTI), common mental health disorders (CMD), Alcohol Use Disorder (AUD) and to further identify potential predictors of psychological resilience following physical combat related injury (Chapter Three).
3. Explore levels of post-traumatic illness, common mental health disorder, hazardous drinking and psychological resilience in a cohort of UKAF personnel following combat injury and identify potential risk factors for PTI, CMD and AUD and predictors of psychological resilience by addressing the following research questions (Chapters Five to Seven):
    a. Mental health and mental health morbidity:
        i. What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?
        ii. Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?
    b. Psychological resilience:
        i. What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?
        ii. Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

CHAPTER TWO: TRAUMA, MILITARY MENTAL HEALTH MORBIDITY AND PSYCHOLOGICAL RESILIENCE

2.1. Introduction

Psychological distress continues to be seen as a 'relatively unavoidable risk' for those engaged in combat (Wessely 2005a and 2005b) and, left untreated, PTI and CMD have a significantly negative impact upon service career, relationships and health (Figley and Nash, 2007). While it appears that the majority of military personnel returning from operational deployments remain free from these "invisible wounds" (Tanielian and Jaycox, 2008) the difficulty of effectively predicting who will be adversely affected by their experience has long presented a significant challenge to researchers (Brewin et al., 2000b; Ozer et al., 2003; Alexander, Klein and Forbes, 2013). The relationship between traumatic injury and subsequent mental health diagnoses continues to be poorly understood (Walker et al., 2021).

It is well established within military and civilian populations alike that exposure to traumatic events is associated with increased risk of Post-traumatic illness and increased mental health morbidity including PTSD, anxiety and depression leading to suicidal ideation (Blosnich et al., 2014), substance-abuse (Eisen et al., 2012; Roberts et al., 2015), sleep disorders (Basta et al., 2007; Kim and Dimsdale, 2007), aggression (Watkins et al., 2017) anger issues (Kessler et al., 1995; Hoge et al., 2004; Elbogen et al., 2010 and Rona et al., 2015), and in the adoption of increased risk-taking behaviours (Killgore et al., 2008). Additionally, military studies have shown that variation in exposure to, and experience of, traumatic events including combat, differentially impacts on individuals and the manifestation of post-traumatic symptoms (Osório et al., 2017). Despite growing awareness that variation in combat exposure and combat experience differentially impacts on mental health outcomes, little work has yet been done to investigate the effect of physical combat-related injury on mental health outcomes in UKAF personnel.

In order to provide some further context to this study this chapter explores post-traumatic illness, common mental health disorder, alcohol use disorder and resilience (both hardiness and psychological resilience). The discussion places this study within the context of the mental health and mental health morbidity of the general UKAF service population and considers a range of evidence exploring Post-Traumatic Illness (PTI), Common Mental Disorders (CMD), Alcohol Use Disorder (AUD) and resilience within the wider context of combat-related injury.

In relation to PTSD, the first section will ask questions regarding: the prevalence of PTSD in the general UKAF service population (to provide some comparison to the observed prevalence within the study sample); the role of physical combat-related injury as a risk factor for PTSD; and the emerging challenges presented by Complex Post-Traumatic Stress Disorder (CPTSD). In relation to CMD, the second section will ask questions regarding: the prevalence of CMD in the general UKAF service population (again, to provide some comparison for the prevalence identified in this study), the role of physical combat-related injury as a risk factor for CMD and the relationship between PTSD and CMD (comorbidity). Section three will explore Alcohol Use Disorder within the context of the general UKAF service population and within the wider context of physical combat related injury considering its relationship to both CMD and PTSD. The final section of this chapter will consider hardiness and psychological resilience and will explore questions related to the difficulties associated with arriving at a consistently agreed upon definition of psychological resilience, factors likely to promote psychological resilience and the challenges of measuring resilience.

2.2. Post-Traumatic Stress Disorder (PTSD)

The first section of this chapter seeks to explore the relationship between physical combat-related injury and post-traumatic illness and seeks to answer three fundamental questions. Firstly, "What is the reported prevalence of PTSD in the general UKAF service population (without physical combat-related injury)?", secondly, "Is there sufficient evidence in the literature to support the hypothesis that physical combat-related injury may, in itself, be a risk factor/predictor for PTSD?" and thirdly, "What new challenges does the emergence of Complex Post-Traumatic Stress Disorder (CPTSD) present?". Given the homogeneity of the overall UKAF population, answering the first of these questions will provide a basis for comparison between the reported rates of PTSD in the UKAF population and the observed prevalence of PTSD in the prospective cohort of UKAF personnel with physical combat-related injuries reported in this study.

Prior to the recognition of PTSD in the 1980s, 'Gross Stress Reaction' in DSM-I (APA, 1952) and 'Transient Situational Disturbances' in DSM-II (APA, 1968) sought to describe post-traumatic illness. The concept of 'Gross Stress Reaction' emerged concurrently with studies of psychiatric casualties during the Korean War and quickly became the progenitor of 'post-traumatic' stress (Brill and Beebe, 1955). In 1980, DSM-III (APA, 1980) finally recognised PTSD (as an anxiety disorder) following the Vietnam War and subsequent revisions (DSM-III-R (APA, 1987), DSM-IV (1994) and DSM-IV-TR (APA, 2000)) have 'fine-tuned' the now familiar diagnostic criteria based upon the meeting of eight diagnostic criteria (in the absence of other causative factors) related to exposure, presence of symptoms, avoidance, alterations in cognition and mood, alterations in arousal and reactivity, duration of disturbance and distress that we are familiar with today in DSM-5 (APA, 2013).

2.2.1. Prevalence of PTSD in the general UKAF service population

There is considerable heterogeneity across international military studies of the general service population in respect of the prevalence of Post-Traumatic Stress Disorder following operational deployments (Sundin *et al.,* 2010 and Rona *et al.,* 2016). Following the second Gulf War, Hotopf *et al. (*2006) estimated a 4% incidence of PTSD among U.K. troops returning from Iraq (without physical combat-injury) while Hoge *et al.* (2004) report a figure of just under 13% in returning U.S. personnel and Engelhard *et al.* (2007), 4%-21% among Dutch troops returning from operational deployments. While it is certainly true that the variation of reported rates of PTSD may be partly explained by differences in study methodology, length of operational tour and combat exposure there is also evidence to suggest that differences in the deployed role of returning troops may also impact. Recent evidence (Osório *et al.,* 2017) suggests that U.K. personnel deployed in ground close combat roles (GCCR)have a significantly increased risk of developing symptoms of PTSD compared to those deployed in combat support (CS) or combat service support (CSS) role (7% compared to 4%). This conclusion is not surprising given the increased likelihood if being 'in contact with the enemy' experienced by those in GCCRs. While these findings serve to support earlier studies (Hotopf *et al.,* 2006) in respect of prevalence in the general service populations they continue to highlight that combat-exposure and combat-experience have a significant impact on the development of post-traumatic symptoms. It seems more likely therefore, that if combat-exposure and combat experience have a significant impact on post-traumatic symptoms, sustaining a physical combat-related injury while operating in a GCCR will certainly significantly increase the risk.

Recent estimates of the prevalence of PTSD in the general UKAF population suggest that the rate of PTSD remains low at 0.2% (2 in 1000 personnel) however, observed rates of PTSD were significantly higher in those who had previously deployed on operational tours and in 2019/20, figures suggest a 90% increase in the risk of a diagnosis of PTSD for UKAF personnel deployed to Iraq and/or Afghanistan (MoD, 2020). Compared to the prevalence of PTSD in the general UK population of 4.4% (Fear *et al*., 2014) recent estimates of PTSD in the third phase of the KCMHR cohort study suggest an overall prevalence of probable PTSD of 6.2% (Stevelink *et al*., 2018) and it is against this estimate that the observed prevalence of PTSD in UKAF personnel with physical combat-related injuries described in this study will be assessed. While it is also reported that the prevalence of PTSD in veterans who had deployed in combat roles was 17.1% (Murphy *et al*., 2021) this figure includes ex-serving as well as currently serving personnel.

2.2.2. Post-traumatic illness following Traumatic Injury

There remains considerable debate in the literature regarding the relationship between physical trauma and observed levels of PTSD, and the relationship between traumatic injury and subsequent mental health diagnoses continues to be poorly understood (Walker et al., 2021). While a number of studies published over the last 30 years clearly suggest that bodily injury is a predisposing factor for post-traumatic illness (Kulka *et al., 1*990; Michael *et al., 1*999, Koren, 2005 and Grieger *et al.,* 2006), a number of contemporary studies continue to suggest that the empirical evidence supporting such beliefs is lacking (Boals *et al.,* 2017). However, it must be noted that many of those studies failing to conclusively establish a relationship between physical injury and post-traumatic outcomes are studies of civilian cohorts, *e.g.* Boals *et al.* (2017). Considerable caution should be exercised therefore in making any direct comparisons between findings in civilian and military cohorts given the radically different nature of military poly-trauma (see section 1.2. Combat Injury – The OP HERRICK Perspective).

While Boals *et al.,* (2017) study of 460 civilian patients admitted to a Level 1 Trauma Center in the United States, reports a weak association between injury severity score (ISS) and depression, pain, and physical symptoms at twelve months, they fail to identify any significant relationship between physical injury and Post-Traumatic Stress Syndrome (PTSS) during that period and conclude that the relationship between ISS and PTSS is, at best, weak and inconsistent. (Boals *et al.,* 2017). However, it should be argued that, given the inherent limitations in ISS scoring (which consistently fails to account for multiple injuries to the same body region and limits the total number of contributing injuries to only three), studies of this type, utilising ISS, may consistently underestimate the severity of complex poly-trauma. Given the often overwhelming nature of military poly-trauma, the level of injury experienced by armed forces personnel is likely to be much higher than that found in the civilian population and given the methodological difficulties associated with the description of physical combat-related injury using conventional injury severity scores, the direct comparison of military poly-trauma and civilian trauma is problematic at best.

Despite the significant difference that exists between civilian and military trauma, it should also be noted, however, that studies within the military context have also suggested that there is no clear link between physical combat-related trauma and PTSD. As part of an evaluation of the ongoing United States Wounded Warrior Recovery Project, quality of life and psychological outcomes in a cohort of 63 combat amputees and 477 service members (non-amputees with moderate to severe extremity injuries) identified that while it was true that the combat amputees group had poorer reported quality of life (as determined by Health-related Quality of Life (HrQoL) assessment) and poorer overall function, there was no significant difference in depression and symptoms of PTSD (Woodruff et al., 2017).

While there are few prospective studies of post-traumatic illness and mental health morbidity in military populations (and currently none based on UKAF samples), Grieger *et al.* (2006) suggest, in a study of 613 United States Armed Forces Personnel, that high levels of physical combat-related injury one month after injury were strongly associated with the subsequent development of PTSD (odds ratio=9.1: controlled for demographic variables, combat exposure, and duration of deployment) and/or depression (odds ratio=5.7: controlling for 1-month PTSD and depression severity, demographic variables, combat exposure, and deployment length.) at seven months. In an exploration of prevalence, predictors, and outcome in PTSD and depression, Grieger *et al.* (2006) report a prevalence of *probable* PTSD of 4.2% and depression of 4.4% one month after injury. After 4 months, 12.2% of participants had PTSD and 8.9% had depression and at 7 months' prevalence had increased to 12.0% (PTSD) and 9.3% (depression). These findings support the hypothesis that physical combat-related injury is a strong predictor of PTSD. In addition to these findings, Grieger *et al.* (2006) identified that the majority (78.8%) of those participants meeting the diagnostic criteria for PTSD (using the PTSD Checklist) or depression (using the Patient Health Questionnaire) at 7 months screened negative for both conditions at 1 month and this further highlights that the early assessment of post-traumatic illness and mental health morbidity may under-report disorder developing in the longer term. Significantly, therefore, these conclusions also support the suggestion that symptoms of probable PTSD evolve or develop in the longer term and it may be that, within this doctoral study, estimating prevalence at a single time point in terms of the subsequent development of symptoms of PTSD is a limitation.

Subsequent studies of the association between physical injury and PTSD have further confirmed these findings and in a large retrospective study of 3403 United States Military personnel following either battle- (n-1777) or non-battle (n=1626) injury, seeking to examine the relative effects of those injuries on the manifestation of PTSD symptoms as well as the demographic, injury-specific, and pre-injury factors associated with PTSD indicated that physical combat-related injury was a strong predictor of subsequent PTSD (Macgregor *et al*., 2013).

Findings suggested that when compared to those with non-battle injury, personnel with battle injury were observed to have more severe injuries, higher reported levels of combat exposure, and were twice as likely to screen positive for PTSD compared to those with non-battle injury (odds ratio [OR], 2.10; 95% confidence interval [CI], 1.60-2.75) (Macgregor *et al*., 2013). In addition to these findings Macgregor *et al.* (2013) identified that in those with battle injury, moderate and serious-severe injury (OR, 1.49; 95% CI, 1.12-2.00 and OR, 1.64;

95% CI, 1.01-2.68, respectively), previous mental health diagnosis within 1 year of deployment (OR, 2.69; 95% CI, 1.50-4.81), and previous battle injury (OR, 1.96; 95% CI, 1.22-3.16) were all positive predictors of PTSD.

More recently, in a large-scale retrospective cohort study comparing 7,787 combat-injured United States Armed Forces personnel with a 1:1 matched group of combat-deployed, uninjured United States Armed Forces personnel, identified that injured service members had higher observed incidence rates (per 100 person-years) for PTSD when compared to the un-injured group (17.1 vs. 5.8). After adjustment, findings suggested that combat-injured patients were almost three times more likely to develop symptoms of PTSD (HR 2.92, 95%CI 2.68-3.17), (Walker *et al.* 2020). Based on these findings Walker et al. (2020) concluded that traumatic injury is associated with subsequent development of PTSD.

While there is some suggestion that there is a lack of evidence to support the assertion that physical traumatic injury (Boals, 2017) or physical combat-related injury (Woodruff *et al*., 2017) is a predisposing factor for post-traumatic illness the early work of Kulka et al. (1990), Michael et al. (1999), Koren (2005) and Grieger (2006) (amongst others) and the evidence presented in large contemporary retrospective cohort studies of United States Military personnel (Macgregor *et al*., 2013 and Walker et al., 2020) tends to support the underlying hypothesis that physical combat-related injury is a predisposing and predicting factor for Post-traumatic illness and this conclusion forms the basis of the first of the working hypotheses to be tested in this study (see below).

2.2.3. Complex Post-Traumatic Stress Disorder (CPTSD)

Recent evidence suggests that CPTSD may be more prevalent in clinical samples of veterans than PTSD (Murphy *et al*., 2020) and may develop in individuals who are either particularly vulnerable or where trauma exposure is often prolonged or repetitive (Williamson and Greenberg, 2019: Williamson *et al*., 2020) and there is evidence to support the suggestion that military personnel are more likely to have trauma exposure shown to be uniquely associated with CPTSD (Hyland et al., 2017), *i.e*. multiple and severe operational exposures during deployment in a context where 'separation' or escape, is impossible (Murphy et al., 2021). In addition to the traditional diagnostic criteria for PTSD (*i.e*., re-experience, avoidance and sense of threat), the criteria for CPTSD includes three additional clusters that reflect “disturbances in self-organization” (DSO); affect dysregulation, negative self-concept and interpersonal difficulties (World Health Organisation, 2018) and emerging evidence suggests that CPTSD may be more debilitating than PTSD and is associated with a greater burden of comorbid mental health difficulties (Murphy *et al.,* 2021). Based on this conceptualisation of CPTSD it is likely that the presence of physical combat-related injury might be described as a chronic or prolonged exposure from which no ‘separation’ or escape, is possible. It might, therefore, be suggested that CPTSD represents a significant challenge to the management of those with physical combat-related injuries during the rehabilitation process and in the longer term.

In a recent study of 177 help-seeking veterans diagnosed with mental health difficulties, findings confirm that CPTSD (n = 96, 54.3%) appeared more prevalent than PTSD (n= 24, 13.8%) and that those who were employed in a combat role (OR 3.08: 95% CI 1.29–7.36), joined the military after 18 years of age (OR 2.59: 95% CI 1.10–6.08), reported high childhood adversity (OR 2.35: 95% CI 1.05–5.25) significantly increased the likelihood of probable CPTSD. Further, Murphy et al. (2021) reported that those with CPTSD appear to take longer to seek help and that meeting the criteria for CPTSD appears to entail significant comorbid mental health difficulties including high levels of dissociation, anger, moral injury and common mental health difficulties and greater degree of impairment including social isolation, sleep difficulties and impaired functioning.

There are a number of key challenges that the emergence of CPTSD presents in terms of this study. Murphy *et al.* (2021) report that 120 participants (68.0%) of the sample met that diagnostic criteria either stress disorder (PTSD and CPTSD) and highlight that more met the diagnostic criteria for CPTSD (n = 96, 54.3%) than PTSD (n = 24, 13.8%) using the self-administered International Trauma Questionnaire (ITQ) (Cloitre *et al*., 2018). As the Post-Traumatic Checklist (PCL-C) used within this study, while robust in terms of its ability to identify probable PTSD, is not designed to identify CPTSD. Consequently, given the suggestion that CPTSD is more prevalent in clinical samples, this study is not able to draw any conclusions about the prevalence of CPTSD in the sample and further work is clearly needed to address this limitation in future research.

2.3. Mental Health in the Armed Forces

In relation to general mental health and mental health morbidity this section will ask questions regarding: the prevalence of CMD *i.e.* psychological distress, characterised by depressive and anxiety disorders (Goldberg & Huxley, 1992) in the general UKAF service population (again, to provide some comparison for the prevalence identified in this study), the role of physical combat-related injury as a risk factor for CMD and the relationship between PTSD and CMD (comorbidity). Specifically, the section will ask: firstly, "What is the reported prevalence of CMD in the general UKAF service population (without physical combat-related injury)?", secondly, "Is there sufficient evidence in the literature to support the hypothesis that physical combat-related injury may, in itself, be a risk factor/predictor for CMD?" and thirdly, "What is the relationship between PTSD and CMD?".

2.3.1. Mental Health in the general UKAF Service Population

While much of the published research on military mental health is related to post-deployment assessment and does not focus on those with physical combat-related injury, the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study provides an excellent snapshot of the mental health and mental health morbidity of the general UKAF service population. The KMHCR cohort study assessed mental health in both Regular and Reserve UKAF personnel in three phases between 2004 and 2016. The Phase III study sample consisted of 12,280 individuals (including 10,148 regular and 2,132 reserve personnel) and a replenishment sample of trained personnel who joined the military on or after August 2009 (n=8581, comprising both regular (n=6915) and reserve (n=1666) personnel) assessing their general mental health using the General Health Questionnaire (GHQ-12), the presence of probable symptoms of PTSD using the civilian version of the Post-Traumatic Stress Disorder Checklist (PCL-C) and Alcohol Use Disorder (AUD) using the AUDIT-10 Measure (see below). Achieving an overall response rate of 44.3% (57.8% for those followed up from Phase II (n = 6346) and 24.0% for the replenishment sample (n = 1747) the study reported that, overall 21.9% (95% CI 20.75–23.01; n = 1739) of participants reported symptoms of common mental health disorder meeting the GHQ-12 criteria, 6.2% (95% CI 5.49–6.89; n = 417) reported probable PTSD (see above) and 10.0% (95% CI 9.20–10.90; n = 733) reported alcohol use disorder (Stevelink et al., 2018).

Findings suggested that the prevalence of mental health outcomes varied by sociodemographic and military characteristics, however, there appeared to be no significant difference between those regular personnel who deployed and those who did not in terms of CMD, while those regulars who had deployed were statistically more likely to meet the diagnostic criteria of probable PTSD (OR 1.34, 95% CI 1.00 – 1.78) and Alcohol Misuse (OR 1.42, 95% CI 1.13-1.78), (Stevelink et al., 2018). It is worth noting also that these results highlight an increase in reported prevalence of post-traumatic stress disorder but a lowering prevalence of alcohol misuse (both regular and reserve personnel) compared to Phase I and Phase II findings (Stevelink et al., 2018). While it might be argued that the prevalence of existing anxiety and depression in military cohorts should be lower as a result of screening procedures prior to enlistment and the medical discharge of the most unwell after recruitment (Iversen et al., 2009), it remains true that both anxiety and depression emerging during military service often remain unreported and undiagnosed (Kessler et al., 2002). The KCMHR Phase III study represents the most comprehensive assessment of the mental health of serving UKAF personnel available as reported by (Stevelink *et al*., 2018) and it is against this estimate of prevalence that the observed prevalence of PTSD in UKAF personnel with physical combat-related injuries described in this study will be assessed.

In line with previous KMHCR studies of CMD using the GHQ-12 measure, 'caseness' was assumed using the cut-off score of 4 or more (Stevelink et al., 2018) and it may be suggested that as the scale authors recommend a cut-off of >2 (Goldberg and Williams, 1988), that CMD within this study is consistently under reported. As will be discussed below (Chapter Four) the GHQ-12 is a short form screening tool designed to indicate psychiatric caseness in relation to symptoms of anxiety and depression. While there is evidence linking traumatic exposure to anxiety and depression, substance-abuse (Eisen et al., 2012; Roberts et al., 2015), sleep disorders (Basta et al., 2007; Kim and Dimsdale, 2007), aggression (Watkins et al., 2017) anger issues (Kessler et al., 1995; Hoge et al., 2004; Elbogen et al., 2010 and Rona et al., 2015), and risk-taking behaviours (Killgore et al., 2008) the discussion presented within this study is limited to psychiatric caseness in relation to symptoms of anxiety and depression included within the definition of Common Mental Disorders (CMD).

2.3.2. Common Mental Disorder following Traumatic Injury

In relation to the effects of traumatic injury, there is now some evidence within the civilian context to suggest that physical injury has a significant effect on the development of a range of mental health conditions (*e.g.* Bryant *et al*., 2010; Sullivan *et al*., 2017 and Ahl *et al*.,2017), there is also evidence of the impact of mild and severe Traumatic Brain Injury (TBI) in military studies (Chin and Zeber, 2020) however there is still a dearth of literature investigating the effect of physical combat-related injury on mental health.

In a large prospective study of 1,084 traumatically injured patients admitted to four major civilian trauma hospitals across Australia (Bryant *et al*., 2010) report that twelve months after injury, 31% of patients reported a psychiatric disorder, and 22% developed a psychiatric disorder that they had never experienced before. Of those reporting new psychiatric disorders 9% of participants reported symptoms of depression, 9% reported generalised anxiety disorder and 6% reported agoraphobia, additionally 6% of patients reported symptoms of PTSD. Findings suggested that patients diagnosed with mild Traumatic Brain Injury (mTBI) were more likely to develop PTSD (OR=1.92, 95% CI=1.08–3.40), panic disorder (OR=2.01, 95% CI=1.03–4.14), social phobia (OR=2.07, 95% CI=1.03–4.16), and agoraphobia (OR=1.94, 95% CI=1.11–3.39). Reporting that psychiatric illness is more likely to be associated with functional impairment than mTBI, Bryant *et al*. (2010) conclude that a significant range of psychiatric disorders occurs after physical traumatic injury. The relationship between functional impairment and psychiatric illness is one that falls out-with the specific remit of this study but does suggest that in the longer term, those UKAF personnel left with significant levels of physical disability after their rehabilitation is complete may have poorer long-term outcomes related to their mental health.

Subsequent studies within the civilian setting confirm these findings and Sullivan *et al*. (2017) report in their study of 460 civilian patients admitted to U.S. Level 1 trauma centres (Mean age = 44 years, SD = 16.8; 65.4% male), where length of stay exceeded 24 hours, that a significant proportion of those admitted following physical trauma demonstrated increased risk for depression and symptoms of post-traumatic stress (Sullivan *et al.*, 2017). Assessing depression and PTSS at baseline using the PHQ-8 and PC-PTSD measures, their findings suggest that depression was the most prevalent mental health disorder in the sample, affecting 34.1% of participants. Similarly, a recent Scandinavian study of 5,981 patients admitted to an urban university hospital between 2007 and 2012 assessed patient injury severity scores (ISS and AIS), Glasgow Coma Score (GCS) and anti-depressant prescription within the twelve months following injury and reported that 9.2% of participants (n = 551) developed post-traumatic depression (Ahl *et al.*,2017). Findings suggest that those meeting the criteria for post-traumatic depression had significantly longer stays in hospital (Mean = 15 days, SD = 23 vs. Mean 6 days, SD = 13, $p < 0.001$) and required a higher rate of admission to ICU (39.2% vs. 17.4%; $p < 0.001$), (Ahl *et al.*,2017). Approximately 25% of participants met the screening criteria for post-traumatic depression at follow-up and up to 50% reported symptoms of anxiety and depressed mood in the longer term (Ahl *et al.*,2017). Again this study, while not of military personnel supports the suggestion that physical trauma impacts on the mental health of individuals with physical injuries in the longer term and supports the idea that monitoring of mental health following traumatic injury should be extended well beyond the acute phase of injury.

While there are very few prospective studies of physical combat-related injuries reported within the literature, there are a number of large retrospective studies of combat injury and mental health reported within the U.S. military. Caution should be exercised in the interpretation of these results however as many studies of this kind focus on, or at least include (fail to exclude) military personnel with TBI. While TBI is certainly a significant feature of military trauma and is worthy of consideration, there is clear evidence to support the suggestion that acts as a confounding factor in the assessment of post-injury mental health (Hill *et al.*, 2009) due to the considerable overlap in presentation with PTSD (Vasterling et al, 2009).

Within their study of 4,980 military personnel with Mean age of 25.5 years (SD = 6.1) with physical combat-related injuries sustained on military operations in Iraq and Afghanistan between 2002 and 2011 Chin and Zeber (2020) sought to investigate the relationship between TBI/physical combat injury and anxiety and mood disorders, adjustment reactions, schizophrenia and other psychotic disorders, cognitive disorders, and post-traumatic stress disorder. Health records were accessed for participants drawn from all branches of the U.S. military but the majority of physical injuries were found in U.S. Army (72%) or U.S. Marine Corps (25%) personnel. Comprehensive review of participants medical records and the categorisation of mental health diagnosis using six ICD-9-CM codes with minor modifications provided mental health diagnoses (anxiety disorders, mood disorders, adjustment reactions, schizophrenia and other psychotic disorders, cognitive disorders, and PTSD), injury severity was assessed using ISS and the Barell Injury Matrix (Barell *et al*., 2002) was used to assess TBI.

Finding suggested that that 71% of participants met the criteria for at least one mental health condition, and the adjusted risk conferred by TBI ranged from a modest increase for anxiety disorder (OR 1.27, 95% CI 1.11–1.45) to a large increase for cognitive disorder (OR, 3.24, 95% CI, 2.78–3.77) and that TBI was associated with a higher incidence of mental health diagnoses (Incidence Rate Ratio (IRR) 1.52. 95% CI 1.42-1.63), (Chin and Zeber, 2020). Concluding that combat associated TBI had a broad effect on a range of mental health diagnoses in military personnel with physical combat-related injury the study asserted that early recognition and treatment for trauma-associated mental health is crucial to improving outcomes among service personnel (Chin and Zeber, 2020).

Currently, there are no similar studies investigating the relationship between trauma- and stressor- related disorder, presence of symptoms of PTSD, PTSD, general mental health or alcohol misuse, and combat related injury within the U.K. military context. As such, this current study significantly contributes to the scientific understanding of the trauma- and stressor- related and mental health consequences of combat injury.

More recently, subsequent research conducted within the U.S. Military has confirmed the link between physical combat-related injury and mental health morbidity. In their retrospective case-matched cohort study of 7,787 combat-injured U.S. military personnel (matched 1:1 to combat-deployed, uninjured service members) Walker *et al*., (2021) report that compared to non-injured service members, injured service members had higher observed incidence rates per 100 person-years for both depression (10.4 vs. 5.7), and anxiety (9.1 vs. 4.9). Prevalence of depression was estimated at 45%, and anxiety at 39%. (Walker et al., 2021). In the unadjusted model, physical combat-related injury was associated with more than double the risk of development of depression (HR 2.34, 95% CI 2.23–2.46; $p<.001$) and anxiety (HR 2.29, 95% CI 2.17–2.42; $p<.001$). Adjusting for sociodemographic, injury status, health behaviours, and other diagnoses the risks of depression (HR 1.47, 95% CI 1.36–1.58) and anxiety (HR 1.34, 95%CI 1.24–1.45) remained elevated for those with physical combat-related injury.

Citing previous work undertaken by their research group Walker *et al.* (2021) comment that they had previously hypothesized that exposure to combat injury leads to adverse long-term health outcomes through multiple interacting and overlapping pathways, including mental health diagnoses, health behaviours, such as substance abuse, and inflammation (Howard *et al.*, 2018). These findings based on a three-year follow-up suggest that physical combat-related injury is a significant risk factor for the development CMD and that the long term effects of traumatic injury

2.3.3. Comorbidity

While Post-Traumatic Stress Disorder (PTSD) has tended to dominate the focus of military mental health research (Wessely, 2005b) comorbidity in PTSD is the norm rather than the exception (O'Donnell *et al.,* 2004a). In large community (civilian) samples, between 80% and 85% of individuals (male and female) with a diagnosis of PTSD also meet criteria for at least one other psychiatric condition (Creamer, Burgess and MacFarlane, 2001). In early studies of comorbidity, individuals with a diagnosis of PTSD were found to have a 7-fold increase in depression, 6-fold increase in generalized anxiety disorder, 3-fold increase in drug abuse and a 2-fold increase in alcohol abuse (Kessler *et al.,* 1995). Meta-analysis of psychopathology following civilian trauma demonstrates that increased rates of generalised anxiety disorder, substance abuse, phobias, and major depressive disorder occur following exposure to traumatic events (Brown *et al.,* 2000). The military literature mirrors these findings and suggests that military personnel are at risk of symptoms of anxiety, depression, alcohol and substance misuse, anger, sleep disturbance, somatisation, dissociation and sexual problems following exposure to traumatic events in the same way as their civilian counterparts (Goff *et al.,* 2007). Currently, the literature supports the suggestion that these additional symptoms (particularly depression and anxiety symptoms) are more likely in soldiers with PTSD than those without (Ramachand *et al.,* 2015).

2.4. Alcohol Misuse

Alcohol misuse is common in both U.K. and U.S. military populations (Fear *et al.,* 2007; Jacobson *et al.,* 2008; Rona *et al.,* 2010; and Bray *et al.,* 2009 and 2013). Historically, 'the drinking culture' within the U.K. military has been seen as a 'medium of sociability' facilitating the breaking down of barriers between individuals and groups (Hockey, 1986). Military culture has often promoted excessive alcohol consumption (Iversen *et al.,* 2007 and Verrall, 2011) in order to promote 'bonding' or 'unit cohesion'. In this sense it is likely that it has contributed strongly to the development of a sense of belonging (see Section 2.5.2.5. Community Level Factors) and to an overall feeling of camaraderie (see Section 3.6.5.2. Camaraderie) and that this process has positively influenced the psychological resilience of UKAF personnel.

A large population-based survey of U.S. military personnel between 1998 and 2008 indicated significant increases in heavy drinking[8] (15 to 20%) and in binge drinking[9] (35 to 47%), among those with combat exposure (Bray *et al.,* 2013), and these findings are replicated within studies of U.K. military personnel (Iversen *et al.,* 2007). Evidence links heavy drinking and increased incidence of accident, injury, and occupational, relational, and legal problems in military personnel (Mattiko *et al.,* 2011). In military and civilian studies alike, there is evidence that, alcohol use or dependence is the most common co-occurring disorder in males with PTSD (Jacobsen *et al.,* 2014), while in females with PTSD, alcohol use or dependence is second only to depression and anxiety disorder (Jacobsen *et al.,* 2014). Recent U.K. studies demonstrate that military personnel with 'risky' drinking habits were more likely to be identified as having possible mental health problems (Aguirre *et al.,* 2014b) and AUDs are frequently

[8] WHO define 'Heavy Drinking' as: "A pattern of drinking that exceeds some standard of moderate drinking or – more equivocally – social drinking. Heavy drinking is often defined in terms of exceeding a certain daily volume (*e.g.* three drinks a day) or quantity per occasion (*e.g.* five drinks on an occasion, at least once a week) (WHO, 1994).

[9] WHO define 'Binge Drinking' as: "A pattern of heavy drinking that occurs in an extended period set aside for the purpose. In population surveys, the period is usually defined as more than one day of drinking at a time. The terms "bout drinking" and "spree drinking" are also used for the activity, and "drinking bout" for the occasion. A binge drinker or bout drinker is one who drinks predominantly in this fashion, often with intervening periods of abstinence (WHO, 1994)

associated with increased long-term depressive and post-traumatic stress symptoms (Sampson *et al.,* 2015). Additionally, psychiatric comorbidities contribute significantly to the association between impairment and alcohol misuse outcomes (Romeis *et al.,* 1999 and Rona *et al.,* 2010).

Within the UKAFs, 67% of men and 49% of women scored 8+ (defined as hazardous drinking) on an Alcohol Use Disorders Identification Test (AUDIT; Babor *et al.,* 2001) when surveyed in 2003, compared to 38% of men and 16% of women in the general U.K. population (Coulthard *et al.,* 2002 and Doherty *et al.,* 2017). Rates of hazardous drinking, alcohol dependence and alcohol related harm are reported as being consistently higher in U.K. military populations than in the general U.K. population (Fear *et al.,* 2007 and Henderson *et al.,* 2009).

Contemporary estimates suggest that 44% *(n*=47,582) of U.K. military personnel completing a brief alcohol screening tool (AUDIT-C) were either at lower potential risk of alcohol-related harm or were non-drinkers (MoD, 2017). In comparison, 61% *(n*=66,958) of personnel scored ≥5 on the AUDIT-C brief measure indicating an elevated risk of alcohol-related harm, and 2% *(n*=2,502) reported alcohol use behaviours indicating increasing or higher risk of alcohol-related harm (scoring 10-12) requiring General Practitioner (GP) referral (MoD, 2017). While these figures appear to represent a (slight) reduction in levels of hazardous drinking, the pilot study suggested 65% of personnel scored ≥ 5 on the AUDIT-C brief measure (Aguirre *et al.,* 2013b) and caution, therefore, must be observed when drawing this conclusion. It may be that the reduction may equally relate to changes within military culture and in institutional acceptance of alcohol within all three services (Browne *et al.,* 2008), leading to the under reporting of consumption. Despite consistent programmes of health promotion and education and institutional change it would appear that excessive alcohol consumption continues to represent a significant issue (Aguirre *et al.,* 2013b).

Heavy drinking within the U.K. military is reported in 17% of men and 9% of women, and (in males only) is associated with a number of factors including being <25 years of age, being single, being a current smoker, having no children living at home, serving in the Royal Navy (RN) or British Army, being an Other Rank (OR) rather than a Commissioned Officer, having deployed on military operations, being employed in a combat role and having a parent with a drink or drug problem (Fear *et al.,* 2007). There is also evidence supporting the assertion that deployed military personnel (significantly in those who thought they might be killed or who experienced hostility from civilians) demonstrate a greater increase in alcohol consumption and binge drinking when compared to those military personnel not deployed (Hooper *et al.,* 2008).

Binge drinking is reported in 48% of men and 31% of women, and is associated with being (in males) <25 years of age, being single, not having children, being white, being a current smoker and having a parent with a drink or drug problem (Fear *et al.,* 2007). In females, findings were generally consistent with those in the male group but was also associated with being of a lower rank, while there was no association with parental drink or drug problems (Fear *et al.,* 2007). While findings were generally consistent with a comparable U.S. study (Stahre *et al.,* 2009) evidence of functional impairment demonstrated in the U.K. study (Rona *et al.,* 2010), was not evident in the U.S. study.

Research evaluating psychological hardiness (dispositional resilience), as a marker for alcohol misuse risk in serving U.S. military personnel following operational deployment, identified that individuals demonstrating lower levels of hardiness (dispositional resilience) had increased risk of alcohol abuse (Bartone *et al.,* 2012 and 2014).

The core neurobiological alteration in PTSD is hyperarousal (Ford and Russo, 2006). Hyperarousal, hypervigilance and re-experiencing can lead to self-medication with alcohol or other drugs in an attempt to relieve anxiety, increase alertness, avoid traumatic memories, increase emotional numbing and social detachment (Corrigan and Cole, 2008). Bartone *et al.* (2014) suggest that 'avoidance coping' was similarly predictive of alcohol misuse risk. Within U.S. (Iraq and Afghanistan era) veterans, evidence suggests that increased psychological resilience is inversely related to alcohol misuse and is protective against alcohol misuse over time (Green *et al.,* 2014). It is clear that psychological resilience is a predictive and protective factor of/against alcohol abuse and dependence.

2.5. Psychological Resilience

The first examples of the study of psychological resilience within the military context came in the mid-to-late 1980s and mirrored work conducted within the civilian environment (Wald *et al.,* 2006). From an early point, work within the military context focused upon gaining an understanding of the protective processes involved in the promotion of positive adaption rather than simply identifying protective factors (Fikretoglu and McCreary, 2012), and emerged in parallel with the on-going work in the area of Post-Traumatic Stress Disorder (PTSD) research (Elder and Clipp, 1989; Agaibi and Wilson, 2005; Paton, 2006 and Solomon *et al.,* 2007).

Early studies of military personnel identified a number of resilience factors that appeared to have a protective effect on individuals and to promote positive adaption in those exposed to conflict. 'Calmness under pressure', 'intellectual control', 'acceptance of fear' and a 'lack of excessively violent or guilt-arousing behaviours during combat' all appeared to play a significant part in preventing the development of PTSD in Vietnam veterans (Hendin and Haas, 1984). These findings are further supported by subsequent studies identifying 'individual' or 'internal' protective factors like: problem-focused coping (Solomon, Mikulincer and Avitzur, 1988); adaptive attribution styles following combat exposure/military service (Mikulincer and Soloman, 1988 and Elder and Clipp, 1989); perceived beneficial effects of military service (Aldwin, Levenson and Spiro, 1994) and hardiness (dispositional resilience) (Bartone, 1999).

2.5.1. Psychological Resilience – Definitions

While there has been significant interest in psychological resilience within the field of military psychology, military psychologists are no closer to adopting a single definition of resilience than their civilian counterparts (Sinclair *et al.,* 2014). In a systematic review of the psychological resilience literature, the Centre for Military Health Policy Research in the United States, identified 122 potential definitions of psychological resilience in 270 different publications (Sinclair *et al.,* 2014). While the review concluded that there was a lack of a universally agreed definition, the multiplicity of definitions found in the literature offered a number of common features (Meredith *et al.,* 2011). As in much earlier work (Masten, 1990 and 1994), the identification of common features allows for the classification of the various definitions of psychological resilience into three main sub-types: basic definitions, *i.e.* definitions that describe resilience as a process or capacity that develops over time (Connor and Davidson, 2003; Bonanno, 2004; Lepore and

Revenson, 2006 and Bartone *et al.,* 2007); adaptation-based definitions that incorporate the concept of "bouncing back," adapting, or returning to a functional baseline after experiencing adversity or trauma (Rutter, 1999; Masten, 2001; Bonanno, 2004 and 2006 and Hoge *et al.,* 2007); and growth-based definitions that incorporate an element of growth following an experience of adversity or trauma (Luthar and Cicchetti, 2000; Luthar, Cicchetti and Becker, 2000; Connor and Davidson, 2003 and Rosner and Powel, 2006).

While a significant number of the definitions offered within the literature are centred on 'capacity', *i.e.* the ability to cope with stress, without explicitly including the concept of adaptation or "bouncing back" (Letourneau *et al.,* 2001 and Mancini and Bonanno 2006), the majority of the definitions offered emphasize an adaptive process of some kind (Fredrickson *et al.,* 2003 and Jensen and Fraser, 2005), and some of the definitions offered advance the idea that the process of resilience involves improvement or growth following adversity (Connor, 2006 and Punamaki *et al.,* 2006). For the purpose of this study, as with the wider HCTP (Alexander, Klein and Forbes, 2013), the underpinning definition of psychological resilience is that offered by Luthar, Cicchetti & Becker (2000) where psychological resilience is seen as "positive adaptation in the face of stress or trauma".

2.5.2. Factors that Promote Psychological Resilience

Military research on psychological resilience typically finds itself invested in identifying vulnerability and protective factors that modify the negative effects of adversity or exposure to traumatic events and in the subsequent identification of mechanisms or processes that may be employed to promote positive outcomes (Luthar, 2000). Protective factors modify the individual experience of traumatic events in some way to promote positive adaption in the face of significant adversity or to mitigate the effects of that exposure (Meredith *et al.,* 2011).

Following an extensive literature search, Meredith *et al.,* (2011) screened 340 sources on psychological resilience, programs and strategies provided by the U.S. military and civilian sectors alike, in order to identify factors that promote psychological resilience. Following screening they identified 20 factors as promoting psychological resilience (Meredith *et al.,* 2011). The range of protective factors identified within the military context (Meredith *et al.,* 2011) is described as operating within four distinct levels of conceptual focus - the individual, family, community and unit. Following the review of the considered evidence, only five of the potential resilience factors were rated as being strongly supported (*i.e.* where there was clear and consistent evidence based on RCT or longitudinal analysis). These factors were: Positive Coping, Positive Affect, Positive Thinking (individual factors), Support (family factor) and Belongingness (community factor) (Meredith *et al.,* 2011).

2.5.2.1. Positive Coping (individual factor)

Positive coping is identified as that process by which individuals channel resources to manage taxing circumstances, actively seek to solve personal and interpersonal problems, and seek help to manage stress or conflict. Positive coping includes active (Haglund *et al.,* 2007), pragmatic, problem-focused and spiritual approaches to coping (Solomon *et al., 1*998; Conger *et al., 1*999; Williams *et al.,* 2004; Hoge *et al.,* 2007 and Maddi, 2007).

More recently, studies within the military context have also provided strong evidence for the inclusion of positive coping as an individual protective factor. Investigating the effects of the mental-health programme, *Boot Camp Survival Training for Navy Recruits – A Prescription* (BOOT STRAP), on new entrants to the U.S. Navy *(n*=801), Williams *et al.* (2004) identified that an increased sense of belonging, a reduction in loneliness and a decrease in insecure attachment were all reported by those undertaking training in positive coping. Within the context of the BOOT STRAP programme, positive coping training included sessions intended to promote the alteration of faulty thinking patterns, a sense of belonging and of peer relationships, and the self-assessment of emotional reactivity, as well as a number of general tips for coping and stress management. The programme, which resulted in an increase in the demonstrated problem-solving coping skills of recruits, led to a significant increase in those completing basic training (from 74% in the non-intervention group to 86% in the BOOT STRAP group) and a significant improvement in both recruit functioning and performance over the nine-week basic training package (Williams *et al.,* 2004).

Similarly, a cross-sectional and longitudinal study of 262 male soldiers identified by the Israel Defense Forces (IDF) as having a combat stress reaction (CSR) following combat exposure during the Lebanon War (1982) assessed the effects of locus of control, coping and social support on Post-Traumatic Stress

Disorder (PTSD), and reported a significant reduction in the intensity of PTSD over time (two and three years' post-exposure), concluding that this represented a process of recovery (Solomon *et al., 1*988). While in the second and third years of follow-up an increase in the intensity of PTSD was associated with an external locus of control, the use of emotion-focused coping and insufficient social-support, there was evidence to support the positive influence of problem-focused coping in the shorter term. Findings indicated that in the second year of follow-up problem-focused coping was inversely associated with the intensity of PTSD. In the third year, the predominant coping style was one characterised by distancing (Solomon *et al., 1*988). These results, at worst, indicate that while problem-focused or positive coping is only effective for a period of two to three years, it is certainly more effective than emotion-focused coping.

In contrast with these findings, Solomon *et al. (*1988) highlighted that emotion-focused coping was more effective than problem-focused coping when dealing with technological disaster. This observation is consistent with previous findings and suggests that, in situations where there is little control over the events being experienced, problem-focused coping may prove frustrating and non-productive (Baum, Fleming, and Singer 1983).

2.5.2.2. Positive Affect (individual factor)

Resilient individuals are often characterized as demonstrating an energetic and zestful approach to life (Tugade and Friedrickson, 2004) and a robust sense of humour (Haglund *et al.,* 2007), which they actively utilise in conjunction with relaxation (Demos, 1989 and Wolin and Wolin, 1993) and optimistic thinking (Kumpfer, 1999) to develop or 'cultivate' their positive emotionality (Werner and Smith, 1992). Positive affect facilitates positive adaption, supports the development and maintenance of emotional resources and enhances positive coping methods (Folkman and Moskowitz, 2000). Positive affect has also been associated with decreased occurrences of stress-related illnesses and mood-disturbance and reduced utilisation of medical services (Scheier *et al., 1*989; Zeidner and Hammer, 1992 and Carver *et al., 1*993).

The impact of positive affect has been strongly demonstrated in a number of studies evaluating its effect on cardiac health (McCraty *et al., 1*995 and McCraty, Atkinson and Tomasino, 2003). One U.S. study of hospitalized patients (*n*=60) with Congestive Heart Failure (CHF) identified that 17% of participants interviewed met the DSM III criteria for major depression (Freedland *et al., 1*991). Study findings indicated that those patients meeting the diagnostic criteria for major depression remained in hospital for longer periods and, at one year, exhibited greater mortality (Freedland *et al., 1*991). In a subsequent randomised-control study (incomplete randomisation, *n*=33), a sample of 14 elderly patients with CHF attending a ten-week stress training programme were assessed in order to evaluate the effects of that programme on depression, stress, optimism, anxiety and emotional distress, as well as on their functional capacity and heart rate variability (Luskin *et al.,* 2002). Statistically significant improvements were noted in perceived stress, emotional distress, optimism and depression, as well as in functional capacity (as assessed by 6-minute walk) and heart rate variability when compared to the control group.

Resilient individuals are often characterised as possessing a robust sense of humour (Haglund *et al.,* 2007). The use of humour has long been identified as being a positive, adaptive and mature defence mechanism (Valliant, 1977) which may be utilised to cope with stressful or traumatic experiences in a range of populations, *e.g.* in military personnel (Hendin and Haas, 1984); cancer patients (Culver *et al.,* 2002); in civilians subjected to bombing and air raid (Gavrilovic *et al.,* 2003); and in patients with end-stage renal failure (Svebak *et al.,* 2006). Humour is used to diminish the effects of threatening or stressful situations through cognitive reappraisal or reframing (Folkman, 1997), *i.e.* adopting a more positive perspective on the situation, and it is often used to achieve a level of detachment or distancing from traumatic events and to foster group cohesion and social support (Kuiper, 2012). In addition, there is considerable evidence to support the long-held anecdotal view that individuals working in high stress environments, *e.g.* military personnel, emergency service personnel or those working in clinical environments, use 'black', 'cynical' or 'gallows' humour to manage stressful situations and to safely express their feelings (Van Wormer and Boes, 1997; Rowe and Regehr, 2010 and Kosenko and Rintamaki, 2010). While there are a number of observational studies demonstrating the use of 'black' humour as an effective coping mechanism within high-stress environments, there are an increasing number of studies that highlight that the use of humour can also be maladaptive, *i.e.* when masking strong emotions or pain, or where 'cynical' humour is used to exclude others (Kosenko and Rintamaki, 2010). The maladaptive use of humour may give the outward appearance of coping while also being associated with increased cardiovascular disease, greater body mass, and increased smoking (Kerkkänen, Kuiper and Martin, 2004). While there is ample evidence to support claims that a sense of humour promotes coping in traumatic situations, contributes to the enhancement of positive life experiences, and promotes positive affect and psychological well-being, there is little evidence that a sense of humour results in positive growth and a "bounce-back from adversity," as would be predicted by resiliency models (Windle, 2011).

2.5.2.3. Positive Thinking (individual factor)

Where positive affect is focused on positive emotions, positive thinking is related to individuals' ability to refocus or reframe their experiences in ways that are more positive, constructive or that enable them to make sense of challenging circumstances. The concept of positive thinking encompasses a number of elements related to the 'understanding' or 'framing' of life-experiences (Meredith *et al.,* 2011). Positive affect and positive emotions act to promote efficient thinking (Isen and Mearns, 1983); flexibility (Isen and Daubman, 1984); creativity (Isen *et al., 1*987); integrative thinking (Isen *et al., 1*997).

2.5.2.4. Family Level Factors

There are a number of family evidence-informed resilience factors that promote positive adaption identified within the literature, these include: Emotional Ties, Communication, Closeness, Nurturing and Adaptability (Meredith *et al.,* 2011). Within the family context the only evidence-informed resilience factors that was strongly supported by evidence was 'Support'. The family-level resilience factor of support is defined as being the perceived emotional, tangible, informational, and spiritual comfort available from and provided to others (Meredith *et al.,* 2011). Additionally, high marital support was found to significantly reduce the association between economic pressure and emotional distress Conger *et al.,* (1999).

2.5.2.5. Community Level Factors

Once again, there are a number of community level factors that promote positive adaption identified within the literature, these include: Belongingness, Cohesion, Connectedness and Collective Efficacy (Meredith *et al.,* 2011). Within the community-level the only resilience factor that was strongly supported by evidence was Belongingness.

Belongingness is defined as including social integration; group membership or participation in spiritual/faith-based organizations and can operate through cultural symbolic structures and systems (Meredith *et al.,* 2011). Belongingness, assessed as strong community spirit, was associated with low rates of PTSD and high subjective well-being scores (Hautamaki and Coleman, 2001), the parallels between belongingness in the community and within military populations is clear.

2.5.2.6. Unit Level Factors

While there was evidence that a number of factors promote psychological resilience and positive adaption within military units, there was a lack of evidence meeting the criteria for strong evidence within this context. Proposed evidence-informed resilience factors at unit level included, Positive Command Climate, Teamwork and Cohesion (Meredith *et al.,* 2011).

2.5.3. The Measurement of Psychological Resilience

There are a number of difficulties associated with the consistent and accurate assessment of psychological resilience in individuals (Atkinson *et al.,* 2009). Given the widespread disagreement regarding the nature and definition of psychological resilience this seems to be an almost insurmountable difficulty when trying to reach a consistent means by which to measure the construct. Additionally, the wide variation in age groups and contexts in which the measurement of psychological resilience is attempted and the predominately qualitative nature of the studies in those fields (Gillespie *et al.,* 2007) make a 'one size fit all' approach to assessing resilience difficult (Atkinson *et al.,* 2009). In studies of children and adolescents, for example, 'competence' is often used as the main outcome, *i.e.* the achievement of social, developmental and educational milestones appropriate to the stage of development of the group studied, while in adults self-reported 'well-being' or 'distress' are more often used as the main outcome measures (Atkinson *et al.,* 2009).

The conceptualisation of psychological resilience as a fixed and stable character trait, however, has led to numerous attempts to identify the component factors of psychological resilience and its measurement using techniques of psychometric testing (Connor and Davidson, 2003). Measures utilised in this regard often depend upon self-reporting and are subject to a number of well-established methodological issues that will be further discussed in relation to the findings of this study.

2.6. Conclusion

The discussion of PTSD in this chapter answers three fundamental questions. Firstly, "What is the reported prevalence of PTSD in the general UKAF service population (without physical combat-related injury)?", secondly, "Is there sufficient evidence in the literature to support the hypothesis that physical combat-related injury may, in itself, be a risk factor/predictor for PTSD?" and thirdly, "What new challenges does the emergence of Complex Post-Traumatic Stress Disorder (CPTSD) present?". Prevalence of PTSD in the general UKAF service population as estimated by the King's Centre for Military Health Research (KCMHR) Health and Wellbeing of UK Armed Forces cohort study (reported in Stevelink *et al*., (2018)) is estimated as being 6.2%. While there are no prospective studies of PTSD in UKAF personnel following physical combat-related injury evidence drawn from large retrospective studies of U.S. Military personnel following combat injury suggest that rates of PTSD are significantly elevated (Grieger et al. 2006: Macgregor et al., 2013: Walker et al., 2021) and these findings confirm the hypothesis that physical combat related injury is associated with increased PTI. Consideration of the emerging diagnosis of CPTSD, recent evidence suggests that CPTSD may be more prevalent (Murphy et al., 2020) and more debilitating that PTSD (Murphy *et al.,* 2021). These are disturbing findings as they suggest that estimating PTSD within study populations fails to fully explore the range and impact of wider PTI. This will be cited as a limitation of this study.

The discussion of CMD in the second section of this chapter answered the key questions "What is the reported prevalence of CMD in the general UKAF service population (without physical combat-related injury)?", secondly, "Is there sufficient evidence in the literature to support the hypothesis that physical combat-related injury may, in itself, be a risk factor/predictor for CMD?" and thirdly, "What is the relationship between PTSD and CMD?". Again, the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study (reported in Stevelink *et al*., (2018) reports the prevalence of

CMD *i.e.* psychological distress, characterised by depressive and anxiety disorders (Goldberg & Huxley, 1992) in the general UKAF service population to be 21.9% (95% CI 20.75–23.01; n = 1739). Again, evidence drawn from large retrospective studies of U.S. Military personnel following combat injury suggest that rates of CMD are significantly elevated (Chin and Zeber 2020 and Walker *et al*., 2021) and these findings confirm the hypothesis that physical combat related injury is also associated with increased CMD. Both of these studies (Chin and Zeber 2020 and Walker *et al*., 2021) corroborate earlier findings (Kessler *et al.,* 1995; Brown *et al.,* 2000 and O'Donnell *et al.,* 2004a) that comorbidity in PTSD is the norm rather than the exception.

Discussion of Alcohol Use Disorder within the context of the general UKAF service population and within the wider context of physical combat related injury considering its relationship to both CMD and PTSD confirms that rates of hazardous drinking, alcohol dependence and alcohol related harm are reported as being consistently higher in U.K. military populations than in the general U.K. population (Fear *et al.,* 2007 and Henderson *et al.,* 2009) and that military personnel with 'risky' drinking habits were more likely to be identified as having possible mental health problems and that AUDs are frequently associated with increased long-term depressive and post-traumatic stress symptoms (Aguirre *et al.,* 2014b; Sampson *et al.,* 2015).

Finally, in relation to resilience the discussion reaffirms that while military psychologists are no closer to adopting a single definition of resilience than their civilian counterparts (Sinclair *et al.,* 2014) there is some agreement that protective factors modify the individual experience of traumatic events in some way to promote positive adaption in the face of significant adversity or to mitigate the effects of that exposure (Meredith et al., 2011). The literature suggests that protective factors identified within the military context (Meredith *et al.,* 2011) is described as operating within four distinct levels of conceptual focus - the individual, family, community and unit and that positive coping, positive affect, positive thinking, support offered within the family, a sense of belonging and camaraderie all play an important part in maintaining resilience. For the purpose of this study, as with the wider HCTP (Alexander, Klein and Forbes, 2013), the underpinning definition of psychological resilience is that offered by Luthar, Cicchetti & Becker (2000) where psychological resilience is seen as "positive adaptation in the face of stress or trauma".

Based on these conclusions a number of initial working hypotheses related to prevalence, comorbidity and coping have been formulated (see below) these hypotheses will be developed fully in Chapter Four prior to testing in Chapter Six

Hypothesis 1:

Physical combat-related injury is a predictor of PTSD, CMD and AUD (Prevalence).

Hypothesis 2:

PTSD is a predictor of CMD and AUD (Comorbidity).

Hypothesis 3:

Physical combat-related injury negatively impacts on psychological resilience (Coping).

Discussion within this chapter clearly demonstrates that, at present there is no significant discussion of the relationship between physical combat-related injury in UKAF personnel and mental health morbidity. This doctoral study seeks to provide some insight into that critical gap in the literature. Building on these findings the next chapter will explore a range of potential risk factors associated with the development of post-traumatic illness, common mental disorders and alcohol misuse following physical combat-related injury.

Figure 1: That 2,000-Yard Stare, Tom Lea (1944)
Permissions Granted: U.S. National Constitution Centre

CHAPTER THREE: POTENTIAL RISK FACTORS AND PREDICTORS FOLLOWING PHYSICAL INJURY

3.1. Introduction

Since the late 1940s, studies highlighting the impact of the combat environment on military mental health have attempted to explain the relationship between combat exposure and the development of post-traumatic illness and mental health (Grinker *et al.,* 1945; Kardiner *et al.,* 1947; Weathers *et al.,* 1995; Fontana *et al.,* 1999 and Osório *et al.,* 2017). Meta-analyses have identified several risk factors for PTSD in both the military (Iversen *et al.,* 2008) and the general population (Brewin *et al.,* 2000b and Ozer *et al.,* 2003) in terms of pre-, peri- and post-trauma factors.

Even though the research literature on traumatic injury is not yet sufficiently advanced to differentiate whether some types of injury are more likely to elicit emotional traumatic responses than others (O'Donnell *et al.,* 2008), epidemiological data suggest that traumatic events, such as those involving interpersonal violence result in higher rates of PTSD (Walsh *et al.,* 2013). Further studies are required to investigate in-depth whether there are key mechanisms inherent in certain physical injuries that increase the risk of poor psychological outcomes.

Over the past twenty years there has been a particular interest in the psychological consequences of physical injury caused by a traumatic event among survivors of road traffic incidents, terrorism, criminal assault, and burn injuries (O'Donnell *et al.,* 2003). Physical combat-related injuries have consistently been linked with deficits in mental and physical health functioning (Woodruff *et al.,* 2017).

In one of the few studies that have attempted to identify predictors of PTSD following physical combat-related injury, Koren *et al. (*2005) directly compared, in a matched case-control design, injured and non-injured Israeli soldiers who experienced the same combat events to estimate the unique contribution of physical injury, over and above that of the trauma itself, to the subsequent development of PTSD. Consistent with the outcome of some earlier studies (Kulka *et al.,* 1990; and Michael *et al.,* 1999, their findings unequivocally indicated that bodily injury is a risk factor for PTSD – rather than a protective one. Approximately fifteen-months post-injury, 16.7% of injured soldiers had been diagnosed with PTSD compared to 2.5% of non-injured soldiers with similar combat experiences. Moreover, the data also suggested that the odds of developing PTSD following traumatic injury are approximately eight times higher than following injury-free trauma. Interpretation of the validity of these figures requires careful analysis of such factors as the intensity of combat; whether the data were from reservists or full time troops; whether the data derived from self-report or from structured clinical interviews; whether the psychopathology was genuinely combat-related, and how long after deployment the surveys were conducted. Moreover, objective measures of physical injury are often not related to PTSD outcome. High levels of physical problems, chronic pain, and seeking of medical care are often seen in patients diagnosed with PTSD. However, the relationship of pain and other physical problems shortly after injury to PTSD outcome has not been well studied. Thus, it is not clear what factors contribute to low initial rates of PTSD.

The benefits of identifying the risk factors associated with post-traumatic illness (PTI) and common mental health disorders (CMD) are clear. The early identification of those deemed to be 'at risk' of developing common mental health disorders (CMD) and post-traumatic illness (PTI) and the targeting of early intervention with this group has the potential to significantly improve functional and psychological recovery after injury (Zatzick *et al.,* 2008). The first step in the prevention of PTSD in the civilian population is the recognition of patients who are at risk for it (Aaron *et al.,* 2011) consequently, the same must be true of military populations.

3.2. Aim and Review Questions

Problem Statement: Little is known about the specific risk factors associated with the development of post-traumatic illness or common mental health disorders in U.K. Armed Forces personnel following physical combat-related injury. Likewise, little is known about the factors which predict psychological resilience in this group.

3.2.1. Aim:

The aim of this systematic review is, therefore, to explore the potential risk factors associated with the development of common mental health disorders/post-traumatic illness and the potential predictors of psychological resilience following physical injury (related to combat).

3.2.2. Review Questions:

a. What are the potential risk factors associated with the development of common mental health disorders (CMD)/post-traumatic illness (PTI) in U.K. Armed forces personnel following combat injury?

b. What are the predictors of psychological resilience in U.K. Armed forces personnel following physical combat-related injury?

These are aetiology/causation type questions, primarily quantitative in nature and focusing on cohort and or case/control type research evidence.

3.3. Methods

The primary purpose of a doctoral literature review is the presentation of a systematic examination of relevant current research intended to distinguish the doctoral project from existing research in the field of study and to clarify the scope of the doctoral project through the refining of the research aim and research questions. In addition, a systematic examination of the literature within that field of study: assists in the further identification of important variables relevant to the doctoral project; helps to synthesise a new perspective on the subject area; identifies relationships between ideas and practice; identifies the context of the identified topic or problem; provides a rationalization of the significance of the problem or topic; facilitates the acquisition and enhancement of the subject vocabulary; demonstrates an understanding of the structure of the subject; relates ideas to theory and applications; identifies the main methodologies and research techniques that have been used; and helps to place the research into a historical context to show familiarity with state-of-the-art developments (Hart, 1998). A systematic review of literature should be conducted according to a peer review protocol to ensure its replicability (Bettany-Saltikov, 2016).

3.3.1. Search Strategy

There has been considerable discussion of post-traumatic stress, mental health and psychological resilience in the literature, however there has been little discussion of the risk factors associated with the development of post-traumatic illness and of common mental health disorders or the predictors of psychological resilience following traumatic bodily injury. The purpose of this review is, therefore, to review literature drawn from those areas of study, to critically discuss the contribution of the available literature and to synthesize new discussion of those subject areas within the military context.

The examination of current research in any field of study begins with a systematic search of authoritative subject databases. As the primary focus of this doctoral project is the role played by psychological resilience following combat injury and its mitigation of a range of traumatic and stressor related disorders in U.K. Servicemen and Servicewomen, the authoritative subject databases identified fall within the 'Nursing' and 'Psychology' subject areas. Within each of these subject areas a number of authoritative subject databases have been identified.

3.3.2. Authoritative Subject Databases

The systematic literature search was undertaken using two main subject gateways: ProQuest and EBSCO. These gateways play host to a range of authoritative subject databases and allow for an integrated and simultaneous search of each of these. For the purpose of this systematic review the following databases were searched through the ProQuest gateway: The Health & Medical Collection; Military Database; Nursing & Allied Health Database; PsycARTICLES; Psychology Database; PsycINFO and PTSDpubs (formerly PILOTS: Published International Literature on Traumatic Stress). The EBSCO gateway was used to access a range of medical, nursing and allied health journals cited in the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and MEDLINE gateways (for detail on the authoritative subject databases please see Appendix A: Authoritative Subject Databases).

3.3.3. SPIDER Search Tool

In order to ensure an exhaustive and comprehensive search of the literature, systematic literature reviews are based upon predetermined search strategies. The comprehensiveness of the search process and search strategy is a key factor in preventing bias and providing a true representation of available literature/research (Methley *et al.,* 2014).

Within quantitative research the PICO tool is commonly used to identify search terms for systematic reviews related to the Population to be studied, the planned Intervention, Comparison and Outcome(s) of the study in question. While the PICO search tool is used almost exclusively to conduct reviews within quantitative research designs, in practice it may be modified to specify 'Study Design' (becoming PICOS) for use within qualitative research designs.

The development of the SPIDER search tool was originally intended to address the lack of utility of the PICO tool within qualitative designs/studies (Cooke *et al.,* 2012). The SPIDER search tool provides researchers with the opportunity to specify both 'design' and 'research type' in order to increase the utility of the tool within qualitative and mixed-method studies (Methley *et al.,* 2014). While the SPIDER tool was developed to address the shortcomings of the PICO (and PICOS) tools within qualitative research, it may also provide increased utility in relation to the identification of literature within quantitative research.

Rather than focusing on the wider population, the SPIDER tool focuses directly on the sample to be studied and eliminates the 'Intervention', 'Comparison' and 'Outcome' elements of the PICO model. Rather, SPIDER focuses on the phenomenon of interest, the research design and the evaluation (outcomes) and research type (Cooke *et al.,* 2012).

While there is limited evidence to suggest that the use of PICO search tool (and modified PICOS search tool) results in a greater 'number of hits' (higher sensitivity) using subject databases, SPIDER searches demonstrate greater specificity (Methley *et al.,* 2014). It is likely therefore that, while the SPIDER search tool may be less sensitive (and yield fewer hits), its increased specificity will ensure that a higher percentage of those papers identified by the initial search will be included in the final review. There is, again, some evidence to suggest this will dramatically reduce the time and resources required to conduct the initial screening of results (Methley *et al.,* 2014).

This systematic literature review will utilise the SPIDER search tool (see Table 1: SPIDER Search Strategy/Search Terms) and will access a number of authoritative subject databases.

Table 1: SPIDER Search Strategy/Search Terms

Spider Tool*		
1	**S:** **Sample**	**UK service-personnel following combat injury** **Search Terms:** "military personnel" "service personnel" "combat injured population" "combat injuries" "combat injury" "physical trauma" AND PEER REVIEWED
2	**P of I:** **Phenomenon of Interest**	**Common mental health disorders (CMD)/post-traumatic illness (PTI) and psychological resilience following complex trauma (military and civilian)** **Search Terms:** "common mental health disorder" OR CMD "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") "psychological resilience" OR hardiness AND PEER REVIEWED
3	**D:** **Design**	**Cohort and or case/control studies** **Search Terms:** Cohort "Case control" AND PEER REVIEWED
4	**E:** **Evaluation**	**Associated risk factors (CMD) and predictors (PTI)** **Search Terms:** risk* OR predict* AND PEER REVIEWED
5	**R:** **Research type**	**Qualitative or mixed-method** **Search Terms:** Quantitative AND PEER REVIEWED

***Search [1 AND 2] AND [(3 OR 4) AND 5]**

3.3.4. Search Strategy

Initial search terms were identified using the SPIDER search tool (see Table 1: SPIDER Search Strategy/Search Terms). The SPIDER search strategy begins with simple searches using identified search terms within each of the individual categories, *i.e.* search terms related to the Sample, the Phenomenon of Interest, the Design, the Evaluation and finally the Research type. Following the initial individual category search phase combination searches using the Boolean Operators 'AND' and 'OR' in pairs and multiples of categories further refine the identification of literature (see Appendix B: Search Strategy (ProQuest and EBSCO).

3.3.5. Selection Criteria

Having identified a range of authoritative subject databases and a number of core search terms utilising the SPIDER search tool based upon existing MeSH descriptors, additional selection criteria were applied to further refine the scope of the literature search. The selection criteria applied were related to the population of interest, date of publication, type of publication and publication language. In order to further filter results the additional MeSH search terms 'Military Psychiatry [H02.403.690.508]' and 'War-Related Injuries [C26.946]' were used. Articles focusing on Mild Traumatic Brain Injury (mTBI) were excluded.

The population of interest for this doctoral project is U.K. service personnel who have sustained physical combat-related injury while serving on military operations in Afghanistan (OP HERRICK). The literature search has been extended, however, to include literature pertaining to adult individuals, military or civilian, sustaining physical injury because of a traumatic event *e.g.* Road Traffic Accident, Occupational/Work Place incident or combat/terror related incident.

The relatively recent emergence of the concepts of Post-Traumatic Stress Disorder (PTSD) and Psychological Resilience suggested that the literature search should be limited to include work published within the last 10 years (2009-2019).

Using the authoritative databases identified and the selected MeSH search terms the literature search is primarily intended to identify literature from peer-reviewed, high impact factor journals. The publication language should be English.

3.4. Results

The initial literature search was conducted in July 2019 using the ProQuest and EBSCO subject gateways and the authoritative subject databases (see above). The initial literature search produced 1,059 results (see Figure 2: PRISMA Diagram).

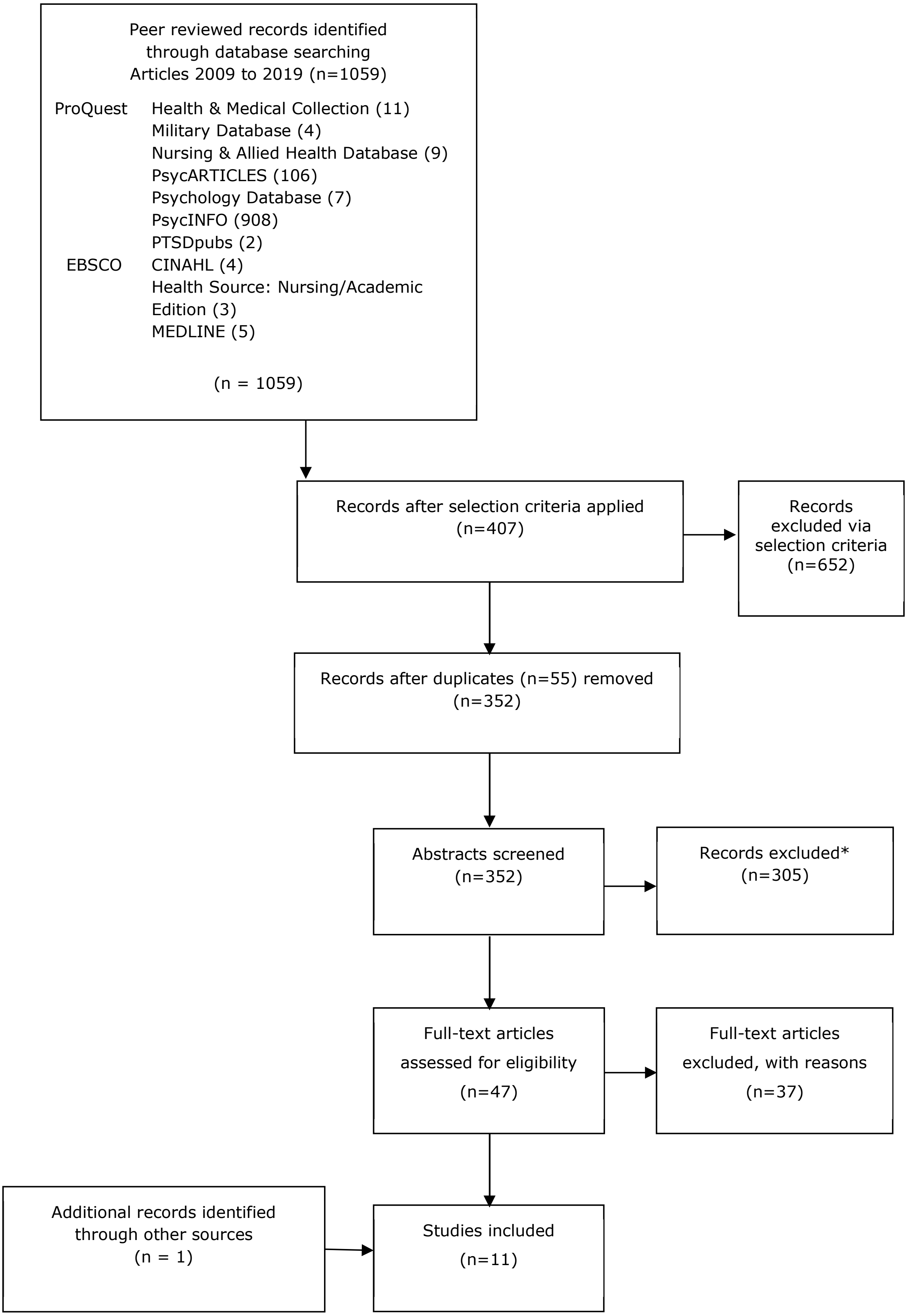
The bibliographic information of each paper was entered into the Endnote x9 reference management software package (version x9.2) produced by Clarivate Analytics (U.S.). The Endnote software permits the storage of bibliographic information and the subsequent storage of full-text PDF copies of downloaded papers. The software also allows the user to sort and organise downloaded literature for ease of access, data extraction and critical appraisal. An initial filter of identified articles using the selection criteria (see above) reduced the number of articles from 1,059 to 407 (excluded, *n*=652).

Following the initial screening of articles by selection criteria, the Endnote x9 reference management software was used to eliminate duplicate papers identified through two or more of the authoritative subject databases *(n*=55). This further reduced the number of articles to 352 and a subsequent comprehensive review of the title and abstract of each study was conducted to assure eligibility (Bettany-Saltikov, 2016). This further eliminated papers which did not meet the selection criteria *(n*=305), reducing the number of eligible papers to 47. In order to facilitate this process a Microsoft Excel spread sheet was compiled where each article was assessed using each of the selection criteria outlined above.

Review of the full-text articles *(n*=47) identified a further 37 papers which could be eliminated from the review, either because they did not deal with physical injury/trauma *(n*=12), discussed Mild Traumatic Brain Injury (mTBI) *(n*=15), or failed to identify either risk factors for common mental health disorders (CMD) or post-traumatic illness (PTI) or predictors of psychological resilience *(n*=10). This review of full-text papers left 10 papers as the subject of this systematic review. In addition to the 10 identified papers, 1 additional paper was identified through the full-text search that met all of the selection criteria. This paper (Russo *et al.,* 2013) was added to the review.

The articles identified in this systematic literature review represent a range of literature drawn from international sources published in English: United States *(n*=8); Australia *(n*=2); Germany *(n*=1); Turkey *(n*=1). None of the identified studies were conducted in the United Kingdom.

Figure 2: PRISMA Diagram



While all of the studies included participants with physical injury these were not exclusively military injury and included studies of civilian participants following motor vehicle accident (Carty *et al.,* 2011 and Gabert-Quillen *et al.,* 2012); mangled hand injuries (Cook *et al.,* 2017); unspecified civilian trauma (Russo et. *al.,* 2013 and Fletcher *et al.,* 2016); and industrial disaster (Taymur *et al.,* 2014).

3.4.1. Assessment of the Methodological Quality

Having identified a core set of eleven papers for the systematic review, an assessment of the methodological quality of the included papers was conducted to assess the generalisability, internal validity and reliability of the included work (Bettany-Saltikov, 2016). The generalisability (external validity) of a work refers to the degree to which the study observations/findings can be expected to apply to the population as a whole. Conversely, the internal validity of a study refers to the degree to which study observations are likely to be an accurate representation of the reality or truth for the participants.

The assessment of the methodological quality of literature selected for inclusion in the systematic review is a crucial step in the process as it facilitates the exploration of the effects that methodological error or bias may have on the quality of the overall results, conclusions and recommendations of cited work (Petticrew and Roberts, 2006). Methodological bias exists in all research, takes many forms (see Table 43: Types of bias and error (selected) (Bowling, 2009) and can occur at any point in the research process. It impacts on the validity and reliability of study findings and may lead to the misinterpretation of results and can significantly impact on practice (Smith and Noble, 2014).

The assessment of the methodological quality of literature selected for inclusion in the systematic review is also a crucial step in acknowledging study limitations. Study limitations represent methodological weaknesses that adversely impact on study findings/outcomes and conclusions (Ross and Bibler Zaidi, 2019). While authors are expected to highlight any limitations associated with their studies

The systematic assessment of the methodological quality of selected studies needs therefore to be based upon the consistent use of a reliable research critique framework and should include assessment of the research design, experimental hypothesis, operational definitions, the population and the study sample, the methods used to obtain the sample, the validity/reliability of the means by which the data has been collected and analysed and the overall generalisability of the work (Caldwell, Henshaw and Taylor, 2011). Rigorous methodological assessment may not eliminate bias from cited studies within a systematic literature review but it does aid in the identification of bias and reduces the risk of misinterpretation and misapplication of research findings.

In order to facilitate the critical analysis of the identified literature the McMaster University critical review form (Law *et al.,* 1998) was used. The critical review form was originally intended for the analysis of quantitative study designs within the Occupational Therapy setting, but has since been used extensively within other disciplines. The McMaster University critical review form has good utility and proven inter- and intra-rater reliability (Bettany-Saltikov, 2016).

The critical review form utilised within this study provides a detailed framework that allows for the systematic assessment of methodological quality in relation to: the study purpose, the literature used to justify the study, the study design, the sample (includes assessment of the justification of the study sample), the outcomes, interventions, results, the clinical importance of the study, attrition and finally of the conclusions and implications (See Appendix C: McMaster University Critical Review Form).

Within each section of the critical review form a brief summary of the study element was included along with the specific consideration of the following questions intended to highlight methodological error and study bias. In addition to a brief written summary the key questions are presented in Box 1: Critical Review Questions.

3.4.2. Data Extraction

Again, in order to assure the consistent extraction and evaluation of data from the identified studies a core data extraction form was devised using the SPIDER framework. A summary of the key findings from each study is included below (See Table 2: Data Extraction Table - Summary of Findings (Risk Factors) and Table 3: Data Extraction Table - Summary of Findings (Predictors of Psychological Resilience).

Box 1: Critical Review Questions

- Study Purpose
    - Was the purpose of the study stated clearly?
    - How does the study apply to your research question?
- Literature
    - Was the relevant background literature reviewed?
    - Does the literature justify the need for the study?
- Design
    - What was the study design?
    - Was the design appropriate for the study question?
    - Were there any biases in operation?
    - What was the direction of influence of any bias identified?
- Sample
    - Was the sample described in detail?
    - Was the sample size justified?
    - What ethical procedures were followed?
    - Was informed consent obtained?
- Outcomes
    - Were the outcome measures reliable?
    - Were the outcome measures valid?
- Intervention
    - Was the intervention described in detail?
    - Contamination was avoided?
    - Cointervention was avoided?
- Results
    - Were results reported in terms of statistical significance?
    - Were the analysis methods appropriate?
- Clinical Importance
    - Was the clinical importance reported?
- Attrition
    - Were drop-outs reported?
- Conclusions and Implications
    - What did the study conclude?
    - What are the implications of these results for practice?
    - What are the main limitations or biases in the study?

Table 2: Data Extraction Table - Summary of Findings (Risk Factors)

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Adams *et al.* (2016) The Association of Combat Exposure with Post Deployment Behavioural Health Problems Among U.S. Army Enlisted Women Returning from Afghanistan or Iraq	42,397 U.S. Active Duty or National Guard/ Reserve Women serving in Iraq and Afghanistan (2008-2011)	Retrospective analysis of large U.S. Army observational database constructed for the Substance Use and Psychological Injury Combat (SUPIC) study. Quantitative Research	US Army enlisted women reporting with any combat exposure had increased odds of PTSD, depression, or at-risk drinking. Large magnitude dose response identified, indicating increased odds of PTSD as combat exposure score increased.	**Combat Experience** **Ethnicity** **Parenthood** **Deployed Role: Healthcare Specialists**	4 Item - Combat Experiences Scale (CES), (Guyker *et al.,* 2013) Primary Care-PTSD (PC-PTSD), (Bliese *et al.,* 2008) Patient Health Questionnaire (PHQ-2), (Kroenke *et al.,* 2001) AUDIT-C
Bandelow *et al.* (2012) Posttraumatic stress disorder (PTSD) in the German Armed Forces: a retrospective study in inpatients of a German army hospital	All soldiers admitted to the German Military Hospital in Hamburg, Germany, with PTSD (n = 117) (*n*=62 in 2006, *n*=55 in 2007)	Retrospective assessment of hospital admission using clinical interview, the Post-Traumatic Stress Scale (PTSS-10 and the Impact of Event Scale—Revised (IES-R). Quantitative Research	Of the soldiers admitted to the German Military Hospital in Hamburg, Germany, with PTSD 39.3% (*n*=46) were in missions abroad (28 in 2006 and 18 in 2007). 18.0% (*n*=21) had participated in battle situations. 53.8% (*n*=64) of all PTSD cases were related to injuries or physical/sexual abuse. Five (4.3%) were wounded in combat, and 4 of them had serious irreversible injury. 46.2% (*n*=54) were due to only psychological traumatization.	**Sex** **Rank** **Level of Education** **Pre-existing comorbid disorder**	Posttraumatische Stress Skala-10 (PTSS10) - Deutsche Version, (Maercker, 1998) Impact of Event Scale—Revised (IES-R), (Weiss and Marmar, 1996)
Carty *et al.* (2011) Predicting posttraumatic stress disorder symptoms and pain intensity following severe injury: the role of catastrophizing	208 participants admitted to one of two Melbourne hospitals following severe injury. Mechanism of injury was MVA (67.8%, *n*=141); fall (11.5%, *n*=24); assault (5.8%, *n*=12), workplace injury (4.3% *n*=9), and other types of accidents (9.1%, *n*=19). Male = 75% (*n*=156): Mean age was 40.25 (SD=13.54).	Prospective examination of the role of catastrophizing in the prediction of PTSD and persistent pain following physical injury. Follow up at 3 and 12 months by telephone. Quantitative Research	Acute catastrophizing significantly predicted PTSD symptoms but not pain intensity at 3 months. In turn, 3-month catastrophizing predicted pain intensity, but not PTSD symptoms at 12 months. Indirect relations were also found between acute catastrophizing and 12-month PTSD symptoms and pain intensity. Relations were mediated via 3-month PTSD symptoms and 3-month catastrophizing, respectively. Acute symptoms did not predict 3-month catastrophizing and catastrophizing did not fully account for the relationship between PTSD symptoms and pain intensity.	**Pain** **Catastrophizing**	Injury Severity Score (ISS), (Baker *et al.,* 1974) Clinician-Administered PTSD Scale (CAPS-IV), (Blake *et al.,* 1998) Visual Analogue Scale (VAS) (Huskisson, 1974; Scott and Huskisson, 1974) 36-item CERQ (Garnefski *et al.,* 2001).

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Cook *et al.* (2017) Screening for Posttraumatic Stress Disorder in Civilians With Mangled Hand Injury	122 civilian patients admitted to a large North-western Trauma Centre (U.S.) with 'mangled' hand injury. An investigation of the degree of PTSD screening and the follow-up referral procedures in patients.	A retrospective review of the electronic medical records (EMRs) of all mangled hand injuries in patients admitted to the hand clinic of a U.S. Level One trauma Centre in 2012. Quantitative Research	PTSD distress indicators were identified in 68% (*n*=83) of patients when reviewing the EMR using the 10-item PTSD Screening tool (Russo *et al.,* (2013). The 83 EMRs listed a total of 102 subjective symptoms, both physical and psychological.78% (of the 102 symptoms identified) were of physical distress. 40% of the 122 patients admitted with mangled hand injury were classified as "at risk" using the 10-item PTSD screening tool (*n*=49). 35% (*n*=17) were referred for rehabilitation psychology. 65% (*n*=32) with mangled hand injury at risk for PTSD were not offered a therapy referral. Pain was the most frequently mentioned physical symptom.	**Pain** **Phantom Pain**	10-item PTSD screening tool (Russo *et al.,* 2013).
Fletcher *et al.* (2016) Personality and trajectories of posttraumatic psychopathology: A latent change modelling approach.	323 Consecutive admissions with physical injury to a level I trauma centre in Victoria, Australia. Examination of whether personality prospectively influences the trajectory of disorder in a broader trauma-exposed sample.	Prospective assessment of Multidimensional Personality Questionnaire—Brief Form and Structured Clinical Interview for DSM-IV, with 3 and 12 month follow up Structured Clinical Interview. Quantitative Research	Identified that those with internalizing class personality showed a high risk of developing all disorders. Those with normal personality class not always at lowest risk of disorder. Those with externalizing class, more likely than normal personality class to develop substance use disorders BUT less likely to develop PTSD and depression. Concluded that personality is an important mechanism in influencing the development and form of psychopathology after trauma. Findings suggest that early intervention using a personality-based trans diagnostic approach may be an effective method of predicting and ultimately preventing post-traumatic disorder.	**Personality Type**	Multidimensional Personality Questionnaire (Brief form) (MPQ-BF) (Patrick, Curtin, and Tellegen, 2002). Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) (First *et al.,* 2002)

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Gabert-Quillen *et al.* (2012) The Impact of Social Support on the Relationship between Trauma History and PTSD Symptoms in Motor Vehicle Accident Victims	235 adult MVA victims who had experienced a prior potentially traumatic event, not including the current trauma (the MVA). An assessment of the extent to which social support buffered against the increased vulnerability to short-term and long-term PTSS afforded by trauma history.	Prospective cohort study of MVA victims with 6 weeks, 6 months and 12 month follow up. Quantitative Research	Results indicated that number of prior trauma types and subjective responses to prior traumatization predicted subsequent PTSS (not PTSD: see discussion). Results were controlled for gender, injury severity and income. Appraisal social support was a significant moderator of the total number of types of trauma and subjective physical injury during the prior trauma in predicting PTSS. Results underscore the importance of examining both trauma history and social support as multi-dimensional constructs and suggest merit to addressing social support in trauma victims with a prior trauma history.	**Prior exposure to trauma**	Injury Severity Score (ISS: Baker *et al.,* 1974) Traumatic Stress Schedule (TSS: Norris, 1992) Interpersonal Support Evaluation List (ISEL: Cohen and Hoberman, 1983) Clinician Administered PTSD Scale (CAPS; Blake, *et al.,* 1995)
Holbrook *et al.* (2010) Morphine Use after Combat Injury in Iraq and Post-Traumatic Stress Disorder	696 injured U.S. military personnel with combat-injury sustained on Operation Iraqi Freedom. An examination of the effect of morphine use during early resuscitation and trauma care on the risk of PTSD in injured military personnel.	Retrospective review U.S. Navy–Marine Corps Combat Trauma Registry Expeditionary Medical Encounter Database (CTR EMED) and inpatient Medical Records. Quantitative Research	Of 696 military personnel with physical injury 35% (*n*=243) received a diagnosis of PTSD and 65% (*n*=453) did not. The use of Morphine Sulphate during early resuscitation and trauma care was significantly associated with a lower risk of PTSD after injury. In patients with PTSD - 61% had been given Morphine. In those without PTSD 76% received morphine (odds ratio, 0.47; P<0.001). This association remained significant after adjustment for injury severity, age, mechanism of injury, status with respect to amputation, and selected injury-related clinical factors.	**Physical Injury** **Use of Morphine Sulphate**	Clinical data drawn from U.S. Navy–Marine Corps Combat Trauma Registry Expeditionary Medical Encounter Database (CTR EMED) Abbreviated Injury Scale (Gennarelli and Wodzon, 2005) Injury Severity Score (Baker *et al.,* 1974) Glasgow Coma Scale (Teasdale and Jennett, 1974) NO PTSD MEASURE USED, diagnosis by clinician using DNS-IV criteria.
Nasky *et al.* (2009) The USS Cole Bombing: Analysis of Pre-Existing Factors as Predictors for Development of Post-Traumatic Stress or Depressive Disorders	191 United States Sailors and Naval Officers aboard the USS Cole during a terrorist attack/suicide bombing in 2000. To determine if pre-existing demographic factors forecasted predisposition or resilience to the development of post-traumatic stress or depressive symptoms	Assessment of subjective distress using IES-R with subscales for Intrusion, Avoidance, and Hyperarousal. Assessment also of affective, psychological, and somatic symptoms associated with depression using the SDS Scale. Quantitative Research	Higher rank, older age, and male gender were protective factors against developing symptoms of post-traumatic stress. Lower rank, younger age, female gender, and having been injured or having had a friend injured or killed were associated with the development of symptoms of post-traumatic stress. Other pre-existing factors examined did not demonstrate any predictive value.	**Rank** **Age** **Sex** **Physical Injury**	Zung Self-Rating Depression Scale (SDS), (Zung, 1965) Impact of Event Scale—Revised (IES-R), (Weiss and Marmar, 1996)

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Russo *et al.* (2013) The Development of a Population-Based Automated Screening Procedure for PTSD in Acutely Injured Hospitalized Trauma Survivors	878 injured trauma survivors admitted to the University of Washington's Harborview Level I Trauma Centre undergoing assessment for recruitment into an existing stepped care intervention trial Post-Traumatic Stress Disorder (PTSD) risk prediction among hospitalized injury survivors by developing a population-based automated screening tool derived from data elements available in the electronic medical record (EMR).	Prospective cohort study of hospitalized inpatients using Electronic Medical Record (EMR). Quantitative Research	Russo *et al.,* (2013) identified that the optimal risk prediction model for PTSD comprised of 10 data elements: 1. EMR PTSD ICD-9-CM diagnosis, 2. Other ICD-9-CM psychiatric diagnosis 3. ICD-9-CM substance use disorder diagnosis or positive BAC on admission 4. Tobacco use as evidenced by current or prior ICD-9-CM diagnosis, 5. Demographic characteristics: a. female gender, b. non-White ethnicity, c. non-private insurance status (*e.g.* self-pay, public or active duty military or veteran insurance status), 6. Intentional injury, 7. Intensive care unit (ICU) admission during the current hospitalization, and 8. Any prior EMR documentation of prior trauma centre inpatient hospitalizations. A risk cut-off of 3 out of 10 retained good sensitivity (71%) and specificity (66%) for PTSD while correctly classifying 68% of the population.	**Sex** **Ethnicity** **Uninsured and/or veteran status** **Pre-existing/comorbid disorder** • Current or past PTSD or psychiatric disorder • Alcohol, tobacco, or drug use problem **Pre-existing chronic medical condition** • (including ICU admission) **Intentional injury inflicted by individual other than self** **Any prior inpatient hospitalization for medical, surgical, or psychiatric conditions**	PTSD Checklist–Civilian Version (PCL-C), (Blanchard *et al.,* 1996) Electronic Medical Record (EMR) Data including: • Demographic Characteristics • Psychiatric, Substance Abuse and Other Medical Diagnoses • Substance Levels • Injury Aetiology and Severity Abbreviated Injury Scale (Gennarelli and Wodzon, 2005) Injury Severity Score (Baker *et al.,* 1974) • Pre-injury Emergency Department and Hospital Visits
Taymur *et al.* (2014) Possible Risk Factors for Acute Stress Disorder and Post-Traumatic Stress Disorder After an Industrial Explosion	197 survivors of an industrial disaster involving a factory explosion and an 'earthquake effect' in four nearby buildings. The aim of this study was to determine the prevalence of acute stress disorder (ASD) and Post-Traumatic Stress Disorder (PTSD), and to determine the variables which can be the risk factors for PTSD.	Prospective cohort of 197 civilian disaster survivors assessed one month after the event using CAPS-IV and SCID. Participants were assessed at one month (*n*=197) and then again at six months (*n*=157) Quantitative Research	A statistically significant difference was found between the subjects with and without PTSD in terms of: Education time (X2=11.46, p=.022; x2=11.86, p=.018, respectively for the first and sixth months). Presence of previous psychiatric disease was found to be different between the individuals who did and did not develop PTSD in favour of the ones who developed PTSD (x2=5.66; p=.017) Individuals reporting: exposure to dead people, presence of mild and severe physical damage, presence of acquaintances among dead and injured people and being present in the event showed a statistically significant difference in favour of development of PTSD.	**Education (Level of)** **Pre-existing/comorbid disorder** **Physical injury** **Types of exposure**	Clinician-Administered PTSD Scale (CAPS-IV), (Blake *et al.,* 1998) Structured Clinical Interview for DSM-IV Axis I Disorders (SCID) (First *et al.,* 2002)

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Woodruff *et al.*, (2017) Body-Region-Specific Injuries as Predictors of Psychosocial Outcomes Among Those Injured in Combat: Results from the Wounded Warrior Recovery Project	Study of 1,011 combat injured U.S. military personnel enrolled onto the Wounded Warrior Recovery Project. An investigation of the relationship between body-region-specific injuries and quality of life (QOL); Post-Traumatic Stress Disorder (PTSD);and depression)	This study is described as an ambidirectional longitudinal cohort study of Quality of Life (QOL) outcomes in combat injured U.S. military personnel identified through the U.S. Navy-maintained Expeditionary Medical Encounter Database (EMED). Web-based survey. Quantitative Research	Injuries to the spine and head are consistently associated with adverse effects on quality of life (QOL); Post-Traumatic Stress Disorder (PTSD); and depression. 67% of participants had injuries to multiple body regions. Comparison of responders/non-responders identified differences only in relation to age, commissioned rank, and lower ISS (responders). 53% of participants were neither depressed nor had PTSD. <3% had a likely PTSD diagnosis only, 18% had depression only, and 26% reported both depression and PTSD. Adjusting for overall injury severity and 'time since injury' those with combat-related head and spine injuries were particularly at risk for relatively worse psychosocial outcomes.	**Physical Injury/Body regions**	Clinical data drawn from U.S. Navy–Marine Corps Combat Trauma Registry Expeditionary Medical Encounter Database (CTR EMED) Abbreviated Injury Scale (Gennarelli and Wodzon, 2005) Injury Severity Score (Baker *et al.,* 1974) Glasgow Coma Scale (Teasdale and Jennett, 1974) Quality of Well-Being Scale–Self-Administered (QWB-SA), (Kaplan *et al.,* 1997) PTSD Checklist–Civilian Version (PCL-C), (Blanchard *et al.,* 1996). Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977).

Table 3: Data Extraction Table - Summary of Findings (Predictors of Psychological Resilience)

Article	Sample/Phenomenon of Interest	Design/Research Type	Evaluation/Findings	Risk Factors Identified	Outcome Measures
Gabert-Quillen *et al.* (2012) The Impact of Social Support on the Relationship between Trauma History and PTSD Symptoms in Motor Vehicle Accident Victims	235 adult MVA victims who had experienced a prior potentially traumatic event, not including the current trauma (the MVA). An assessment of the extent to which social support buffered against the increased vulnerability to short-term and long-term PTSS afforded by trauma history.	Prospective cohort study of civilian MVA victims with 6 week, 6 month and 12 month follow up.	Results indicated that number of prior trauma types and subjective responses to prior traumatization predicted subsequent PTSS (not PTSD: see discussion). Results were controlled for gender, injury severity and income. Appraisal social support was a significant moderator of the total number of types of trauma and subjective physical injury during the prior trauma in predicting PTSS. Results underscore the importance of examining both trauma history and social support as multi-dimensional constructs and suggest merit to addressing social support in trauma victims with a prior trauma history.	**Social support**	Injury Severity Score (ISS: Baker *et al.,* 1974) Traumatic Stress Schedule (TSS: Norris, 1992) Interpersonal Support Evaluation List (ISEL: Cohen and Hoberman, 1983) Clinician Administered PTSD Scale (CAPS; Blake, *et al.,* 1995)

3.5. Findings

Within the identified literature a range of risk factors for common mental health disorders (CMD) or post-traumatic illness (PTI) were identified (see Table 4: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Sociodemographic Factors; Table 5: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Military Factors; Table 6: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Physical (Injury) Factors and Table 7: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Psychological Factors). The identified risk factors have been categorised into four risk classes: sociodemographic risk factors; military risk factors; physical (injury) factors and psychological factors. There was limited discussion of the predictors of psychological resilience noted in the identified papers (see Table 8: Summary of Identified Themes – Potential Predictors of Psychological Resilience).

Table 4: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Sociodemographic Factors

Factor	Papers	Summary of Main Findings Related to Factors	Observations / Conclusions
Gender (see Section 3.6.1.1.)	1 - Bandelow *et al.* 2012 2 - Nasky *et al.* 2009 3 - Russo *et al.* 2013	1 – Prevalence of PTSD in female participants was significantly higher (30.8%) when compared to the overall percentage of women serving in the German Army (5.17%, P<0.0001). Paper argued this may be related to prior exposure to trauma (higher pre-enlistment levels of sexual traumatization). 2 - Higher IES-R scores in female crew members when compared to male on USS Cole. Paper concludes that female participants are at higher risk of developing symptoms of PTSD (even when controlling for differing severities of traumatic events). 3 – This large prospective cohort study of 878 hospitalized inpatients seeking to develop a population-based automated screening tool derived from data elements available in the electronic medical record (EMR). Identified that female participants were twice as likely to meet the criteria for PTSD than male participants (OR 2.04: CI=1.53-2.71).	Limitation: Nasky et al. (2009) include a sample of individuals both injured and non-injured, there is no separate reporting of those with physical combat-related injury. Applicability of findings may be limited due to lack of differentiation of injured/non-injured.
Ethnicity (see Section 3.6.1.2)	3 - Russo *et al.* 2013 4 - Adams *et al.* 2016	3 – Identified that participants identified within the grouping 'Race (Non-white) we more likely to meet the diagnostic criteria for PTSD (OR 1.82: CI=1.38-2.41). 4 – In active duty personnel: the odds of developing PTSD were significantly increased in both Black and Hispanic women while the odds of developing at risk drinking were significantly decreased. In respect of depression black women were at higher risk. For National Guard/Reserve personnel, the odds of depression were increased significantly for black women while the odds of at-risk drinking were significantly decreased for both black and Hispanic women.	Limitation: Adams *et al.*, 2016 study of combat exposure and trauma is based on a large retrospective sample of women serving in the U.S. Army. It cannot be included in 'Gender' as it provides no gender comparison. Limitation: While Adams et al. (2016) assessed individuals with physical injury, there is no separate reporting of those with physical combat-related injury. Applicability of findings may be limited due to lack of differentiation of injured/non-injured.
Age (see Section 3.6.1.3.)	2 - Nasky *et al.* 2009	2 - Findings suggest that those aged 22–25 showed higher levels of avoidance. Being of lower age was also associated with the development of symptoms of depression. Nasky et al. (2009) suggest also that higher levels of avoidance may reflect less affect tolerance and greater use of primitive defence mechanisms among younger service members.	Limitation: Nasky et al. (2009) include a sample of individuals both injured and non-injured, there is no separate reporting of those with physical combat-related injury. Applicability of findings may be limited due to lack of differentiation of injured/non-injured.
Parenthood (see Section 3.6.1.5)	4 - Adams *et al.* 2016	4 - There appears to be a strong association between parenthood and increased odds of PTSD and depression and reduced odds of at-risk drinking, in both AD and NG/R U.S. Servicewomen.	Limitation: Adams et al., 2016 study of combat exposure and trauma is based on a large retrospective sample of women serving in the U.S. Army. It cannot be included in 'Gender' as it provides no gender comparison. Applicability of findings may be limited due to male bias on this study.
Education (Level of) (see Section 3.6.1.4)	1 - Bandelow *et al.* 2012 5 - Taymur *et al.* 2014	1 - High school graduates were significantly over-represented in the sample of those diagnosed with PTSD when compared to the whole German Armed Forces population, while primary and high school graduates were less frequently represented. 5 - Statistically significant difference was found between those with and without PTSD in terms of time spent in education in their study of survivors of Turkish industrial disaster. Those with less time spent in education demonstrated higher levels of PTSD at one and six months after industrial disaster.	

Table 5: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Military Factors

Factor	Papers	Summary of Main Findings Related to Factors	Observations / Conclusions
Rank (see Section 3.6.2.1.)	4 - Adams *et al.* 2016 1 - Bandelow *et al.* 2012 2 - Nasky *et al.* 2009	5 – In all multivariate models being 'senior enlisted' was associated with reduced odds of PTSD, depression, and at-risk drinking 1- The percentage of privates diagnosed with PTSD was lower than in the overall percentage of that rank in the overall German military population. The percentage of officers diagnosed with PTSD was 'not higher than expected'. 2 - Senior Officers achieved lower IES-R scores than the Enlisted Personnel and the Senior Enlisted ranks scored lower than the Non-Commissioned Officers (NCOs) on both the Intrusion and Hyperarousal subscales. Comparison of junior to senior ranks indicates that junior ranks scored significantly higher on IES-R and all its subscales indicating higher levels of subjective distress. Junior ranks reported higher levels of affective, psychological, and somatic symptoms associated with depression. Based on these findings the author suggests a strong inverse correlation between military rank and PTSD and Depression.	
Experience of Combat (see Section 3.6.2.2.)	4 - Adams *et al.* 2016	4 - Reported a large magnitude dose response indicative of increased odds of PTSD with increased combat exposure, they acknowledge that the assessment of exposure was specific only to the indexed deployment and failed to provide any indication of lifetime combat exposure or multiple exposure to each item on the CES scale	
Deployed Role: Healthcare Specialists (see Section 3.6.2.3)	4 - Adams *et al.* 2016	4 - Enlisted women deployed in a healthcare specialist role had increased odds of at-risk drinking.	

Table 6: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Physical (Injury) Factors

Factor	Papers	Summary of Main Findings Related to Factors	Observations / Conclusions
Pain and Phantom Pain (see Section 3.6.3.1)	6 - Carty *et al.* 2011 7 - Cook *et al.* 2017	6 - Post-Traumatic Stress Disorder (PTSD) and persistent pain are frequently comorbid, between 10 and 50% of individuals with persistent pain meet diagnostic criteria for PTSD 7 - PTSD distress indicators were identified in 68% (n=83) of patients with 'mangled hand' following retrospective review of their Electronic Medical Record (EMR) and screening for PTI using a 10-item PTSD Screening tool.	
Use of Morphine Sulphate (see Section 3.6.3.2)	8 - Holbrook *et al.* 2010	8 - Of 696 military personnel with physical injury sustained on Operation Iraqi Freedom (OIF) 35% (n=243) received a diagnosis of PTSD. Morphine Sulphate was significantly associated with a lower risk of PTSD after injury (in patients with PTSD 61% had been given Morphine and in those without PTSD 76% had received morphine. There was no indication that the protective effect of morphine use was dependent on the dose and no significant difference in rates of PTSD according to the dose.	Limitation: Despite the finding that Morphine Sulphate administration was significantly associated with lower risks of PTSD, Holbrook et al. (2010) presented no assessment or discussion of the pain scores or reported levels of pain in participants. Limitation: Holbrook et al. (2010) excluded a number of patients from the study where the available data on medication administration was incomplete, it remains difficult to confidently predict the effect that this bias may have introduced.
Physical Injury and Bodily Region (see Section 3.6.3.3)	2 - Nasky *et al.* 2009 5 - Taymur *et al.* 2014 9 - Woodruff *et al.* 2017	2 - Following the USS Cole bombing, injured service members reported an increased sense of hyperarousal on the IES-R Scale 5 - Following exposure to civilian disaster, those with mild and severe physical damage at one month (and again at six months) demonstrated a statistically significant difference in favour of development of PTSD. 9 - After adjusting for overall injury severity and time since injury, those with combat-related head and spine injuries were particularly at risk of developing Post-Traumatic Stress Disorder (nearly 30%) and depressive symptoms (44%), and reported relatively lower quality of life 2–3 years after injury. 9 – Poor quality of life (QoL), PTSD and depression outcomes linked to the nine different body regions. There is strong evidence to support the claim that injuries to the spine and head were consistently associated with adverse effects on QoL, and higher levels of PTSD and depression.	Limitation: Woodruff et al. (2017) acknowledged that respondents tended to be slightly older, in officer ranks, and had lower overall Injury Severity Scores than non-respondents and there was no assessment of preinjury mental or physical health status.
Pre-existing chronic medical condition (see Section 3.6.3.4.)	3 - Russo *et al.* 2013	3 - Factors identified as predictors of risk for PTSD were related, more specifically, to the use of tobacco, substance use disorder or positive Blood Alcohol Concentration (BAC) on admission.	

Table 7: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Psychological Factors

Factor	Papers	Summary of Main Findings Related to Factors	Observations / Conclusions
Pre-existing psychiatric disorder (see Section 3.6.4.1)	1 - Bandelow *et al.* 2012 5 - Taymur *et al.* 2014	5 - While the study made no specific assessment of the individual diagnoses, at one month, 17.3% of participants (n=34) self-reported previous psychiatric disorder and 11.7% (n=23) stated that they had received previous psychiatric treatment. Previous psychiatric disease was found to be a predictor of PTSD at one month (X^2=5.66; p=.017). While there was no evidence that pre-existing psychiatric disorder was a risk factor for the development of PTSD at six months (X^2=2.74; p=.098), there is evidence supporting the suggestion that pre-existing psychiatric disorder may be a risk factor for stress-related disorders. 1 – Prevalence of pre-existing psychiatric disorder of 35.9% (n=42) in their study of German Armed Forces personnel admitted to the German Military Hospital in Hamburg. Among the comorbid psychiatric conditions, major depression (n = 33; 28.2%) and anxiety disorders (panic disorder/agoraphobia (n = 8; 6.8%), social anxiety disorder (n = 1; 0.9%)) were most common.	Limitation: Bandelow et al. (2012) present no confirming analysis presented in this study demonstrating the link between pre-existing psychiatric disorders, such as anxiety disorders and depression and the development of PTSD in participants. Limitation: Bandelow et al. (2012) report relatively low numbers of participants with physical/combat-injury and the lack of detailed analysis of the relationship between outcomes and potential risk factors is a significant limitation.
Prior exposure to trauma (see Section 3.6.4.2)	10 - Gabert-Quillen *et al.* 2012 2 - Nasky *et al.* 2009	10 - Controlling for gender, injury severity and income, prior trauma, subjective fear, distress and physical injury all predicted subsequent Post-Traumatic Stress Syndrome (PTSS) at six and twelve months. Exposure to a greater number of trauma types and increasing levels of physical injury were positively related to PTSS. 2 - U.S. Navy personnel from the USS Cole that reported having previously experienced significant traumatic events achieved higher Depression (SDS) scores than those who had not and that this suggested an association between previous exposure and depression.	
Personality type (see Section 3.6.4.3.)	11 - Fletcher *et al.* 2016	11 - Participants members of the internalizing class were at increased risk of a PTSD or depression diagnosis within the first three months following injury and the risk of a diagnosis of anxiety or substance use disorder between three and twelve months following injury was also highest in this group. The study found that those participants in Class 1 (normative class) were not always at lowest risk of disorder and while those in Class 3 (externalizing class) were more likely to develop substance use disorders they were less likely to develop PTSD and depression than those in Class 1 (normative class).	
Alcohol, tobacco, or drug use (see Section 3.6.5.3)	3 - Russo *et al.* 2013	3 - Within the optimal risk prediction model developed both positive BAC on admission (or other substance use disorder diagnosis) and tobacco use were identified as being statistically significant predictor/risks factors for PTSD.	
Catastrophizing (see Section 3.6.4.4.)	6 - Carty *et al.* 2011	6 - Findings suggest that while acute catastrophizing significantly predicted PTSD symptoms but not pain intensity at three months, catastrophizing at three months predicted pain intensity but not PTSD symptoms at twelve months.	

Table 8: Summary of Identified Themes – Potential Predictors of Psychological Resilience

Factor	Papers	Summary of Main Findings Related to Factors	Observations / Conclusions
Social Support	10 - Gabert-Quillen *et al.* 2012	10 - Social support has a moderating effect on the relationship between trauma history and PTSS. Appraisal support and total social support were significant moderators of the total number of types of trauma and subjective physical injury during the prior trauma in predicting PTSS.	
Camaraderie	2 - Nasky *et al.* 2009	2 - following the USS Cole bombing, service members who experienced difficult separations from their shipmates were found to have higher depression scores and suggest that this may be explained as a natural reaction to the removal of a positive unit characteristic—camaraderie.	

3.6. Discussion

There is a well-established body of work seeking to identify modifiable risk factors for common mental health disorders (CMD) and post-traumatic illness (PTI) in military personnel. In a retrospective cohort study of 4,762 (Regular) UKAF personnel deployed on OP TELIC in 2003, the King's Centre for Military Health Research (KCMHR) identified that post-traumatic symptoms were associated with a range of pre-deployment factors (sociodemographic/psychological/history of trauma) including: lower rank; being single, separated or divorced; educational attainment; and childhood adversity (Hotopf *et al.,* 2008). These findings confirm previous findings in the general civilian population (educational attainment) (Brewin *et al.,* 2000) and in the wider military population (sex, younger age, less educated, single, white, short-term service and lower rank) (Riddle *et al.,* 2007). While Hotopf *et al.,* 2008) do not report sex as a risk factor for CMD or PTI in UKAF personnel, Riddle *et al.,* 2007) suggest that it remains a significant predictor in U.S. Army personnel, and it may be suggested that the historical lack of employment of women in front-line combat roles by the U.K. Armed Forces may account for this difference. Sex may become an identifiable risk factor in future conflict as the U.K. Armed Forces do now employ women in front-line combat roles.

In addition to the identification of a range of pre-deployment factors, the KCMHR study also supports findings of previous studies suggesting that combat exposure is associated with an increased risk of post-deployment psychiatric injury (Kulka *et al., 1*990 and Lee *et al., 1*995), and that the appraisal of events (by those experiencing them) as involving a 'threat to life' or situations where individuals are deployed out with their own Combat Employment Group (CEG) or beyond their level of experience is strongly associated with the development of symptoms of post-traumatic stress (Hotopf *et al.,* 2006 and 2008). Feeling unprepared is often associated with perceived loss of control or with a threat to one's autonomy (Hotopf *et al.,* 2008) and these perceptions are associated with higher rates of post-traumatic illness (Baum *et al., 1*993 and Ehlers *et al.,* 2000). Within the KCMHR study the personal appraisal of threat to life emerged as the strongest predictor of symptoms (Hotopf *et al.,* 2008).

There are a number of post-deployment military risk factors including: low morale, poor social support within the Unit, and the lack of homecoming brief (Hotopf *et al.,* 2008). The provision of a homecoming brief (as distinct from specific Trauma Risk Management (TRiM) debrief) was associated with lower prevalence of PTSD (Hotopf *et al.,* 2008) and is an example of an intervention designed to mediate the effects of stressful or traumatic experiences and mitigate the risk of common mental health disorders and/or post-traumatic illness by normalising symptoms and experiences (Hotopf *et al.,* 2008).

While there is a body of literature identifying risk factors for common mental health disorders and post-traumatic illness in military personnel following deployment, there is no single study at present which seeks to focus specifically on the identification of risk factors (or predictors of psychological resilience) in military personnel following combat injury. This is a significant gap in the literature. This systematic review of the literature seeks to explore the risk factors associated with the development of common mental health disorders/post-traumatic illness and the predictors of psychological resilience following complex traumatic injury.

3.6.1. Sociodemographic Factors

The sociodemographic risk factors identified within the literature are: age (Nasky *et al.,* 2009); ethnicity (Adams *et al.,* 2016 and Russo *et al.,* 2013); sex (Bandelow *et al.,* 2012, Nasky *et al.,* 2009, and Russo *et al.,* 2013); parenthood (Adams *et al.,* 2016); and level of education (Bandelow *et al.,* 2012 and Taymur *et al.,* 2014).

3.6.1.1. Gender

Bandelow *et al.,* (2012) conducted a retrospective study of 117 German Armed Forces personnel admitted to the German Military Hospital in Hamburg with PTSD in 2006 (*n*=62) and 2007 (*n*=55). Patients were assessed retrospectively using clinical interview, the Posttraumatische Stress Skala-10 (PTSS10) - Deutsche Version (Maercker, 1998), and the Impact of Event Scale—Revised (IES-R) (Weiss and Marmar, 1996). Where 46.2% (*n*=54) of participants were admitted due to psychological traumatization only, 53.8% (*n*=64) of all PTSD cases were related to physical injuries or to physical/sexual abuse. Five (4.3%) were wounded in combat, and four had serious irreversible injury (Bandelow *et al.,* 2012).

In relation to the sex of the participants it was reported that the percentage of female PTSD patients was significantly higher (30.8%) when compared to the overall percentage of women serving in the German Army (5.17%, P<0.0001). Bandelow *et al.* (2012) suggest that the statistically significant overrepresentation of women reporting distress may be related to higher levels of sexual traumatisation. Twenty-three of the participants in this study were women (19.7%) who reporting being sexually traumatized prior to their military service or being subject to sexual traumatisation, by non-serving members of the public, while serving. This may be an indication that prior exposure to trauma also has some predictive utility for the development of subsequent CMD and PTI (see 3.6.4.2. Prior Exposure to Trauma).

Findings amongst female crew members of the USS Cole also suggest that sex plays a significant role in the development of CMD and PTI, as Nasky *et al.* (2009) report significantly higher IES-R (t (179) =2.332, p=0.021) and the IES-R Sense of Intrusion subscale (t (179) =2.491, p =0.014) scores in female crew members compared to male. Concluding that female participants are at higher risk of developing symptoms of PTSD (even when controlling for differing severities of traumatic events), Nasky *et al.* (2009) highlight that, while there is evidence to support the assertion that in the wider population female veterans experience higher rates of trauma compared with the general population (Zinzow *et al.,* 2007), there is little evidence to suggest that sex is a significant factor in the military and "the homogeneous exposure to trauma among men and women in the armed services" may be a confounding factor (Brewin *et al.,* 2000).

3.6.1.2. Ethnicity

In a study of 42,397 U.S. Active Duty (AD) or National Guard/Reserve (NG/R) women serving in Iraq and Afghanistan (2008-2011), Adams *et al.* (2016) demonstrate that while for AD Black women the odds of developing PTSD and depression were significantly increased (AOR = 1.33 (95% CI = 1.17 - 1.51) p<0.001) and (AOR = 1.15 (95% CI = 1.04 - 1.27) p<0.01) respectively, the odds of developing at risk drinking were significantly decreased (AOR = 0.62 (95% CI = 0.58 - 0.67) p<0.001). In Hispanic women, the odds of developing PTSD were significantly increased (AOR = 1.25 (95% CI = 1.07 - 1.46) p<0.01), while the odds of at-risk drinking were again significantly decreased (AOR = 0.85 (95%

CI = 0.78 - 0.93) $p<0.001$). Similarly, for Black NG/R personnel, the odds of the development of depression were increased significantly (AOR = 1.61 (95% CI = 1.41 - 1.84) $p<0.001$), and the odds of at-risk drinking were significantly decreased (AOR = 0.46 (95% CI = 0.41 - 0.51) $p<0.001$). For Hispanic women, at risk drinking was significantly decreased (AOR = 0.80 (95% CI = 0.70 - 0.92) $p<0.001$) (Adams *et al.,* 2016).

The reported composite combat exposure score (0, 1, 2, 3+) was calculated using all four items from the 4 Item - Combat Experiences Scale (CES), (Guyker *et al.,* 2013) which, in addition to 'Wounded, injured, assaulted or otherwise hurt' includes: 'Saw dead bodies, people killed or wounded', 'In direct combat and discharged a weapon' and 'In great danger of being killed'. The Adjusted Odds Ratios (AOR) for PTSD, depression and at-risk drinking post-deployment are only reported in terms of 'composite combat exposure score' and are not presented separately for those reporting wounds, injuries, assaults or being hurt (AD *n*=4,839 (17.3%) and NG/R *n*=4,174 (29.0%). While the overall headline finding may be that Black and Hispanic women were more likely to screen positive for PTSD, but less likely to be at-risk drinkers (Adams *et al.,* 2016), there is no separate assessment of those with combat injury and, correspondingly, it is difficult to support the assertion that ethnicity is a risk factor for those individuals with combat injury based on the presented literature.

While Nasky *et al.* (2009) and Adams *et al.* (2016) are both studies of military populations, neither study focuses solely on populations following traumatic injury. In a prospective cohort study of 878 injured civilian trauma survivors designed to facilitate the development of an automated population-based screening tool for PTSD, Russo *et al.* (2013) identified 10 data elements/risk factors through a review of patient Electronic Medical Record (EMR) Data and retrospective assessment of PTSD using the PTSD Checklist–Civilian Version (Blanchard *et al.,* 1996). Russo *et al.* (2013) identified that a range of sociodemographic characteristics, along with a previous history of psychiatric diagnosis, substance abuse and substance levels; injury aetiology and injury severity scores (Abbreviated Injury Scale, (Gennarelli and Wodzon, 2005) and Injury Severity Score, (Baker *et al.,* 1974)) and history of pre-injury Emergency Department and Hospital visits, all provided some predictive utility as screening criteria. Subsequent screening for PTSD identified, in relation to the sociodemographic characteristics, that sex and ethnicity were effective predictors of PTSD (Russo *et al.,* 2013).

3.6.1.3. Age

In studies of the general military population younger age is often identified as being a significant risk factor for CMD and PTI (Riddle *et al.,* 2007). Older age is often identified as being associated with a decreased risk of developing PTSD (Schnurr *et al.,* 2004 and Vincent *et al.,* 1994). Within a military context, lower age is often associated with lower rank and lower levels of combat experience. It may be suggested, therefore, that where lower rank and being single feature as risk factors in other studies of military cohorts, these might be viewed as surrogates of lower age (Ursano, 2006). There is limited evidence within this review to support the suggestion that younger age is a risk factor for CMD and PTI specifically following injury.

Attempting to establish whether any pre-existing sociodemographic factors predicted the development of (or resilience to) post-traumatic stress or depressive symptoms, Nasky *et al.* (2009) conducted a study of the 191 crew members of the USS Cole following a terrorist attack in the Port of Aden in the Yemen in October 2000 (mixed population of Junior Ratings, Seniors and Naval Officers but homogenous group, *i.e.* a 'complete crew'). Nasky *et al.* (2009) assessed subjective distress using the Impact of Event Scale—Revised (IES-R) and its intrusion, avoidance, and hyperarousal subscales (Weiss and Marmar, 1996), and affective, psychological, and somatic symptoms associated with depression were assessed using the Zung Self-Rating Depression Scale (SDS), (Zung, 1965).

Findings suggest that younger age was significantly associated with the development of symptoms of avoidance (Nasky *et al.,* 2009). Specifically, of the four age subgroups studied (18–21, 22–25, 26–29, and 30 and over), those aged 22–25 showed higher levels of avoidance (Nasky *et al.,* 2009). In addition to age, lower rank, sex, and having been injured or having had a friend injured or killed in the attack were also found to be associated with the development of symptoms associated with depression. These findings suggest that higher levels of avoidance may reflect less affect tolerance and greater use of primitive defence mechanisms among younger service members (Nasky *et al.,* 2009).

Consistent with this observation, seniority of rank emerged as a salient protective factor (further supporting the assertion that rank may act in some way as a surrogate for age), however, it may be that lower reported levels of distress in senior ranks might be related to the fear of disclosure of psychiatric symptoms (Nasky *et al.,* 2009). The view that reporting psychiatric symptoms may be prejudicial to participants ongoing military careers, and the perception that they may need to be seen as role models for junior ranks (in terms of strength and reassurance), may result in a reporting bias that may impact on these findings, but is entirely consistent with the belief that reporting poor mental health indicates 'weakness' and further supports the suggestion that the stigmatisation of mental health in the military leads to the significant underreporting of symptoms. Another limitation of this study (in relation to the goal of identifying risk factors in those individuals with a combat injury) is that while Nasky *et al. (*2009) do report increased levels of hyperarousal in those with combat injury they present no evidence of this in relation to age.

3.6.1.4. Level of Education

Again, there appears to be limited evidence in the identified literature that levels of education may have predictive utility as a risk factor. While Bandelow *et al.* (2012) found that high school graduates were significantly over-represented in the sample of those diagnosed with PTSD ($V^2 = 9.5$, df = 2, P = 0.008) when compared to the whole German Armed Forces population, while primary and high school graduates were less frequently represented.

Taymur *et al.* (2014) report a statistically significant difference was found between those with and without PTSD in terms of time spent in education in their study of survivors of Turkish industrial disaster. Those with less time spent in education demonstrated higher levels of PTSD at one and six months after industrial disaster.

3.6.1.5. Parenthood

There appears to be a strong association between parenthood and increased odds of PTSD and depression and reduced odds of at-risk drinking, in both AD and NG/R U.S. Servicewomen (Adams *et al.,* 2016). Both AD *(n*=27,997) and NG/R *(n*=14,400) women serving in the U.S. Army with children who are eligible for

Military Health Service benefits (AD Single Parent n=4,525 (16.2%): NG/R Single parent n=2,623 (18.2%) and AD Married Parent n=6,658 (23.8%): NG/R Married Parent n=2,283 (15.9%), are at increased odds of developing both PTSD and depression (Adams *et al.,* 2016). Adams *et al.* (2016) suggest that these findings are consistent with existing studies of female OEF/OIF veterans seeking support or treatment through the Veterans Administration (Janke-Stedronsky *et al.,* 2016) and serving women who experience combat exposure after childbirth who are at increased risk of depression (Nguyen *et al.,* 2013).

The evidence suggests that women serving in the U.S. Army with children are also at reduced odds of at-risk drinking (Adams *et al.,* 2016) and that this may be due either to the recognition of parental responsibility (Schulenberg *et al.,* 2005) or through the perception that at-risk drinking may impact negatively on their children (Adams *et al.,* 2016).

3.6.2. Military Factors

A number of military risk factors were identified in the sourced literature: Rank (Adams *et al.,* 2016, Bandelow *et al.,* 2012 and Nasky *et al.,* 2009); Experience of Combat (Adams *et al.,* 2016) and Deployed Role (Adams *et al.,* 2016).

3.6.2.1. Rank

Within the identified literature the most comprehensive evaluation of rank as a risk factor was undertaken in the U.S. Navy study (Nasky *et al.,* 2009). In an analysis of five categories of rank, Senior Officers achieved lower IES-R scores than the Enlisted Personnel ($F\ (4,185) = 4.494$, $p = 0.002$) and the Senior Enlisted ranks scored lower than the Non-Commissioned Officers (NCOs) on both the Intrusion ($F\ (4,185) = 3.936$, $p = 0.004$) and Hyperarousal IES-R subscales ($F\ (4,185) = 4.103$, $p = 0.003$) (Nasky *et al.,* 2009).

Subsequent analysis comparing 'juniors' [my classification](collectively all Junior Enlisted and NCOs, Grades E1 to E6) to 'seniors' (Senior Enlisted and Commissioned Officers Grades E7 to O5) indicated that 'juniors' scored significantly higher than the 'seniors' in IES-R $t\ (190) = 3.606$, $p < 0.001$ and all its subscales (Avoidance $t\ (190) = 2.736$, $p = 0.007$, Intrusion $t\ (190) = 3.379$, $p = 0.001$ and Hyperarousal $t\ (190) = 3.589$, $p < 0.001$) indicating higher levels of subjective distress (Nasky *et al.,* 2009). The 'juniors' also scored significantly higher on the Zung inventory (t (200) = 3.276, p = 0.001) indicating higher levels of affective, psychological, and somatic symptoms associated with depression (Nasky *et al.,* 2009). Based on these findings it is reasonable to conclude a strong inverse correlation between military rank and both IES-R and Zung scores (Nasky *et al.,* 2009).

While Adams *et al. (*2016) identified in all multivariate models that being senior enlisted was associated with reduced odds of PTSD, depression, and at-risk drinking (and confirm the findings of Nasky *et al.* (2009)), Bandelow *et al.* (2012) report that, in comparison to the distribution of military ranks within the German Armed Forces, the percentage of non-commissioned officers diagnosed with PTSD was significantly higher. While lower rank appears to be a risk factor identified in both U.S. studies, Bandelow *et al.* (2012) report that in the German study the percentage of privates diagnosed with PTSD was lower than in the overall percentage of that rank in the military population (V2 = 16.9, df = 2, P = 0.0002). Bandelow *et al.* (2012) also report that the percentage of officers diagnosed with PTSD was not higher than expected.

Nasky *et al.* (2009) suggest that there are difficulties associated with interpreting the relationship between rank and subjective distress and affective, psychological, and somatic symptoms associated with depression. It is suggested that there is a complex relationship between rank and other factors such as age, education, and intelligence. Rank is often seen as a surrogate for age (Ursano, 2006) and typically implies a higher level of educational achievement and intelligence as well as the presence of other psychological characteristics, such as self-efficacy and internal locus of control (Nasky *et al.,* 2009). These other factors may account for the differences between the findings of the U.S. studies cited here and the study of German Armed Forces personnel (Bandelow *et al.,* 2012) and may act as a confounding factor in the identification of rank as a predictor of risk.

3.6.2.2. Experience of Combat

From the identified literature only one study, Adams *et al.* (2016), seeks to investigate the contribution of combat exposure to the development of CMD or PTI. Adams *et al.* (2016) identified that women serving in the U.S. Army reporting combat exposures, *i.e.* being injured, wounded, assaulted or hurt (AD 17.3%: NG/R 29.0%); encountering dead bodies/seeing people killed (AD 15.5%: NG/R

11.7%); experiencing a feeling of danger of being killed (AD 19.2%: NG/R 18.4%); and being in direct combat /discharging a weapon (AD 1.4%: NG/R 0.6%), had increased odds of PTSD, depression, or at-risk drinking. Combat experience was assessed using the four-item Combat Experiences Scale (CES) (Guyker *et al.,* 2013) and subsequent retrospective assessment of CMD and PTI were undertaken using the Primary Care-PTSD (PC-PTSD) measure (Bliese *et al.,* 2008) and the Patient Health Questionnaire (PHQ-2) measure (Kroenke *et al.,* 2001), respectively. Assessment of at-risk drinking was assessed using the AUDIT-C measure (Babor *et al.,* 2001).

While Adams *et al. (*2016) reported a large magnitude dose response indicative of increased odds of PTSD with increased combat exposure, they acknowledge that the assessment of exposure was specific only to the indexed deployment and failed to provide any indication of lifetime combat exposure or multiple exposure to each item on the CES scale. Further, they identified that the four-item CES scale failed to capture data regarding the specific nature of the incident and that 'being injured, wounded, assaulted or hurt' might also include incidents of military sexual assault during deployment. Given the lack of specificity and the absence of any clear discussion of the combat exposure of those sustaining a combat injury it remains unclear as to the utility of combat exposure as a predictor of CMD or PTI in those with combat injury.

3.6.2.3. Deployed Role

There is very little discussion of combat role in the identified literature, however, Adams *et al.* (2016) identified that enlisted women deployed in a healthcare specialist role had increased odds of at-risk drinking. These findings are consistent with previous studies indicating that enlisted healthcare providers are at increased risk of post-deployment psychiatric morbidity (Mayo *et al.,* 2013). Again, Hotopf *et al.* (2006) and Hotopf *et al.* (2008) suggested that individuals deployed out with their own Combat Employment Group (CEG) or beyond their level of experience are at increased risk of the development of symptoms of post-traumatic stress. It may be argued, therefore, that there is a strong link between deployed role and combat exposure as those encountering situations they feel ill-prepared to manage or out with their current experience whilst deployed on military operations may regard these experiences as 'combat exposure'.

3.6.3. Physical (Injury) Factors

A number of physical (injury) factors are identified within the literature. The presence of Pain and Phantom Pain (Carty *et al.,* 2011 and Cook *et al.,* 2017); the use of Morphine Sulphate (Holbrook *et al.,* 2010); the presence of physical injury (Gabert-Quillen *et al.,* 2012; Nasky *et al.,* 2009; Taymur *et al.,* 2014 and Woodruff *et al.,* 2017) as well as the type of injury (body location) (Woodruff *et al.,* 2017) and the presence of pre-existing chronic medical conditions (Russo *et al.,* 2013).

3.6.3.1. Pain and Phantom Pain

Cook *et al.* (2017) followed up 122 civilian patients admitted to a large north-western Trauma Centre (U.S.) with 'mangled' hand injury. Their findings suggested that PTSD distress indicators were identified in 68% *(n*=83) of patients following retrospective review of their Electronic Medical Record (EMR) and screening for PTI using a 10-item PTSD Screening tool (Russo, Katon, and Zatzick, 2013). In all, Cook *et al.* (2017) identified 102 subjective symptoms and 40% of the 122 *(n*=49) patients were classified as "at-risk" using the 10-item PTSD screening tool.

Many of the indicators of distress identified by Cook *et al.* (2017) may, more properly, be regarded as symptomatic indicators of PTSD and should not, in themselves, be taken to be risk factors. Pain amongst the most commonly reported subjective physical symptoms and this is consistently identified as being one of the most difficult experiences of a mangling hand injury (Cook *et al.,* 2017). Pain and phantom pain are often associated with increased levels of traumatic stress symptoms and, arguably may be a warning signal for future issues (Cook *et al.,* 2017). This finding supports previous studies suggesting that pain is a primary risk factor for PTSD (Ponsford *et al.,* 2008 and Vranceanu *et al.,* 2014) and is consistent with studies indicating that Post-Traumatic Stress Disorder (PTSD) and persistent pain are frequently comorbid (Carty *et al.,* 2011). Recent reviews have reported that between 10 and 50% of individuals with persistent pain meet diagnostic criteria for PTSD, while 21-80% of PTSD samples report the presence of comorbid pain (Otis *et al.,* 2006 and Villano *et al.,* 2007).

Phantom pain sensations are reported by 50%–85% of amputees and it is suggested that the risks associated with phantom pain also warrant attentive screening for PTSD in patients with a mangling hand injury (Cook *et al.,* 2017).

3.6.3.2. Use of Morphine

Previous research has identified that symptoms of PTSD and pain mutually maintain each other (Carty *et al.,* 2011) and there is some evidence to suggest that the inadequate management of patient pain through ineffective administration of analgesia (increased pain levels) may be a predictor of subsequent PTI. As part of a retrospective review of the U.S. Navy–Marine Corps Combat Trauma Registry Expeditionary Medical Encounter Database (CTR EMED) and inpatient medical records examining the effect of morphine during early resuscitation and trauma care, it was identified that of 696 military personnel with physical injury sustained on Operation Iraqi Freedom (OIF) 35% *(n*=243) received a diagnosis of PTSD (Holbrook *et al.,* 2010). Holbrook *et al.* (2010) further identified that the use of Morphine Sulphate was significantly associated with a lower risk of PTSD after injury (in patients with PTSD 61% had been given Morphine and in those without PTSD 76% had received morphine, odds ratio, 0.47; P<0.001). The identified association between morphine administration and PTSD remained significant after adjustment for injury severity, age, mechanism of injury, status with respect to amputation, and other selected injury-related clinical factors (Holbrook *et al.,* 2010). There was no indication that the protective effect of morphine use was dependent on the dose and no significant difference in rates of PTSD according to the dose (Holbrook *et al.,* 2010).

One significant limitation of this study was that, despite the finding that morphine sulphate administration was significantly associated with lower risks of PTSD, there was no assessment or discussion of the pain scores or reported levels of pain in participants. Further, Holbrook *et al.* (2010) acknowledge that as a number of patients were excluded from the study (where the available data on medication administration was incomplete), it remains difficult to confidently predict the effect that this bias may have introduced. Due to the protocol driven administration of analgesia in the deployed clinical environment, the question of whether or not there was a dose–response relationship between the morphine sulphate administered and the risk of PTSD remains unanswered (Holbrook *et al.,* 2010). However, despite these limitations, there is sufficient evidence to suggest that the administration of Morphine Sulphate (and potentially other opiate analgesics) for optimal control of pain and anxiety after injury may reduce the risk of PTSD (Holbrook *et al.,* 2010). It may therefore be suggested that increased pain scores or increased anxiety after injury may be predictors of subsequent PTI.

3.6.3.3. Physical Injury and Bodily Region

An increasing number of studies have suggested that bodily injury is a risk factor for PTSD (Kulka *et al. 1*990, Michael *et al. 1*999, Koren *et al.* 2005, Grieger *et al.* 2006 and Forbes *et al.* 2012). Within the identified literature, there is also additional evidence to support the suggestion that there is a correlation between serious injuries suffered during traumatic events and increased prevalence of both PTSD and depression (Nasky *et al.,* 2009). Following the USS Cole bombing, injured service members reported an increased sense of hyperarousal $t(190) = 2.125$, $p = 0.035$ (Nasky *et al.,* 2009), and following exposure to civilian disaster, those with mild and severe physical damage at one month (and again at six months) demonstrated a statistically significant difference in favour of development of PTSD (Taymur *et al.,* 2014).

More significantly, in a comprehensive study of 1,011 combat injured U.S. military personnel enrolled onto the Wounded Warrior Recovery Project investigating the relationship between body-region-specific injuries and psychosocial outcomes (Quality of Life was measured using the Quality of Well-Being Scale–Self-Administered (QWB-SA), (Kaplan *et al.,* 1997); PTSD measured using the PTSD Checklist–Civilian Version (PCL-C), (Blanchard *et al.,* 1996) and depression measured using the Center for Epidemiologic Studies Depression Scale (CES-D), (Radloff, 1977)). Woodruff *et al.* (2017) identified after adjusting for overall injury severity and time since injury, those with combat-related head and spine injuries were particularly at risk of developing Post-Traumatic Stress Disorder (nearly 30%) and depressive symptoms (44%), and reported relatively lower quality of life 2–3 years after injury (Woodruff *et al.,* 2017) (Mean QWB-SA score of .53 compared to population estimate of.69 to .72 for men 35–44 years of age in a U.S. population survey (Fryback *et al.,* 2007)).

Woodruff *et al.* (2017) further linked quality of life (QoL), PTSD and depression outcomes to the nine different body regions (head, face, neck, thorax, spine, abdomen, upper extremity, lower extremity, and external skin/other). There is strong evidence to support the claim that injuries to the spine and head were consistently associated with adverse effects on QoL, and higher levels of PTSD and depression (Woodruff *et al.,* 2017).

While there are a number of limitations acknowledged by Woodruff *et al.* (2017), *e.g.* respondents tended to be slightly older, in officer ranks, and had lower overall ISSs than non-respondents and there was no assessment of preinjury mental or physical health status, the findings continue to support the assertion that bodily injury (and specific regional injuries) are a significant risk factor for CMD and PTI outcomes.

In relation to military trauma, discussion of the nature of the injury (Holbrook *et al.,* 2010) suggests that there is little evidence to support the suggestion that mechanism of injury is a significant risk factor. In their study of 696 U.S. Marine personnel with physical injury, there were no marked or significant differences noted between PTSD positive and PTSD negative patients following injury by IEDs, GSW or other explosive device (grenades, mortar, and rocket-propelled grenades) (Holbrook *et al.,* 2010)

3.6.3.4. Pre-existing Chronic Medical Condition

While Russo *et al.* (2013) identified a range of pre-existing chronic medical conditions within the Electronic Medical Records (EMRs) of their sample, the factors identified as predictors of risk for PTSD were related, more specifically, to the use of tobacco (as evidenced by current or prior International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis), or other ICD-9-CM substance use disorder diagnosis or positive Blood Alcohol Concentration (BAC) on admission (OR (95% CI)= 1.36 (0.97 – 1.90). While Russo *et al.* (2013) discuss alcohol abuse and dependence (and their combination) under pre-existing psychiatric disorder they are not further differentiated.

It is worth nothing that, while the range of chronic medical conditions identified by Russo *et al.* (2013) is very broad, it is unlikely that they would be of any significant use in respect of military cohorts with combat injury. As UKAF personnel are all required to demonstrate a minimum level of medical fitness to deploy on operations, those with identified chronic medical conditions would be precluded from deployment. What is interesting however is that tobacco, alcohol and substance use may all be predictors of risk and are worthy of further investigation. Russo *et al.* (2013) identify that ICU admission during index trauma hospitalization and prior inpatient hospitalizations may be predictors of risk and this too is worthy of further examination. As combat injury is, by its very nature, complex trauma requiring ICU admission in the operational environment and again upon return to RCDM, and subsequent hospitalisations for ongoing management or surgical revision, these factors may have some utility as predictors within military cohorts.

3.6.3.5. Alcohol, Tobacco, or Drug Use

As previously noted, alcohol misuse is common in both U.K. and U.S. military populations (Fear *et al.,* 2007; Jacobson *et al.,* 2008; Rona *et al.,* 2010 and Bray *et al.,* 2009 and 2013) and military personnel with 'risky' drinking habits are at higher risk of having mental health problems (Aguirre *et al.,* 2014b) and increased long-term depressive and post-traumatic stress symptoms (Sampson *et al.,* 2015). Within the identified literature substance use disorder, and specifically the use of alcohol, is frequently identified as a comorbid disorder (Bandelow *et al.,* 2012; Adams *et al.,* 2016 and Fletcher *et al.,* 2016).

Within the optimal risk prediction model developed by Russo *et al.* (2013) both positive BAC on admission (or other previous ICD-9-CM substance use disorder diagnosis) (OR=1.49 (95% CI = 1.11 – 2.01)) and tobacco use as evidenced by current or prior ICD-9-CM diagnosis (OR = 1.24 (95% CI = 0.89 – 1.72)) were identified as being statistically significant predictor/risks factors for PTSD (as defined by total PCL-C score >35) and may also have some utility as a predictor/risk factor (Russo *et al.,* 2013 and Cook *et al.,* 2017).

3.6.4. Psychological Factors

Again, there are a range of factors identified within the sourced literature related to pre-existing psychiatric disorder.

3.6.4.1. Pre-existing Psychiatric Disorder

There is ample evidence within the literature to support the hypothesis that those exposed to trauma often have a significant pre-trauma history of psychopathology (O'Donnell *et al.,* 2009) and that the existence of pre-existing psychiatric disorder serves as a risk factor for future diagnosis (Shalev *et al.,* 1998 and Ozer *et al.,*

2003) and evidence from the identified literature is broadly consistent with previous findings.

Taymur et al. (2014) assessed 197 survivors of civilian industrial explosion using the structured clinical interview for DSM-IV Axis-I disorders (SCID-I) (First *et al.,* 1997) and the Clinician-Administered PTSD Scale (CAPS) (Blake *et al.,* 1995) was used at one and six months to assess for PTSD. While the study made no specific assessment of the individual diagnoses, at one month, 17.3% of the sample *(n*=34) self-reported previous psychiatric disorder and 11.7% of participants *(n*=23) stated that they had received psychiatric treatment (Taymur *et al.,* 2014). Reporting that the presence of previous psychiatric disease was found to be different between the individuals who did (33.3%) and those who did not (14.7%) develop PTSD at one month in favour of the ones who developed PTSD (x^2=5.66; p=.017). While there was no evidence that pre-existing psychiatric disorder was a risk factor for the development of PTSD at six months (x^2=2.74; p=.098), there is evidence supporting the suggestion that pre-existing psychiatric disorder may be a risk factor for stress-related disorders (Taymur *et al.,* 2014).

Bandelow *et al.* (2012) identified pre-existing psychiatric disorder in 35.9% *(n*=42) of the participants in their study of German Armed Forces personnel admitted to the German Military Hospital in Hamburg. Among the comorbid psychiatric conditions, major depression (n = 33; 28.2%) and anxiety disorders (panic disorder/agoraphobia (n = 8; 6.8%), social anxiety disorder (n = 1; 0.9%)) were most common. While there is a suggestion that "proneness to PTSD" may be a potential risk factor (Bandelow *et al.,* 2012), there is no confirming analysis presented in this study demonstrating the link between pre-existing psychiatric disorders, such as anxiety disorders and depression and the development of PTSD in participants.

Bandelow *et al.* (2012) report the sample size *(n*=117) as a limitation of their study, stating that their participants represented only 17.8% of all reported PTSD cases in the German Armed Forces, the study did include 45.2% of all inpatient PTSD cases admitted to German Military Hospitals. However, the relatively low numbers of participants with physical/combat-injury and the lack of detailed analysis of the relationship between outcomes and potential risk factors may be a more significant limitation.

3.6.4.2. Prior Exposure to Trauma

There is evidence that prior exposure to trauma increases risk for the development of Post-Traumatic Stress Syndrome (PTSS) following a subsequent trauma (Gabert-Quillen *et al.,* 2012). In their study of 235 adult motor vehicle accident (MVA) victims with prior experience of potentially traumatic events, Gabert-Quillen *et al.* (2012) identified that (controlling for gender, injury severity and income) prior trauma, subjective fear, distress and physical injury all predicted subsequent Post-Traumatic Stress Syndrome (PTSS) at six and twelve month follow up. Further, the study identified that both exposure to a greater number of trauma types and increasing levels of physical injury were positively related to PTSS (Gabert-Quillen *et al.,* 2012).

In contrast, while acknowledging that many previous studies have indicated a relationship between previous exposure to trauma and PTSD (*i.e.* Ozer *et al.,* 2003 and Davidson *et al.,* 1991), Nasky *et al.* (2003) identified that U.S. Navy personnel from the USS Cole that reported having previously experienced significant traumatic events achieved higher SDS scores than those who had not (Zung *et al.,* 1965) and that this suggested an association between previous exposure and depression.

3.6.4.3. Personality Type

Within the identified literature there is evidence to support the suggestion that personality type provide some utility as a predictor of CMD and/or PTI. Fletcher *et al.* (2016) suggest that the identification of different personality typologies may present an opportunity to target interventions in at risk trauma survivors. As part of a large study of adult inpatients admitted to a Level 1 trauma centre in Victoria, personality type was assessed using the Multidimensional Personality Questionnaire (Brief Form) (MPQ-BF: Patrick, Curtin, and Tellegen, 2002). Following a Latent Profile Analysis (LPA) of gathered MPQ-BF data, three personality types (classes) were identified within the sample: a normative class (Class 1: n=230, 71.2%), an externalizing class (Class 2: n=22, 6.8%) and an internalizing class (Class 3: n=71, 22%) (Fletcher *et al.,* 2016).

Assessment of participant depression, PTSD, anxiety disorder (including generalised anxiety, panic disorder, agoraphobia, obsessive compulsive disorder, and specific phobia) and substance use disorder was conducted at three time points using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID: First *et al.,* 2002) in order to explore whether or not personality prospectively influences the trajectory of identified disorder (Fletcher *et al.,* 2016).

Findings suggest that those participants in Class 3 (internalizing class) were at increased risk of a PTSD or depression diagnosis within the first three months following injury and the risk of a diagnosis of anxiety or substance use disorder between three and twelve months following injury was also highest in this group (Fletcher *et al.,* 2016). The study found that those participants in Class 1 (normative class) were not always at lowest risk of disorder and while those in Class 3 (externalizing class) were more likely to develop substance use disorders they were less likely to develop PTSD and depression than those in Class 1 (normative class).

These findings support the conclusion that personality is a significant predictor of the development and type of post-trauma disorder and suggest that early intervention using a personality-based trans-diagnostic approach may be an effective method of predicting and ultimately preventing post-traumatic disorder (Fletcher *et al.,* 2016). These findings may also be closely linked with the evidence supporting the suggestion that alcohol, tobacco and drug use may also have some utility as predictors of CMD and PTI.

3.6.4.4. Catastrophizing

Carty *et al.* (2011) highlight that that PTSD and persistent pain are frequently comorbid (see above) and suggest that catastrophizing (an exaggerated negative orientation toward noxious stimuli (Sullivan *et al.,* 1995)) has been implicated in dominant theoretical models of both persistent pain (Norton and Asmundson, 2003 and Vlaeyen and Linton, 2000) and PTSD (Ehlers and Clark, 2000).

Seeking to establish the predictive utility of catastrophizing following severe injury, Carty *et al.* (2011) followed up 208 participants admitted to a Melbourne hospital following Moving Vehicle Accident (MVA) (67.8%, *n*=141), fall (11.5%, *n*=24), assault (5.8%, *n*=12), workplace injury (4.3% *n*=9), and other types of accidents (9.1%, *n*=19). Participants were assessed on admission, at three months and again at twelve months using Clinician-Administered PTSD Scale for DSM-5 (CAPS-5) (Blake *et al.,* 1998), the Visual Analogue Scale (VAS) (Huskisson, 1974 and Scott and Huskisson, 1974), a self-report measure assessing intensity of pain, and the catastrophizing subscale of the 36-item Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski *et al.,* 2001).

Path analysis examined both the direct and indirect relationships between catastrophizing, symptoms of PTSD and pain intensity at baseline, three months and again at twelve months. Findings suggest that while acute catastrophizing significantly predicted PTSD symptoms but not pain intensity at three months, catastrophizing at three months predicted pain intensity but not PTSD symptoms at twelve months (Carty *et al.,* 2011). Concluding that these findings partially support the claim that catastrophizing may increase vulnerability to PTSD, pain and the development of comorbid pathology, Carty *et al.* (2011) suggest that targeting trauma focused interventions upon catastrophic reactions may enhance recovery and reduce vulnerability to the development of long-term physical and psychological pathology. It would appear therefore that there is some predictive utility in identifying catastrophizing in patients following severe injury.

3.6.5. Predictors of Psychological Resilience

Within this systematic literature review, only two papers identified potential predictors of psychological resilience. Both papers discussed the role of others within family, community or military groups/units in terms of social support (Gabert-Quillen *et al.,* 2012) and camaraderie (Nasky *et al.,* 2009).

3.6.5.1. Social Support

There is significant evidence within the literature to suggest that social support provides an effective buffer to PTSS (Gabert-Quillen *et al.,* 2012). Social support is defined as a process of providing or exchanging perceived resources with another person (Cohen *et al.,* 2000). Additionally, there is evidence supporting the suggestion that some aspects of total social support may be more effective predictors of well-being than others (Cohen and Wills, 1985 and Schaefer *et al.,* 1981: reported in Gabert-Quillen *et al.,* 2012). Social support can be further divided into appraisal support (emotional support), tangible support (instrumental support), and belonging support (companionship support) (Gabert-Quillen *et al.,* 2012) and these factors are consistent with factors (identified above) promoting psychological resilience (*i.e.* positive thinking (individual factors), support (family factor) and belongingness (community factor) (Meredith *et al.,* 2011).

As previously reported within their study of U.S. MVA survivors with physical injury, Gabert-Quillen (2012) suggest that prior exposure to trauma increases risk for the development of Post-Traumatic Stress symptoms (PTSS) following subsequent trauma. However, it would appear that social support has a moderating effect on the relationship between trauma history and PTSS (Gabert-Quillen *et al.,* 2012) and findings in that study suggested that appraisal support and total social support were significant moderators of the total number of types of trauma and subjective physical injury during the prior trauma in predicting PTSS (Gabert-Quillen *et al.,* 2012).

3.6.5.2. Camaraderie

There is little discussion of camaraderie in the identified literature. However, Nasky *et al*. (2009) identified that, following the USS Cole bombing, service members who experienced difficult separations from their shipmates were found to have higher depression scores and suggest that this may be explained as a natural reaction to the removal of a positive unit characteristic—camaraderie. There is limited evidence within the literature to support this.

3.7. Conclusion

Post-traumatic illness is a major concern for the military community due to the considerable levels of disability and associated mental health sequelae (Zatzick *et al.,* 1997 and Kessler, 2000). Consequently, the identification of potential modifiable risk factors for common mental health disorders and post-traumatic illness in military personnel provides a fundamental opportunity for the development of strategies intended to mediate or mitigate against those risks or to contribute to the identification of a range of interventions that may positively impact on the maintenance of the mental health and well-being of military personnel.

The primary aim of the systematic review presented in this chapter was the exploration of potential risk factors associated with the development of post-traumatic illness and common mental health disorders and the potential predictors of psychological resilience following complex traumatic injury. Utilising the SPIDER search tool (Cooke *et al.,* 2012) a number of authoritative subject databases were searched using the ProQuest and EBSCO subject gateways. While the population of interest for this doctoral project is U.K. service personnel with combat injury, the literature search was extended to include adult individuals, military or civilian, sustaining all types of physical injury within the previous 10 years (2009-2019). The initial literature search produced 1,059 results and, following initial screening, elimination of duplicate records and title and abstract review 1,012 papers were rejected. Comprehensive review of the 47 remaining papers further reduced included studies to 11. The assessment of methodological quality was achieved through the critical review of each paper using the McMaster University process (Law *et al.,* 1998). The SPIDER framework (Cooke *et al.,* 2012) was then adapted to ensure consistent data extraction and evaluation of the identified studies.

In relation to the identification of potential risk factors for PTI and CMD, the studies identified 17 themes (see Tables 4, 5, 6 and 7) and, while there was considerably less discussion of the predictors of psychological resilience in the identified papers (see Table 8: Summary of Identified Themes – Potential Predictors of Psychological Resilience) two themes were identified. The identified factors have been categorised into four classes: sociodemographic factors; military factors; physical health factors; and psychological health factors, and these categories will be used within Part Two of this doctoral study to further structure the exploration of the relationships between these potential predictor variables and a range of outcome variables in Chapter Eight.

3.7.1. Gaps in the Literature

While the included studies provide some insight into potential risk factors and predictors for PTI, CMD, AUD, Hardiness and Psychological Resilience this systematic review highlights some key gaps in the literature:

1. None of the identified studies were conducted in the United Kingdom.
2. Limited number of studies of military cohorts
3. Military studies tended to be large retrospective studies
   (except the study of trauma following the USS Cole bombing)
4. Many of the injuries discussed were relatively minor and none of the
   studies discussed/identified complex military poly trauma.

Having identified these gaps in the literature, it is further suggested that this doctoral study is well placed to provide a unique prospective perspective on the mental health and mental health morbidity of UKAF personnel following complex military poly trauma.

3.7.2. Emerging Hypotheses

Discussion of the potential risk/predictors identified through this systematic literature review has been instrumental is formulating four additional working hypotheses about the relationships that exist between these factors and PTI, CMD, AUD, Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

Hypothesis 4:

- a – There is a relationship between sociodemographic characteristics and mental health morbidity
- b – There is a relationship between sociodemographic characteristics and hardiness and psychological resilience

Hypothesis 5:

- a – There is a relationship between military characteristics and mental health morbidity
- b – There is a relationship between military characteristics and reported levels of Hardiness and Psychological Resilience

Hypothesis 6:

- a – There is a relationship between physical health factors and mental health morbidity
- b – There is a relationship between physical health factors and reported levels of Hardiness and Psychological Resilience

Hypothesis 7:

- a – There is a relationship between psychological health factors and mental health morbidity
- b – Relationship between psychological health factors and reported levels of Hardiness and Psychological Resilience

These hypotheses will be developed in the next chapter (see 4.2: Study Hypotheses) and in combination with the three hypotheses identified in Chapter Two will form that basis of the exploration of the relationships between the factors identified above and PTI, CMD, AUD, Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

Figure 3: Al Qaysumah - Ted Zuber (1991).
Image courtesy of Beaverbrook Collection of War Art; CWM

PART TWO: PHYSICAL COMBAT INJURY, MENTAL HEALTH AND RESILIENCE

CHAPTER FOUR: METHODOLOGY AND RESEARCH DESIGN

4.1. Introduction

The primary aim of this doctoral study is to investigate mental health and mental health morbidity in a prospective sample of United Kingdom Armed Forces (UKAF) personnel following physical combat-related injury, and to explore the relationships between potential risk factors and predictors and subsequent mental health disorder (CMD), post-traumatic illness (PTI), Alcohol Use Disorder (AUD) and psychological resilience. Specifically, the research design described in this chapter seeks to address the primary aim of this study by answering the following research questions:

a. Mental health and mental health morbidity:

   i. What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?

   ii. Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?

b. Psychological resilience:

   i. What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?

   ii. Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

This doctoral study adopts a positivist approach and this chapter describes the main elements of the quantitative research design adopted, and begins with a brief discussion of the conceptual elements, *i.e.* the paradigmatic approach (Positivism) underpinning this doctoral work. Having established these conceptual elements, the chapter presents an outline of the methodological elements of the research design and includes discussion of the selection criteria and recruitment process, the selection of measures and the means by which the collected data will be analysed. This chapter concludes with a discussion of the ethical governance of the study.

4.2. Study Hypotheses

Following on from the discussion in Chapter Two and Chapter Three it has been possible to formulate a number of study hypotheses that form the basis of the data collection and data analysis phases of this doctoral study.

Hypothesis 1: Physical combat-related injury is a predictor of PTSD, CMD and AUD (Prevalence).

H_1 - UKAF personnel with a physical combat-related injury are more likely to meet the diagnostic criteria for PTSD, CMD and AUD when compared to the general UKAF population.

H_0 - There is no difference, in respect of the prevalence of PTSD, CMD and AUD, between UKAF personnel with a physical combat-related injury and the general UKAF population.

Hypothesis 2 – PTSD is a predictor of CMD and AUD (Comorbidity).

H_1 - In UKAF personnel with a physical combat-related injury, meeting the diagnostic criteria for PTSD significantly increases the risk of also meeting the diagnostic criteria for CMD and AUD.

H_0 – There is no direct relationship between PTSD, CMD or AUD in UKAF personnel with a physical combat-related injury.

Hypothesis 3 – Physical combat-related injury negatively impacts on both hardiness and resilience (Coping).

H_1 – In UKAF personnel with a physical combat-related injury lower levels of hardiness/resilience are associated with higher levels of PTSD, CMD and AUD.

H_0 – There is no direct relationship between PTSD, CMD or AUD and reported levels of hardiness and resilience in UKAF personnel with a physical combat-related injury.

Hypothesis 4a – There is a relationship between sociodemographic characteristics and mental health morbidity

H_1 – There is a direct relationship between sociodemographic characteristics like ethnicity, age, levels of educational attainment, relationship status and parenthood and reported levels of PTSD, CMD and AUD in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between sociodemographic characteristics and reported levels of PTSD, CMD or AUD in UKAF personnel with physical combat-related injury.

Hypothesis 4b – There is a relationship between sociodemographic characteristics and hardiness and psychological resilience

H_1 – There is a direct relationship between sociodemographic characteristics like ethnicity, age, levels of educational attainment, relationship status and parenthood and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between sociodemographic characteristics and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

Hypothesis 5a – There is a relationship between military characteristics and mental health morbidity

H_1 – There is a direct relationship between military characteristics like type of service, branch of service, military rank, length of service, number of operational deployments and perception of deployed role and reported levels of PTSD, CMD and AUD in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between military characteristics and reported levels of PTSD, CMD or AUD in UKAF personnel with physical combat-related injury.

Hypothesis 5b – There is a relationship between military characteristics and reported levels of Hardiness and Psychological Resilience

H_1 – There is a direct relationship between military characteristics like type of service, branch of service, military rank, length of service, number of operational deployments and perception of deployed role and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between military characteristics and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

Hypothesis 6a – There is a relationship between physical health factors and mental health morbidity

H_1 – There is a direct relationship between physical health factors like the mechanism of injury, perception of pain, use of tobacco and use of alcohol and reported levels of PTSD, CMD and AUD in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between physical health factors and reported levels of PTSD, CMD or AUD in UKAF personnel with physical combat-related injury.

Hypothesis 6b – There is a relationship between physical health factors and reported levels of Hardiness and Psychological Resilience

H_1 – There is a direct relationship between physical health factors like the mechanism of injury, perception of pain, use of tobacco and use of alcohol and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between physical health factors and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

Hypothesis 7a – There is a relationship between psychological health factors and mental health morbidity

H_1 – There is a direct relationship between psychological health factors like perceived comradeship, emotional support, practical support, memory of the injurious event, distress and previous experience of trauma and reported levels of PTSD, CMD and AUD in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between psychological health factors and reported levels of PTSD, CMD or AUD in UKAF personnel with physical combat-related injury.

Hypothesis 7b – There is a relationship between psychological health factors and reported levels of Hardiness and Psychological Resilience

H_1 – There is a direct relationship between psychological health factors like perceived comradeship, emotional support, practical support, memory of the injurious event, distress and previous experience of trauma and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injuries.

H_0 – There is no direct relationship between psychological health factors and reported levels of Hardiness and Psychological Resilience in UKAF personnel with physical combat-related injury.

4.3. Research Paradigm:

All research activity is based upon a number of philosophical assumptions about the nature of reality, the phenomena to be studied and the ways in which knowledge of phenomenon can be obtained. These philosophical assumptions shape or frame enquiry and determine the paradigmatic approach upon which it is based. Social research involves the exploration and understanding of social reality, causal relationships and associations between phenomena. This study adopts a positivist approach to explore the causal relationships between combat injury and mental health, post-traumatic illness and psychological resilience.

4.3.1. Research Paradigm (Positivism)

The philosophical tradition of positivism asserts that knowledge of the world is attained through observation and experience and is interpreted through the 'lens' of logic and scientific reason (Popper, 1934 and 1979). The positivist and neo-positivist paradigms, therefore, suggest that knowledge of human behaviour comes through observation and experience and draw heavily on the four basic assumptions of science: determinism; empiricism; parsimony; and generality (Cohen *et al*., 2000).

In contrast, the non-positivist approach (or interpretivism) adopts, as one might expect, the opposite view of the source or basis of knowledge. Rather than suggesting that knowledge is empirically-based and comes through objective observation of the world or of social reality, the non-positivist would claim that individuals construct their own 'social-reality' and that their view or interpretation of reality is shaped by their own subjective ideological position or perspective.

Non-positivism/interpretivism is most commonly associated with the research method phenomenology. From a paradigmatic perspective, phenomenology is described as an approach which "attempts to describe and elucidate the meanings of human experience" (Rudestein and Newton, 1992). Within this research paradigm, the primacy of context is central and implies that knowledge of the world, 'as it is' can only be gained by examining phenomena as experienced *by* people. While adopting a non-positivist/interpretivist approach undoubtedly provides insight into individual experience and is useful in exploring the impact of experience (*e.g.* Williamson *et al*., 2019 on moral injury), this study does not fit well within that paradigm.

In general, studies aligned with positivism have as their focus the identification of explanatory associations or causal relationships through quantitative approaches (Park *et al*., 2020). A primary goal of positivist inquiry is, therefore, to generate explanatory associations of causal relationships that ultimately lead to prediction and control of the phenomena in question (Sciarra *et al*., 1999). As this doctoral project seeks to explain the relationship between risk factors and predictors of the type identified in the systematic review (Chapter Four) and post-traumatic illness (PTI), common mental health disorder (CMD) and psychological resilience and will ultimately have utility in predicting, preventing and managing mental illness, it must adopt positivist paradigm and a quantitative approach.

4.4. Research Design

There are a number of well-established methodological problems identified with studies of military populations that are observed as having a consistently negative affect upon the validity and reliability of findings (O'Donnell *et al*., 2003; Hotopf & Wessely, 2005). Low response rates and high participant attrition, recall and self-selection bias and the lack of comparable 'non-combat' controls are often seen as being significant limitations and potential sources of bias in military studies of this type (Fear *et al.,* 2010).

In order to avoid these limitations, this doctoral study seeks to: facilitate high participation rates through face-to-face recruiting; minimise selection bias through comprehensive and well-defined selection criterion; and to enhance the interpretation of the relationship between physical combat-related injury and outcome through the use of established standardised measures. Additionally, this study seeks to minimise recall bias through the inclusion of a prospective sample of combat-injured service personnel drawn from those patients presenting for the first time at the DMRC.

4.4.1. Prospective Sample

There are a number of benefits to a prospective design within military research. O'Donnell *et al*. (2003), Hotopf & Wessely (2005), and Fear *et al*., (2010) highlight recall bias as a major limitation and potential sources of bias in military studies. Recall bias (when participants in a study are systematically more or less likely to recall and relate information on exposure based on their outcomes, the idea that, essentially, individuals reinterpret exposure based on outcome) is especially problematic in case-control studies and adopting a prospective design is beneficial as prospective studies minimize the likelihood that reverse causality is the cause of any reported association and decrease recall bias (Katz, 2006). There is ample evidence to support to support the suggestion that prospective studies also provide much stronger evidence in support of the identification of causal relationships (Katz, 2006). Utilising a prospective sample in this research was important as it allowed for the collection of data (in the HCTP) over a twelve-month follow-up period while minimizing the likelihood of reverse causality being the cause of any identified association and ensured minimized the effects of recall bias. The original HCTP design (upon which this design is based) was a case-control design intended to facilitate the comparison of one group of UKAF personnel with physical combat-related injury and another (control) group of UKAF personnel admitted with non-combat related Physical Injuries *i.e.*

musculoskeletal injuries related to training, sports and 'civilian' trauma *e.g*. MVA. The adoption of a prospective design was intended to facilitate the identification of potential participants by study group.

4.4.2. Face-to-face recruiting

Recruiting the required number of participants is vital to the success of clinical research and yet many studies fail to achieve their expected recruitment rate (Newington and Metcalfe, 2014). Within this study face-to-face recruitment was adopted to facilitate higher participation rates and to enhance return rate. Evidence has shown that there are multiple benefits of face-to-face recruitment in healthcare provider settings in that they: facilitate the building of rapport with potential participants; help to validate the research in the eyes of the potential participant (the individual already has a relationship with the healthcare provider); that they assist in the more accurate identification of large numbers of eligible potential participants (Manohar *et al.,* 2018). Within the context of this study approaching potential participants through the DMRC also provided individuals that the research was validated by the MoD and that they were not 'divulging potentially sensitive operational information' to unauthorised individuals or organisations. Many of the potential participants voiced this concern and being approached by a serving officer, in uniform who was supported and validated by the DMRC was clearly beneficial.

4.4.3. Selection Criteria

Selection bias within quantitative studies comes from any error in selecting the study participants and/or from factors affecting the study participation (Tripepi *et al*., 2010) This study sought to minimise the effect of selection bias by approaching every patient admitted to the DMRC admission for the first time who met the comprehensive and rigorous selection criteria (see Section 4.4.8.). Patients were extensively reviewed by the Defence Rehabilitation Consultants prior to admission to the DMRC and their admission under the care of the Complex Trauma Team (CTT). Those individuals admitted to the Peter Long Unit at the DMRC excluded those with TBI and minor injuries and met the study selection criteria. Patients did not self-select and every patient admitted was offered the opportunity to be involved in the research.

4.4.4. Validated Measures

The use of a range of well-tested, reliable and validated measures within this study containing a number of reverse scoring items was intended to minimise the effects of acquiescence response (Moors *et al.*, 2014). The effects of analysis bias may still introduce some error and the difficulties of handling outliers, where unusual values in small studies introduce errors, have been observed in the analysis of the PCL-C and CD-RISC-10 data, acknowledged in the text and are accepted as being potential limitations effecting the reliability of the findings of this study (see above).

Prior to the finalisation of the research design a small pilot study was undertaken in order to assess the face validity of the participant assessments and to test the most effective ways of identifying, recruiting and tracking patients while at the DMRC.

4.4.5. HCTP Pilot Study

Prior to the commencement of the main HCTP, a pilot study of the baseline assessment had been undertaken at the DMRC in December 2009 with a representative sample of twenty-five complex-trauma patients admitted at the beginning of the rehabilitation stage of their recovery. Participants in the pilot study had been admitted to the DMRC as a result of complex trauma injuries sustained either on military operations (combat injury) or as a result of moving vehicle collision or sporting injuries (non-combat injury). The pilot study consisted of both male and female participants, drawn from all three Services (Royal Navy, British Army and Royal Air Force), in whom there was no evidence of moderate or severe TBI or other cerebral impediment likely to limit their understanding of, or participation in, the study. Participants in the pilot study were also free from any other contraindication and their participation was agreed with the DDR. The only difference in respect of eligibility of the participants in the pilot and main studies was that a number of other national troops, (n=2) from Estonia, were included in the pilot study. Neither of the Estonian participants returned the pilot questionnaire.

Patients admitted to the DMRC have short periods of inpatient admission (one or two weeks at a time) for ongoing assessment and rehabilitation and longer periods of sick leave at home. The pilot study involved the administration of an initial draft of the baseline assessment with 25 participants recruited over a 30-day period. Pilot participants who completed the initial draft of the baseline assessment were not followed up at six- or twelve- months and were not included in either the HCTP or this study.

The response rate of the pilot study was 60%, and a number of revisions to the proposed assessment were made in response to comments from participants and clinicians and the analysis of the completed pilot assessment documents, *e.g.* an evaluation of partial completion and the identification of themes related to non-response.

The larger HCTP study incorporated the study of both prospective and retrospective patient groups and a parallel study of the partners of patient participants funded by the Headley Court Trust (Alexander *et al*., 2013). Further reference to the HCTP is made only to contextualise this study.

4.4.6. Population and Sample

The recruitment phase of the project began on the 3rd January 2010 and ended on the 30th October 2011. The utilisation of an 18-month recruitment phase was intended to facilitate as large a sample of participants as possible in order to maximise participation, to facilitate higher response rates and to minimise the impact of participant attrition. Potential participants admitted to the DMRC at the beginning of the rehabilitation phase of their injury were approached in person, by the researcher, provided with information regarding the purpose and nature of the research project and, following a period of no less than 24 hours, were asked to participate in the project.

Initial estimates of participant numbers, based on previous admissions of UKAF personnel injured on OP HERRICK between November 2001 and October 2009 suggested that up to 340 potential participants might be admitted to the DMRC during the recruitment phase (Alexander *et al*., 2013). While statistical power analysis was conducted to calculate the optimal sample size for this study (see below), due to the unpredictability of combat-injury numbers, there was no way to control the numbers of potential participants arriving at the DMRC. While a period of open-ended recruitment may have resolved this problem, neither funding nor permission for such a period of recruitment were available.

4.4.7. Statistical Power Analysis

In order to establish the optimal sample size for this study a power analysis was calculated using G*Power 3.1 (Faul *et al*., 2007: Faul *et al*., 2009) to predict required sample sizes for both Logistic regression and Chi-square analysis. Based on an α err prob=0.05 and a target Power (1-β err prob) =.80, G*Power estimated a required sample size for logistic regression of 376. Based on this analysis and the study sample (n=101) Binary Logistic Regression was not conducted.

In respect of Chi-Square analysis (predicted Effect size, w = 0.3, α err prob = 0.05, target Power (1-β err prob) = .80 (Df = 1) G*Power 3.1 estimated the required sample size to be 88. Based on these assumptions and the study sample size the reported power of this study is (1-β err prob) = .85 (Df = 1).

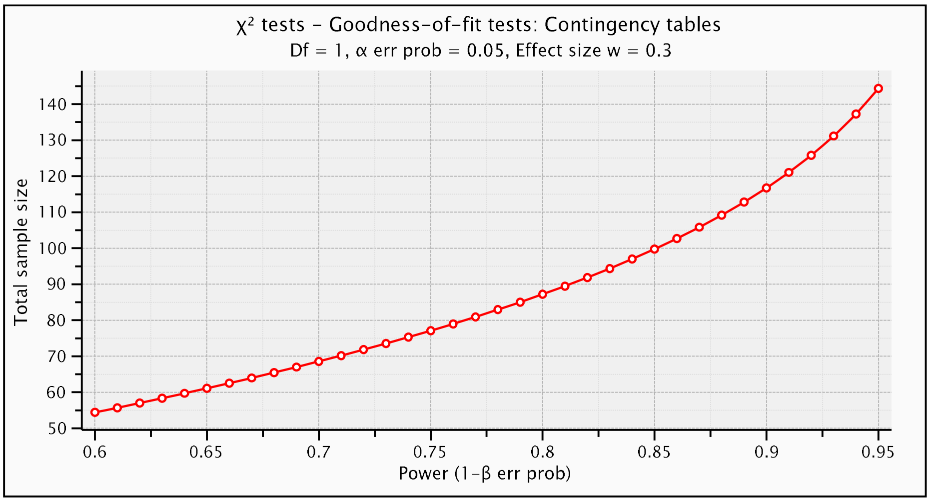


Figure 4: Power Analysis Plot

4.4.8. Selection Criteria

In order to avoid the difficulties of a self-selection bias, every patient admitted to the DMRC within the 18-month recruitment period was approached. Potential participants meeting the selection criteria were provided with information regarding the nature and purpose of the study and, following a period of not less than 24 hours, were approached for a second time and, if willing, were invited to participate. A summary of all selection criteria is presented in Table 8: Summary of Selection Criteria. Those patients consenting to participate were inducted into the study (see below).

4.4.8.1. Inclusion Criteria

Eligibility for inclusion in the study was assessed by age, injury and reason for admission. In terms of age, potential participants needed to be a minimum of 18 years of age at first admission to the DMRC and be able to give full informed consent.

For the purpose of this doctoral study, potential participants in the study group were required to have sustained a physical combat-related injury on operations, and the injury must have been the cause of their admission to the DMRC. Potential control group participants were to have sustained a non-combat-related injury out-with the operational environment, occurring either on or off military duty which must be the cause of their admission to the DMRC (*e.g.*, road traffic incident, sporting injury or other accident). Recruitment from a core population of 'first-time' in-patients at the DMRC was intended to ensure the provision of a suitable homogeneous group. A summary of inclusion criteria is presented in Table 8: Summary of Selection Criteria (all groups).

4.4.8.2. Exclusion Criteria

Potential participants meeting the stated inclusion criteria were excluded from the study if they had been admitted to the DMRC with comorbid mild, moderate or severe Traumatic Brain Injury (TBI) or other identifiable cerebral impediment likely to compromise their understanding of, or ability to respond to, verbal and written assessments. The criteria utilised for the identification of traumatic brain injury in participants was that adopted by the World Health Organisation (WHO) and employed within the Centre for Mental and Cognitive Health (CMCH) at the DMRC. For the purpose of this study, mild TBI (mTBI) was defined as being a cerebral injury resulting from, or being represented by, a Glasgow Coma Scale (GCS) score of >12 within 30 minutes of injury; a loss of consciousness of <30 minutes, and post-traumatic amnesia <24 hours. This definition includes complex mTBI where focal lesions may be evident using Computerised Tomography (CT) Scan. Moderate or severe traumatic brain injury has previously been identified as a confounding factor in the assessment of post-injury mental health (Hill *et al.,* 2009). Those individuals presenting with mild traumatic brain injury often exhibit symptoms consistent with PTSD and considerable overlap in presentation and sequelae serves only to complicate their diagnosis and management (Vasterling *et al*, 2009). A summary of exclusion criteria is presented in Table 8: Summary of selection criteria (all groups).

The International Security Assistance Force (ISAF) operating in Afghanistan during the period of study was a NATO-led security mission. In cases of combat-injury, where no rehabilitation facilities existed in home nations and agreement had been reached with the U.K. government, military personnel from non-UK nations could be admitted to the DMRC following combat-injury. Those troops from non-UK nations were also excluded from the study due to the potential difficulties associated with tracking and follow up and where the longer term rehabilitation provided may not be comparable to that provided within the U.K. military context (see below).

Table 9: Summary of Selection Criteria

<table>
<tr><th></th><th>Inclusion Criteria</th><th>Exclusion Criteria</th></tr>
<tr><td>Study Group</td><td>• Must be able to give informed consent.
• Must be aged eighteen years and above at time of recruitment to the study.
• Victim of an operational physical combat-related injury.</td><td rowspan="2">• Nationals of non-U.K. nations
• Moderate or severe TBI
• Cerebral impediment or
• Any other contraindication agreed with the DDR.</td></tr>
<tr><td>Control Group</td><td>• Must be able to give informed consent.
• Must be aged eighteen years and above at time of recruitment to the study.
• Victim of non-combat-related injury.</td></tr>
</table>

4.4.9. Participant Recruitment and Induction

Potential participants were identified in collaboration with the complex trauma team at the DMRC and initial eligibility was determined following a joint review of the clinical summary of injuries presented in the weekly complex-trauma admission list. Prior to their admission to the DMRC, potential patients were assessed by the Director of Defence Rehabilitation (DDR) or one of the consultant physicians or consultant surgeons on his team. Potential patients were primarily assessed at the Royal Centre for Defence Medicine (RCDM) at the Queen Elizabeth Hospital Birmingham (part of the University Hospitals Birmingham NHS Foundation Trust). Patient assessment consisted of a one-to-one consultation with a named consultant physician or consultant surgeon representing DDR at

RCDM and a comprehensive review of patient medical records and clinical history. Those patients admitted to the DMRC were those requiring specialist rehabilitation for complex trauma.

Following patient admission to the DMRC, both medical and psychiatric opinions were available regarding the final suitability of potential participants. In the event of any uncertainty or disagreement regarding the final suitability or competence of potential participants, it had been agreed prior to recruiting phase that DDR would make the final determination of patient suitability.

During the 18-month recruiting phase (3rd January 2010 to 30th June 2011), every patient admitted to the care of the complex trauma team at the DMRC during their first cycle of in-patient care who met the agreed selection criteria was approached in order to further assess their eligibility. It is a considerable strength of the design of this study that every eligible patient admitted to the complex trauma patient group at the DMRC was assessed and invited to participate. The research design incorporated face-to-face recruitment of consecutive admissions in order to facilitate maximum participation, maximum response, and to minimise problems associated with selection bias. The strengths and potential limitations associated with the employment of face-to-face recruitment by the researcher will be discussed further in Chapter Nine: Discussion.

Eligible potential participants were approached within the first week of their initial admission to the DMRC during their initial induction to the clinical area. Approaching patients during the induction phase prior to being started on their treatment/rehabilitation ensured that there was no disruption to the delivery of care. Patients were approached in the general 'common room' area of the Peter Long Unit (PLU) where the complex Trauma Team was based. During the recruitment phase, those patients who were not seen in their own single room were seen in one of the small treatment rooms on the PLU to ensure privacy and anonymity were maintained. During this initial approach, potential participants were provided with a patient-information leaflet in a 'commonly asked questions' format (see Appendix F: Prospective Patient Participant – Information Leaflet). In support of the initial patient briefing potential participants were provided with the opportunity to ask questions at first contact. Eligible potential participants were subsequently left for a minimum of 24 hours to consider their participation, before being approached a second time by the researcher who would provide them with an additional opportunity to ask questions or seek clarification regarding the purpose and nature of the study and seek their consent to participate.

Prior to the commencement of the recruitment and data collection phase of the project agreement had been reached between the Commanding Officer of the DMRC, the Director of Defence Rehabilitation and the Primary Investigators of the Headley Court Trust Project that the initial and subsequent approaches should be made in uniform. As the researcher was a serving military officer it was felt that such an approach would facilitate access to the clinical area, validate the researcher in the eyes of the potential participants and encourage participation (see Section 4.4.2. Face-to-face recruiting)

Those eligible potential participants willing to participate at second contact were taken through the consent process (see Appendix I: Consent Forms – Patient and Appendix J: Additional Consent Forms – Patient), enrolled into the study (see Appendix G: Contact Information Form – Patients and Appendix H: Clinical Data Sheet – Patients) and provided with the baseline assessment document (see Appendix K: Prospective Patient – Baseline Assessment (01PGBA)).

4.5. Data Collection

4.5.1. Participant Assessments

In order to comprehensively address its broad and admittedly general research aims[10], the main HCTP sought to utilise a wide range of clinical outcome and standardised self-report data. Data obtained through outcome measure assessments conducted at the DMRC during day-to-day clinical practice were collected in order to assess spinal injury, mobility, pain, balance, anxiety and depression, quality of life and functional capability in participants.

[10] The primary aims of HCTP were to identify: (1) [the] durability of psychiatric and psychosocial gains from rehabilitation following combat-related injury, and (2) [the] impact of combat-related injury on the partner of military personnel in terms of mental health, psychosocial adjustment, and relationships.

Data regarding injury severity score and the neurological status of participants recorded in the operational environment on OP HERRICK following their injury were requested through the Academic Department of Military Emergency Medicine (ADMEM) and through the Defence Analytical Services and Advice (DASA) (DASA is now as Defence Statistics).

Self-report data, collected on admission through the initial contact, recruitment and data collection phase of the project using the Baseline Assessment (01PGBA) (see Appendix K Prospective Patient Baseline Assessment), provided information on participants' sociodemographic background, military experience and exposure to traumatic events as well as self-reported physical health, resilience, perceived social support, general trauma-related psychopathology and quality of life.

Table 10: Participant Assessment and Summary of Measures

	Baseline Assessment (01PGBA)
Sociodemographic and Military Characteristics	KCMHR Phase II
Resilience variables	DRS-15 CD-RISC-10
General and trauma-related psychopathology variables	GHQ-12 PCL-C
Alcohol Use Disorder (AUD)	AUDIT-10

In order to minimise participant burden and to avoid causing unnecessary distress only those measures deemed essential in order to fulfil the aims of the main HCTP study were included in the patient assessment. Further discussion of the content of the patient assessments in relation to participant burden will be presented in Chapter Eight: Discussion.

4.5.1.1. Clinical Outcome Data

Within the larger HCTP, a wide range of clinical outcome data was made available by the DMRC who provided access to medical, nursing, occupational therapy and physiotherapy case notes as well as the Defence Medical Information Capability Programme (DMICP). While the HCTP collected a wide range of clinical outcome data it's use was problematic and a number of reasons prevented its consistent use across the sample.

Firstly, the range and type of physical combat-related injuries presenting at the DMRC for the first time provided a cohort of patients each with unique injuries. While there are certainly patterns of injury consistent with different mechanism of injury (see Chapter One), the reality of military polytrauma is that individual participants present with unique injury profiles and no two patients are truly alike. The uniqueness of the injury profile for each participant also impacted on: the length of time spent at the RCDM in Birmingham (length of stay varied greatly from two weeks to 14 months); the number of surgeries required to manage those complex poly-trauma injuries (and the numbers of subsequent revisions required); the prescribed treatment regimens and the prescribed range of physical therapy offered at the DMRC. While it is true that, on arrival at the DMRC, patients were all at the beginning of their rehabilitative pathway these factors served to ensure that the range of clinical data collected was diverse and specifically tailored to each patient (not all patients were subject to the same assessments). In reality that meant that it was impossible to use the clinical data collected to consistently assess the whole sample. In discussion with the primary Investigators of the NCTP and the Director of Defence Rehabilitation the decision was taken to limit the range of data collected. Accordingly, no data was collected in respect of patient medication or individual management of wounds e.g. wound dressings or drains etc.

Secondly, while data regarding Injury Severity Score (ISS), New Injury Severity Score (NISS) and Glasgow Coma Score (GCS) obtained within the operational theatre were collected within the Emergency Department at Camp Bastion in Afghanistan and recorded on the U.K. Joint Theatre Trauma Registry (JTTR) databases the data rather than belonging to the DMRC was owned by the Academic Department of Military Emergency Medicine (ADMEM) and held by the Defence Analytical Services and Advice (DASA) (DASA is now as Defence

Statistics). While the ISS, NISS and GCS data sets were requested by the Aberdeen Centre for Trauma Research at RGU for the purposes of the HCTP the request was rejected and data was not released by ADMEM.

While it is recognised that combat-associated TBI may have a broad effect on several mental health conditions in military personnel with physical combat-related injuries (Chin and Zeber, 2020) it has also been suggested that those individuals presenting with mild traumatic brain injury often exhibit symptoms consistent with PTSD and considerable overlap in presentation and sequelae serves only to complicate their diagnosis and management (Vasterling et al, 2009). As noted above, moderate or severe traumatic brain injury has previously been identified as a confounding factor in the assessment of post-injury mental health (Hill et al., 2009) and consequently those potential participants admitted to the DMRC with confirmed TBI were excluded from the study (see Section 4.4.8.2.).

It is acknowledged that many traumatic events involve physical injuries that leave chronic pain and the interplay of PTSD and physical pain is a phenomenon worthy of study (Beck and Clapp, 2011: Sharp, Busutti and Murphy, 2020). Likewise, it is acknowledged that there may be a relationship between sleep quality, pain and serious mental illness (Travaglini, Cosgrave, & Klingaman, 2019) however, the data collected for the purpose of this doctoral study does not allow for the assessment of chronic pain or pain related insomnia in UKAF personnel with physical combat-related injury. While there is data available on participant experience of pain this is acute pain it it's assessment is limited to participants' experience of pain in the month prior to their admission to the DMRC (see Section 5.7.6.).

4.5.1.2. Self-Report Data

In order to comprehensively address the stated research questions, this study utilises a range of standardised measures relating to psychological resilience, common mental health disorder (CMD), post-traumatic illness (PTI) and alcohol use disorder (AUD).

In relation to the effect that having sustained a physical combat-related injury may have on reported psychological resilience, two measures of psychological resilience were included in patient assessments. The Dispositional

Resilience Scale (DRS-15) was used within the 01PGBA (Baseline assessment) as a measure of dispositional (fixed capacity, characteristic or character trait) resilience (Bartone, 2007). The administration of the DRS-15 was not repeated in the six- or twelve-month assessment. Further assessment of the psychological resilience of participants was achieved through the use of the Connor-Davidson Resilience Scale (CD-RISC-10) (Connor and Davidson, 2003). Assessment of the CD-RISC-10 was carried out as part of the baseline, the six- and the twelve-month assessments. Assessment of CD-RISC-10 at baseline, six-months and twelvemonths was intended to facilitate the assessment of the change in psychological resilience over time and evaluate its moderating/mediating effect on CMD, PTSD and AUD.

The assessment of common mental health disorders (CMD) was achieved through the use of the General Health Questionnaire (GHQ-12) (Goldberg and Williams, 1988) and the assessment of the presence and severity of the symptoms of PTSD was achieved through the use of the PTSD Checklist-Civilian Version (PCL-C) (Blanchard *et al*., 1996). Both GHQ-12 and PCL-C assessments were carried out as part of the baseline, six- and twelve-month assessments. In addition to the assessment of CMD and PTSD, this study also assesses the presence and level of Alcohol Use Disorder (AUD) at all three stages of follow-up using the Alcohol Use Disorders Identification Test (AUDIT) (Babor *et al.,* (2001).

A summary of these measures and their use is presented in Table 10: Participant Assessment and Summary of Measures. The following sections provide more detail on the psychometric properties of the chosen measures, their use within the study and the means by which the data obtained should be analysed.

4.5.1.3. Comparability of Data

As this study utilises a sample of current (at time of first assessment) serving members of the UKAF, permission was sought to incorporate elements of the *Health & Wellbeing Survey of Serving & Ex-serving Members of the U.K. Armed Forces: Phase 2 study* conducted by King's Centre for Military Health Research (KCMHR) at King's College London on behalf of the Ministry of Defence to ensure the comparability of data. Consistency in the collection of a range of participant data ensures the comparability of results between this sample of combat-injured service personnel and the large cohort of current and ex-service personnel included in the Phase II study and subsequent work (Phase III of the KCMHR study is currently underway). This is a considerable strength of this study and will be discussed further in Chapter Nine: Discussion.

4.5.1.4. Sociodemographic Variables

For the purposes of this study a range of sociodemographic data was collected including gender, ethnicity, age, highest level of educational attainment, relationship status, and whether or not they had financially dependent children. Data regarding participants' military service was also obtained, *e.g.* whether they were regular, reserve, recalled ex-regular members of the UKAF or whether they were now ex-regulars, what their length of service was, and their current rank. Data regarding participants' history of operational deployments was obtained including numbers and duration of deployments along with information regarding their most recent deployment and their role on operations.

The collection of categorical data regarding sociodemographic distribution and military service was intended to facilitate the identification of a range of potential risk factors/predictors consistent with those identified in the systematic review (see Table 4: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Sociodemographic Factors; Table 5: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Military Factors; Table 6: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Physical (Injury) Factors and Table 7: Summary of Identified Themes – Potential Risk Factors for CMD and PTI – Psychological Factors and Table 8: Summary of Identified Themes – Potential Predictors of Psychological Resilience).

Again, the collection of sociodemographic and military service data was incorporated into the participant assessments at all three time points and mirrored the data collection strategy of the KCMHR: Phase II study. In addition to the collection of data through the main patient assessments, as part of the induction process data was collected regarding the incident causing the injury, when it had occurred, whether or not it was a combat-related incident, and what the nature of the incident had been using a clinical data sheet (see Appendix H) *e.g.* 'Explosion/Blast', 'Vehicle' or 'Sport' related injury. The clinical data sheet also facilitated the collection of data regarding whether or not the injured individual had been alone during the incident, what their memory or the incident was and to what extent they found the incident upsetting.

4.5.1.5. Psychological Resilience

'Resilience' refers to positive adaptation in the face of stress or trauma (Luthar *et al.*, 2000), and for the purpose of this study is defined as a dynamic process, influenced by both intrinsic and extrinsic factors which changes or develops over the course of the lifespan that facilitates positive psychological adaption and incorporates post-traumatic growth. Two standardised measures have been employed within this study to assess participant resilience, one measuring hardiness (dispositional resilience) as a stable character trait (Bartone *et al.,* 1989) and the other measuring psychological resilience as a state (Connor and Davidson, 2003). The selection of measures used to assess psychological resilience was influenced by the decision to ensure that the data collected was compatible/comparable with the larger KCMHR: Phase II dataset and subsequent Phase III study. Again, maximising the compatibility of collected data ensures comparability of findings and provides the opportunity to make significant comparisons between populations.

4.5.1.5.1. Dispositional Resilience Scale (DRS-15)

The Dispositional Resilience Scale (DRS-15) (Bartone *et al.,* 1989) is a brief 15-item scale developed in order to measure the personality trait of hardiness and its three component elements, *i.e.* commitment, control and challenge. The measure is derived from work on measure of personality hardiness (Kobasa, 1979). The 15-item Dispositional Resilience Scale (DRS-15) was developed from the longer DRS-30 version which in turn was developed from the original DRS-45 (Bartone *et al.,* 1989; Bartone 1991) in response to a need to create a measure of resilience which could be completed quickly and easily by respondents while eliminating items only weakly associated with the core construct (Bartone, 2007). The DRS-15 has the advantages of brevity, good internal consistency, and validity (Bartone, 2000), and has been shown to have good test-retest reliability using a military sample (Bartone, 2007). An example of the DRS-15 measure used within this study can be found in Appendix H (01PGBA Assessment).

The DRS-15 scale is described as a short hardiness scale (Bartone, 2007) and comprises of the three hardiness subscales 'Commitment', 'Control' and 'Challenge' (each of five items). Completing the scale, participants highlight the degree to which they believe that each of the presented statements describes them, *e.g.* 'If I am working on a difficult task, I know when to ask for help' (Item 8), on a rating scale with four values ('Not at all' to 'Completely True'). Nine of the item statements are scored 0-3 and six of the item statement use reverse scoring (Item statements 3, 4, 8, 11, 13 and 14). Total hardiness score is calculated by summing the totals of the scores for the 15 items with an expected range of results between 0 and 45.

The DRS-15 was originally validated on a study of 104 students (86.5% male and 13.5% female with a Mean age of 18.9 years) at the United States Military Academy (USMA), West Point New York, demonstrating high test-retest reliability over a period of three weeks (Bartone, 2007). The three-week test-retest reliability [Pearson correlation] coefficient reported for the DRS-15 in this study was .78 with hardiness subscales 'Commitment', 'Control' and 'Challenge' achieving .75, .58 and .81 respectively (Bartone, 2007). While Bartone (2007) comments that the Cronbach coefficient alpha is the most common index used to report the reliability of self-report scales, he suggests that it can underestimate reliability when complex constructs are measured using lower numbers of items. Subsequent assessment of the data using the internal consistency coefficients (Cronbach-alpha) for the hardiness components (control, commitment, challenge), demonstrates coefficients between 0.70 and 0.77 for the hardiness subscales and 0.83 for hardiness as a whole (Vasiliu *et al.,* (2015). The results published by Bartone confirm the criterion validity and the predictive validity of this test (Vasiliu *et al.,* (2015).

Adult male *(n*=7,281, Aged 20 to 60 years, Mean=39.76) norm scores for DRS-15 published in the Norwegian Health Survey (2007) suggest that for total hardiness the Mean score was 30.37 *(n*=7,281, SD=5.206), with corresponding hardiness component scores of: 'Commitment' Mean=10.20 *(n*=7281, SD=2.484), 'Control' Mean=10.27 *(n*=7282, SD=7.282) and 'Challenge' Mean=9.90 *(n*=7281, SD=2.314). Hardiness component scores (5 items each) range from 0 – 15.

The Dispositional Resilience Scale (DRS-15) has been widely used to measure hardiness in a range of different populations, and many different military cohorts, *e.g.* U.S. Army reserves (Bartone, 1999), U.S. special forces personnel (Bartone *et al.,* 2008), U.S. Navy and Marine Corps personnel (Taylor *et al.,* 2013) and Norwegian soldiers (Johnsen *et al.,* 2014) demonstrating consistently good internal consistency and validity. No consistent population-wide assessment of dispositional resilience is undertaken by the MoD in the U.K.

In terms of limitations, Bartone (2019) suggests of the DRS-15 that with only 5 items each to measure the hardiness sub-scales of commitment, control and challenge, the scales sometimes show lower reliability coefficients than is desired. While the 3-week test-retest reliability for the measure indicates 'acceptably high reliability' the author cautions the lower reliability coefficients of the control scale (.58) (Bartone, 2007). While this measure is only used once and does not attempt to measure Hardiness over a specified time period it may be that the measure, when compared to the newer Hardiness Resilience Gauge (HRG), may not fully capture the complexity of the hardiness facets (Bartone, 2019).

Permission to use the DRS-15 scale was obtained from the author Dr. Paul T. Bartone and the end user license obtained authorised use of the Dispositional Resilience Scale within this study.

4.5.1.5.2. Connor-Davidson Resilience Scale (CD-RISC-10)

This 10-item scale was developed from the original 25-item self-report scale (CD-RISC-25) (Connor and Davidson, 2003) and comprises items from the original scale measuring coping ability in adversity (Campbell-Stills and Stein, 2007). While the original CD-RISC-25 contained 5 factors: persistence/tenacity and strong sense of self-efficacy; emotional and cognitive control under pressure; adaptability/ability to bounce back; control/meaning; and meaning, the development of the unidimensional CD-RISC-10 scale still reflects participants' ability to tolerate experiences such as change, personal problems, illness, pressure, failure, and painful feelings. (Campbell-Stills and Stein, 2007). Preliminary studies of the original CD-RISC-25 scale reported good internal consistency, test–retest reliability, and convergent and divergent validity (Connor and Davidson, 2003). Similarly, the CD-RISC-10 measure has good internal consistency and construct validity thereby promoting the efficient measurement of resilience as a dynamic process (i.e., both quantifiable and influenced by health status) (Wald et al, 2006).

The CD-RISC-10 scale has been designed for use as a self-report scale and consists of a list of 10 statement items. Participants are directed to indicate how much they feel that statement items apply to them over the previous 30 days, *e.g.* 'I try to see the humorous side of things when I am faced with problems. (Item 3), on a rating scale with five values ('Not true at all' to 'True nearly all of the time'). Participants are also instructed that if the particular item statement describes a situation that has not occurred that they should answer in accordance with what they believe their response would have been, *i.e.* how they would/might have felt in that situation. Each of the statement items is scored 0 to 4 and the total resilience score is calculated by summing the scores for all ten items. The expected range of total resilience scores on the CD-RISC-10 is between 0 and 40.

In a study of U.S. undergraduate students *(n*=532) the internal consistency of a revised CD-RISC scale (CD-RISC-10) was evaluated by calculating Cronbach's alpha and the reported alpha value of .85 indicates good reliability (Campbell-Stills and Stein, 2007), concluding that the CD-RISC-10 scale demonstrated good internal consistency and construct validity. Overall, the 10-item CD-RISC displays excellent psychometric properties and allows for efficient measurement of resilience (Campbell-Stills and Stein, 2007).

Subsequent studies of general populations using CD-RISC-10 generally report Mean scores between 29 *(n*=1922, SD=0.1), (Antunez *et al*., 2015) and 33.5 *(n*=160, SD=6.2), (Goins *et al.,* 2012). Studies of subjects presenting with a diagnosis of PTSD or following exposure to severe trauma report Mean scores of 30.3 *(n*=1,686, SD=6.6) in a national sample of older U.S. veterans (aged 60-96) (Pietrzak *et al.,* 2014).

The Connor Davidson Resilience Scale has also been widely used to measure psychological resilience in a wide range of different populations and many different military cohorts, *e.g*. in 252 U.S. veterans of Iraq and Afghanistan (Roberts *et al.,* 2007) and U.S. military medical personnel preparing to deploy on military operations (Maguen *et al.,* 2008) demonstrating consistently good internal consistency and validity.

While, the CD-RISC-10 displays excellent psychometric properties in terms of internal consistency and construct validity and allows for efficient measurement of resilience (Campbell-Stills and Stein, 2007) there is some debate about the conceptual coherence of the measure (Gonzales et al., 2016). The CD-RISC-10 measure contains six items intended to assess ability to experience adversity and positive adaptation but it also contains four items which may, more accurately, be considered to measure individual qualities that might 'accompany resilience' (Gucciardi *et al*., 2011) and none of the items capture the process of the experience of adversity plus positive coping (one of the traditional elements of resilience).

Permission to use the CD-RISC-10 scale was obtained directly from the author Dr. Kathryn M. Connor and the end user license obtained authorised use of the Connor Davidson Resilience Scale within this study. An example of the CD-RISC-10 measure used within this study can be found in Appendix H (01PGBA Assessment).

4.5.1.6. Common Mental Health Disorder, PTSD and Alcohol

The collection of data regarding participants' general mental health, and more specifically any symptoms of PTSD was achieved through the administration of the *General Health Questionnaire* (GHQ-12) (Goldberg and Williams, 1988) and the *PTSD Checklist-Civilian Version* (PCL-C) (Blanchard *et al*, 1996).

4.5.1.6.1. General Health Questionnaire (GHQ-12)

The General Health Questionnaire (GHQ-12) was developed as a screening tool for those identified as being likely to develop, or at risk of developing, psychiatric disorders (Goldberg *et al*., 1997) and is now one of the most widely used assessments of common mental health problems in both community settings and in non-psychiatric settings (Jackson, 2007). In addition to the GHQ-12 the General Health Questionnaire is available in 4, 28, 30 and 60 item versions, however, the twelve item version of the General Health Questionnaire has been used extensively to assess the presence of common mental health diagnoses and general psychiatric caseness in a wide range of military populations. The GHQ-12 was used in the KCMHR: Phase 2 study and is reported widely in studies of UKAF peacekeepers (Greenberg et al., 2008) and UKAF personnel following operational deployments to Iraq and Afghanistan (Fear et al., 2010) and more recently in an examination of trajectories of posttraumatic stress disorder (PTSD) and associated risk factors symptoms over a 14-year period in the general UKAF service population (Palmer *et al*., 2019). The 12-item version (GHQ-12) was selected for use in this study based on the fact that it is a quick, reliable and sensitive short form designed for use in research studies (including the KCMHR cohort studies of health and wellbeing in military personnel and other studies of occupational health).

The GHQ-12 scale has been designed for use as a self-report scale and consists of a list of 12 question items regarding general mental health. The GHQ items pertain to: symptoms of anxiety, depression, social dysfunction, and loss of confidence (Makikangas *et al*., 2006). Evaluation using the GHQ typically focuses on two major areas: (i) the inability to carry out normal functions, and (ii) the appearance of new and distressing phenomena (Jackson, 2007).

Participants are asked to consider each question item and to indicate which of the presented answers (answers differ from question item to question item) most nearly applies to them, *e.g.* 'Have you recently felt constantly under strain?' (Question 5). Response items for Question 5 range from 'Not at all' to Much more than usual'. The response to each of the question items can be scored and the total score is calculated by summing the scores for all twelve items. There are two methods of scoring the GHQ-12, the Likert method (where individual question items are scored 0-1-2-3) and the GHQ (binary) method (where question items are scored 0-0-1-1). The expected range of total GHQ-12 scores using the Likert method of scoring is between 0 and 36. The expected range of total GHQ-12 scores using the GHQ method of scoring is between 0 and 12. Use of the GHQ scoring method is advocated as the most efficient method of indicating general psychiatric caseness *i.e*. that scores indicate that it is highly likely that clinical examination by a mental health specialist would identify the participant as suffering from a genuine psychiatric condition (Goldberg *et al*., 1997). In contrast to the previous measures of psychological resilience that produce total scores indicating severity, the use of the GHQ-12 as a screening tool for general psychiatric caseness is based upon the use of a pre-determined threshold score (Goldberg *et al*., 1997). In general, it is recommended that threshold values are determined on a study-by-study or population-by-population basis and are based on past clinical use or research evidence relevant to their assessment circumstances (Goldberg *et al.*, 1997).

In an international two phase validation study of GHQ-12 and GHQ-28 conducted in 15 centres around the world, Goldberg *et al.* (1997) administered the GHQ-12 scale with 25,916 participants in phase one and conducted interviews with 5,438 individuals in phase two. The resulting analysis of data reported that the validity coefficients for GHQ-12 were generally high with an overall sensitivity of 83.4% and overall specificity of 76.3%. Within the U.K., sensitivity and specificity reported in the Manchester centre were reported as 84.6% and 89.3% respectively (area under the calculated Receiver Operating Characteristic (ROC) curve was 0.95) (Goldberg *et al.,* 1997).

While it is generally identified as a reliable screening tool there are a number of potential limitations associated with the GHQ-12. As described above, variation in scoring method has been found to affect the sensitivity (Crockett *et al*., 2008), discrimination (Hankins, 2007 and 2008) and the apparent dimensionality of the GHQ-12 (Martin and Newell, 2005). Across studies the variation in scoring provides some difficulty in directly comparing results.

Permission to use the GHQ-12 scale was obtained from GL Assessment Limited on behalf of the author Professor Sir David Goldberg and the end user license obtained authorised use of the twelve item version of the General Health Questionnaire within this study. An example of the GHQ-12 measure used within this study can be found in Appendix H (01PGBA Assessment).

4.5.1.6.2. PTSD Checklist (Civilian Version) (PCL-C)

The PCL-C measure is a 17-item checklist that can be used to screen individuals for PTSD, as a diagnostic tool, or to monitor symptom change during and after treatment (Weathers *et al.,* 1993). While the PTSD Checklist is available in three different versions, *i.e.* PCL-M (military), PCL-C (civilian), and PCL-S (specific), the civilian version of this measure has been utilised within this study to ensure the compatibility and comparability of collected data with the existing King's Centre for Military Health Research (KCMHR) cohort studies of health and wellbeing in UKAF personnel.

The PCL-C scale has been designed to be used as either a self- or clinician-administered scale. Participants are presented with a series of 17 common problems or complaints that may be experienced following exposure to stressful events or occurrences and are asked to indicate how much they regard themselves as being 'bothered' by the problems or complaints within the last 30 days, *e.g.* 'Suddenly acting of feeling as if a stressful experience were happening again (as if you were reliving it)?'. Participants responses are rated on a five-point scale from 'Not at all' to 'Extremely' and each of the participant responses is scored between 1 and 5. The expected range of total severity score PCL-C is between 17 and 85. The PCL-C scale can be used as a screening tool or as a diagnostic tool (Weathers *et al.,* 1993). The total severity score can be calculated by summing the scores for all 17 items (screening) or individual scale items can be used to make diagnostic judgements based on calculated symptom cluster scores (diagnostic). Given recent changes in the diagnostic criteria published in DSM-5, the poor correlation coefficients reported in Blanchard *et al.* (1996) in relation to psychogenic amnesia and hypervigilance (below 0.5), and the general caution advised in that paper, PCL-C has only been used to produce a total severity score in this study. As with the GHQ-12, general psychiatric caseness is indicated by a pre-determined cut-off score. The threshold score for PCL-C in this study will be discussed in the following chapter.

In a study of 40 U.S. adults experiencing symptoms of post-traumatic illness following motor vehicle accident *(n*=27) or violent sexual assault *(n*=13), the Clinician Administered PTSD Scale (CAPS) (Blake *et al.,* 1990) was used to validate the PCL-C scale (Blanchard *et al.,* 1996). Total PCL-C severity scores ranged from 17 to 74 with a Mean of 45.8 (SD = 16.1) and the overall correlation of the PCL-C score to CAPS was 0.929 using the threshold score of 50, indicating 86% common variance, a sensitivity of 0.778, specificity of 0.864 and an overall diagnostic efficiency of 0.825 (Blanchard *et al.,* 1996). Following a reduction of the cut-off score to 40 the diagnostic efficiency of the PCL-C scale increased to 0.900, with a sensitivity of 0.944 and specificity of 0.864 (Blanchard *et al.,* 1996). Blanchard *et al.* (1996) also found the internal consistency coefficient (Cronbach's alpha) for the total scale to be 0.939 indicating high reliability. While initial estimates of the test-retest reliability of PCL-C report it as being 0.96 (Weathers *et al*., 1993) there is no stated interval (Blanchard *et al.,* 1996).

The PCL-C measure is commonly used in conjunction with the GHQ-12 in a wide range of military populations including in the KCMHR: Phase 2 study.

Again, while the PCL-C is widely regarded as being a robust measure which demonstrates good temporal stability, internal consistency, test-retest reliability, and convergent validity (Willkins *et al*., 2011) there is some suggestion that it may overestimate PTSD prevalence. The lack of a universal cut-off means that selecting a specific cut-off tends to depend on the base rate of PTSD in the population being measured and the desired sensitivity (e.g., selecting a low cut-off for high sensitivity if the goal is not to miss anyone who may have PTSD) (Willkins *et al*., 2011). The variation in validated cut-off scores used across multiple settings and studies leads to the suggestion that the PCL-C more accurately measures 'probable' PTSD and the gold standard for diagnosing PTSD remains a structured clinical interview.

PCL-C is an open source assessment and no permissions or licence is required for its use. An example of the PCL-C scale used within this study can be found in Appendix H (01PGBA Assessment).

4.5.1.6.3. Alcohol Use Disorders Identification Test (AUDIT-10)

The Alcohol Use Disorders Identification Test (AUDIT-10) is designed to identify hazardous and harmful patterns of alcohol consumption. The AUDIT-10 has been developed and evaluated over the last 20 years and has consistently been found to provide an accurate measure of risk across gender, age, and cultures (Babor *et al.,* 2001). The AUDIT-10 measure can be used both as a self-report and as a clinician-led interview.

Participants completing an AUDIT-10 assessment are presented with a series of ten question items designed to assess hazardous alcohol use (frequency, quantity and patterns of heavy drinking), dependence symptoms (functional impairment, increased salience of drinking and morning drinking) and harmful alcohol use (presence of guilt, blackout, alcohol-related injury and the expressed concern of others) (Babor *et al.,* 2001). Question items are presented in a straight forward plain language way and are accompanied by a range of answers, *e.g.* 'How often during the past year have you needed a first drink in the morning to get yourself going after a drinking session?' (Question Item 6), answer range from 'Never' to 'Daily/Almost Daily'. Participants' answers are scored and the total AUDIT-10 score is calculated by summing the scores of the ten question items. Scores for individual sub-scales of hazardous alcohol use (Question Items 1 – 3), dependence symptoms (Question Items 4 – 6) and harmful alcohol use

(Question Items 7 - 10) can be calculated by summing the scores from each of the question item groups (Babor *et al.,* 2001). Total AUDIT-10 scores of >8 are associated with harmful or hazardous drinking and scores of >13 in women and >15 in men are likely to indicate alcohol dependence.

In assessments of its reliability, the AUDIT-10 measure consistently demonstrated a high degree of internal consistency across 18 studies between 2002 and 2005 (0.83, range 0.75 to 0.97) (Reinert and Allen, 2007). The test-retest reliability of AUDIT has .87 (kappa for non-problem drinkers and .89 in primary healthcare patients with a diagnosis of problem drinking after one week (Rubin *et al.,* 2006). In respect of the sensitivity and specificity of AUDIT-10, one study of U.K. admissions to acute medical units in adults (over 17 years of age) suggested a sensitivity of 0.93 and specificity of 0.94 (MacKenzie *et al.,* 1996).

The AUDIT-10 measure is commonly used in conjunction with both the GHQ-12 and PCL-C to assess comorbid AUD. The AUDIT-10 measure has been consistently used to assess patterns of hazardous and binge drinking in military populations (Fear *et al.,* 2007; Jacobson *et al.,* 2008; Rona *et al.,* 2010 and Bray *et al.,* 2009).

In studies assessing the stability of the AUDIT-10 measure findings suggest that while the measure has moderate stability, the stability is somewhat dependent on age (Sahker, Lancianese and Arndt, 2017). Specifically, alterations in drinking behaviours may subject to maturation effects and may change with age. The stability of AUDIT-10 was markedly reduced for younger people (Sahker, Lancianese and Arndt, 2017) this an important consideration and may be a significant limitation in the use of the AUDIT-10 measure in a study where the majority of the sample are young males.

The AUDIT-10 measure is an open source assessment produced and distributed freely by the WHO and no permission or licence is required for its use. An example of the AUDIT-10 measure used within this study can be found in Appendix H (01PGBA Assessment).

4.6. Data Analysis

The systematic literature review identified four categories of potential risk factor (for post-traumatic illness and common mental health disorder). The potential risk factors identified have been categorised into four potential predictor categories, *i.e.* sociodemographic factors, military factors, physical (injury) factors and psychological factors and these categories will be used to structure the reporting of the study sample in Chapter Five. These factors will also provide the theoretical framework for the subsequent analysis of the study data in Chapter Seven. The statistical analysis of data collected through the participant assessments was carried out using the software package SPSS for Windows (Version 26).

Chapter Five will begin by reporting findings related to the recruitment of participants, response rates and will briefly compare responders and non-responders before moving on to the more detailed description of the study sample. The reporting of categorical data regarding sociodemographic, military, psychological and physical injury characteristics of the sample will be done using descriptive statistics, *i.e.* frequencies and measures of central tendency.

Chapter Six will address the following research questions:

a(i) What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?

and

b(i) What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?

In order to comprehensively answer these research questions Chapter Six will report study findings in respect of the mental health morbidity of our prospective sample of UKAF personnel presenting at the DMRC for the first time with a physical combat-related injury. Mental health morbidity will be reported in terms of PTSD (using the PCL-C measure), common mental health disorder as indicated by psychiatric caseness (using the GHQ-12 measure), and Alcohol Use Disorder (using the AUDIT-10 measure), observed levels of dispositional resilience

(Hardiness), using the DRS-15 measure, and psychological resilience (CD-RISC-10).

Within Chapter Six the first three of the study hypotheses will be tested:

- Hypothesis 1: Physical combat-related injury is a predictor of PTSD, CMD and AUD (Prevalence).
- Hypothesis 2 – PTSD is a predictor of CMD and AUD (Comorbidity).
- Hypothesis 3 – Physical combat-related injury negatively impacts on both hardiness and resilience (Coping).

The internal reliability of the utilised primary outcome measures, assessed at baseline, will be reported using the Cronbach's Alpha test.

Chapter Seven will address the following research questions:

a(ii) Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?

b(ii) Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

In order to comprehensively answer these research questions Chapter Seven will utilise the potential risk factor/predictors categories identified in the systematic literature review to explore the relationships between a range of categorical predictor variables drawn from the previously identified categories (sociodemographic factors, military factors, physical (injury) factors and psychological factors and observed levels of CMD, PTSD, AUD and Hardiness and Psychological Resilience (categorical outcome variables). The exploration of these relationships will allow the remaining study hypotheses to be comprehensively tested:

- Hypothesis 4a – There is a relationship between sociodemographic characteristics and mental health morbidity
- Hypothesis 4b – There is a relationship between sociodemographic characteristics and hardiness and psychological resilience

- Hypothesis 5a – There is a relationship between military characteristics and mental health morbidity
- Hypothesis 5b – There is a relationship between military characteristics and reported levels of Hardiness and Psychological Resilience
- Hypothesis 6a – There is a relationship between physical health factors and mental health morbidity
- Hypothesis 6b – There is a relationship between physical health factors and reported levels of Hardiness and Psychological Resilience
- Hypothesis 7a – There is a relationship between psychological health factors and mental health morbidity
- Hypothesis 7b – There is a relationship between psychological health factors and reported levels of Hardiness and Psychological Resilience

The associations between categorical predictor variables and categorical outcome variables can be tested using a number of different statistical tests including logistic regression, Pearson's chi-square or likelihood ratio (Field, 2018) see below.

While logistic regression is commonly used to determine association and for predictive modelling, based on power analysis using the computer software package G*Power intended to establish the optimal sample size for this study. The estimated sample size required for logistic regression was n=376 (based on α err prob=0.05 and a target Power (1-β err prob) =.80). While original estimates of potential numbers of participants at the DMRC suggested that, based on operational tempo and previous experience that up to 340 potential participants would be admitted during the data collection phase of the study actual numbers were far less (see 4.4.6 Population and Sample). Based on the power analysis and the study sample (n=101) Binary Logistic Regression was not conducted.

In respect of Pearson's Chi-Square Analysis G*Power 3.1 estimated the required sample size to be 88 (predicted Effect size, w = 0.3, α err prob = 0.05, target Power (1-β err prob) = .80 (Df = 1).

4.6.1.1. Pearson's Chi-Square Test

Pearson's chi-square test (Fisher, 1922; Pearson 1900) is an 'elegant statistic' (Field, 2018) based on the comparison of frequencies or occurrences within identified categories (categorical predictor variables), *i.e*. gender, rank and injury type, against frequencies or occurrences within identified categories (categorical outcome variables), *i.e*. psychiatric caseness or diagnosis of PTSD. Both predictor and outcome variables should be binary, *i.e.* achieves psychiatric caseness/doesn't achieve psychiatric caseness, male/female, drinker/non-drinker. Chi-square testing in SPSS (v26) is done by creating contingency tables through the crosstabs command.

Chi-square tests depend on two important assumptions being met to be meaningful (Field, 2018). Firstly, that each 'occurrence' should be independent and appear in only one cell of the contingency table, *i.e.* participants cannot be both male and female or drinkers and non-drinkers. Secondly, within the contingency tables no variable should present with less than five occurrences, *i.e.* the frequency of tested variables should not be less than 5 (Howell, 2012).

Chi-square tests are intended to indicate how likely it is that an observed relationship is due to chance and are used to test the null-hypothesis, *i.e.* that the categorical variables being tested are independent. Where reported data fail to fit the statistical model based on the expected distribution, the chi-square test implies that the null-hypothesis should be rejected and that the variables are, more likely, dependent.

Having calculated the chi-square value ($\mathcal{X}^2$), this statistic is used in conjunction with the degrees of freedom (df) to calculate the p-value. Degrees of freedom for a 2x2 contingency table equal 1. The calculated p-value is, in essence, the statistical probability that the null-hypothesis is correct. As p-values approach 1.000 it becomes more and more likely that the categorical variables being tested and independent. The smaller the p-value, the more likely that the null-hypothesis (variables are independent) is incorrect and should be rejected. By convention, the criteria for statistical significance is a p-value of <0.05. A p-value of <0.05 indicates that there is less than a 5% chance that the null-hypothesis is correct. For the purpose of this study the p-value of <0.05 will be taken to indicate statistical significance. Chi-Square results will be reported using the American Psychological Association standard:

($\mathcal{X}^2$(1, *n* = 'number of cases') = chi-square value, p = significance)

4.6.1.2. Odds Ratio

Having rejected the null-hypothesis during the chi-square test and having identified that the categorical variables being tested are dependent and that a causal relationship exists, *i.e*. that the potential categorical predictor variable does, in fact predict the categorical outcome variable, odds ratios will be calculated.

An odds ratio (OR) is a measure of association between an exposure and an outcome. Odds ratios are used to compare the relative odds of the occurrence of the outcome of interest (*e.g*. PTSD, CMD or AUD), given exposure to the categorical predictor variable of interest (*e.g*. age, rank, tobacco use). The odds ratio can also be used to determine whether a particular exposure is a risk factor, or predictor, for a particular outcome, and to compare the magnitude of various risk factors for that outcome (Szumilas, 2010) where OR>1 indicates increased risk, OR<1 indicates decreased risk, and OR=1 indicates that the observed outcome is unaffected by the exposure. Odds ratios are deemed to be statistically significant at p<0.05 where the 95% confidence intervals do not span 1.00.

Where Adjusted Odds Ratios (AOR) are often cited in studies utilising logistic regression and are able to account for confounding variables due to sample size Pearson's Chi-Square has been used in preference to logistic regression. The odds ratios presented within this study are unadjusted and do not account for confounding variables. Given the complex nature of military physical trauma this may be a significant limitation of this study (see 8.9 Limitations).

4.6.1.3. Cronbach's Alpha

The internal consistency of a scale or measure can be assessed using the correlation coefficient Cronbach's alpha. Assuming that all of the statement or question items in a given scale measure the same outcome, there should be a degree of correlation between them. The value of alpha (α) for any given scale lies between negative infinity and 1. (Streiner and Norman, 2015). In practical terms the value for the α coefficient is generally found to be between 0 to 1 and may be used to describe the reliability of factors extracted from dichotomous and/or multi-point formatted questionnaires or scales (Streiner and Norman, 2015). Again, in general terms, internal reliability scores of 0.700 or higher are regarded as indicating that the reliability of the scale is acceptable and above 0.900 excellent (Kline, 2000, p.13). Caution is advised however as the α is dependent also upon the number of items in a scale and it is reported that a scales apparent homogeneity can be improved by simply doubling the number of items (Streiner and Norman, 2015).

4.7. Research Governance

By virtue of the fact that this study involves participants who may have suffered traumatic injury, and investigates topics about which some participants may be sensitive, embarrassed or upset, it is recognised that participation in this project may be harmful. At each stage, measures have been taken to minimise the potential risk to participants and the study was conducted in full compliance with the Research Ethics Policy of the Robert Gordon University (RGU). The study has been reviewed by the Surgeon General's Research Strategy Group and granted full ethical approval by both the Ministry of Defence Research Ethics Committee (MODREC) and the National Research Ethics Service – North of Scotland (NRES) Committee. Ethical approval from the Ministry of Defence Research Ethics Committee (MoDREC) was granted on the 1st October 2009 (MoDREC references, 62/Gen/09 (Patient study) and 63/Gen/09 (Partner study)). A favourable ethical opinion was granted by the National Research Ethics Service Committee – North of Scotland (NRES) on the 29th July 2009 (NRES reference number 09/S0801/47).

As part of a funded project sponsored by The Headley Court Trust, annual reports outlining the progress of the HCTP and of this doctoral study were returned to the Board of Trustees through the chair Commodore Tobin Elliott OBE as well as to both the Ministry of Defence Research Ethics Committee (MODREC) and the National Research Ethics Service – North of Scotland (NRES) Committee.

4.7.1. Participant Consent

Informed written consent was obtained from each participant prior to their enrolment in the study (see Appendix I: Consent Forms – Patient and Appendix J: Additional Consent Form – Patient). For the purpose of this study, written consent included permission from the participant to access their medical and resettlement records and, where appropriate, to contact their partner or the study medical officer (Surg. Capt. (now Professor) Neil Greenberg R.N.) should any concern be raised over their health and well-being. During the induction process, participants were provided with a verbal briefing, informed as to the nature, aims and risks of the study and provided with a detailed patient information sheet (see Appendix F: Prospective Patient Participant – Information Leaflet). Participants were reminded that they are entitled to ask questions on any aspect of the study that may occur to them at any time during their participation and that they were are at liberty to withdraw from the study at any point without requiring to provide any explanation of their withdrawal. Additionally, participants were reminded that a decision to withdraw would not affect either their military careers or the care provided by the DMRC.

4.7.2. Participant Coercion

As potential participants are currently, or have previously been, in receipt of treatment from the DMRC and because they may continue to serve in the armed forces, it was feasible that some individuals may feel compelled to participate in the study. Participants were informed, however, that although the study was being conducted in collaboration with the DMRC and was funded and supported by the Headley Court Trust, the researchers remained independent of these bodies and that participation in the study was entirely voluntary. Participants were also reminded that they retained the right to withdraw their consent at any time during the study without prejudicing either their medical care or their military career (or medical care or military career of their partner).

4.7.3. Confidentiality, Anonymity and Data Storage

In compliance with Caldicott (2013) guidance, participants were assured that their responses would remain confidential throughout and that on completion of the study; no personally identifying information will be released into the public domain. Participants were informed also that that no individual would be identified in reports or publications and that all findings would be reported anonymously on the basis of aggregated data.

As participants were asked to consent to the storage of personal information it was also made clear that any data collected would be used only for the purpose of the current study and that their information would be handled in accordance with the Data Protection Act 1998.

Computerised data (which may be militarily sensitive and/or clinically confidential) was/is stored on an encrypted hard-disk that remains accessible only by authorised members of the research team. As MoDREC requires the retention of the original hard copy of participant assessments for a period of not less than 100 years, hard copy information will be stored in a locked cupboard within the secure ACTR site which is accessible only by designated RGU staff.

4.8. Summary

In summary, this chapter presents a description of a quantitative research design that fits within the positivist paradigm. The research design described in this chapter has been optimised to achieve the primary study aim by addressing objective three of this study:

3. Explore levels of post-traumatic illness, common mental health disorder, hazardous drinking and psychological resilience in a cohort of UKAF personnel following combat injury and identify potential risk factors for PTI, CMD and AUD and predictors of psychological resilience

This chapter has described the main elements of the research design including the selection and recruitment of participants. The methods described in this chapter are intended to facilitate high recruitment and minimise recall and self-selection bias. It should be noted, again, that as participants were serving UKAF personnel who have been injured in an operational environment little control can be exercised over the sample size. Consequently, this is not a powered study.

The next chapter will begin by reporting findings related to participant recruitment and response rates and will then present a comprehensive description of the study sample structured around the ‘risk categories’ identified in the systematic review.

Figure 5:Ajax Bay Field Hospital - David Cobb

CHAPTER FIVE: RECRUITMENT, RESPONSE AND SAMPLE CHARACTERISTICS

5.1. Introduction

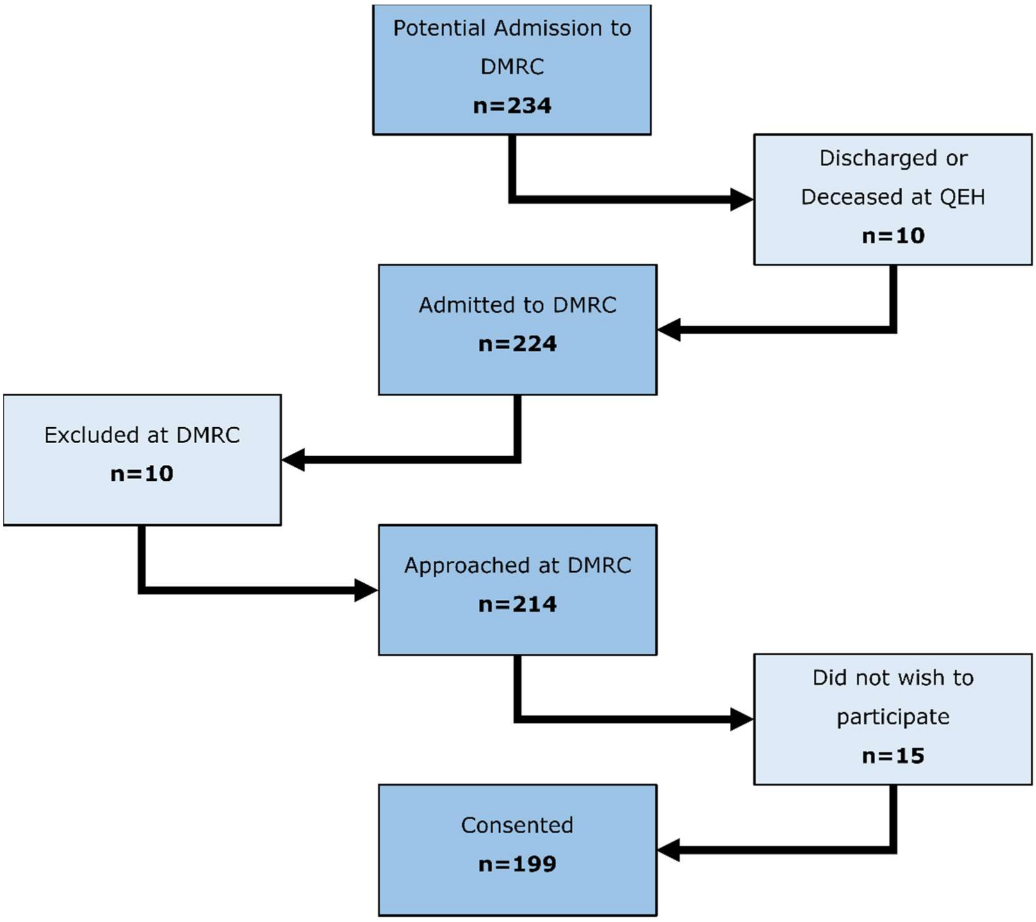
Previous studies of the general UKAF population have identified that gender, age, relationship status, educational attainment, type of service (regular or reserve), branch of service and rank are all risk factors for anxiety and depression (Iversen *et al.,* 2009), Alcohol Use Disorder (Fear *et al.,* 2007) or PTSD (Rona *et al.,* 2016). Within the systematic review, four categories of potential risk factor (for post-traumatic illness and common mental health disorder) and two categories of potential predictor (of psychological resilience) were identified in the literature. These 'risk categories', *i.e.* 'Sociodemographic', 'Military', 'Physical Health' and 'Psychological Health' will be used to structure the description of the study sample in this chapter, and provide the theoretical framework for the subsequent analysis of the study data. This chapter begins by reporting findings related to participant recruitment and response rates and provides a description of the study sample in terms of its sociodemographic, military, physical and psychological health characteristics. This chapter concludes by identifying the potential categorical predictor variables (risk factors and predictors) that will be tested in Chapter Seven.

5.2. Recruitment

Each week, between the 3rd of January 2010 and the 30th of June 2011, details of expected in-patient admissions to the DMRC (*n*=234) were published on the complex trauma admission list. Published details included the regimental number, rank and name of each of the potential admissions, along with a brief clinical summary of their injuries and treatment. Subsequently, during the recruitment period, 224 individuals were admitted to the care of the Complex Trauma Team at the DMRC. The differential between expected in-patient and actual in-patient admissions (*n*=10) is explained by, either an improvement in patient condition following initial DMRC review and subsequent referral to a regional rehabilitation centre or to a facility other than the DMRC, or by in-patient death at the Queen Elizabeth Hospital in Birmingham (QEHB).

The initial screening of potential participants on arrival at the DMRC resulted in the exclusion of an additional number of individuals (*n*=10) due to their failure to meet the stated study selection criteria (see 4.4.3. Selection Criteria) *e.g.* those presenting: following elective procedures; with comorbid (mild, moderate or severe) traumatic brain injury; admitted to a rehabilitation group other than complex-trauma; or by virtue of their being non-U.K. national or civilians.

Figure 6: Recruitment



Two-hundred and fourteen potential participants were approached during the recruitment phase of the study, had the purpose of the study explained and were provided with detailed information (see Appendix F: Prospective Patient Participant – Information Leaflet). Following a period of not less than 24 hours, potential participants were approached a second time and, if willing to participate were enrolled onto the study. One-hundred and ninety-nine individuals (93.0%) consented to participate (see Figure 6: Recruitment), and were enrolled into the study. Study induction involved recording participant consent (see Appendices I and J), the collection and storage of participant contact information (see Appendix G) and the initial collection of information regarding the circumstance of the causative event (see Appendix H).

5.3. Response

The response rate on the baseline assessment was 56.3% *(n*=112). A summary of response rates is presented below (see Table 11: Response Rates). The following section presents a description of the sample characteristics for those returning the baseline assessment *(n*=112).

While it had been the methodological aspiration of this study to include an age- and gender-matched control group of musculoskeletal patients to facilitate comparison, of the 199 participants consented, 85.4% *(n*=170) reported physical combat-related injury and 14.6% *(n*=29) reported non-combat (musculoskeletal) injury. At baseline *(n*=112), 90.2% *(n*=101) reported a physical combat-related injury. Given the difficulties associated with comparing such small numbers and the limited number available as a control group, the case-control element of the research design became unsustainable.

Table 11: Response Rates

		Patient Group
Baseline Assessment (01PGBA)	Administered	199*
	Returned (Rate)	112 (56.28%)

***Baseline Assessment (BA) for the Patient Study Group was administered at the DMRC as a self-report questionnaire.**

5.4. Comparison of responders and non-responders

While there is little by way of data describing either the sociodemographic and military characteristics or the physical/psychological health of non-responders within this study, there were some indications of a difference between those groups. The Mean age of responders *(n*=112) was 26.12 years (SD 5.951) while the Mean age of the non-responders *(n*=87) was 24.95 years (SD 5.967).

A higher percentage of White British participants were found in the non-responders group (94.3%) as opposed to the responders group (87.5%). Correspondingly, higher percentages of Black and Asian British participants were found in the responders group (4.6% and 3.6% respectively) compared to the non-responders group (2.3% for each).

Independent-samples T Test indicates that for age there was no statistically significant difference between responders and non-responders (Levene's test for equality of variances, F=.057, sig. .812). In respect of ethnicity however, there does appear to be a significant difference between responders and non-responders (Levene's test for equality of variances F=4.057, sig. .045). These findings suggest that White British participants are more likely to be represented in the non-responders group.

5.5. Sociodemographic Characteristics

This section provides a description of the sample of UKAF personnel admitted to the DMRC for the rehabilitation of physical combat-related injuries in relation to their sociodemographic characteristics, *i.e.* gender, ethnicity, age, highest level of educational attainment, relationship status and parenthood (financially dependent children). A summary of sociodemographic findings of those participants returning the baseline assessment at DMRC during the period of study *(n*=112) is presented in Appendix L: Summary of Sociodemographic Characteristics.

5.5.1. Gender

The overwhelming majority of participants responding at baseline were male (99.1%, *n*=111). Only three female participants took part in the overall study and only one chose to return the baseline assessment (0.9%, *n*=1). This distribution of gender is not representative of the overall distribution of gender in the UKAF population and, at 1st April 2011, 90.4% of Regular UKAF personnel were male *(n*=168,500) and 9.6% were female *(n*=17,850). The distribution of gender described in this section is, however, likely to be representative of those undertaking frontline combat duties at the time. From October 2018, women already serving in the British Army have been able to transfer into infantry roles and, as a consequence of this change in policy, it is possible that this gender bias would be less evident in future studies of UKAF personnel with combat. A summary of the distribution of gender is presented below (see Appendix L: Summary of Sociodemographic Characteristics).

5.5.2. Ethnicity

The majority of participants enrolled in the patient study identified themselves as being 'White: British' (87.5%, *n*=98). The remainder of the participants identified themselves as being either 'White: Irish' (3.57%, *n*=4), 'White: Other' (0.89%, *n*=1) or as being either 'Asian or Asian British' (3.57%, *n*=4) or 'Black or Black: British: African' (4.46%, *n*=5). The distribution of ethnic origin was roughly in line with that reported by the DASA (2012) in respect of U.K. Regular Forces at 1st April 2011 where, for the NATO ranks of OF3 (Army Captain) and below, 91.4% (*n*=164,980) were identified as being 'White' and 6.7% were reported as being 'Black and Minority Ethnic'. Those participants reporting their ethnicity as 'White: Other' were exclusively South African and, while the use of U.K. Census categories for ethnicity is not particularly useful in identifying Nepalese participants, the majority of those identifying themselves as 'Asian or Asian British: Other' were Ghurkha participants (2.3%, *n*=5). The distribution of participant ethnicity is presented below (see Figure 7: Ethnicity). Ethnicity is also summarised in Appendix L: Summary of Sociodemographic Characteristics.

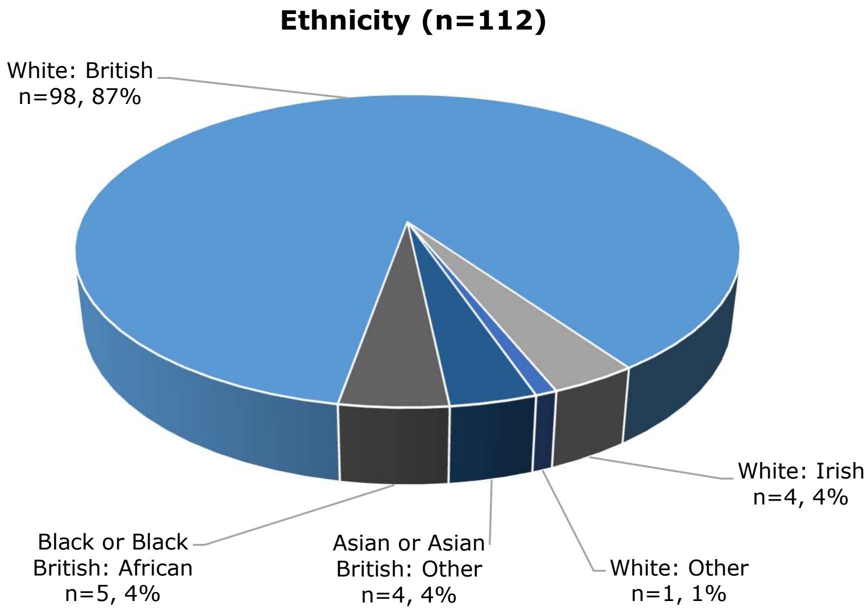


Figure 7: Ethnicity (*n*=112)

5.5.3. Age

Participants ranged in age between 18 and 55 years on first admission to the DMRC (minimum age was 18 years and maximum age was 55 years, Range=37 years). The Mean age of patients at first admission to the DMRC was 26.21 years

(SD=5.827). At 1st April 2011, the Mean age of UKAF personnel serving as 'Other Ranks' was 29 years and as 'Officers' was 37 years of age. The Mean age of participants is noticeably lower than that of the general UKAF population, and this again is most likely a reflection of the 'junior' nature (in both age and rank) of those deployed on military operations, and employed in a combat role in forward areas, and therefore, at higher risk of combat injury.

Age at first admission to the DMRC was calculated as being the difference between the date of birth of participant patients and the date of their first admission to the DMRC expressed in whole years. A distribution of age is presented below (see Figure 8: Age at First Admission to the DMRC) and age is summarised in Appendix L: Summary of Sociodemographic Characteristics.

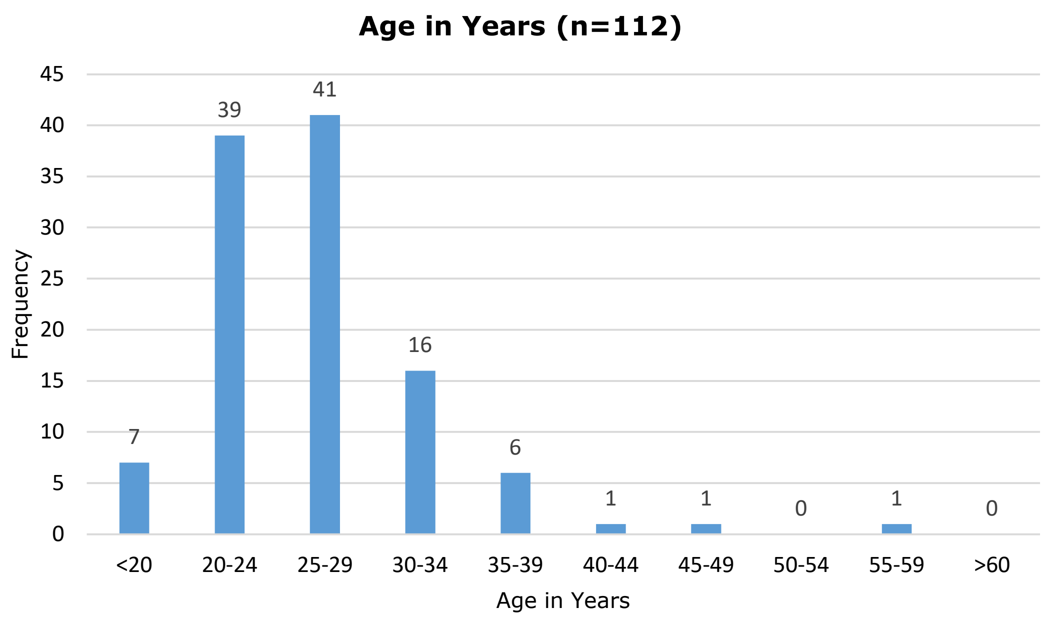


Figure 8: Age at First Admission to DMRC (*n*=112)

5.5.4. Highest Level of Educational Attainment

Participants were asked to report their highest level of education attainment. Of those responding (*n*=112), the majority of participants (68.75%, *n*=77) reported the completion of secondary school as their highest level of education. While, a significant percentage of participants (15.18%, *n*=17) left secondary school prior to sixteen years of age with no formal qualification, 38.39% (*n*=43) achieved GCSE/CSE/O-Level or equivalent, and 15.18% (*n*=17) reported leaving secondary school with A-Level or equivalent qualifications.

Of those completing further or higher education, 18.75% *(n*=21) achieved a college certificate, diploma or equivalent qualification, 10.5% *(n*=13), one participant (0.9%) completed a programme of higher education to certificate level and 8.93% *(n*=10) completed first degrees. While the numbers gaining higher degrees (*i.e.* MSc and PhD) is small (0.9%, *n*=1), a number of participants described continuing (but as yet unfinished), or aspirations to continue, their education at a higher level. Two participants described educational attainment in terms of accredited award (City and Guilds Certificate, *n*=1, 0.89%) and overseas qualification (Nepal Secondary School Certificate, *n*=1, 0.89%). The distribution of educational attainment can be found in Figure 9: Highest Level of Educational Achievement and is summarised in Appendix L: Summary of Sociodemographic Characteristics.

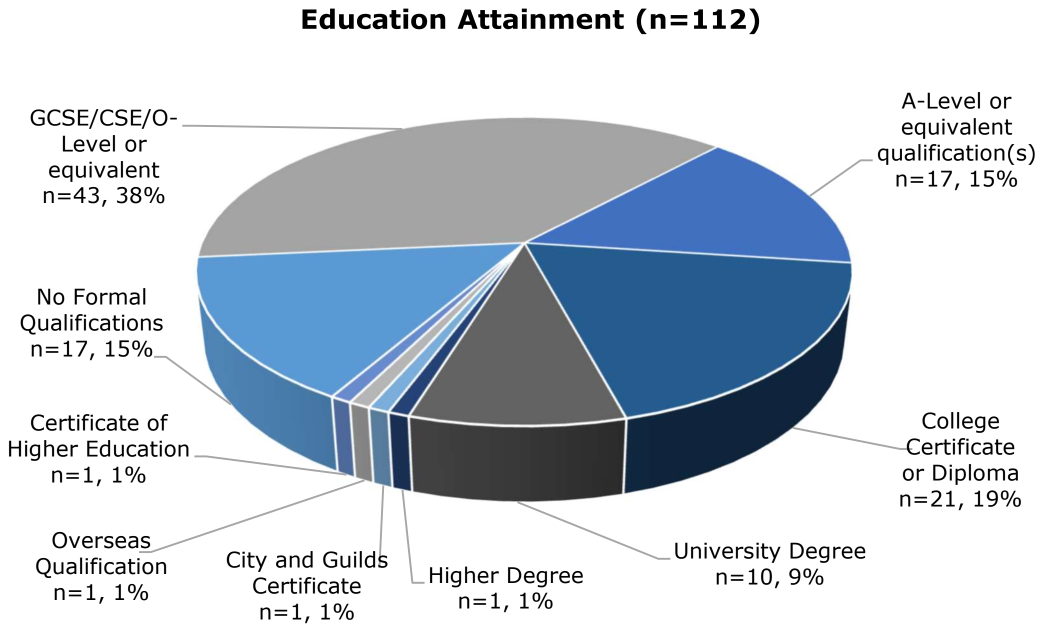


Figure 9: Highest Level of Educational Achievement *(n*=112)

5.5.5. Relationship Status

Participants were asked about their current relationship status. The majority of participants (66.1%, *n*=74) reported that they were in a 'committed relationship', describing themselves as being 'married' (26.8%, *n*=30), 'living with a partner' (10.7%, *n*=12) or 'in a long-term relationship' (28.6%, *n*=32). The remaining 33.9% of participants *(n*=38) reported being 'Single', 'Separated' or 'Divorced'. A distribution of the relationship status of participants is presented in Figure 10:

Relationship Status *(n*=112) and is further summarised in Appendix L: Summary of Sociodemographic Characteristics.

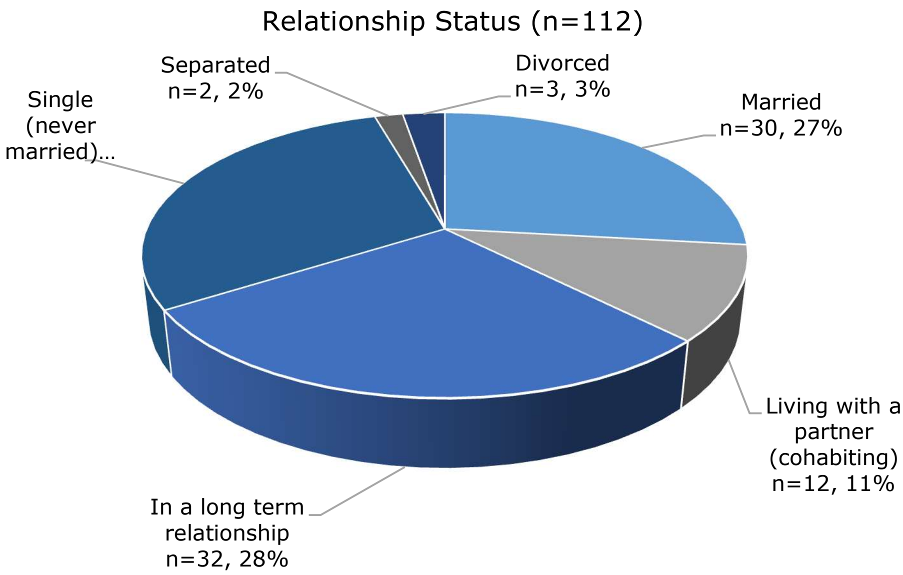


Figure 10: Relationship Status *(n*=112)

5.5.6. Financially Dependent Children

The definition of 'financially dependent children' is difficult and does not rely solely upon residential status. Participants were asked, firstly, whether or not they regarded themselves as having any financially dependent children. If they answered 'yes' they were then asked: how many they had; their ages; their gender and whether or not the children lived with them. The majority of participants reported that they did not have financially dependent children (74.1%, *n*=83). The numbers of children reported by the remaining 25.9% *(n*=29) of participants varied from one child to six children (see Figure 11: Financially Dependent Children). The ages of the reported children ranged from two weeks to 23 years of age, with a Mean age of 6.5 years.

Of those reporting that they had financially dependent children *(n*=29), 65.5% *(n*=19) reported living in the same residence as their children and 24.1% *(n*=7) reported that they did not. The distribution of financially dependent children is presented in Figure 11: Financially Dependent Children, and is further summarised in Appendix L: Summary of Sociodemographic Characteristics.

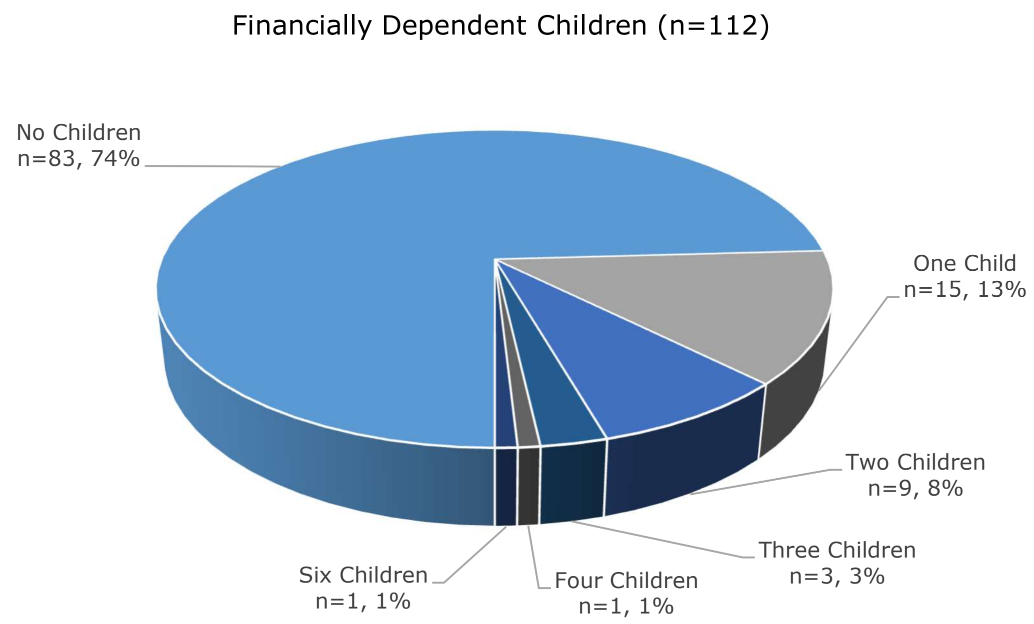


Figure 11: Financially Dependent Children (*n*=112)

5.6. Military Characteristics

This section provides further description of the sample of UKAF personnel admitted to the DMRC for rehabilitation following physical combat-related injury in relation to their military service and their operational experience. In respect of their military service this section reports: type of service; branch; military rank; length of service, the total number of operational deployments they had participated in during their military careers and their experience of their deployed role. A summary of military characteristics is presented in Appendix M: Summary of Military Characteristics.

5.6.1. Branch and Type of Service

Participants were asked about their military service, specifically they were asked about their current branch of service, *i.e.* whether they were currently serving in the Royal Navy (RN), the Royal Marines (RM), the British Army or the Royal Air Force (RAF). The majority of participants reported serving in either the British Army or the Royal Marines (97.32%, *n*=109) and the remainder reported serving in the Royal Air Force (2.68%, *n*=3). Serving members of the Royal Marines more properly belong to the Royal Navy, however, for the purposes of this study, and to ensure comparability with the existing KMHCR: Phase II Study dataset, the Army and the Royal Marines were regarded as one group as this, also, more accurately reflects the nature of their role and utilisation in the operational environment on OP HERRICK. Participants reporting Royal Air Force service, were all members of the Royal Air Force Regiment and were not Aircrew or employed on flying duties (see Table 12: Branch and Type of Service).

Participants were asked whether they were in regular military service, including Full-Time Reserve Service (FTRS), serving members of the Reserve Forces, *i.e.* Territorial Army (TA), Royal Auxiliary Air Force (RAuxAF), Royal Naval Reserve (RNR) or Royal Marine Reserve (RMR) or, either re-called ex-regulars or ex-forces. As participants were all first time, in-patient, admissions to the DMRC, all reported currently serving in the UKAFs and the majority (92.9%, *n*=104) were in regular service or on FTRS. Members of the Reserve Forces comprised 7.1% (*n*=8) of the overall sample. None of the participants reported being a 'Re-Called Ex-Regular' or 'Ex-Forces'. Those participants identifying themselves as members of the Reserve Forces were all members of the Territorial Army (see Table 12: Branch and Type of Service).

Table 12: Branch and Type of Service

		Type of Service	
		Regular (Including FTRS)	Reserve
Branch of Service	Royal Navy	0 (0.0%)	0 (0.0%)
	British Army and Royal Marines	101 (90.18%)	8 (7.14%)
	Royal Air Force	3 (2.68%)	0 (0.0%)

5.6.2. Military Rank

Participants were asked about their current military rank. Almost half of those that responded (49.1%, *n*=55) were 'Other Ranks' (ORs), *i.e.* private soldiers holding NATO ranks OR1 and OR2. Junior Non-Commissioned Officers (JNCOs), *i.e.* those holding NATO Ranks OR3 and OR4 (Lance Corporal and Corporal) constituted 31.3% (*n*=35) of the sample, and Senior Non-Commissioned Officers (SNCOs) *i.e.* individuals holding NATO ranks OR5 to OR9 (Sergeants to Warrant Officer Class I) made up 9.8% (*n*=11) of the sample. A similar number of (junior)

Commissioned Officers[11] was observed within the sample (9.8%, *n*=11). The rank range of participants was private soldier (OR1) to Captain (OF2). The distribution of rank is presented in Figure 12: Military Rank and summarised in Appendix M: Summary of Military Characteristics.

The distribution of soldier ranks reported is consistent with the employment of different ranks in the deployed setting, *i.e*. ORs and JNCOs are more likely to be deployed in forward areas, participate in foot-patrols and engage with enemy forces.

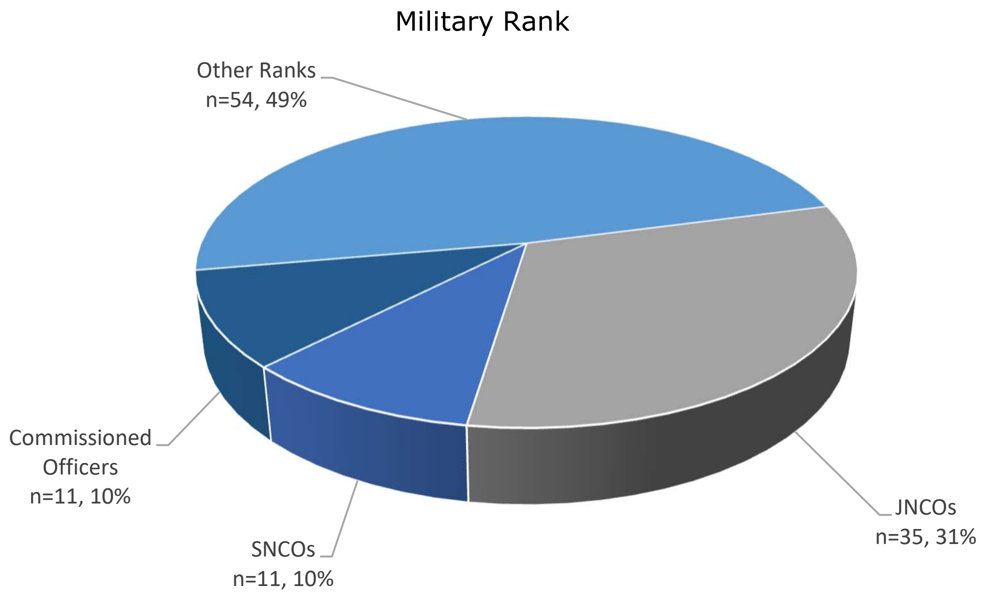


Figure 12: Military Rank

5.6.3. Length of Service

Those participants reporting that they currently served as regular members of the Armed Forces or that they were undertaking Full-time Reserve Service (FTRS) had a Mean length of service of 6.4 years (SD=4.585). Those patient participants serving in the Reserve Forces had periods of service ranging from 2 to 35 years and the Mean length of service was 11.7 years (SD=12.842).

The length of service for regular members of the Armed Forces and for those serving on FTRS was biased toward the lower end of the range and 52.4% of regular participants had served in the Armed Forces for five years or less and

[11] In respect of Commissioned Officer ranks, OF1 (Lieutenant) and OF2 (Captain) are regarded as Junior Officers. Majors (and equivalent) are 'Field' Rank officers and Lieutenant Colonel and above are 'Senior' officers.

34.3% had served less than three years. Distribution of length of service are presented in Figure 13: Length of Service (Regular/FTRS) and Figure 14: Length of Service (Reserves). A summary of findings in presented in Appendix M: Summary of Military Characteristics.

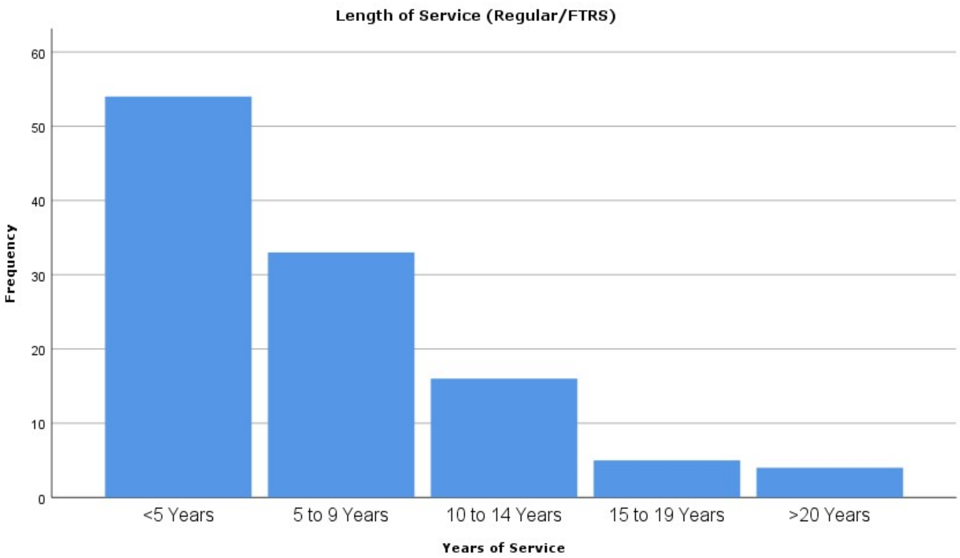


Figure 13: Length of Service (Regular/FTRS)

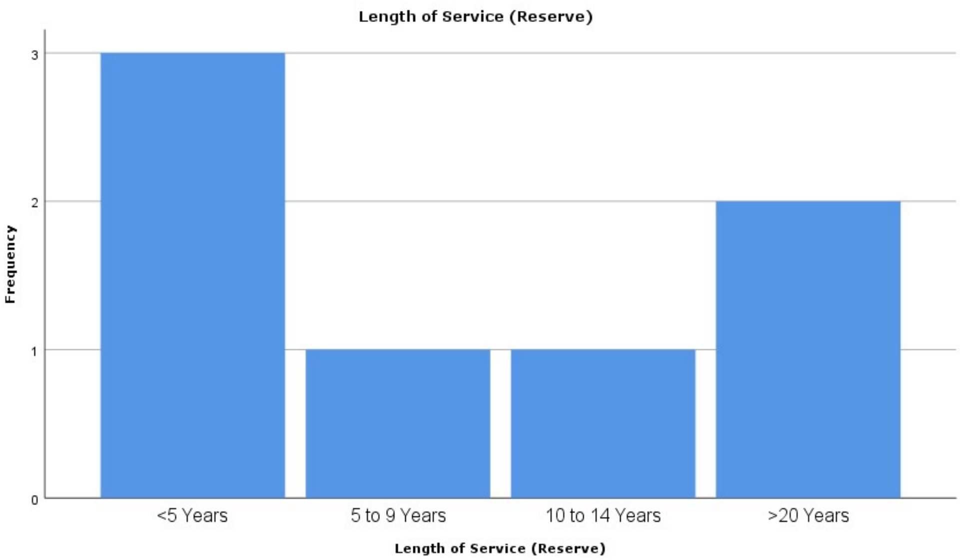


Figure 14: Length of Service (Reserves)

5.6.4. Operational Deployments

Participants were asked if they had ever deployed. Of those regular UKAF personnel returning the baseline assessment only three reported never having deployed (2.9%) the majority (97.1%, n=101) reported having deployed between one and five times in their military career (see Figure 15: Number of Operational Deployments (Regular/FTRS) and Figure 16: Number of Operational Deployments (Reserves)).

All of the reserve UKAF personnel reported deploying, 62.6% *(n*=5) having sustained their combat injury on their first operational deployment. The Mean number of tours for reserve personnel was 1.63 and for regulars 1.83. 46.2% *(n*=48) of regulars reported having been injured on their first operational deployment. A summary of operational deployments can be found in Appendix M: Summary of Military Characteristics.

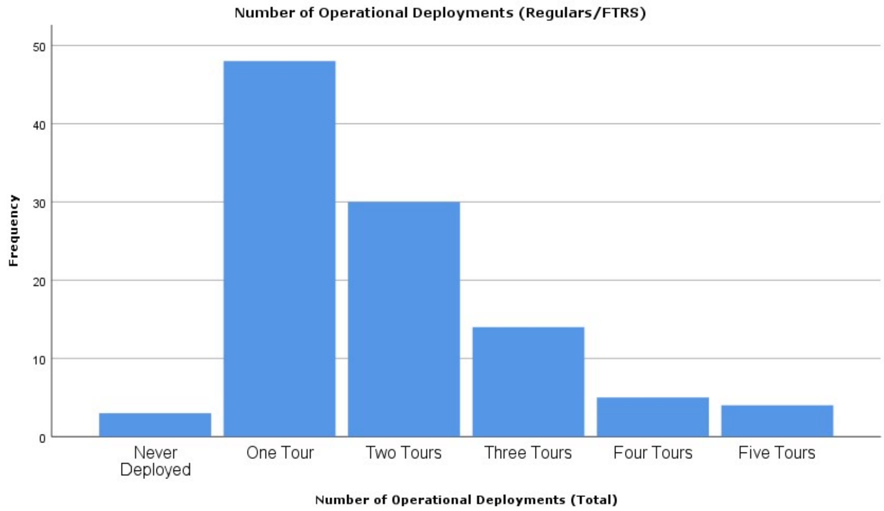


Figure 15: Number of Operational Deployments (Regular/FTRS)

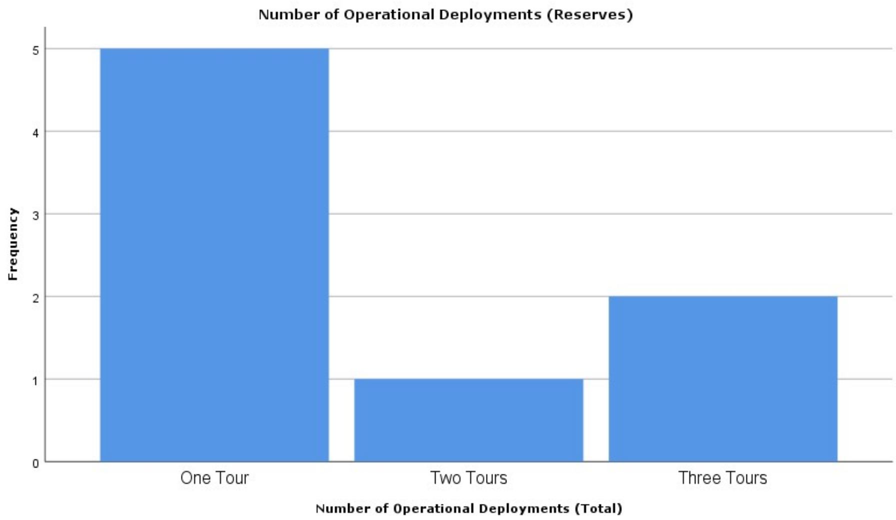


Figure 16: Number of Operational Deployments (Reserves)

5.6.5. Deployed Role

As part of the baseline assessment participants were asked, 'On your most recent tour, did your deployed role matched you trade experience?'. Of those responding, 87.5% *(n*=98) reported that their deployed role did match their trade experience, 6.3% *(n*=7) reported that the work undertaken was generally above their trade experience and 4.5% *(n*=5) reported that the deployed role was beneath their trade experience. (See Appendix M: Summary of Military Characteristics).

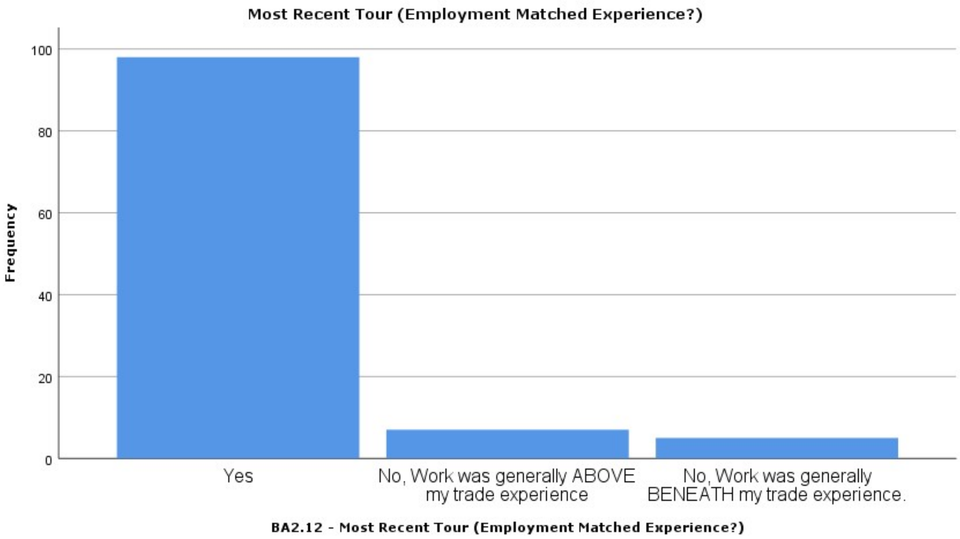


Figure 17: Operational Duties

5.7. Physical Health Characteristics

This section provides further description of the sample of UKAF personnel admitted to the DMRC for rehabilitation following physical combat-related injury in relation to their physical injury. Within the systematic literature review a number of physical injury factors were identified, these included, the presence of pain and phantom pain, the use of morphine sulphate during the acute management of injury, the type of injury sustained, the bodily region affected and the presence of pre-existing chronic medical condition. In the larger HCTP study, while access to clinical data at the DMRC was granted, it was not possible to consistently or uniformly access this for all participants. As part of the baseline assessment data regarding the nature of the incident resulting in the physical injury, the nature of the injury and participants experience of pain in the month leading up to their first admission at the DMRC were collected. This section also reports tobacco use and alcohol use in the sample. A summary of physical health characteristics is presented in Appendix N: Summary of Physical Health Characteristics.

5.7.1. Type of Incident

The majority of participants responding at baseline were admitted to the DMRC as a result of a physical combat-related injury (90%, *n*=101) and non-combat-related injury accounted for the remaining 9.82% *(n*=11) (see Figure 18: Type of Incident)

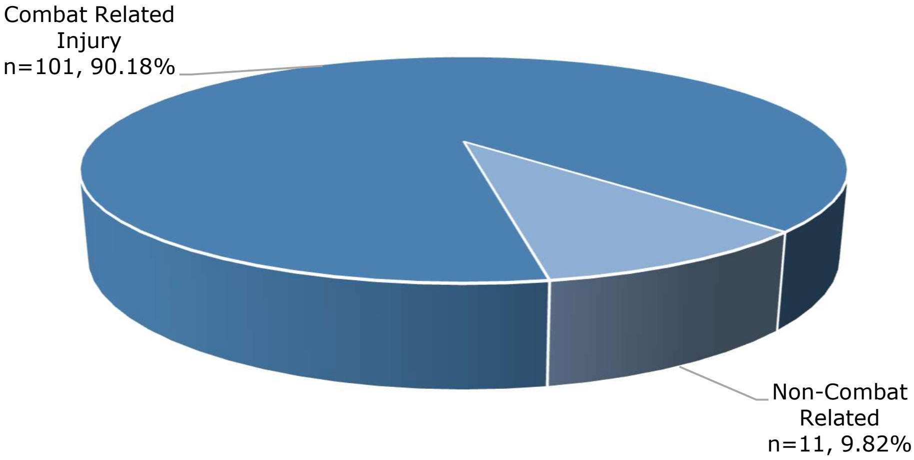


Figure 18: Type of Incident

5.7.2. Nature of Incident

Closer examination of the nature of the incident indicates that 67.0% *(n*=75) of patient participants sustained physical combat-related injuries resulting from explosion/blast causes, *i.e.* Improvised Explosive Device (IED), Rocket Propelled Grenade (RPG), Anti-Personnel Mine (APM) or through Grenade strike. Twenty-Four (21.4%) report having been injured as a result of a Gunshot Wound (GSW). Within the non-combat-injury category incidents involving vehicles (predominantly motorcycles) were the most common cause of injury (6.3%, *n*=7). A summary of the reported causes of injury in the patient participant study is presented in Table 10: Nature of Incident, and in Figure 19: Nature of Incident. A summary of this data is presented in Appendix N: Summary of Physical Health Characteristics.

Table 13: Nature of Incident

	Frequency	Percent
Explosion / Blast (IED, RPG, APM, Grenade)	75	67.0
Bullet	24	21.4
Fall	2	1.8
Vehicle	7	6.3
Sport	1	.9
Alcohol Related	1	.9
Other	2	1.8
Total	112	100.0

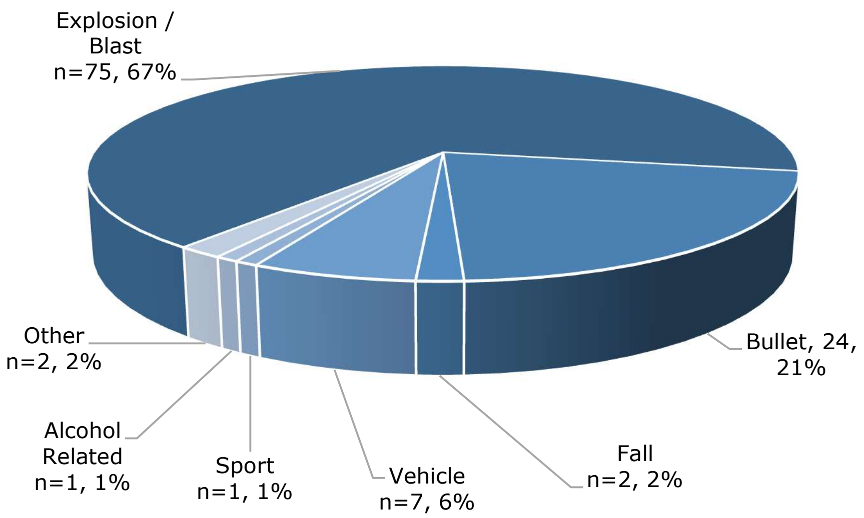


Figure 19: Nature of Incident

5.7.3. Nature of Injuries

The range of injuries sustained by patient participants admitted to the DMRC is broad and diverse and represents a significant challenge in terms of categorising injuries. In order to best describe the range of injuries, participant injuries are identified using following categories: 'Gunshot Wound'; 'Spinal Injury'; 'Blast/Fragmentation Injuries'; 'Single Traumatic Amputation', 'Double Traumatic Amputation' and 'Triple Traumatic Amputation' and 'Other' injuries. Due to the complex nature of military poly-trauma related to physical combat-related injury, participants may present with a number of co-existing injuries which make it impossible to categorise individual participants by injury type. The distribution below was drawn from clinical records at the DMRC.

The three largest categories of injury are single traumatic amputation (44.2%), blast and fragmentation injuries (39.2%) and gunshot wounds (36.1%). Double traumatic amputation accounts for 34.2% of the injuries sustained by the study group and triple traumatic amputation accounts for a further 9.4% of injuries. Spinal injuries and 'Other' injuries account for 33.6% of admissions to the DMRC during the study period. The category 'Other' includes sporting injuries; injuries related to Road Traffic Accident (RTA), burns, falls and crush injuries. A summary of this data is presented in Appendix N: Summary of Physical Health Characteristics.

5.7.4. Tobacco Use

As part of the baseline assessment participants were asked about their use of tobacco. They were asked, whether or not they smoked and, if they did, how many cigarettes, cigars or roll-ups they smoked per day. The majority of the sample reported that they were not smokers (71.3%, *n*=72). Those participants that reported being smokers (26.7%, *n*=27) suggested that they smoked between one and 20 cigarettes, cigars or roll-ups per day. (see Figure 20: Use of Tobacco) and Appendix N: Summary of Physical Health Characteristics.

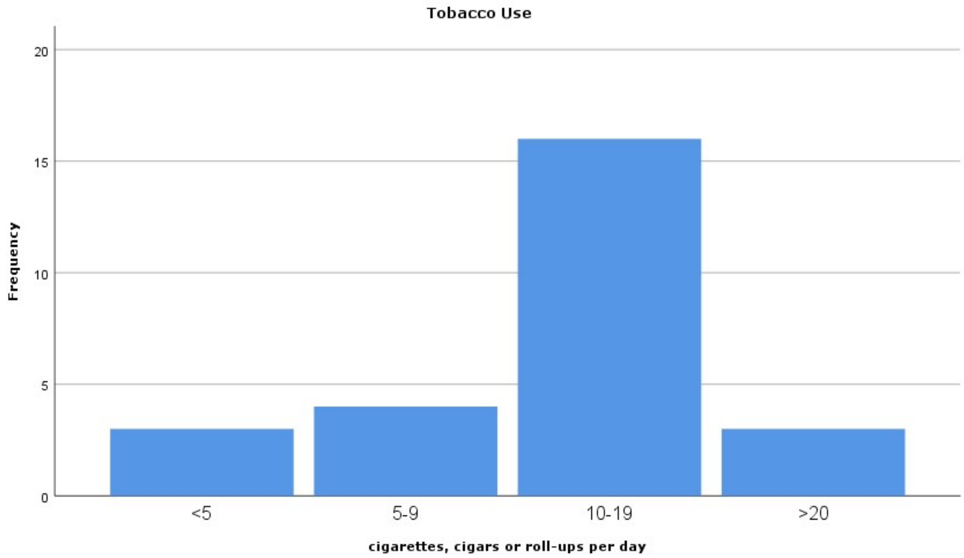


Figure 20: Use of Tobacco

This percentage is higher than in the general U.K. population where 14.1% of people aged 18 years and above report smoking cigarettes (Annual Population Survey (APS), 2019). Compared to the adult male population, the percentage of smokers in this sample is still higher (15.9% of men smoked compared with 12.5% of women). Within the general population, those aged 25 to 34 years had the highest proportion of current smokers (19.0%).

5.7.5. Alcohol Use

While there is a more detailed analysis of the use of alcohol presented in the Section 6.3: Alcohol Use Disorders Identification Test (AUDIT-10) (below) general alcohol drinking behaviours were assessed using the question 'How often do you have a drink containing alcohol?' At baseline, the majority of the sample reported being drinkers (67.3%, *n*=69). The remaining participants either reported never drinking (21.8%, *n*=22) or did not provide any information about their drinking (10.9%, *n*=11), (see Appendix N: Summary of Physical Health Characteristics). Further discussion of the drinking behaviours of the sample will be reported in the next chapter.

5.7.6. Pain

As part of the baseline assessment participants *(n*=112) were asked about their experience of pain in the month leading up to their admission to the DMRC. While the vast majority (69.6%, *n*=78) reported that they had experienced no 'pain without swelling or redness in several joints', 29.5% of patients reported that they had experienced pain within the period. When asked about their severity of their pain, 8.9% *(n*=10) reported mild pain, 13.4% *(n*=15) reported moderate pain and 7.1% *(n*=8) reported severe pain. A summary of physical pain is presented below (see Appendix N: Summary of Physical Health Characteristics).

5.8. Psychological Health Factors

The final section of this chapter provides further description of the sample of UKAF personnel admitted to the DMRC for rehabilitation following physical combat-related injury in relation to a number of psychological factors. These factors include, camaraderie and social support. A summary of the psychological health factors is to be found in Appendix O: Summary of Psychological Health Characteristics.

5.8.1. Previous Experience of Trauma (Military)

As part of the participant assessment at baseline, participants were asked to think about their most recent deployment and, in relation to a 13 item list of potential military exposures drawn from the *KCMHR: Health and Wellbeing of UK Armed Forces Personnel – Cohort Study,* report whether or not they had experienced the listed event and, if so, how often they had experienced it. Events included, e.g. 'See personnel seriously wounded or killed', 'Handle bodies' and Come under mortar/artillery fire/rocket attack' (see Appendix K, Baseline Assessment p. 11). Each event was coded and scored and the measure returned a total exposure score for each participant within a possible range 0 to 52. Of participants returning the baseline assessment that had been deployed/admitted following physical combat injury *(n*=101), scores ranged from Two to 42 (Range=40) and the Median total military trauma exposure score was 18.91 (SD=9.329). A distribution of scores is presented below in Figure 21.

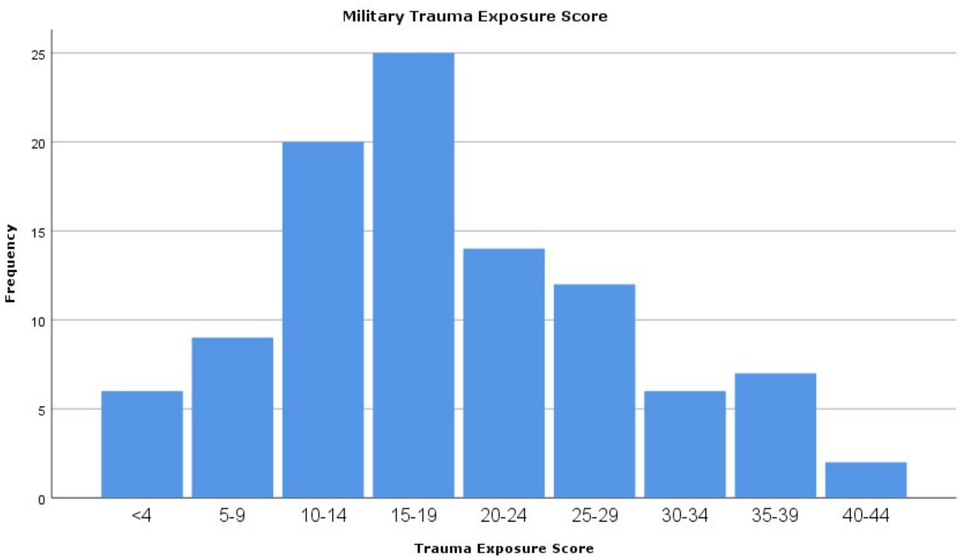


Figure 21: Military Trauma Exposure Score

5.8.2. Camaraderie

As part of the bassline assessment participants were asked to rate their agreement with the statement "I felt a sense of comradeship (or closeness) between myself and other people in my unit". Participant responses rated on a five-point scale from 'Strongly agree' to 'strongly disagree' were intended to provide some insight into the sense of comradeship felt. High levels of comradeship were reported by participants with 70.3% (*n*=71) strongly agreeing (Appendix O: Summary of Psychological Health Characteristics).

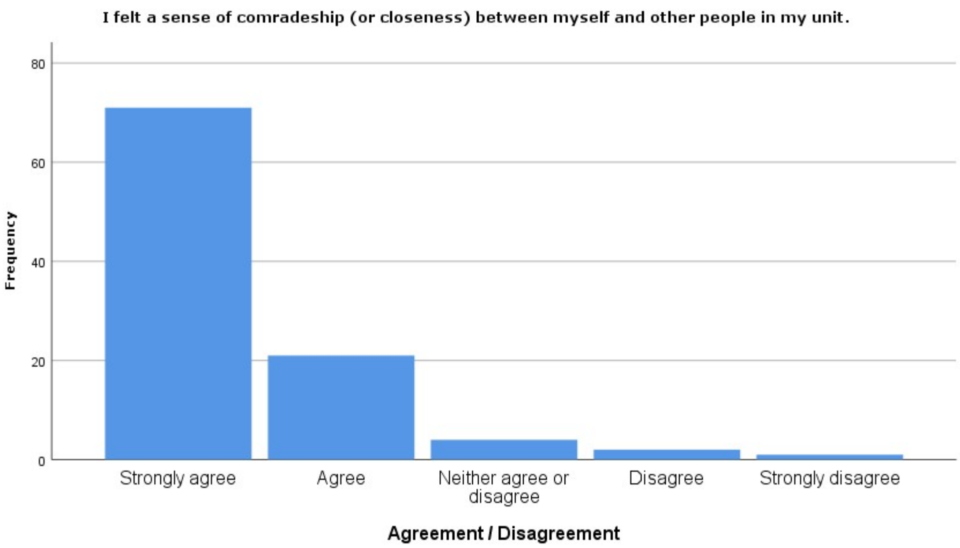


Figure 22: Comradeship

5.8.3. Social Support

As part of the baseline assessment participants were asked to rate the social support the received from the individual closest to them along a scale from 'Very Good' to 'Very Poor'. Responses at suggested that the vast majority of participants rated the social support they received very highly with 48.5% (*n*=40) attributing the maximum score available (Appendix O: Summary of Psychological Health Characteristics).

5.9. Predictor Variables

The systematic literature review (Chapter Three) allowed for the categorisation of identified risk factors and predictors. Following on from the discussion of those factors and the description of the study sample in this chapter using that categorical framework, *i.e*. in terms of its sociodemographic, military, physical and psychological health characteristics, the following variables will be tested, as potential predictors of risk in Chapter Seven:

Table 14: Potential Risk/Predictor Variables

Risk Factor/Predictor Category	Potential Risk Factor/Predictor
Sociodemographic	• Ethnicity • Age • Highest level of educational attainment • Relationship status • Parenthood
Military	• Type of service • Branch of service • Military rank • Length of service • Number of operational deployments • Deployed role
Physical Health	• Physical injury cause • Experience of Pain • Tobacco use • Alcohol Use
Psychological Health	• Sense of comradeship • Perception of emotional support • Perception of practical support • Memory of the causative event • Distress (Memory)

5.10. Summary

While original estimates of potential study participants suggested that up to 340 patients would be admitted to the DMRC between the 3rd of January 2010 and the 30th of June 2011 the actual number of admissions over that period was 224. Of those approached *(n*=214) 93.9% *(n*=199) agreed to participate and were inducted into the study.

While the response rate was good (56.3%, *n*=112) and it had been the methodological aspiration of this study to include an age- and gender-matched control group of musculoskeletal patients to facilitate comparison, of the 199 participants consented, 85.4% *(n*=170) reported physical combat-related injury and 14.6% *(n*=29) reported non-combat (musculoskeletal) injury. At baseline *(n*=112), 90.2% *(n*=101) reported a physical combat-related injury. Given the difficulties associated with comparing such small numbers at follow up the case-control element of the research design became unsustainable.

In order to establish the optimal sample size for this study a power analysis was calculated using G*Power 3.1 (Faul et al., 2007: Faul et al., 2009) (see 4.3.7. Statistical Power Analysis). While the study did not achieve the sample required for logistic regression it did achieve the minimum sample required for Pearson's Chi-Square analysis.

The primary aim of this study is the investigation of the mental health and mental health morbidity of United Kingdom Armed Forces (UKAF) personnel following physical combat-related injury. While the majority of participants responding at baseline were admitted to the DMRC as a result of a physical combat-related injury (90%, *n*=101) the remaining 9.82% (*n*=11) had been admitted as the result of a non-combat-related injury. Moving forward to the next chapter individuals with non-combat-related injury will be excluded from the analysis.

The next chapter will explore reported levels of psychological resilience and the prevalence of post-traumatic illness, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC.

Figure 23: Joint Forces Medical Group by Graeme Lothian.
Permission granted by the Artist

CHAPTER SIX: GENERAL AND TRAUMA-RELATED PSYCHOPATHOLOGY AND PSYCHOLOGICAL RESILIENCE

6.1. Introduction

This chapter will partially address study objective four, by exploring the prevalence of post-traumatic illness, common mental health disorder, alcohol use, and reported levels of psychological resilience in a cohort of UKAF personnel admitted for the first time to the Defence Medical Rehabilitation Centre (DMRC) for rehabilitation following physical combat-related injury (*n*=101). As previously stated, those participants reporting non-combat-related injuries (*n*=11) have been excluded from the analysis from this point (see Chapter Five, Section 5.10).

Specifically, this chapter will answer the following research questions:

a. Mental health and mental health morbidity:

   i. What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?

b. Psychological resilience:

   i. What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?

In addition to answering the stated research questions this chapter will also test hypotheses 1, 2 and 3:

Hypothesis 1: Physical combat-related injury is a predictor of PTSD, CMD and AUD (Prevalence).

H_1 - UKAF personnel with a physical combat-related injury are more likely to meet the diagnostic criteria for PTSD, CMD and AUD when compared to the general UKAF population.

H_0 - There is no difference, in respect of the prevalence of PTSD, CMD and AUD, between UKAF personnel with a physical combat-related injury and the general UKAF population.

Hypothesis 2 – There is a direct relationship between PTSD, CMD and AUD (Comorbidity).

H_1 - In UKAF personnel with a physical combat-related injury, there is a direct relationship between PTSD, CMD and AUD.

H_0 – There is no direct relationship between PTSD, CMD or AUD in UKAF personnel with a physical combat-related injury.

Hypothesis 3 – Physical combat-related injury negatively impacts on both hardiness and resilience (Coping).

H_1 – In UKAF personnel with a physical combat-related injury higher levels of hardiness/resilience are associated with lower levels of PTSD, CMD and AUD.

H_0 – There is no direct relationship between PTSD, CMD or AUD and reported levels of hardiness and resilience in UKAF personnel with a physical combat-related injury.

The prevalence of common mental health disorder (CMD) and post-traumatic illness (PTI) will be assessed in this chapter using the Post-Traumatic Checklist (PCL-C) (Blanchard *et al.*, 1996), the General Health Questionnaire (GHQ-12) (Goldberg *et al.*, 1997), and the AUDIT-10 screening tool for hazardous and harmful drinking use of alcohol (Babor *et al*., 2001). The PCL-C measure can be used as both a diagnostic and a screening tool indicating Post-Traumatic Stress Disorder (PTSD). While GHQ-12 does not perform a diagnostic function, in the sense that does not indicate individual psychiatric disorders (see Chapter Two), it does indicate general psychiatric caseness in participants in terms of depression and anxiety disorders.

Within this chapter, levels of psychological resilience will be reported using both the Dispositional Resilience Scale (DRS-15) (Bartone *et al*., 1989) and the Connor-Davidson Resilience Scale-10 (CD-RISC-10) (Connor and Davidson, 2003) primary outcome variables.

6.2. General and Trauma Related Psychopathology

Again, as part of the earlier Headley Court Trust Project, 199 participants were asked to complete the PCL-C, GHQ-12 and AUD measures during their initial admission to the DMRC at Headley Court. The following sections present self-reported levels of post-traumatic illness (PC-C), common mental health disorder (GHQ-12) and Alcohol Use Disorder (AUD).

6.2.1. Post-Traumatic Checklist – Civilian Version (PCL-C)

The civilian version of the Post-Traumatic Checklist (PCL-C) was used to estimate the prevalence of PTSD within the sample. The PCL-C can be used as a diagnostic tool by calculating symptom cluster scores within three subscales, however, within this study the PCL-C was used as a screening tool rather than as a diagnostic tool, and the total severity score for each participant was calculated and compared against a predetermined normative threshold. For the purpose of this study, a cut-off score of 50 was used as the normative threshold and those participants scoring 50 or more were taken to have met the screening criteria for PTSD. A cut-off score of 50 was used to ensure consistency between this data set and the data set maintained by the KCMHR at King's College London.

The assessment of PCL-C for all participants at first admission to DMRC with a physical combat-related injury returned a Mean score of 31.8 (SD = 13.125). Of the total number of participants completing the PCL-C assessment at baseline *(n*=101), 12 participants achieved scores greater than, or equal to, 50 (Mean = 58.58, SD = 8.028) providing an estimated prevalence of PTSD within the group of 11.9% (see Appendix P: PCL-C Distribution). Eighty-nine participants achieved scores <50 and did not meet the screening criteria for PTSD (Mean = 28.19, SD = 8.758).

An analysis of the reliability of the PCL-C using Cronbach's alpha for the full scale was .920 at baseline *(n*=108). These findings suggest that prevalence of PTSD within this sample is higher than within the UKAF general service population (See Chapter Eight: Discussion).

Based on the previous estimation of PTSD in the general UKAF service population offered in the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study of 6.2% (Stevelink *et al*., 2018), these findings support the suggestion that prevalence of PTSD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is a risk factor for PTSD.

Table 15: PTSD – At First Admission to DMRC

		Baseline	Yes PTSD (%)	No PTSD (%)
N	Valid	101	12 (11.9)	89 (88.1)
	Missing	0		
	Mean	31.80	58.58	28.19
	Std. Deviation	13.125	8.028	8.758
	Range	58	25	32
	Minimum	17	50	17
	Maximum	75	75	49
	PTSD Prevalence		11.9%	

6.2.2. General Health Questionnaire (GHQ-12)

The 12-item General Health Questionnaire (GHQ-12) is used to identify general psychiatric caseness in participants and is sensitive to short-term mental health disorder rather than to the long-standing attributes of the respondent. The GHQ-12 is scored by calculating the sum of the scores for each individual scale item and then comparing the total score achieved against a pre-determined threshold[12]. There are two methods of scoring the GHQ-12, the Likert method (where individual items are scored 0-1-2-3) and the GHQ (binary) method (where items are scored 0-0-1-1). While Goldberg *et al*. (1997) advocate the use of the GHQ (0-0-1-1) scoring method for identifying psychiatric caseness (a score of ≥ 2 indicating psychiatric caseness), both methods have been included within this study. The GHQ-12 was administered at baseline (at first admission to the DMRC) in order to produce an estimate of the prevalence of common mental health disorder as determined by general psychiatric caseness. While the GHQ-12 is not sensitive enough to identify the nature of the common mental health disorder it is able to identify caseness in participants, and this allows an estimate of prevalence to be made.

The recommended threshold level for GHQ-12 is 11/12 (max score 36) using the Likert method and 1/2 (max score 12) using the GHQ method (Goldberg *et*

[12] Within GHQ-12 each of the 12 scale items have a 4 point scoring system that ranges from a 'better/healthier than normal' option, through a 'same as usual' and a 'worse/more than usual' to a 'much worse/more than usual' option. The exact wording will depend upon the particular nature of the item.

al., 1997). For the purpose of this study, those participants scoring ≥ 12 using the Likert method or ≥ 2 using the GHQ method were deemed to have met the criteria for general psychiatric caseness.

At first admission, findings indicated Mean GHQ-12 scores of 13.21 (SD = 6.530) (Likert) and 3.66 (SD = 3.166) (GHQ). The distribution of GHQ-12 scores are presented in Appendix Q: GHQ-12 Distributions. These findings suggest that 53 participants met the criteria for general psychiatric caseness using the Likert method (Mean 17.87, SD = 5.417) at baseline, and 66 met the criteria using the recommended GHQ scoring method (Mean 5.24, SD = 2.706). This estimates prevalence of common mental health disorders (CMD) (as defined by psychiatric caseness of between 52.5% (Likert) and 66.7% (GHQ).

Table 16: CMD At First Admission to DMRC

		(*n*=101)		Yes CMD		No CMD	
		GHQ12 TOTAL (Likert)	GHQ12 TOTAL (GHQ)	GHQ12 (Likert)	GHQ12 (GHQ)	GHQ12 (Likert)	GHQ12 (GHQ)
N	Valid	99	99 (66)	53	66	48	34
	Missing	2					
	Mean	13.21	3.66	17.87	5.24	8.04	.53
	Std. Deviation	6.530	3.166	5.417	2.706	2.361	.563
	Range	34	12	24	10	9	2
	Minimum	2	0	12	2	2	0
	Maximum	36	12	36	12	11	2
	GHQ Caseness			52.5%	66.7%		

Again, based on the previous estimation of CMD in the general UKAF service population offered in the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study of 21.9% (Stevelink *et al*., 2018), these findings support the suggestion that prevalence of CMD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is also a risk factor for Common Mental Disorder *i.e.* psychological distress, characterised by depressive and anxiety disorders (Goldberg & Huxley, 1992)

Analysis of the reliability of the GHQ-12 using Cronbach's alpha for the full scale was .866 *(n*=99) indicating reliability and demonstrating the stability of that measure. These findings suggest that prevalence of CMD within this sample is considerable higher than in the general service population (See Chapter Eight: Discussion).

6.3. Alcohol Use Disorders Identification Test (AUDIT-10)

The World Health Organisation (WHO) AUDIT-10 measure was used to assess alcohol consumption. The AUDIT-10 measure consists of a ten-item scale designed to reflect participants' relative level of risk related to their alcohol use. The WHO recommend an AUDIT-10 score of ≥8 as an indicator of hazardous and harmful alcohol use, and possible alcohol dependence (higher scores indicating greater likelihood of hazardous and harmful drinking (Babor *et al*., 2001). While the WHO recommend the use of a cut-off score of ≥8, they acknowledge that a secondary cut-off score of ≥10 provides, albeit at the expense of sensitivity, greater specificity in terms of hazardous and harmful drinking (Babor *et al*., 2001). Assessment of drinking behaviour is achieved using the three subscales for hazardous alcohol use (scores of ≥1 on Q2. – Q3.), dependence symptoms (scores of >0 on Q4. – Q6.) and harmful alcohol use (scores of >0 on Q7. – Q10.). While higher scores generally indicate the likelihood of hazardous and harmful drinking, they may also reflect severity of alcohol problems and dependence (Babor *et al*., 2001).

Of those returning the baseline assessment, 88.1% reported drinking alcohol *(n*=89) and 10.9% *(n*=12) reported that they were non-drinkers. Further analysis of individual scores suggests a prevalence of hazardous and harmful alcohol use (those who meet the screening criteria for AUD of >8) at baseline of 60.1% (n=54, 12.37, SD=4.18). 39.3% (n=35) of respondents did not meet the diagnostic criteria for AUD of >8 (Mean 5.11, SD=1.57). Using the upper cut off score of ≥10 estimates of prevalence decreased to 41.6% (n=37, Mean 14.16, SD=3.89). Using the secondary cut-off score of >10, 58.4% (n=52) did not meet the diagnostic criteria for AUD (Mean 6.21, SD=2.06).

Analysis of drinking behaviours using the hazardous alcohol use subscale suggests the 97.8% *(n*=87). Dependence symptoms were generally lower at 35.9% *(n*=32). Harmful alcohol use was 62.9% *(n*=56) at baseline.

An analysis of the reliability of the AUDIT-10 using Cronbach's alpha for the full scale was .717 *(n*=93).

Finally, based on the previous estimation of AUD in the general UKAF service population offered in the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study of 10.0% (Stevelink *et al*., 2018), these findings greatly support the suggestion that prevalence of AUD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is also a risk factor for Alcohol Use Disorder.

Table 17: AUDIT-10 Scores At First Admission to DMRC

N=89, Missing = 0	AUD Yes	AUD No	Hazardous Alcohol Use	Dependence Symptoms	Harmful Alcohol Use
Meets Criteria*	54 (60.1%)	35 (39.3%)	87 (97.8%)	32 (35.9%)	56 (62.9%)
Mean	12.37	5.11	4.19	.70	2.35
Std. Deviation	4.18	1.57	2.105	1.112	2.727
Range	16	5	8	4	11
Minimum	8	2	0	0	0
Maximum	24	7	8	4	11
Meets Secondary Criteria°	37 (41.6%)	52 (58.4%)			
Mean	14.16	6.21			
Std. Deviation	3.89	2.06			
Range	14	7			
Minimum	10	2			
Maximum	24	9			

***The WHO recommend a cut off score of ≥8 as an indicator of hazardous and harmful alcohol use (Babor *et al*., 2001). Cut off values for subscales are: Hazardous Alcohol Use (≥1 on Q.2 – Q3.); Dependence Symptoms (>0 on Q.4 – Q.6.) and Harmful Alcohol Use (>0 on Q.7. – Q.10.) (Babor *et al*., 2001).**

° Secondary cut-off score of ≥ 10 provides greater specificity in terms of hazardous and harmful drinking (Babor *et al*., 2001).

6.4. Psychological Resilience

As part of the earlier Headley Court Trust Project, 199 participants were asked to complete the DRS-15 and the CD-RISC-10 measure at baseline. The following sections present self-reported levels of psychological resilience for those responding at baseline with a physical combat-related injury *(n*=101).

6.4.1. Dispositional Resilience Scale (DRS-15)

The Dispositional Resilience Scale (DRS-15) (Bartone *et al.*, 1989) is a brief 15-item scale developed in order to measure the personality trait of hardiness and its three component elements, *i.e.* commitment, control and challenge (see Chapter Four: Dispositional Resilience Scale (DRS-15)).

Hardiness has been described as a personality style (Bartone, 2007) or a "personality dimension that develops early in life and is reasonably stable over time" (Bartone, 2006., p.137). Viewing hardiness as a fixed and stable personality trait, the administration of the DRS-15 at baseline was not repeated at six- or twelve- months. The total hardiness score is calculated by summing the totals of the scores for the 15 items (each item is scored 0 to 3) with an expected range of results between 0 and 45.

Hardiness is reported for 98 participants with a physical combat-related injury. While 101 participants returned the baseline assessment, three failed to complete the DRS-15 element. The baseline assessment of participants *(n*=98) returned a Mean DRS-15 score of 23.83 (SD = 4.922, Range=21), (see Table 18: DRS-15 – Baseline and Appendix R: DRS-15 Baseline). Reported DRS-15 scores provide only a general measure of levels of hardiness, there is no threshold or cut off that is used to determine whether individuals meet any form of hardiness criteria. In the next chapter the median DRS-15 score for the strict sample of participants *(n*=98, Median=24.00), with physical combat-related injury will be used to determine those with 'higher' and 'lower' levels of Hardiness. Subsequent analysis and comparison of the reported levels of hardiness in this group and various population standards is presented below (see Chapter Eight: Discussion). Chapter Seven will discuss a range of potential predictors of hardiness.

An analysis of the reliability of the DRS-15 using Cronbach's α for the full scale was .560 (.573 based on standardised items) at baseline *(n*=98). Cronbach's alpha consistently underestimates reliability in complex constructs measures in short scales with relatively few items (Bartone, 2007).

Table 18: DRS-15 At First Admission to DMRC

N=89, Missing = 3	Baseline	Higher Hardiness	Lower Hardiness
Valid	98	56 (57.1%)	42 (47.1%)
Mean	23.83	27.29	19.21
Std. Deviation	4.922	2.49	3.29
Range	21	10	10
Minimum	13	24	13
Maximum	34	34	23

As previously reported (Chapter Five), norm scores for DRS-15 published in the Norwegian Health Survey (2007) suggest that for total Hardiness, the Mean score was 30.37 (SD=5.206, *n*=7,281). While it is difficult to directly compare UKAF personnel with Norwegian males, the Mean DRS-15 score for UKAF personnel reported here is considerably lower than that civilian population. No current baseline assessment of Hardiness is undertaken by the U.K. Military.

6.4.2. Connor-Davidson Resilience Scale-10 (CD-RISC-10)

The Connor-Davidson Resilience Scale-10 (CD-RISC-10) is a 10-item scale measuring coping ability in adversity (Campbell-Stills and Stein, 2007). The unidimensional scale has been designed for self-report use and consists of a list of 10 statement items representing beliefs about individual coping. Each statement item is scored 0 to 4 and the total resilience score is calculated by summing the scores for all ten items. The expected range of total resilience scores on the CD-RISC-10 is between 0 and 40 (see Chapter Four: Connor-Davidson Resilience Scale (CD-RISC-10)).

The CD-RISC-10 scale was administered to 199 participants at baseline and the Mean calculated. The results reported in this section are for the sample of those with a physical combat-related injury (*n*=101) returning the baseline assessment (*n*=100). While in the earlier Headley Court Trust Project a Repeated Measures Analysis (RMA) of paired-samples of CD-RISC-10, GHQ-12 and PCL-C (baseline/six-month and six/twelve month) had been attempted, the [required] strict panel of participants returning questionnaires across all three time-points limited the analysis to 12 participants only (Alexander, Klein and Forbes, 2013).

Due to the small sample size, it was impossible, therefore, to draw any real conclusions from the data presented in relation to changes in levels of psychological resilience over the three time points. In the next chapter the median CD=RISC-10 score for the strict sample of participants *(n*=100, Median=33.00), with physical combat related injury will be used to determine those with 'higher' and 'lower' levels of psychological resilience.

At baseline *(n*=100), the Mean CD-RISC-10 score was 30.83 (SD=7.405). Table 16: CD-RISC-10: At first Admission presents a summary of the descriptive statistics for CD-RISC-10. The distribution of scores is presented in: Appendix S: CD-RISC-10 Baseline.

An analysis of the reliability of the CD-RISC-10 using Cronbach's α for the full scale was .899 at baseline *(n*=100).

Table 19 CD-RISC-10 At First Admission to DMRC

n=100, Missing = 1	Baseline	Higher Resilience	Lower Resilience
Valid	100 (99%)*	51 (51%)	49 (49%)
Mean	30.83	36.55	24.88
Std. Deviation	7.405	2.23	6.08
Range	35	7	27
Minimum	5	33	5
Maximum	40	40	32

Chapter Eight will discuss a range of potential predictors of psychological resilience. The levels of resilience reported in this section will be discussed further in Chapter Nine: Discussion.

6.5. Resilience and Mental Health Morbidity

In order to further explore the relationships between the primary outcome variables (PTSD, CMD, AUD, Hardiness and Psychological Resilience) and to test study hypotheses 1, 2 and 3 (See Section 6.1 above) a series of chi-square tests of independence were performed. As will be discussed in Chapter Seven, further exploration of the relationships between the primary outcome variables requires the collapsing of the data into binary categories that can be incorporated into 2x2 contingency tables for the purposes conducting Pearson's Chi-Square tests and the subsequent calculation of risk using odds ratios.

The collapsing of data into binary categories in relation to the primary outcome variables has been done using the stated cut-off points for each of the stated variables *e.g.* meets criteria for PTSD/does not meet criteria for PTSD (Cut-off score >50 on PCL-C), meets criteria for CMD/does not meet criteria for CMD (Cut off score of >2 of GHQ-12), meets criteria for AUD/does not meet criteria for AUD (cut-off score for AUD >10 on AUDIT-10) and around the Median levels of Hardiness *i.e.* higher level/lower level (as determined by Median score on DRS-15, Median = 24) and Psychological Resilience i.e. higher level/lower level (as determined by Median score on CD-RISC-10, Median = 33).

6.5.1. Hardiness

A series of chi-square tests of independence were performed to explore the relationships between Hardiness and PTSD, CMD, AUD and Psychological Resilience. While no significant relationships were identified between Hardiness, PTSD, CMD or AUD, the relationship between Hardiness and Psychological Resilience was significant ($X^2(1, n = 98) = 19.679, p = .000$). This is not a surprising finding as DRS-15 and CD-RISC-10 are both measures of resilience. While there may remain differences in Hardiness and Psychological Resilience they both assess participants' ability to cope with trauma. Those individuals demonstrating higher levels of Hardiness (>24.00) were almost three times as likely to also demonstrate higher levels of psychological resilience personnel (OR = 2.727, 95% C.I = 1.599 – 4.652), (see Table 20: Hardiness and PTSD, CMD, AUD and Psychological Resilience).

6.5.2. Psychological Resilience

A series of chi-square tests of independence were performed to explore the relationships between Psychological Resilience and PTSD, CMD, AUD and Hardiness. While no significant relationships were identified between Psychological Resilience (as determined by CD-RISC-10), CMD or AUD, the relationship between Psychological Resilience and PTSD was significant ($X^2(1, n = 100) = 6.432, p = .014$). Those individuals demonstrating higher levels of Psychological Resilience (>33.00) were less likely to meet the diagnostic criteria for PTSD (OR = .192, 95% C.I = .044 - .833) and those UKAF personnel reporting higher levels of resilience were significantly more likely to be free from symptoms of PTSD (OR = 1.207, 95% C.I = 1.037 – 1.406).

Again it is unsurprising that those participants reporting higher levels of Psychological Resilience also demonstrated higher levels of Hardiness and the relationship here was also significant ($X^2(1, n = 100) = 19.679, p = .000$), (OR = 2.304, 95% C.I = 1.509 – 3.518), see Table 21: Psychological Resilience and PTSD, CMD, AUD and Hardiness.

6.5.3. PTSD, CMD and AUD

Finally, a series of chi-square tests of independence were performed to explore the relationships between PTSD, CMD and AUD. While there appeared to be no significant relationship between PTSD and AUD, there was a strongly significant relationship identified between PTSD and CMD ($X^2(1, n = 100) = 7.205, p = .007$) and those who met the diagnostic criteria for PTSD (PCL-C score >50) were over one and a half times more likely to also meet the diagnostic criteria for CMD (GHQ-12 score >2), (OR = 1.630, 95% C.I = 1.381 – 1.923), see Table 22: PTSD, CMD and AUD.

Table 20: Hardiness and PTSD, CMD, AUD and Psychological Resilience

Hardiness (DRS-15) / Mental Health Morbidity	**Count (*n*=98)**	**>Hardiness** (n = 56)**	**<Hardiness** (n =42)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=98)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
PTSD (PCL-C)						
Yes	11 (11.2)	6 (6.1)	5 (5.1)	.34	1.000*	.900 (.297 – 2.751)
No	87 (88.8)	50 (51.0)	37 (37.8)	.34	1.000*	1.014 (.878 – 1.170)
CMD (GHQ-12)						
Yes	65 (66.3)	37 (37.8)	28 (28.6)	.004	1.000*	.991 (.746 – 1.317)
No	33 (33.6)	19 (19.4)	14 (14.3)	.004	1.000*	1.018 (.580 – 1.787)
AUD (AUDIT-10)						
Yes	53 (54.1)	27 (27.6)	26 (26.5)	1.811	.221	.779 (.543 – 2.155)
No	45 (46.9)	29 (29.6)	16 (16.3)	1.811	.221	1.39 (.857 – 2.155)
Psychological Resilience (CD-RISC-10)						
>Resilience	**51 (52.0)**	**40 (40.8)**	**11 (11.2)**	**19.679**	**.000**	**2.727 (1.599 – 4.652)**
< Resilience	**47 (47.9)**	**16 (16.3)**	**31 (31.6)**	**19.679**	**.000**	**.387 (.246 - .608)**

***Fisher's exact test used due to small sample size**
Statistically sig. results are in bold
**** Membership of '>Hardiness' and '<Hardiness' determined by <Median (≤23.00) or >Median (≥24.00)**

Table 21: Psychological Resilience and PTSD, CMD, AUD and Hardiness

Psychological Resilience (CD-RISC-10) / Mental Health Morbidity	**Count (*n*=100)**	**>Resilience** (n = 51)**	**<Resilience** (n =49)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=98)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
PTSD (PCL-C)						
Yes	**12 (12)**	**2 (2)**	**10 (10)**	**6.432**	**.014**	**.192 (.044 - .833)**
No	**88 (88)**	**49 (49)**	**39 (39)**	**6.432**	**.014**	**1.207 (1.037 – 1.406)**
CMD (GHQ-12)						
Yes	66 (66)	31 (31)	35 (35)	1.262	.296	.851 (.641 – 1.129)
No	34 (34)	20 (20)	14 (14)	1.262	.296	1.373 (.785 – 2.401)
AUD (AUDIT-10)						
Yes	54 (54)	26 (26)	28 (28)	.382	.892	(.621 – 1.282)
No	46 (46)	25 (25)	21 (21)	.382	1.144	(.764 – 1.754)
Hardiness						
>Hardiness	**56 (57.1)**	**40 (40.8)**	**16 (16.3)**	**19.679**	**.000**	**2.304 (1.509 – 3.518)**
<Hardiness	**42 (42.8)**	**11 (11.2)**	**31 (31.6)**	**19.679**	**.000**	**.327 (.186 - .574)**

***Fisher's exact test used due to small sample size**
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**
Statistically sig. results are in bold

Table 22: PTSD, CMD and AUD

PTSD / CMD and AUD	**Count (*n*=100)**	**PTSD Yes (n = 12)**	**PTSD No (n =88)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=98)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
CMD (GHQ-12)						
Yes	**66 (66)**	**12 (12)**	**54 (54)**	**7.025**	**.007**	**1.630 (1.381 – 1.923)**
No	34 (34)	0 (0)	34 (34)	7.025	.007	-
AUD (AUDIT-10)						
Yes	37 (37)	3 (3)	34 (34)	.005	1.000	1.034 (.423 – 2.525)
No	52 (52)	4 (4)	48 (48)	.005	1.000	.967 (.501 – 1.902)

***Fisher's exact test used due to small sample size**
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**
Statistically sig. results are in bold

6.6. Summary

Chapter Seven has comprehensively addressed the research questions:

a. Mental health and mental health morbidity:

   i. What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?

b. Psychological resilience:

   i. What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?

Having excluded all participants reporting a non-combat related injury in Chapter Six, this chapter reports the prevalence of common mental health disorder, post-traumatic illness, hazardous alcohol use and observed levels of psychological resilience in a cohort of UKAF personnel admitted to the Defence Medical Rehabilitation Centre (DMRC) for the first time for rehabilitation following combat injury *(n*=101)

The civilian version of the Post-Traumatic Checklist (PCL-C) was used to estimate the prevalence of PTSD. Findings suggest that the prevalence of PTSD in the sample was 11.9% at baseline. When compared to the previous estimation of PTSD in the general UKAF service population offered in the King's Centre for Military Health Research (KCMHR) *Health and Wellbeing of UK Armed Forces* cohort study of 6.2% (Stevelink *et al*., 2018), these findings support the suggestion that prevalence of PTSD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is a risk factor for PTSD.

The 12-item General Health Questionnaire (GHQ-12) was used to identify general psychiatric caseness in participants and is sensitive to short-term mental health disorder rather than to the long-standing attributes of the respondent. While GHQ-12 cannot be used diagnostically to give any indication of specific presenting disorder, it does indicate the general presence of common mental health disorder (CMD). These findings suggest that the prevalence of CMD at baseline of between 52.5% (Likert) and 66.7% (GHQ) and, again, when compared to previous estimates of 21.9% (Stevelink *et al*., 2018), these findings support the suggestion that prevalence of CMD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is also a risk factor for Common Mental Disorder *i.e.* psychological distress, characterised by depressive and anxiety disorders (Goldberg & Huxley, 1992)

The AUDIT-10 alcohol screening tool was used to assess alcohol consumption at baseline to report hazardous alcohol use, alcohol dependence and harmful alcohol use. Findings indicate that, 41.6% (*n*=37) of alcohol consuming participants met the WHO's secondary criteria (score of ≥10) for hazardous and harmful alcohol use. Analysis of drinking behaviours using the hazardous alcohol use subscale suggests the 97.8% (n=87). Dependence symptoms were generally lower at 35.9% (n=32). Harmful alcohol use was 62.9% (n=56) at baseline. Compared against the previously estimated level in the general UKAF population of 10.0% (Stevelink *et al*., 2018), these findings greatly support the suggestion that prevalence of AUD in those with physical combat-related injury is higher than the general service population and supports the hypothesis that physical combat-related injury is also a risk factor for Alcohol Use Disorder.

Levels of psychological resilience were assessed using both the Dispositional Resilience Scale (DRS-15) and the Connor-Davidson Resilience Scale-10 (CD-RISC-10). Findings indicate a Mean DRS-15 score at baseline of 23.83 (SD = 4.922) and Mean CD-RISC-10 score of 30.83 (SD = 7.405).

Exploration of the relationship between psychological resilience (as measured by CD-RISC-10) and PTSD, CMD and AUD suggests that there is an association between Psychological Resilience and PTSD ($X^2(1, n = 100) = 6.432, p = .014$). Those individuals demonstrating higher levels of Psychological Resilience (>33.00) were less likely to meet the diagnostic criteria for PTSD (OR = .192, 95% C.I = .044 - .833) and those UKAF personnel reporting higher levels of resilience were significantly more likely to be free from symptoms of PTSD (OR = 1.207, 95% C.I = 1.037 – 1.406). Identification of this allows for the partial rejection of the null-hypothesis in study hypothesis (see 6.1).

Exploration of the relationships between the primary outcome variables suggests that there is a significant relationship between PTSD and CMD (X^2(1, n

= 100) = 7.205, p = .007) (indicating comorbidity) the identification of this relationship (see Section 6.5.3.) allows us to reject the null hypothesis in study hypothesis 2 (see 6.1) and assert that there is a relationship between PTSD and CMD (comorbidity). However, the lack of significant relationship between PTSD and AUD does not allow for the rejection of the null-hypothesis and therefore these findings do not support the hypothesis that PTSD presents comorbidly with AUD.

These findings will be further contextualised in Chapter Eight: Discussion. These findings will be used within the next chapter to further explore the relationship between these outcomes and the potential risk factors and predictors identified in Chapter Three.

Figure 24: Battle MIST - Stuart Brown (2007)
Permission granted by Artist

CHAPTER SEVEN: POTENTIAL RISK FACTORS AND PREDICTORS

7.1. Introduction

The primary objective of Part Two of this doctoral study has been to explore levels of post-traumatic illness (PTI), common mental health disorder (CMD), hazardous drinking (AUD) and psychological resilience in a cohort of UKAF personnel following physical combat-related injury and to identify potential factors associated with the development of CMD/PTI/AUD and potential predictors of psychological resilience. Drawing together elements from the systematic literature review in Chapter Three (the identification of a range of previously identified predictors of risk for PTI, CMD and AUD), Chapter Five (the reported sociodemographic, military, physical health and psychological health characteristics of the sample), and Chapter Six (the reported levels of psychological resilience, PTSD, CMD and AUD) this chapter will now explore the relationships between a range of sociodemographic and military characteristics, physical and psychological health factors (categorical predictor variables) and the categorical outcome variables (PTSD, CMD, AUD, Hardiness and Psychological Resilience) in order to answer the following research questions and bring this study to a conclusion:

a(ii). Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?

b(ii). Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

While the systematic literature review highlighted a number of other potential predictors of risk, this doctoral study, as part of the earlier HCTP study is constrained by the data collected by that study, and consequently is not able to further explore issues relating to the use of analgesia, the presence of phantom pain, pre-existing medical conditions, psychiatric history, personality type or catastrophizing.

Again, as highlighted in Chapter Four (see 4.6.1.1: Pearson's Chi-Square Test), the comparison of categorical predictor variables and categorical outcome variables involved in the exploration of those relationships depends on two basic assumptions (Field, 2018). Firstly, that each 'occurrence' should be independent and appear in only one cell of the contingency table, *i.e.* participants cannot be both male and female or drinkers and non-drinkers. Secondly, within the contingency tables, no variable should present with less than five occurrences, *i.e.* the frequency of tested variables should not be less than 5 (Howell, 2012). As a result of the low numbers of participants returning the baseline assessments the analysis of the data using binary logistic regression was impracticable and, in order to facilitate the analysis of the relationships between the categorical predictor variables and the categorical outcome variables the data required to be collapsed into binary categories for subsequent analysis.

The following sections will: highlight the sociodemographic and military characteristics and the physical and psychological health factors identified as independent variables; provide a rationale for the collapsing of data into binary categories; and explore the relationships identified between those independent variables and post-traumatic illness (PTI), common mental disorder (CMD), alcohol use disorder (AUD) and both dispositional and psychological resilience (dependent variables).

7.2. Sociodemographic Characteristics

In Chapter Five, a number of sociodemographic characteristics likely to be associated with mental health morbidity or psychological resilience were identified as potential predictor variables (see Table 14: Potential Risk/Predictor Variables). These characteristics included: ethnicity, age, the highest level of educational attainment, relationship status and parenthood. While Chapter Six presents a detailed description of the study sample in terms of these characteristics, further exploration of the relationships between these characteristics and reported levels of mental health morbidity and psychological resilience requires the collapsing of the data into binary categories that can be incorporated into 2x2 contingency tables for the purposes conducting Pearson's Chi-Square tests and the subsequent calculation of risk using odds ratios.

In order to meet the second basic assumption of chi-square tests (see 4.6.1.1. Pearson's Chi-Square Test) and to construct 2x2 contingency tables it was necessary in collapse some of the variable categories into a binary format. In relation to the ethnicity of participants, the distribution of data suggested collapsing the categories into 'White British' and 'Black and Asian British'. While this did not result in an equal distribution it did ensure that the assumption of minimum number of cases was met. Reported age at first admission was generally well distributed between the '<25 years' and '25 years and over' categories. The existing sociodemographic categories were distributed between clearly identifiable categories, *i.e*. in a relationship/not in a relationship, completed further or higher education/did not complete further or higher education and is a parent/is not a parent (Table 24: Sociodemographic Characteristics and PTSD).

7.2.1. Post-Traumatic Stress Disorder (PCL-C)

A chi-square test of independence was performed to examine the relationship between ethnicity and PTSD. The relationship between those variables was significant ($\mathcal{X}^2$(1, n = 101) = 5.986, p = .034) and this finding suggests that Black and Asian British (including Commonwealth) UKAF personnel were more likely to meet the diagnostic cut-off for PTSD than their White British counterparts. Further examination of the relationship using odds ratios indicates that they were approximately five times more likely to meet the PCL-C criteria than White British (including Commonwealth) UKAF personnel (OR = 5.063, 95% C.I = 1.245 - 20.589), (see Table 23: Sociodemographic Characteristics and PTSD).

There is also a significant relationship observed between Age (Years), at first admission to the DMRC and PTSD. Those participants <25 years of age are more likely to meet the diagnostic criteria for PTSD (using PCL-C) than UKAF personnel over the age of 25 ($\mathcal{X}^2$(1, n = 101) = 9.254, p = .004). The odds ratio suggests that those <25 years of age are 8.4 times (OR = 8.485, 95% C.I. = 1.751 – 41, 109) more likely to meet the PCL-C criteria (see below).

Chi-square tests of independence for educational attainment, relationship status and parenthood indicated that that there was no significant association between those variables and PTSD, $\mathcal{X}^2$(1, n = 101) = .933, p = .502, $\mathcal{X}^2$(1, n = 101) = .215, p = .751, and $\mathcal{X}^2$(1, N = 101) = 1.789, p = .285 respectively (see below).

7.2.2. Common Mental Health Disorder (GHQ-12)

Chi-square tests of independence showed that there was no significant association between the identified sociodemographic characteristics of ethnicity (χ^2(1, n = 100) = .492, p = .540), age (χ^2(1, n = 100) = 2.383, p = .140), educational attainment (χ^2(1, n = 100) = .008, p = 1.000), relationship status (χ^2(1, n = 101) = .599, p = .511) and parenthood (χ^2(1, n = 101) = .827, p = .459) and the outcome variable common mental health disorder (psychiatric caseness as determined by GHQ-12), (see Table 24: Sociodemographic Characteristics and CMD).

7.2.3. Alcohol Use Disorder (AUDIT-10)

In respect of hazardous drinking, a significant association between relationship status and hazardous drinking was identified (χ^2(1, n = 89) = .4.298, p = .044). Participants who were single, separated or divorced were more likely to meet the criteria of hazardous drinking than those who were in a relationship, cohabiting or married. In terms of dangerous drinking those that reported being single, separated or divorced were over two and a half times more likely to meet the higher AUDIT-10 criteria (Score ≥ 10) than those in relationships (OR = 2.700, 95% C.I. = 1.040 - 7.011), (see Table 25: Sociodemographic Characteristics and AUD).

7.2.4. Hardiness (DRS-15)

Chi-square tests of independence showed no significant association between Hardiness (as determined by DRS-15) and the sociodemographic characteristics: ethnicity (χ^2(1, n = 98) = .285, p = .757), age (χ^2(1, n = 98) = .681, p = .536), educational attainment (χ^2(1, n = 98) = 1.179, p = .372), relationship status (χ^2(1, n = 98) = 2.287, p = .144) and parenthood (χ^2(1, n = 101) = .303, p = .635), (Table 27: Sociodemographic Characteristics and Hardiness).

7.2.5. Psychological Resilience (CD-RISC-10)

Likewise, Chi-square tests of independence showed no significant associations/relationships between the sociodemographic characteristics of ethnicity (χ^2(1, n = 100) = .005, p = 1.000), age (χ^2(1, n = 100) = .001, p = 1.000), educational attainment (χ^2(1, n = 100) = 1.389, p = .279), relationship status ($\mathcal{X}^2(1, n = 101) = .321, p = .678$) or parenthood ($\mathcal{X}^2(1, n = 101) = 1.101, p = .353$) and the outcome variable psychological resilience (as determined by CD-RISC-10), (see Table 27: Sociodemographic Characteristics and Psychological Resilience).

Table 23: Sociodemographic Characteristics and PTSD

Sociodemographic Characteristics / PCL-C (Cutoff=50)	**Count (*n*=101)**	**PTSD (n = 12)**	**No PTSD (n =89)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Ethnicity						
White British	**89 (88.1)**	**8 (66.6)**	**81 (91.1)**	**5.986**	**.034**	**.198 (.049 – .803)**
Black and Asian British	**12 (11.8)**	**4 (33.4)**	**8 (8.9)**	**5.986**	**.034**	**5.063 (1.245 - 20.589)**
Age (Years)						
25 and Over	**58 (57.4)**	**2 (16.7)**	**56 (62.9)**	**9.254**	**.004**	**.118 (.024 - .571)**
Under 25	**43 (42.6)**	**10 (83.3)**	**33 (37)**	**9.254**	**.004**	**8.485 (1.751 - 41.109)**
Highest Level of Educational Attainment						
Completed Further or Higher Education	30 (29.7)	5 (41.7)	25 (28.1)	.933	.502	1.829 (.531 - 6.301)
Completed Secondary School	71 (70.3)	7 (58.3)	64 (71.9)	.933	.502	.547 (.159 - 1.885)
Relationship Status						
Not in a Relationship (Single, Separated, Divorced)	36 (35.6)	5 (41.7)	31 (34.8)	.215	.751	1.336 (.392 - 4.562)
In a Relationship / Cohabiting / Married	65 (64.4)	7 (68.3)	58 (65.2)	.215	.751	.748 (.219 - 2.554)
Parenthood						
No Children	77 (76.2)	1 (8.3)	23 (25.8)	1.789	.285	3.833 (.469 - 31.348)
Children	24 (23.8)	11 (91.7)	66 (74.2)	1.789	.285	.261 (.032 - 2.133)

***Fisher's exact test used due to small sample size**
Statistically sig. results are in bold

Table 24: Sociodemographic Characteristics and CMD

Sociodemographic Characteristics / GHQ-12 (Caseness >2)	**Count (*n*=100)**	**CMD (n = 66)**	**No CMD (n =34)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=100)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Ethnicity						
White British	88 (88.0)	57 (86.4)	31 (91.2)	.492	.540	.613 (.155 - 2.431)
Black and Asian British	12 (12.0)	9 (13.6)	3 (8.8)	.492	.540	1.632 (.411 - 6.472)
Age (Years)						
25 and Over	57 (57.0)	34 (51.5)	23 (67.6)	2.383	.140	1.968 (.828 - .677)
Under 25	43 (43.0)	32 (48.5)	11 (32.4)	2.383	.140	.508 (.214 - 1.208)
Highest Level of Educational Attainment						
Completed Further or Higher Education	30 (30.0)	20 (30.3)	10 (29.4)	.008	1.000	.958 (.388 - 2.370)
Completed Secondary School	70 (70.0)	46 (69.7)	24 (70.6)	.008	1.000	1.043 (.422 - 2.580)
Relationship Status						
Not in a Relationship (Single, Separated, Divorced)	36 (36.0)	22 (33.3)	14 (41.2)	.599	.511	.714 (.304 - 1.677)
In a Relationship / Cohabiting / Married	64 (64.0)	44 (66.7)	20 (58.8)	.599	.511	1.400 (.596 - 3.287)
Parenthood						
No Children	76 (76.0)	14 (21.2)	10 (29.4)	.827	.459	1.548 (.602 - 3.981)
Children	24 (24.0)	52 (78.8)	24 (70.6)	.827	.459	.646 (.251 - 1.662)

***Fisher's exact test used due to small sample size**

Table 25: Sociodemographic Characteristics and AUD

Sociodemographic Characteristics / AUDIT-10 (Criteria ≥10)	**Count (*n*=89)**	**AUD (n = 54)**	**No AUD (n =35)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Ethnicity						
White British	82 (92.1)	51 (94.4)	31 (84.6)	1.011	.427	2.194 (.460 - 10.460)
Black and Asian British (Includes Commonwealth)	7 (7.9)	3 (5.6)	4 (15.4)	1.011	.427	.456 (.096 - 2.174)
Age (Years)						
25 and Over	51 (57.3)	29 (53.7)	22 (62.9)	.727	.511	.685 (.287 - 1.635)
Under 25	38 (42.7)	25 (46.3)	13 (37.1)	.727	.511	1.459 (.611 - 3.481)
Highest Level of Educational Attainment						
Completed Further or Higher Education	24 (30.0)	17 (31.5)	7 (20.0)	1.421	.329	1.838 (671 - 5.035)
Completed Secondary School	65 (70.0)	37 (68.5)	28 (80.0)	1.421	.329	.544 (.199 - 1.491)
Relationship Status						
Not in a Relationship (Single, Separated, Divorced)	**32 (35.6)**	**24 (44.4)**	**8 (22.9)**	**4.298**	**.044**	**2.700 (1.040 - 7.011)**
In a Relationship / Cohabiting / Married	**57 (64.4)**	**30 (55.6)**	**27 (77.1)**	**4.298**	**.044**	**.370 (.143 - .962)**
Parenthood						
No Children	71 (79.8)	47 (87.0)	24 (68.6)	4.488	.057	3.077 (1.058 - 8.950)
Children	18 (20.2)	7 (13.0)	11 (31.4)	4.488	.057	.325 (.112 - .945)

***Fisher's exact test used due to small sample size**
Statistically sig. results are in bold

Table 26: Sociodemographic Characteristics and Hardiness

Sociodemographic Characteristics / DRS-15**	**Count (*n*=98)**	**>Hardiness**** (n = 56)**	**<Hardiness**** (n =42)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=98. Missing=3)	n (%)	n (%)	n (%)	$X^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Ethnicity						
White British	86 (87.8)	50 (89.3)	36 (85.7)	.285	.757	1.389 (.414 - 4.657)
Black and Asian British (Includes Commonwealth)	12 (12.2)	6 (10.7)	6 (14.3)	.285	.757	.720 (.215 - 2.414)
Age (Years)						
25 and Over	42 (42.9)	30 (53.6)	26 (61.9)	.681	.536	.710 (.314 - 1.604)
Under 25	56 (57.1)	26 (46.4)	16 (38.1)	.681	.536	1.408 (.624 - 3.181)
Highest Level of Educational Attainment						
Completed Further or Higher Education	29 (29.6)	19 (33.9)	10 (23.8)	1.179	.372	1.643 (.668 - 4.042)
Completed Secondary School	69 (70.4)	37 (66.1)	32 (76.2)	1.179	.372	.609 (.247 - 1.497)
Relationship Status						
Not in a Relationship (Single, Separated, Divorced)	36 (36.7)	17 (30.4)	19 (45.2)	2.287	.144	.528 (.229 - 1.214)
In a Relationship / Cohabiting / Married	62 (63.3)	39 (69.6)	23 (54.8)	2.287	.144	1.895 (.824 - .359)
Parenthood						
No Children	75 (76.5)	44 (78.6)	31 (73.8)	.303	.635	1.301 (.509 - 3.325)
Children	23 (23.5)	12 (21.4)	11 (26.2)	.303	.635	.769 (.301 - 1.964)

***Fisher's exact test used due to small sample size**
**** Membership of '>Hardiness' and '<Hardiness' determined by <Median (≤23.00) or >Median (≥24.00)**

Table 27: Sociodemographic Characteristics and Psychological Resilience

Sociodemographic Characteristics / CD-RISC-10**	**Count (*n*=100)**	**>Resilience** (n = 51)**	**<Resilience** (n =49)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=100, Missing =1))	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Ethnicity						
White British	88 (88.0)	45 (88.2)	43 (87.8)	.005	1.000	1.047 (.313 - 3.497)
Black and Asian British (Includes Commonwealth)	12 (12.0)	6 (11.8)	6 (12.2)	.005	1.000	.956 (.286 - 3.193)
Age (Years)						
25 and Over	57 (57.0)	29 (56.9)	28 (57.1)	.001	1.000	.989 (.448 - 2.183)
Under 25	43 (43.0)	22 (43.1)	21 (42.8)	.001	1.000	1.011 (.458 - 2.233)
Highest Level of Educational Attainment						
Completed Further or Higher Education	30 (30.0)	18 (35.3)	12 (24.5)	1.389	.279	.595 (.250 - 1.417)
Completed Secondary School	70 (70.0)	33 (64.7)	37 (75.5)	1.389	.279	1.682 (.706 - 4.007)
Relationship Status						
Not in a Relationship (Single, Separated, Divorced)	36 (36.0)	17 (33.3)	19 (38.8)	.321	.678	.789 (.348 - 1.789)
In a Relationship / Cohabiting / Married	64 (64.0)	34 (66.7)	30 (61.2)	.321	.678	1.267 (.559 - 2.870)
Parenthood						
No Children	76 (76.0)	41 (80.4)	35 (71.4)	1.101	.353	1.640 (.648 - 4.150)
Children	24 (24.0)	10 (19.6)	14 (28.6)	1.101	.353	.610 (.241 - 1.543)

***Fisher's exact test used due to small sample size**
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**

7.3. Military Characteristics

As with our potential sociodemographic a number of potential military risk factors were identified in Chapter Six, (see Table 14: Potential Risk/Predictor Variables). These potential risk factors included: type of service, branch of service, military rank, length of service, number of operational deployments and deployed role. While Chapter Six presents a detailed description of the study sample in terms of these categories further exploration of these requires the collapsing of the data into binaries that can be incorporated into 2x2 contingency tables for the purposes of testing using Pearson's Chi-Square test and the subsequent calculation of risk using odds ratios.

In respect of military characteristics, it became more difficult to establish a clear binary distribution of data into categories for chi-square testing. While type of service (Regular or Reserve) offered two clear categories the numbers in the Reserve category were low. Likewise, with the division of branch of service. Rank was divided into junior ranks and senior ranks/officers and length of service, number of operational deployments were divided based on the distribution of the reported data, *i.e.* the <5 years' service and >5 years' service distribution is equal around 50%. Whether or not individual participants reported their deployed role as meeting their experience was already a binary (yes/no) question.

7.3.1. Post-Traumatic Stress Disorder (PCL-C)

Chi-square tests of independence showed that there were no significant associations/relationships identified between PTSD (cut-off score of ≥50 on the PCL-C measure) and type of service ($\mathcal{X}^2$(1, n = 101) = 1.014, p = .595), military rank ($\mathcal{X}^2$(1, n = 101) = 2.9534, p = .118), length of service (Regular), ($\mathcal{X}^2$(1, n = 101) = 291, p = .759), number of operational deployments ($\mathcal{X}^2$(1, n = 101) = .001, p = 1.000), and deployed role ($\mathcal{X}^2$(1, n = 101) = 3.480, p = .096).

The military potential predictor 'branch of service' was not tested as it did not meet the minimum criteria regarding numbers *i.e.* where British Army/Royal Marines constituted 99.0% *(n*=100) and Royal Air Force personnel 1.0% *(n*=1). In respect of length of service, only the lengths of service of regular/FTRS UKAF personnel were tested as the number of reserve participants was low and failed to meet the basic conditions for the Pearson's Chi-Square test (see Table 28: Military Characteristics and PTSD).

7.3.2. Common Mental Health Disorder (GHQ-12)

Again, as in the previous section, Chi-square tests of independence showed that there were no significant associations between psychiatric caseness (cut-off score of ≥2 on the GHQ-12 measure) and the potential predictor variables (military) identified above. Neither length of service (reserves) nor branch of service were tested as they failed to meet the minimum criteria regarding numbers for Pearson's Chi-square test.

No significant association was identified between psychiatric caseness and: type of service ($\mathcal{X}^2(1, n = 101) = .263, p = .687$), military rank ($\mathcal{X}^2(1, n = 101) = 1.357, p = .285$), length of service (Regular), ($\mathcal{X}^2(1, n = 101) = 1.744, p = .271$), number of operational deployments ($\mathcal{X}^2(1, n = 101) = .178, p = .833$), and deployed role ($\mathcal{X}^2(1, n = 101) = 1.268, p = .301$), (see Table 29: Military Characteristics and CMD).

7.3.3. Alcohol Use Disorder (AUDIT-10)

The relationship between the potential predictor variables (military) identified above and hazardous drinking was explored in a sub-sample of 'drinkers' (*n*=89) and, as with CMD, no significant association was found between hazardous drinking (as determined by AUDIT-10 score of ≥ 10) and: type of service ($\mathcal{X}^2(1, n = 89) = .829, p = .644$), military rank ($\mathcal{X}^2(1, n = 89) = .866, p = .418$), length of service (Regular), ($\mathcal{X}^2(1, n = 89) = .503, p = .512$), number of operational deployments ($\mathcal{X}^2(1, n = 89) = .435, p = .524$), or deployed role ($\mathcal{X}^2(1, n = 89) = 1.105, p = .474$), (see Table 30: Military Characteristics and AUD).

As above, neither length of service (reserves) nor branch of service were tested as they failed to meet the minimum criteria regarding numbers for Pearson's Chi-square test.

7.3.4. Hardiness (DRS-15)

The relationship between dispositional resilience (Hardiness) and the potential predictor variables (military) identified above, failed to indicate any relationship and supports the null hypothesis of independence. A chi-square test of independence showed that there was no significant association between those reporting higher (as determined by the median DRS-15 score of ≥23.00) or lower (as determined by the median DRS-15 score of ≤23.00) levels of Hardiness, and type of service ($\mathcal{X}^2$(1, n = 98) = .628, p = .695), military rank ($\mathcal{X}^2$(1, n = 98) = .023, p = .1.000), length of service (Regular), ($\mathcal{X}^2$(1, n = 98) = .078, p = .834), number of operational deployments ($\mathcal{X}^2$(1, n = 98) = .167, p = .838), or deployed role ($\mathcal{X}^2$(1, n = 89) = .752, p = .509), (see Table 31: Military Characteristics and Hardiness).

7.3.5. Psychological Resilience (CD-RISC-10)

Finally, chi-square tests of independence showed that there was no significant association between psychological resilience and type of service ($\mathcal{X}^2$(1, n = 100) = 1.257, p = .437), military rank ($\mathcal{X}^2$(1, n = 100) = .009, p = 1.000), length of service (Regular), ($\mathcal{X}^2$(1, n = 100) = .273, p = .680), number of operational deployments ($\mathcal{X}^2$(1, n = 100) = 1.961, p = .230), and deployed role ($\mathcal{X}^2$(1, n = 100) = .004, p = 1.000), (see Table 32: Military Characteristics and Psychological Resilience).

As in previous sections, neither length of service (reserves) nor branch of service were tested as they failed to meet the minimum criteria regarding numbers for Pearson's Chi-square test.

Table 28: Military Characteristics and PTSD

Military Characteristics / PCL-C (CutOff=50)	**Count (*n*=101)**	**PTSD (n = 12)**	**No PTSD (n =89)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Type of Service						
Reserve Service	7 (6.9)	0 (0.0)	7 (7.9)	1.014	.595	-
Regular / Full-Time Reserve Service (FTRS)	94 (93.1)	12 (100)	82 (92.1)	1.014	.595	-
Branch of Service						
Army and Royal Marines	100 (99.0)	12 (100)	88 (98.9)	-	-	-
Royal Air Force	1† (1.0)	0 (0.0)	1 (1.1)	-	-	-
Military Rank						
Other Ranks / JNCOs	83 (82.2)	12 (100.0)	71 (79.8)	2.953	.118	-
SNCOs Officers	18 (17.8)	0 (0.0)	18 (20.2)	2.953	.118	-
Length of Service						
Regular (*n*=94)						
<5 Years	48 (47.5)	7 (58.3)	41 (46.1)	.291	.759	1.400 (.411 - .773)
5 Years and Over	46 (45.5)	5 (41.7)	41 (46.1)	.291	.759	.714 (.209 - 2.435)
Reserves (*n*=7)						
<5 Years	3† (3.0)	0 (0.0)	3 (3.4)	-	-	-
5 Years and Over	4† (4.0)	0 (0.0)	4 (4.5)	-	-	-
Number of Operational Deployments (Regular and Reserve)						
One Tour	51 (50.5)	6 (50.0)	45 (50.1)	.001	1.000	.978 (.293 - 3.264)
More than One Tour	50 (49.5)	6 (50.0)	44 (49.4)	.001	1.000	1.023 (.306 - 3.414)
Deployed Role (Did it match your trade Experience?)						
Yes	91 (90.0)	9 (75.0)	82 (92.1)	3.480	.096	.256 (.056 - 1.168)
No, it was ABOVE/BENEATH my trade experience	10 (10.0)	3 (25.0)	7 (7.9)	3.480	.096	3.905 (.856 - 17.810)

***Fisher's exact test used due to small sample size**
†No of cases = <5, does not meet basic assumptions (Field, 2018)

Table 29: Military Characteristics and CMD

Military Characteristics / GHQ-12 (Caseness >2)	**Count (*n*=100)**	**CMD (n = 66)**	**No CMD (n =34)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$X^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Type of Service						
Reserve Service	7 (7.0)	4 (6.1)	3 (8.8)	.263	.687	.667 (.140 - 3.166)
Regular / Full-Time Reserve Service (FTRS)	93 (93.0)	62 (93.9)	31 (91.2)	.263	.687	1.500 (.316 - 7.123)
Branch of Service						
Army and Royal Marines	99 (99.0)	65 (98.5)	34 (100.0)	-	-	-
Royal Air Force	1† (1.0)	1 (1.5)	0 (0.0)	-	-	-
Military Rank						
Other Ranks / JNCOs	82 (82.0)	52 (78.8)	30 (88.2)	1.357	.285	.495 (.149 - 1.642)
SNCOs Officers	18 (18.0)	14 (21.2)	4 (11.8)	1.357	.285	2.019 (.609 - 6.695)
Length of Service						
Regular (*n*=93)						
<5 Years	48 (48.0)	35 (53.1)	15 (44.1)	1.744	.271	1.795 (.750 - 4.294)
5 Years and Over	45 (45.0)	27 (40.9)	19 (55.9)	1.744	.271	.557 (.233 - 1.333)
Reserves (*n*=7)						
<5 Years	4† (4.0)	3 (4.5)	1 (2.9)	-	-	-
5 Years and Over	3† (3.0)	1 (1.5)	2 (5.9)	-	-	-
Number of Operational Deployments (Regular and Reserve)						
One Tour	50 (50.0)	34 (51.5)	16 (47.1)	.178	.833	1.195 (.522 - 2.737
More than One Tour	50 (50.0)	32 (48.5)	18 (52.9)	.178	.833	.837 (.365 - 1.916)
Deployed Role (Did it match your trade Experience?)						
Yes	90 (90.0)	61 (92.4)	29 (85.3)	1.268	.301	2.103 (.564 - 7.843)
No, it was ABOVE/BENEATH my trade experience	10 (10.0)	5 (7.57)	5 (14.7)	1.268	.301	.475 (.127 - 1.773)

***Fisher's exact test used due to small sample size**
†No of cases <5, does not meet basic assumptions (Field, 2018)

Table 30: Military Characteristics and AUD

Military Characteristics / AUDIT-10 (Criteria ≥10)	**Count (*n*=89)**	**AUD (n = 54)**	**No AUD (n =35)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Type of Service						
Reserve Service	5 (5.6)	4 (7.4)	1 (2.9)	.829	.644	2.720 (.291 - 25.402)
Regular / Full-Time Reserve Service (FTRS)	84 (94.4)	50 (92.6)	34 (97.1)	.829	.644	.368 (.039 - 3.433)
Branch of Service						
Army and Royal Marines	88 (98.9)	53 (98.1)	35 (100.0)	-	-	-
Royal Air Force	1† (1.1)	1 (1.9)	0 (0.0)	-	-	-
Military Rank						
Other Ranks / JNCOs	72 (80.1)	42 (77.8)	30 (85.7)	.866	.418	.583 (.186 - 1.831)
SNCOs Officers	17 (19.9)	12 (22.2)	5 (14.3)	.866	.418	1.714 (.546 - 5.380)
Length of Service						
Regular (*n*=84)						
<5 Years	41 (46.1)	26 (48.1)	15 (42.9)	.503	.512	1.372 (.572 - 3.293)
5 Years and Over	43 (48.3)	24 (44.4)	19 (54.3)	.503	.512	.729 (.304 - 1.749)
Reserves (*n*=5)						
<5 Years	2† (2.2)	2 (1.9)	0 (0.0)	-	-	-
5 Years and Over	3† (3.4)	2 (1.9)	1 (2.85)	-	-	-
Number of Operational Deployments (Regular and Reserve)						
One Tour	42 (52.8)	27 (50.0)	15 (42.9)	.435	.524	1.333 (.566 - 3.138)
More than One Tour	47 (47.2)	27 (50.0)	20 (57.1)	.435	.524	.750 (.319 - 1.765)
Deployed Role (Did it match your trade Experience?)						
Yes	80 (89.9)	50 (92.6)	30 (85.7)	1.105	.474	2.083 (.519 - 8.369)
No, it was ABOVE/BENEATH my trade experience	9 (10.1)	4 (7.4)	5 (14.3)	1.105	.474	.480 (.119 - 1.928)

***Fisher's exact test used due to small sample size**
†No of cases <5, does not meet basic assumptions (Field, 2018)

Table 31: Military Characteristics and Hardiness

Military Characteristics / DRS-15**	**Count (*n*=98)**	**>Hardiness**** **(n = 56)**	**<Hardiness**** **(n =42)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Type of Service						
Reserve Service	7 (7.1)	5 (8.9)	2 (4.76)	.628	.695	.510 (.094 - 2.767)
Regular / Full-Time Reserve Service (FTRS)	91 (92.8)	51 (91.1)	40 (95.2)	.628	.695	1.961 (.361 - 10.640)
Branch of Service						
Army and Royal Marines	97 (98.9)	55 (98.2)	42 (100.0)	-	-	-
Royal Air Force	1† (1.1)	1 (1.8)	0 (0.0)	-	-	-
Military Rank						
Other Ranks / JNCOs	80 (81.6)	46 (82.1)	34 (81.0)	.023	1.000	1.082 (.386 - 3.032)
SNCOs Officers	18 (18.4)	10 (17.8)	8 (19.0)	.023	1.000	.924 (.330 - 2.588)
Length of Service						
Regular (*n*=91)						
<5 Years	47 (48.0)	27 (48.2)	20 (47.6)	.078	.834	1.125 (.491 - 2.576)
5 Years and Over	44 (44.9)	24 (42.9)	20 (47.6)	.078	.834	.889 (.388 - 2.036)
Reserves (*n*=5)						
<5 Years	2† (2.2)	2 (1.9)	0 (0.0)†	-	-	-
5 Years and Over	3† (3.4)	2 (1.9)	1 (2.85)	-	-	-
Number of Operational Deployments (Regular and Reserve)						
One Tour	49 (50.0)	29 (51.8)	20 (47.6)	.167	.838	1.181 (.530 - 2.632)
More than One Tour	49 (50.0)	27 (48.2)	22 (52.4)	.167	.838	.846 (.380 - 1.885)
Deployed Role (Did it match your trade Experience?)						
Yes	88 (89.8)	49 (87.5)	39 (92.9)	.752	.509	.538 (.131 - 2.220)
No, it was ABOVE/BENEATH my trade experience	10 (10.2)	7 (12.5)	3 (7.1)	.752	.509	1.857 (.451 - 7.656)

***Fisher's exact test used due to small sample size**
**** Membership of '>Hardiness' and '<Hardiness' determined by <Median (≤23.00) or >Median (≥24.00)**
†No of cases <5, does not meet basic assumptions (Field, 2018)

Table 32: Military Characteristics and Psychological Resilience

Military Characteristics / CD-RISC-10**	**Count (*n*=100)**		**>Resilience** (n = 51)**		**<Resilience** (n =49)**		**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n	(%)	n	(%)	n	(%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Type of Service									
Reserve Service	7	(7.0)	5	(9.8)	2	(4.1)	1.257	.437	2.554 (.472 - 13.836)
Regular / Full-Time Reserve Service (FTRS)	93	(93.0)	46	(90.2)	47	(95.9)	1.257	.437	.391 (.072 - 2.121)
Branch of Service									
Army and Royal Marines	99	(99.0)	50	(98.0)	49	(100.0)	-	-	-
Royal Air Force	1†	(1.0)	1	(2.0)	0	(0.0)	-	-	-
Military Rank									
Other Ranks / JNCOs	82	(82.0)	42	(82.4)	40	(81.6)	.009	1.000	1.050 (.378 - 2.913)
SNCOs Officers	18	(18.0)	9	(17.6)	9	(18.4)	.009	1.000	.952 (.343 - 2.642)
Length of Service									
Regular (*n*=93)									
<5 Years	48	(48.0)	25	(49.0)	23	(46.9)	.273	.680	1.242 (.550 - 2.805)
5 Years and Over	45	(45.0)	21	(41.2)	24	(49.0)	.273	.680	.805 (.356 - 1.818)
Reserves (*n*=7)									
<5 Years	3†	(3.0)	2	(3.9)	1	(2.0)	-	-	-
5 Years and Over	4†	(4.0)	3	(5.9)	1	(2.0)	-	-	-
Number of Operational Deployments (Regular and Reserve)									
One Tour	50	(50.0)	29	(56.9)	21	(42.9)	1.961	.230	1.758 (.796 - 3.880)
More than One Tour	50	(50.0)	22	(43.1)	28	(57.1)	1.961	.230	.569 (.258 - 1.256)
Deployed Role (Did it match your trade Experience?)									
Yes	90	(90.0)	46	(90.2)	44	(89.8)	.004	1.000	1.045 (.283 - 3.862)
No, it was ABOVE/BENEATH my trade experience	10	(10.0)	5	(9.8)	5	(10.2)	.004	1.000	.957 (.259 - 3.533)

***Fisher's exact test used due to small sample size**
†No of cases <5, does not meet basic assumptions (Field, 2018)
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**

7.4. Physical Health Factors

A number of factors related to physical health and physical combat-related injury were identified in Chapter Six (see Table 14: Potential Risk/Predictor Variables). These factors included: The cause of the physical injury, the experience of pain in the preceding 30 days, use of tobacco and use of alcohol. While a detailed description of the study sample in terms of these categories is presented above, once again, further exploration of the relationship between these potential predictor variables and the stated outcome variables requires the collapsing of the data into binaries that can be incorporated into 2x2 contingency tables for the purposes of testing using Pearson's Chi-Square test and the subsequent calculation of risk using odds ratios.

The distribution of data into binary categories in relation to the physical health variables was far easier. The distribution here is based upon whether or not participants report, pain, being a smoker or drinking alcohol. The distribution of cases by injury cause between blast explosion/blast injuries and injuries caused by bullet was based on a pragmatic view of the injury type and the likelihood of disfiguring injury.

7.4.1. Post-Traumatic Stress Disorder (PCL-C)

A chi-square test of independence was performed to examine the relationship between the use of alcohol and PTSD (cut-off score of ≥50 on the PCL-C measure). The relationship between these variables was significant ($\mathcal{X}^2$(1, n = 101) = 11.54, p = .005), and this finding suggests that those participants who reported never drinking alcohol were more likely to meet the diagnostic cut-off for PTSD than those UKAF personnel who reported drinking. Further examination of the relationship using odds ratios indicates that those participants who abstained from alcohol were approximately eight times more likely to meet the PCL-C criteria (OR = 8.367, 95% C.I = 2.099 – 33.359) than those that did, (see Table 33: Physical Health Factors and PTSD)

Chi-square tests of independence showed that there was no significant association between PTSD (cut-off score of ≥50 on the PCL-C measure) and physical injury cause ($\mathcal{X}^2$(1, n = 101) = .410, p = .726), experience of pain in the preceding 30 days ($\mathcal{X}^2$(1, n = 101) = .127, p = .754), or tobacco use, ($\mathcal{X}^2$(1, n = 101) = 4.192, p = .072), (see Table 33: Physical Health Factors and PTSD).

7.4.2. Common Mental Health Disorder (GHQ-12)

A chi-square test of independence was performed to examine the relationship between the reported experience of pain in the preceding 30 days and psychiatric caseness as determined by GHQ-12 score of ≥2. The relation between these variables was significant ($\mathcal{X}^2$(1, n = 100) = 4.294, p = .043), and this finding suggests that those participants who reported experiencing pain (unrelated to joint swelling and redness) in the preceding 30 days were more likely to meet the criteria for psychiatric caseness. Those UKAF personnel reporting the experience of pain within the preceding 30 days were almost three times as likely to meet the criteria for psychiatric caseness (indicating the presence of common mental health disorder) than those who reported not to have experienced pain in this period (OR = 2.846, 95% C.I = 1.034 – 7.831), (see Table 34: Physical Health Factors and CMD).

Chi-square tests of independence showed that there was no significant relationship between psychiatric caseness and physical injury cause ($\mathcal{X}^2$(1, n = 100) = .059, p = 1.000), tobacco use, ($\mathcal{X}^2$(1, n = 100) = 4.192, p = .072) or alcohol use ($\mathcal{X}^2$(1, n = 100) = .1.147, p = .371), (see Table 34: Physical Health Factors and CMD).

7.4.3. Alcohol Use Disorder (AUDIT-10)

The relationship between the potential predictor variables (physical health) identified above and hazardous drinking was, once again, explored in a sub-sample of 'drinkers' (*n*=89) and no significant association was found between hazardous drinking (as determined by AUDIT-10 score of ≥ 10) and physical injury cause ($\mathcal{X}^2$(1, n = 89) = .224, p = .805), the experience of pain in the preceding 30 days ($\mathcal{X}^2$(1, n = 89) = 426, p = .638) and tobacco use, ($\mathcal{X}^2$(1, n = 89) = 690, p = .460), (see Table 35: Physical Health Factors and AUD).

Alcohol use was not explored as a potential predictor of hazardous drinking as the sub-sample did not include those who reported being tee-total.

7.4.4. Hardiness (DRS-15)

A chi-square test of independence was performed to examine the relationship between the reported use of alcohol and Hardiness. Findings indicated that the relationship between these variables was significant ($\mathcal{X}^2$(1, n = 98) = 6.655, p = .011). The odds ratio suggests that those who abstain from alcohol are ten times more likely to demonstrate higher levels of dispositional resilience (Hardiness) (OR = 10.022, 95% C.I = 1.239 – 81.061) thank those UKAF personnel who drink, (see Table 36: Physical Health Factors and Hardiness).

A chi-square test of independence showed that there was no significant association between Hardiness, and the remaining potential predictor variables of: physical injury cause ($\mathcal{X}^2$(1, n = 98) = .018, p = .1.000), experience of pain in the preceding 30 days ($\mathcal{X}^2$(1, n = 98) = .2.080, p = .190), and tobacco use, ($\mathcal{X}^2$(1, n = 98) = .362, p = .641), (see Table 36: Physical Health Factors and Hardiness).

7.4.5. Psychological Resilience (CD-RISC-10)

No significant associations were identified between potential physical health predictors and psychological resilience, *i.e.* physical injury cause ($\mathcal{X}^2$(1, n = 100) = .654, p = .429), experience of pain in the preceding 30 days ($\mathcal{X}^2$(1, n = 100) = .897, p = .392), tobacco use, ($\mathcal{X}^2$(1, n = 100) = .330, p = .651), or alcohol use ($\mathcal{X}^2$(1, n = 100) = .654, p = .429), (Table 38: Physical Health Factors and Psychological Resilience).

Table 33: Physical Health Factors and PTSD

Physical Health Factors	Count (*n*=101)	PTSD (n = 12)	No PTSD (n =89)	Pearson's Chi-Square Test*		Odds Ratio (OR)
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Physical Injury Cause						
Explosion / Blast (IED, RPG, APM, Grenade)	75 (74.3)	8 (66.6)	67 (75.2)	.410	.726	.657 (.180 - 2.393)
Bullet	26 (25.7)	4 (33.4)	22 (24.7)	.410	.726	1.523 (.418 - .550)
Pain						
No pain in the last month	68 (67.3)	8 (66.6)	60 (67.4)	.127	.754	.776 (192 - 3.143)
Pain in the last month	32 (31.7)	3 (33.4)	29 (32.6)	.127	.754	1.289 (.318 - 5.221)
Tobacco Use						
Never Smoked	75 (74.3)	6 (50.0)	69 (77.5)	4.192	.072	.290 (.084 - .998)
Smoker	26 (25.7)	6 (50.0)	20 (22.5)	4.192	.072**	3.450 (1.002 - 11.877)
Alcohol Use (See Chapter Seven)						
Never Drink Alcohol	**14 (13.9)**	**7 (58.3)**	**7 (78.7)**	**11.540**	**.005**	**8.367 (2.099 - 33.359)**
Drink Alcohol	**87 (86.1)**	**5 (41.7)**	**82 (21.3)**	**11.540**	**.005**	**.120 (.030 - .476)**

***Fisher's exact test used due to small sample size**
****Using Asymptotic Significance (2-sided) this is SIGNIFICANT**
Statistically sig. results are in bold

Table 34: Physical Health Factors and CMD

Physical Health Factors	**Count (*n*=100)**	**CMD (n = 66)**	**No CMD (n =34)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Physical Injury Cause						
Explosion / Blast (IED, RPG, APM, Grenade)	75 (75.0)	50 (75.8)	25 (73.5)	.059	1.000	1.125 (.436 - 2.901)
Bullet	25 (25.0)	16 (24.2)	9 (26.5)	.059	1.000	.889 (.345 - 2.292)
Pain						
No pain in the last month	**69 (69.0)**	**41 (62.1)**	**28 (82.4)**	**4.294**	**.043**	**.330 (.120 - .906)**
Pain in the last month	**31 (31.0)**	**25 (37.9)**	**6 (17.6)**	**4.294**	**.043**	**2.846 (1.034 - 7.831)**
Tobacco Use						
Never Smoked	74 (74.0)	50 (75.8)	24 (70.6)	.312	.634	1.302 (.515 - 3.293)
Smoker	26 (26.0)	16 (24.2)	10 (29.4)	.312	.634	.768 (.304 - 1.943)
Alcohol Use (See Chapter Seven)						
Never Drink Alcohol	14 (14.0)	11 (16.7)	3 (8.8)	1.147	.371	2.067 (.536 - 7.975)
Drink Alcohol	86 (86.0)	55 (83.3)	31 (91.2)	1.147	.371	.484 (.125 - 1.867)

***Fisher's exact test used due to small sample size**
****Using Asymptotic Significance (2-sided) this is SIGNIFICANT**
Statistically sig. results are in bold

Table 35: Physical Health Factors and AUD

Physical Health Factors	**Count (*n*=89)**	**AUD (n = 54)**	**No AUD (n =35)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Physical Injury Cause						
Explosion / Blast (IED, RPG, APM, Grenade)	65 (73.0)	41 (75.9)	25 (71.4)	.224	.805	1.262 (.482 - 3.304)
Bullet	23 (27.0)	13 (24.1)	10 (28.6)	.224	.805	.793 (.303 - 2.076)
Pain						
No pain in the last month	62 (69.7)	39 (72.2)	23 (65.7)	.426	.638	1.239 (.499 - 3.079)
Pain in the last month	27 (30.3)	15 (27.8)	12 (34.3)	.426	.638	.737 (.295 - 1.845)
Tobacco Use						
Never Smoked	67 (75.3)	39 (64.8)	28 (80.0)	.690	.460	.650 (.234 - 1.803)
Smoker	22 (24.7)	15 (27.8)	7 (20.0)	.690	.460	1.538 (.555 - 4.267)
Alcohol Use (See Chapter Seven)						
Never Drink Alcohol	0 (0.0)†	-	- -	-	-	-
Drink Alcohol	89 (100.0)	-	- -	-	-	-

***Fisher's exact test used due to small sample size**

Table 36: Physical Health Factors and Hardiness

Physical Health Factors / DRS-15**	Count (*n*=98)	>Hardiness** (n = 56)	<Hardiness** (n =42)	Pearson's Chi-Square Test*		Odds Ratio (OR)
Overall study sample (*n*=98)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Physical Injury Cause						
Explosion / Blast (IED, RPG, APM, Grenade)	74 (75.5)	42 (75.0)	32 (76.2)	.018	1.000	.938 (.369 - 2.383)
Bullet	24 (24.5)	14 (25.0)	10 (23.8)	.018	1.000	1.067 (.420 - 2.711)
Pain						
No pain in the last month	67 (68.4)	35 (62.5)	32 (76.2)	2.080	.190	1.920 (.786 - 4.688)
Pain in the last month	31 (31.6)	21 (37.5)	10 (23.8)	2.080	.190	.521 (.213 - 1.272)
Tobacco Use						
Never Smoked	73 (74.5)	43 (76.8)	30 (71.4)	.362	.641	1.323 (.531 - 3.296)
Smoker	25 (25.5)	13 (23.2)	12 (28.6)	.362	.641	.756 (.303 - .883)
Alcohol Use (See Chapter Seven)						
Never Drink Alcohol	**12 (12.2)**	**11 (19.6)**	**1 (2.4)**	**6.655**	**.011**	**10.022 (1.239 - 81.061)**
Drink Alcohol	**86 (87.8)**	**45 (80.4)**	**41 (97.6)**	**6.655**	**.011**	**.100 (.012 - .807)**

***Fisher's exact test used due to small sample size**
**** Membership of '>Hardiness' and '<Hardiness' determined by <Median (≤23.00) or >Median (≥24.00)**
Statistically sig. results are in bold

Table 37: Physical Health Factors and Psychological Resilience

Physical Health Factors / CD-RISC-10**	**Count (*n*=100)**		**>Resilience** (n = 51)**		**<Resilience** (n =49)**		**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=100)	n	(%)	n	(%)	n	(%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Physical Injury Cause									
Explosion / Blast (IED, RPG, APM, Grenade)	75	(75.0)	40	(78.4)	35	(71.4)	.654	.492	1.455 (.585 - 3.616)
Bullet	25	(25.0)	11	(21.6)	14	(28.6)	.654	.492	.688 (.277 - 1.709)
Pain									
No pain in the last month	69	(69.0)	33	(64.7)	36	(73.5)	.897	.392	.733 (.315 - 1.707)
Pain in the last month	31	(31.0)	18	(35.3)	13	(26.5)	.897	.392	1.510 (.642- 3.554)
Tobacco Use									
Never Smoked	74	(74.0)	39	(76.5)	35	(71.4)	.330	.651	1.300 (.531 - 3.185)
Smoker	26	(26.0)	12	(23.5)	14	(28.6)	.330	.651	.769 (.314 - 1.884)
Alcohol Use (See Chapter Seven)									
Never Drink Alcohol	12	(12.0)	6	(11.8)	6	(12.2)	.005	1.000	.956 (.286 - 3.193)
Drink Alcohol	88	(88.0)	45	(88.2)	43	(87.8)	.005	1.000	1.047 (.313 - 3.497)

***Fisher's exact test used due to small sample size**
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**

7.5. Psychological Health Factors

Finally, a number of potential predictors/risk factors related to psychological health and physical combat-related injury were identified in Chapter Six (see Table 14: Potential Risk/Predictor Variables). These factors included: the sense of comradeship (camaraderie), the perception of emotional support, the perception of practical support, the memory of the injurious event, distress and previous experience of traumatic events on military operations. While a detailed description of the study sample in terms of these categories is presented above, further exploration of the relationship between these potential predictor variables and the stated outcome variables requires the collapsing of the data into binaries that can be incorporated into 2x2 contingency tables for the purposes of testing using Pearson's Chi-Square test and the subsequent calculation of risk using odds ratios.

The psychological health potential predictor variables are predominantly based on binary responses from single item measures. While this will be discussed below as a limitation, it did allow for the simple identification of binaries for sense of comradeship (camaraderie), perception of emotional support, perception of practical support and distress. While participants had been asked if they had, full, partial or no memory of the injurious event, the responses for full and partial were collapsed. Military trauma exposure was assessed through the completion of a military trauma exposure checklist and the distribution around the median score was taken to indicate 'higher' and 'lower' levels of exposure to military trauma. (see 5.8.1. Previous Experience of Trauma (Military).

7.5.1. Post-Traumatic Stress Disorder (PCL-C)

Significant relationships were identified between a number of the potential predictor variables and PTSD (cut-off score of ≥50 on the PCL-C measure), *i.e.* sense of comradeship (camaraderie) ($\mathcal{X}^2$(1, n = 101) = 5.447, p = .052), the perception of emotional support ($\mathcal{X}^2$(1, n = 101) = 6.893, p = .035), distress ($\mathcal{X}^2$(1, n = 101) = 10.640, p = .001) and previous experience of traumatic events on military operations ($\mathcal{X}^2$(1, n = 101) = 7.743, p = .016). Those participants who reported that they did not feel a sense of comradeship (camaraderie) with those around them on military operations were five and a half times more likely to meet the diagnostic criteria for PTSD (OR = 5.600, 95% C.I = 1.144 – 27.403) while those who reported feeling less positive about the emotional support offered by those closest to them were over seven times more likely to meet the diagnostic criteria for PTSD (OR = 7.083, 95% C.I = 1.364 – 36.775).

Those UKAF personnel who reported the memory of the injurious event being distressing to some extent were fifteen times more likely to meet the diagnostic criteria for PTSD (OR = 15.459, 95% C.I = 1.912 – 124.997). This relationship is not surprising however given the nature and presentation of PTSD (see Chapter Two). Those participants who reported higher levels of military trauma exposure (as determined by a total military trauma exposure score ≥Median (18.91), see 5.8.1: Previous Experience of Trauma (Military)) were over five times more likely to meet the diagnostic criteria for PTSD (OR = 5.643, 95% C.I = 1.503 – 21.183), (see Table 38: Psychological Health Factors and PTSD).

Again, Chi-square tests of independence showed that there was no significant association between PTSD (as determined by a cut-off score of ≥50 on the PCL-C measure) and the perception of practical support, $\mathcal{X}^2$(1, n = 101) = .2.804, p = .148) and the memory of the injurious event, ($\mathcal{X}^2$(1, n = 101) = 1.496, p = .360).

7.5.2. Common Mental Health Disorder (GHQ-12)

Chi-square tests of independence showed that there was no significant relationship identified between psychiatric caseness as determined by GHQ-12 score of ≥2, and the stated psychological health factors, *i.e*. sense of comradeship (camaraderie), ($\mathcal{X}^2$(1, n = 100) = .314, p = .713), the perception of emotional support ($\mathcal{X}^2$(1, n = 100) = .3877, p = 092), the perception of practical support ($\mathcal{X}^2$(1, n = 100) = .855, p = .413), the memory of the injurious event ($\mathcal{X}^2$(1, n = 100) = .178, p = .713), distress ($\mathcal{X}^2$(1, n = 100) = .3.332, p = .091), and previous experience of traumatic events on military operations ($\mathcal{X}^2$(1, n = 100) = .423, p = 572), (see Table 39: Psychological Health Factors and CMD).

While the Pearson's Chi-square test was not significant for the perception of emotional support ($\mathcal{X}^2$(1, n = 100) = .3877, p = 092) the calculated odds ratio (OR = 1.576, 95% C.I = 1.351 – 1.839) suggests that those reporting being less positive about the levels of emotional support provided by the person closest to them are at increased risk of developing CMD.

7.5.3. Alcohol Use Disorder (AUDIT-10)

The relationship between the potential predictor variables (psychological health) identified above and hazardous drinking was, once again, explored in a sub-sample of 'drinkers' (*n*=89) and no significant association was found between hazardous drinking (as determined by AUDIT-10 score of ≥ 10) and sense of comradeship (camaraderie), ($\mathcal{X}^2$(1, n = 89) = .1.011, p = .427), the perception of emotional support ($\mathcal{X}^2$(1, n = 89) = 1.384, p = 397), the perception of practical support ($\mathcal{X}^2$(1, n = 89) = .001, p = 1.000), the memory of the injurious event ($\mathcal{X}^2$(1, n = 89) = .012, p = 1.000), distress ($\mathcal{X}^2$(1, n = 89) = .146, p = .828), and previous experience of traumatic events on military operations ($\mathcal{X}^2$(1, n = 89) = .209, p = .758), (see Table 40: Psychological Health Factors and AUD).

7.5.4. Hardiness (DRS-15)

A chi-square test of independence showed that there was no significant association between Hardiness, and sense of comradeship (camaraderie), ($\mathcal{X}^2$(1, n = 98) = .181, p = .721), the perception of emotional support ($\mathcal{X}^2$(1, n = 98) = 2.513, p = .233), the perception of practical support ($\mathcal{X}^2$(1, n = 98) = 1.479, p = .397), the memory of the injurious event ($\mathcal{X}^2$(1, n = 98) = 2.376, p = .181), distress ($\mathcal{X}^2$(1, n = 98) = .277, p = .277), and previous experience of traumatic events on military operations ($\mathcal{X}^2$(1, n = 98) = .067, p = 1.000), (see Table 41: Psychological Health Factors and Hardiness).

7.5.5. Psychological Resilience (CD-RISC-10)

There is a significant relationship between psychological resilience and distress ($\mathcal{X}^2$(1, n = 100) = 8.970, p = .005). This finding suggests that those participants who report, that when they think about the injurious event, they are not distressed by the memory are over three times more likely to meet the criteria for 'demonstrates higher levels of psychological resilience (OR = 3.444, 95% C.I = 1.513 – 7.839), (see Table 42: Psychological Health Factors and Psychological Resilience).

No further associations were identified between the remaining potential psychological health predictors and those reporting higher or levels of psychological resilience, *i.e*. sense of comradeship (camaraderie), ($\mathcal{X}^2$(1, n = 100) = .634, p = .483), the perception of emotional support ($\mathcal{X}^2$(1, n = 100) = 200, p

= .712), the perception of practical support ($\mathcal{X}^2$(1, n = 100) = .003, p = 1.000), the memory of the injurious event ($\mathcal{X}^2$(1, n = 100) = .004, p = .1.000, and previous experience of traumatic events on military operations ($\mathcal{X}^2$(1, n = 100) = .2.204, p = .168), (see Table 42: Psychological Health Factors and Psychological Resilience).

Table 38: Psychological Health Factors and PTSD

Psychological Health Factors	**Count (*n*=101)**	**PTSD (n = 12)**	**No PTSD (n =89)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Sense of Comradeship						
Felt a sense of comradeship	**93 (92.1)**	**9 (75.0)**	**84 (94.3)**	**5.447**	**.052**	**.179 (.036 - .874)**
Did not feel a sense of comradeship	**8 (7.9)**	**3 (25.0)**	**5 (5.61)**	**5.447**	**.052**	**5.600 (1.144 - 27.403)**
Emotional Support						
More positive about emotional support	**94 (93.1)**	**9 (75.0)**	**85 (95.5)**	**6.893**	**.035**	**.141 (.027 - .733)**
Less Positive about emotional support	**7 (6.9)**	**3 (25.0)**	**4 (4.7)**	**6.893**	**.035**	**7.083 (1.364 - 36.775)**
Practical Support						
More positive about practical support	95 (94.1)	10 (83.3)	85 (95.5)	2.804	.148	.235 (.038 - 1.451)
Less Positive about practical support	6 (5.94)	2 (16.7)	4 (4.5)	2.804	.148	4.250 (.689 - 26.216)
Memory of the event						
No memory	10 (9.9)	0 (0.0)	10 (11.24)	1.496	.360	1.152 (1.063 - 1.248)
Full or partial memory	91 (90.1)	12 (100.0)	79 (88.8)	1.496	.360	.868 (.801 - .941)
Is the memory of the event distressing?						
Not at all	**53 (52.5)**	**1 (8.3)**	**52 (58.4)**	**10.640**	**.001**	**.065 (.008 - .523)**
Yes, to some extent	**48 (47.5)**	**11 (91.7)**	**37 (41.6)**	**10.640**	**.001**	**15.459 (1.912 - 124.997)**
Previous Experience of Trauma						
Military Trauma Exposure						
Lower Levels	**86 (85.2)**	**7 (58.3)**	**79 (88.8)**	**7.743**	**.016**	**.177 (.047 - .665)**
Higher Levels	**15 (14.8)**	**5 (41.7)**	**10 (11.2)**	**7.743**	**.016**	**5.643 (1.503 - 21.183)**

***Fisher's exact test used due to small sample size**
****Using Asymptotic Significance (2-sided) this is SIGNIFICANT**
Statistically sig. results are in bold

Table 39: Psychological Health Factors and CMD

Psychological Health Factors	**Count (*n*=100)**	**CMD (n = 66)**	**No CMD (n =34)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=101)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Sense of Comradeship						
Felt a sense of comradeship	92 (92.0)	60 (90.9)	32 (94.1)	.314	.713	.625 (.119 - 3.277)
Did not feel a sense of comradeship	8 (8.0)	6 (9.1)	2 (5.88)	.314	.713	1.600 (.305 - 8.388)
Perception of Emotional Support						
More positive about emotional support	93 (93.0)	59 (89.4)	34 (100.0)	3.877	.092	-
Less Positive about emotional support	7 (7.0)	7 (10.6)	0 (0.0)	3.877	.092	1.576 (1.351 - 1.839)
Perception of Practical Support						
More positive about practical support	94 (94.0)	61 (92.4)	33 (97.1)	.855	.431	.370 (.041 - 3.298)
Less Positive about practical support	6 (6.0)	5 (7.6)	1 (2.9)	.855	.431	2.705 (.303 - 24.131)
Memory of the event						
No memory	10 (10.0)	6 (9.1)	4 (11.8)	.178	.731	.750 (.197 - 2.861)
Full or partial memory	90 (90.0)	60 (90.9)	30 (88.2)	.178	.731	1.333 (.350 - 5.087)
Is the memory of the event distressing?						
Yes, to some extent	48 (48.0)	36 (54.5)	12 (35.3)	3.332	.091	2.200 (.936 - 5.168)
Not at all	52 (52.0)	30 (45.5)	22 (64.7)	3.332	.091	.455 (.193 - 1.068)
Previous Experience of Trauma						
Military Trauma Exposure						
Higher Levels	15 (15.0)	11 (16.7)	4 (11.8)	.423	.572	1.500 (.439 - 5.121)
Lower Levels	85 (85.0)	55 (83.3)	30 (88.2)	.423	.572	.667 (.195 - 2.276)

***Fisher's exact test used due to small sample size**
Statistically sig. results are in bold

Table 40: Psychological Health Factors and AUD

Psychological Health Factors	**Count (*n*=89)**	**AUD (n = 54)**	**No AUD (n =35)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (Drinkers Only, *n*=89)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Sense of Comradeship						
Felt a sense of comradeship	82 (92.1)	51 (94.4)	31 (88.6)	1.011	.427	2.194 (.460 - 10.460)
Did not feel a sense of comradeship	7 (7.9)	3 (5.6)	4 (11.4)	1.011	.427	.456 (.096 - 2.174)
Perception of Emotional Support						
More positive about emotional support	83 (93.3)	49 (90.7)	34 (97.1)	1.384	.397	.288 (.032 - 2.578)
Less Positive about emotional support	6 (6.7)	5 (9.3)	1 (2.85)	1.384	.397	3.469 (.388 - 31.035)
Perception of Practical Support						
More positive about practical support	84 (94.4)	51 (94.4)	33 (94.3)	.001	1.000	1.030 (.163 - 6.500)
Less Positive about practical support	5 (5.6)	3 (5.6)	2 (5.71)	.001	1.000	.971 (.154 - 6.124)
Memory of the event						
No memory	8 (9.0)	5 (9.3)	3 (8.6)	.012	1.000	.919 (.205 - 4.114)
Full or partial memory	81 (91.0)	49 (90.7)	32 (91.4)	.012	1.000	1.088 (.243 - 4.874)
Is the memory of the event distressing?						
Yes, to some extent	41 (46.0)	24 (44.4)	17 (48.6)	.146	.828	.847 (.361 - 1.988)
Not at all	48 (53.9)	30 (55.6)	18 (51.4)	.146	.828	1.181 (.503 - 2.770)
Previous Experience of Trauma						
Military Trauma Exposure						
Higher Levels	12 (13.5)	8 (14.8)	4 (11.4)	.209	.758	1.348 (.373 - 4.866)
Lower Levels	77 (86.5)	46 (85.1)	31 (88.6)	.209	.758	.742 (.206 - 2.678)

***Fisher's exact test used due to small sample size**

Table 41: Psychological Health Factors and Hardiness

Psychological Health Factors / DRS-15**	**Count (*n*=98)**	**>Hardiness** (n = 56)**	**<Hardiness** (n =42)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=98)	n (%)	n (%)	n (%)	$\mathcal{X}^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Sense of Comradeship						
Felt a sense of comradeship	90 (91.8)	52 (92.8)	38 (90.5)	.181	.721	1.368 (.322 - 5.820)
Did not feel a sense of comradeship	8 (8.2)	4 (7.1)	4 (9.5)	.180	.721	.731 (.172 - 3.108)
Perception of Emotional Support						
More positive about emotional support	91 (92.8)	54 (96.4)	37 (88.1)	2.513	.233	3.649 (.672 - 19.820)
Less Positive about emotional support	7 (7.1)	2 (3.6)	5 (11.9)	2.513	.233	.274 (.050 - 1.489)
Perception of Practical Support						
More positive about practical support	92 (93.8)	54 (96.4)	38 (90.5)	1.479	.397	2.842 (.495 - 16.312)
Less Positive about practical support	6 (6.1)	2 (3.6)	4 (9.5)	1.479	.397	.352 (.061 - 2.019)
Memory of the event						
No memory	10 (10.2)	8 (14.3)	2 (4.8)	2.376	.181	3.333 (.669 - 16.598)
Full or partial memory	88 (89.8)	48 (85.7)	40 (95.2)	2.376	.181	.300 (.060 - 1.494)
Is the memory of the event distressing?						
Yes, to some extent	46 (46.9)	25 (44.6)	21 (50.0)	.277	.277	.806 (.362 - 1.799)
Not at all	52 (53.0)	31 (55.4)	21 (50.0)	.277	.277	1.240 (.556 - 2.766)
Previous Experience of Trauma						
Military Trauma Exposure						
Higher Levels	13 (13.3)	7 (12.5)	6 (14.3)	.067	1.000	.857 (.265 - 2.768)
Lower Levels	85 (86.7)	49 (87.5)	36 (85.7)	.067	1.000	1.167 (.361 - 3.767)

***Fisher's exact test used due to small sample size**
**** Membership of '>Hardiness' and '<Hardiness' determined by <Median (≤23.00) or >Median (≥24.00)**

Table 42: Psychological Health Factors and Psychological Resilience

Psychological Health Factors / CD-RISC-10**	**Count (*n*=100)**	**>Resilience** (n = 51)**	**<Resilience** (n =49)**	**Pearson's Chi-Square Test***		**Odds Ratio (OR)**
Overall study sample (*n*=100)	n (%)	n (%)	n (%)	$\chi^2(1)$	Exact Sig. (2-sided)	Unadjusted OR (95% CI)
Sense of Comradeship						
Felt a sense of comradeship	92 (92.0)	48 (94.1)	44 (89.8)	.634	.483	1.818 (.410 - 8.057)
Did not feel a sense of comradeship	8 (8.0)	3 (5.9)	5 (10.2)	.634	.483	.550 (.124 - 2.437)
Perception of Emotional Support						
More positive about emotional support	93 (93.0)	48 (94.1)	45 (91.8)	.200	.712	1.422 (.301 - 6.709)
Less Positive about emotional support	7 (7.0)	3 (5.9)	4 (8.2)	.200	.712	.703 (.149 - 3.317)
Perception of Practical Support						
More positive about practical support	94 (94.0)	48 (94.1)	46 (93.9)	.003	1.000	1.043 (.200 - 5.437)
Less Positive about practical support	6 (6.0)	3 (5.9)	3 (6.1)	.003	1.000	.958 (.184 - 4.993)
Memory of the event						
No memory	10 (10.0)	5 (9.8)	5 (10.2)	.004	1.000	.957 (.259 - 3.533)
Full or partial memory	90 (90.0)	46 (90.2)	44 (89.7)	.004	1.000	1.045 (.283 - 3.862)
Is the memory of the event distressing?						
Yes, to some extent	**48 (48.0)**	**17 (33.3)**	**31 (63.3)**	**8.970**	**.005**	**.290 (.128 - .661)**
Not at all	**52 (52.0)**	**34 (66.7)**	**18 (36.7)**	**8.970**	**.005**	**3.444 (1.513 - 7.839)**
Previous Experience of Trauma						
Military Trauma Exposure						
Higher Levels	15 (15.0)	5 (9.8)	10 (20.4)	2.204	.168	.424 (.134 - 1.346)
Lower Levels	85 (85.0)	46 (90.2)	39 (79.6)	2.204	.168	2.359 (.743 - 7.489)

***Fisher's exact test used due to small sample size**
**** Membership of '>Resilience' and '<Resilience' determined by <Median (≤33.00) or >Median (≥33.00)**
Statistically sig. results are in bold

7.6. Summary

Building on the findings of Chapter Four (the identification of a range of predictors of risk for PTI, CMD and AUD within the systematic literature review), Chapter Six (the reported sociodemographic, military, physical health and psychological health characteristics of the sample), and Chapter Seven (the reported levels of psychological resilience, PTSD, CMD and AUD) this chapter conclusively answers the research questions:

a(ii). Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?

b(ii). Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

Ethnicity ($\mathcal{X}^2(1, N = 101) = 5.986, p = .034$) and age ($\mathcal{X}^2(1, N = 101) = 9.254, p = .004$) were identified as being significant sociodemographic risk factors for the development of PTSD. Black and Asian British (including Commonwealth) UKAF personnel were approximately five times more likely to meet the PCL-C criteria for PTSD than White British (including Commonwealth) UKAF personnel (OR = 5.063, 95% C.I = 1.245 - 20.589). Those who were under 25 years of age (at first admission to the DMRC) were 8.4 times (OR = 8.485, 95% C.I. = 1.751 – 41.109) more likely to meet the PCL-C criteria for PTSD than those over the age of 25. While no military risk factors were identified for PTSD, in terms of physical health, it appeared that those participants reporting that they abstain from alcohol were approximately eight times more likely to meet the criteria for PTSD (OR = 8.367, 95% C.I = 2.099 – 33.359) than those that reported that they consumed alcohol. This finding may initially appear dichotomous but will be discussed further in Chapter Nine: Discussion.

In respect of the psychological health, sense of comradeship (camaraderie), (OR = 5.600, 95% C.I = 1.144 – 27.403), perception of emotional support (OR = 7.083, 95% C.I = 1.364 – 36.775), distress (OR = 15.459, 95% C.I = 1.912 – 124.997) and previous exposure to traumatic events within the military environment (OR = 5.643, 95% C.I = 1.503 – 21.183) all appear to be statistically significant predictors of PTSD.

While there appear to have been no statistically significant findings in respect of potential sociodemographic, military or psychological health predictors of common mental health disorder (CMD), it would appear that the experience of pain in the preceding 30 days is a statistically significant ($\mathcal{X}^2$(1, n = 100) = 4.294, p = .043) predictor of common mental health disorder (as determined by a GHQ-12 score of ≥2). Participants reporting having experienced pain, unrelated to joint swelling and redness within the preceding 30 days were almost three times more likely to meet the criteria for psychiatric caseness (OR = 2.846, 95% C.I = 1.034 – 7.831) than those that did not.

Those participants who reported being single, separated or divorced were significantly more likely to meet the criteria for hazardous drinking ($\mathcal{X}^2$(1, n = 89) = .4.298, p = .044) and were over two and a half times more likely to meet the higher AUDIT-10 criteria (Score ≥ 10) than those in relationships (OR = 2.700, 95% C.I. = 1.040 - 7.011). Despite the continued 'drinking culture' within the British military, there were no observed military predictors of hazardous drinking. Neither were there any physical or psychological health predictors of dangerous drinking and relationship status remains the single identified risk factor for AUD.

In respect of resilience, neither Hardiness and psychological resilience appeared to be predictable within this sample by sociodemographic factor or military factor, however, those participants reporting that they abstained from alcohol demonstrated higher levels of dispositional resilience (Hardiness), ($\mathcal{X}^2$(1, n = 98) = 6.655, p = .011) and are ten times more likely to demonstrate higher levels of hardiness (OR = 10.022, 95% C.I = 1.239 – 81.061) than those UKAF personnel who drink. This finding was not replicated in relation to psychological resilience (assessed by CD-RISC-10) suggesting (at baseline) that there is a difference between dispositional resilience (hardiness) and psychological resilience.

While there were no significant findings in respect of dispositional resilience (hardiness) and potential psychological predictors, those who reported that they did not find the memory of the injurious event distressing in any way were more likely to demonstrate higher levels of psychological resilience ($\mathcal{X}^2$(1, n = 100) =

.8.970, p = .005) and were three times more likely to demonstrates higher levels of psychological resilience (OR = 3.444, 95% C.I = 1.513 – 7.839). It seems likely in this case that rather than distress predicting psychological resilience it is more likely that the high levels of psychological resilience predict levels of distress.

In the following chapter the findings from Chapter Six: Recruitment, Response and Sample Characteristics, Chapter Seven: General and Trauma-related psychopathology and Psychological Resilience and this chapter will be discussed in the context of the findings of the systematic literature review. The following chapter will also present a discussion of the limitations, strengths and contribution made to the field by this study. The next chapter will conclude by indicating future directions of research based on the conclusions and recommendations of this study.

Figure 25: Camp Bastion - Operating Theatre by Graeme Lothian.
Permission granted by the Artist

CHAPTER EIGHT: DISCUSSION

8.1. Introduction

The primary aim of this doctoral study is to investigate mental health and mental health morbidity in a prospective sample of United Kingdom Armed Forces (UKAF) personnel following physical combat-related injury, and to explore the relationships between potential risk factors and predictors and subsequent mental health disorder (CMD), post-traumatic illness (PTI), Alcohol Use Disorder (AUD) and psychological resilience. Building on the findings of the systematic literature review conducted at the conclusion of Part One of this thesis, the preceding chapters have comprehensively addressed the following research questions:

a. Mental health and mental health morbidity:

   i. What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury?

   ii. Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?

b. Psychological resilience:

   i. What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?

   ii. Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?

This chapter will bring the study to its conclusion by placing the findings of the study within the context of the identified literature discussed in Part One of this doctoral thesis, discussing a number of key limitations and presenting the strengths of this study. The chapter will close with a statement of the significance of this study, it's place within the body of evidence and the potential for further research in the area.

8.2. Recruitment and Response

Based on initial broad estimates of numbers, the admission of UKAF personnel to the DMRC following traumatic injury (both combat and non-combat) was unpredictable and forced the adoption of a pragmatic approach to sampling (see 5.3: Response). While the study was originally intended as a case-control study the absence of any real control group provided an overwhelming challenge to that aspiration. From a methodological perspective, the non-probability sampling strategy employed within this study can only best be described as convenience sampling (Robson, 2011).

Between the 3rd January 2010 and the 30th October 2011, 234 UKAF personnel were admitted to the DMRC with physical injuries (both combat-related and non-combat-related). Initial recruitment to the study was positive (85%, *n*=199), and the study achieved a good response rate (56.3%, *n*=112) (see table 11: Response Rates). A comparison of responders *(n*=112) and non-responders *(n*=87) suggests that non-responders were more likely to be marginally younger. The Mean age of responders *(n*=112) was 26.12 years (SD = 5.951) while the Mean age of the non-responders *(n*=87) was 24.95 years (SD = 5.967). The percentage of 'White: British' participants was higher in the non-responders group (94.3%) as opposed to (87.5%) in the responders group.

8.2.1. Sample comparison with general UKAF service population

The vast majority of participants in the study were male (99.10%, *n*=111) but this was not unexpected. During the period of the study, the UK Armed Forces still had a ban on women serving in ground close combat (GCC) roles. It is likely, therefore, that the low numbers of female participants were due in large part to the exclusive use of male UKAF personnel in GCC roles. The ban was only lifted in November 2016 (MoD, 2016).

The majority of study participants described themselves as being 'White: British', 'White: Irish' or 'White: Other' (91.96%, *n*=103), and this is broadly representative of that in the wider UKAF population (DASA, 2012). The Mean age of participants was significantly less than that of those serving in the UK Regular Forces as either Other Ranks (Mean age = 29 years) or as Officers (Mean age = 37 years), (DASA, 2012). The differential in Mean age is also likely to be a reflection of the 'junior' nature (in both age and rank) of those deployed in GCC roles.

In terms of their military service, 92.9% *(n*=104) of the sample were regular members of the UKAF or on full-time reserve service (FTRS), and the remaining 7.1% were members of the Reserve Forces. Of this number the majority were employed within the British Army or the Royal Marines (97.3%) with the remaining 2.7% serving with the RAF Regiment (Appendix M: Summary of Military Characteristics). As 41.4% of the sample was under the age of 25 years, it is likely that they were also early career soldiers, sailors or airpersons, and 48.2% of regular participants had served in the Armed Forces less than five years. Distribution of ranks within the sample confirmed that the tri-service equivalents of private soldier accounted for 49.1% *(n*=55) and Junior Non-Commissioned Officers (JNCOs: Lance Corporal and Corporal) accounted for 31.3% *(n*=35). Senior NCOs (SNCOs) and Warrant Officers accounted for only 9.8% of the overall sample. The percentage of junior Commissioned Officer ranks (Second Lieutenant to Captain) similarly accounted for only 9.8% (Appendix M: Summary of Military Characteristics). Once again, the rank bias apparent in the sample is a reflection of the relative risk faced by deployed troops on military operations and the employment of junior ranks in GCC roles.

While no attempt is made to suggest that the study sample is representative of the general service population, it need not be. It is, however, representative of those injured on OP HERRICK between 2001 and 2014 by virtue of being a sample of convenience, obtained over a period of 18 months, drawn from those injured on UK military operations in Afghanistan. It is the long-established practice of the UKAF to medically discharge service personnel deemed unfit for military service (Bergman and Millar, 2000). It seems increasingly clear that those who have sustained what would previously have been regarded as un-survivable injuries or life-changing disability, even following a positive period of rehabilitation, will be deemed incompatible with continued military service and likely to result in medical discharge.

8.3. Common Mental Health Disorder

While this study is not able to make any direct statements about the effects of combat injury on the prevalence of CMD due to the lack of a pre-injury measure in the sample, a comparison of the findings in this study with the general UKAF population (see Chapter Two) is possible. In UKAF personnel following operational deployments to Iraq and Afghanistan *(n*=9,990), prevalence of CMD determined by GHQ-12 caseness was reported as 19.7% (Fear *et al*., 2010) and in previous studies of UKAF peacekeepers *(n*=1,198), GHQ caseness was reported as 29.1% *(n*=357) (Greenberg *et al*., 2008). Neither Fear *et al*. (2010) nor Greenberg *et al*. (2008) report the cut off or the method used to score GHQ-12, so caution must be advised when directly comparing the rates of psychiatric caseness identified in those studies to this study. Subsequent studies published by the KCMHR indicate that using the GHQ scoring method (0-0-1-1) a score of ≥4 was used to assess psychiatric caseness (Diehl *et al*., 2019).

Within this study, findings indicate that the prevalence of CMD as determined by GHQ-12 caseness is between 52.5% (Likert) and 66.7% (GHQ). The criteria used for psychiatric caseness is a GHQ-12 score ≥ 12 using the Likert method or ≥ 2 using the GHQ method (Goldberg *et al*., 1997). While the KCMHR study utilises a score of ≥ 4 to indicate caseness, Goldberg, *et al*. (1997) recommend the lower score. While this means that this study will overestimate the levels of psychiatric caseness in the sample when compared to the KCMHR study it is consistent with the scoring method recommended by the measures authors.

A recent large meta-analysis of the prevalence of CMD and PTSD in UKAF personnel *(n*=21,746) following operational deployment to both Iraq (OP TELIC) and Afghanistan (OP HERRICK) reports the pooled prevalence of CMD (drawn from nine studies) on return home (baseline) of 12.1% (95% CI, 6.3-17.8, p=<0.001) (Rona, *et al*., 2016). Prevalence of CMD in the general UKAF population at six-months is 19.0% (95% CI, 16.6-21.5, p=0.52) and at twelve months 17.7% (95% CI, 15.9 – 19.4, p=0.40) (Rona, *et al*., 2016). Even allowing for delayed presentation of mental health symptoms this study reports considerably higher levels of CMD in the sample of UKAF personnel admitted to the DMRC following physical combat-related injury and concludes that physical combat-related injury is a risk factor for the development of common mental health disorder. A summary of these findings is presented in Table 43: Summary Table of Findings (Chapter Six), see below

8.4. Post-Traumatic Illness

The reported pooled prevalence of PTSD in the general UKAF population returning home following operational deployment is 2.0% (95% CI, 1.1 – 2.9, p=0.080), at six-months 3.2% (95% CI, 2.2 – 4.2, p=0.86) and twelve months 3.1% (95% CI, 2.3 – 3.9, p=0.55) (Rona *et al*., 2016). Within this study the prevalence of PTSD at first admission to the DMRC was estimated at 11.9% (see Table 15: PTSD – At first admission to the DMRC). Again, as with CMD, this study reports considerably higher levels of PTSD in the sample when compared to the general UKAF population even up until twelve months following return from deployment.

A large study of deployed British Army personnel *(n*=3,896) linking Emergency Department attendance and the prevalence of CMD, PTSD and AUD reported by the KCMHR: Phase I and II Military Health Studies suggests that those presenting at military ED on OP TELIC or OP HERRICK, who were later medically evacuated back to the UK with a physical combat-related injury, were at a statistically significant risk of developing PTSD (AOR= 4.27, 95% CI, 1.80-10.12, p=0.001) and having poorer general health (AOR= 3.88, 95% CI, 2.01-7.48, p=0.001) (Forbes *et al*., 2012). Once again, caution is advised in attempting to directly compare these results as the criteria 'medically evacuated back to the UK with a physical combat-related injury' does not imply any similarity between samples. The function of a deployed medical treatment facility is to return personnel to duty. Those who are unable to return to duty are medically evacuated back to the UK and this may include a range of minor injuries not manageable in the operational environment and not requiring further rehabilitation through the DMRC.

The general prevalence of PTSD identified in this study was considerably higher than that reported in previous studies of UK troops returning from operations (minus physical combat-related injury), *i.e.* Hotopf *et al.* (2006), and this also serves to support the findings from earlier studies (*e.g.* Kulka *et al.*, 1990 and Michaels *et al*., 1999) that indicate that physical combat-related injury is a risk factor for PTSD.

High levels of common mental health disorder identified further serve to confirm that comorbidity in PTSD is the norm rather than the exception (O'Donnell *et al.,* 2004) and that a significant proportion of those individuals with a diagnosis of PTSD also meet the criteria for at least one other psychiatric condition (Creamer *et al.,* 2001). Once again, while the use of GHQ-12 does not serve to identify what these individual psychopathologies may be, the literature (see Chapter Two) confirms that other symptoms from which soldiers may be at risk include depression, anxiety, anger, sleep disturbance, somatisation, substance misuse, dissociation and sexual problems (Goff *et al*., 2007). A summary of these findings is presented in Table 43: Summary Table of Findings (Chapter Six), see below

8.5. Alcohol Use Disorder (AUD)

Alcohol misuse and AUD is common in the UK military populations (Fear *et al*., 2007; Rona *et al*., 2010 and Aguirre *et al*., 2013b). Historically, military culture has often promoted excessive alcohol consumption in order to promote 'bonding' or 'unit cohesion' (Iversen and Waterdrinker *et al*., 2007; Verrall, 2011). Heavy drinking within the U.K. military is reported in 17% of men and 9% of women and binge-drinking is reported in 48% of male UKAF personnel and 31% of female UKAF personnel (Fear *et al*., 2007).

This study reports a prevalence of hazardous and harmful alcohol use at first admission to the DMRC of 41.6% *(n*=37) using the upper cut-off score of ≥10 (see Table 17: AUDIT-10 Scores at Baseline). Rates of hazardous alcohol use (97.8%, *n*=87), dependence symptoms (35.9%, *n*=32), and harmful alcohol use (62.9%, *n*=56), measured on admission to the DMRC as part of this study suggest an alarming level of alcohol use in this population (see Table 17: AUDIT-10 Scores at Baseline).

In comparison, within the general UKAF population the pooled prevalence of AUDIT-10 findings suggests that 19.2% of those returning from an operational deployment (without physical combat-related injury) meet the criteria for hazardous and harmful alcohol within six-months of returning home and 17.5% meet that criteria within one year (Rona *et al*., 2016). Comparison of these findings with the findings of this study suggest a higher prevalence of hazardous and harmful alcohol use in UKAF personnel following physical combat-related injury.

Paradoxically, when exploring the relationships between reported alcohol consumption, PTSD and Resilience the findings of this study suggest that individuals reporting themselves as abstaining from the consumption of alcohol are 8.3 times more likely to experience symptoms of PTSD (see Table 33: Physical Health Factors and PTSD) and there is tentative evidence to suggest that the consumption of alcohol (which includes the associated social aspects and benefits) may be associated with reduced levels of PTSD (OR = .120 (95% C.I. = .030 - .476). In addition, this study also indicates that there is a significant relationship between reported consumption of alcohol and lower levels of dispositional resilience (OR = .100 (95% C.I. = .012 - .807), (see Table 36: Physical Health Factors and Hardiness). Hardiness has been evaluated as a marker for alcohol misuse risk in serving U.S. military personnel – following operational deployment it was identified that individuals demonstrating lower levels of hardiness had increased risk of alcohol abuse (Bartone *et al.,* 2012 and 2014). That finding is confirmed in this study. One explanation of this phenomenon offered in the wider HCTP report was that it may be that levels of PTSD and common mental health disorder are masked by the use of alcohol and that alcohol is employed as a coping mechanism. In respect of the apparent positive effect of alcohol on resilience, it is possible that the social aspect of alcohol and benefits that derive from the use of alcohol within the military environment reinforce the positive effects of comradeship and that the sense of 'membership of the military family' that this brings has a positive effect on resilience (Alexander *et al*., 2013). This finding would be consistent with the observation that military culture within the UK has often promoted excessive alcohol consumption (Iversen and Waterdrinker *et al*., 2007; Verrall, 2011) in order to promote 'bonding' or 'unit cohesion'. A summary of these findings is presented in Table 43: Summary Table of Findings (Chapter Six), see below

8.6. Hardiness

The assessment of participant hardiness was conducted on admission to the DMRC using the DRS-15 measure. Given the timing of the administration of the assessment, a degree of caution must be exercised in its interpretation, and it is reasonable only to suggest that the individual DRS-15 scores achieved provide a baseline measure of resilience 'at admission' rather than as a baseline assessment of the resilience of the individual participants as a whole. While hardiness has been described as a fixed character trait, there is evidence suggesting that hardiness is only part trait and part state (Bartone, 1999). While hardiness levels appear relatively stable over time they can be influenced by various social and environmental factors (Bartone, 1999). Hardiness is not just a fixed trait, therefore, it is amenable to change and it seems likely that it would be influenced by an experience of combat injury.

There is considerable variation in the duration of the patient care pathways prior to admission to the DMRC. A rudimentary analysis of the difference in elapsed time between 'incident' and admission to the DMRC demonstrates that (for 95% of the group) between 1 and 27 weeks may have elapsed (Mean time between 'injury' and 'admission' = 12.74 weeks). Patients with more complex injuries tended to stay at the Royal Centre for Defence Medicine (RCDM) at the Queen Elizabeth Hospital Birmingham (QEHB) for longer periods. It seems likely that during this time a combination of personal and environmental factors will have had an effect upon overall hardiness. In general, the differences in time between incident and admission and the complexity of physical combat-related injuries are confounding variables that cannot be accounted for in this study and this remains a significant limitation.

The comparison of the Mean DRS-15 score achieved by this sample of UKAF personnel admitted to the DMRC (Mean=23.83, SD=4.922) and the normative values cited by the scale author (Bartone *et al*., 2007) for a generally comparable group of U.S. West Point military academy students (Mean= 29.15) suggest lowered observed levels of hardiness in our sample and further supports this conclusion.

Hardiness is reported in numerous studies of military populations, *e.g.* in US Army Special Forces candidates *(n*=1,138) where DRS-15 scores were used to successfully predict outcomes in those candidates graduating from the US Army Special Forces candidate school (Mean 34.34, *n*=637) and those failing to graduating (33.73, *n*=501) (Bartone *et al.*, 2008), and in a large study *(n*=987) of US Army National Guard soldiers (43.48, SD=5.51) which concluded that hardiness did not predict symptoms of PTSD or depression beyond the effects of positive emotionality and negative emotionality in combat exposed soldiers (Erbes *et al*., 2011).

The variation in reported levels of Mean hardiness across military samples should not be taken to imply that the samples are directly comparable. However, it is comment worthy that hardiness reported for this study sample is significantly lower than comparable groups. In hindsight it is regrettable that hardiness (dispositional resilience) was not assessed beyond baseline in this study and this remains a limitation in the study design. A summary of these findings is presented in Table 43: Summary Table of Findings (Chapter Six), see below

8.7. Psychological Resilience

In previous studies investigating psychological resilience in subjects presenting with a diagnosis of PTSD or following exposure to severe trauma, reported Mean scores are observed of 30.3 (*n*=1,686, SD=6.6) in a national sample of older U.S. veterans (aged 60-96), (Pietrzak *et al*., 2014) and 23.6 (*n*=246, SD=7.9) in U.S. veterans with PTSD and depression (Wingo *et al.,* 2017). Findings within this study suggest that UKAF personnel with a physical combat-related injury report similar levels of psychological resilience (Mean CD-RISC-10 score of 30.83 at baseline). A summary of these findings is presented in Table 43: Summary Table of Findings (Chapter Six), see below

Table 43: Summary Table of Findings (Chapter Six)

Research Question	Research Question	Measure	Summary Findings Reported Prevalence shown in bold	Reference
a(i)	What is the prevalence of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following physical combat-related injury	PTSD (PCL-C) n=101	PCL-C Score (Cut-off >50) Mean (PTSD Yes) 58.58 (SD=8.028) Mean (PTSD No) 28.19 (SD=8.758) Meets Criteria for PTSD **11.9%** (n=12) Does not meet Criteria for PTSD 88.1% (n=89)	Section 6.2.1 Table 15: PTSD – At First Admission to DMRC
		CMD (GHQ-12) n=101	GHQ-12 Score — GHQ Cut-off ≥ 2 — Likert Cut-off ≥ 12 Method — GHQ — Likert Mean (CMD Yes) — 5.24 (SD=2.706) — 17.87 (SD=5.417) Mean (CMD No) — .53 (SD=.563) — 8.04 (SD=2.361) Meets Criteria for CMD — **66.7%** (n=66) — **52.5%** (n=53) Does not meet Criteria for CMD — 33.3% (n=34) — 47.5% (n=48)	Section 6.2.2. Table 16: CMD – At First Admission to DMRC
		AUD* (AUDIT-10) n=89	AUDIT-10 Score — Cut-off ≥ 8 — Cut-off ≥ 10 Mean (AUD Yes) — 12.37 (SD=4.18) — 14.16 (SD=3.89) Mean (AUD No) — 5.11 (SD=1.57) — 6.21 (SD=2.06) Meets Criteria for AUD — **60.1%** (n=54) — **41.6%** (n=37) Does not meet criteria for AUD — 39.3% (n=35) — 58.4% (n=52)	Section 6.3 Table 17: AUDIT-10 Scores At First Admission to DMRC
b(i)	What are the reported levels of Hardiness and Psychological Resilience in UKAF personnel admitted to the DMRC following combat injury?	Hardiness (DRS-15) n=98	DRS-15 Score (Median used to distinguish between 'Higher' and 'Lower' levels of Hardiness Mean (All) = 23.83 (SD=4.922) — Median (All) = 24.00 Mean (Lower Levels of Hardiness) — 19.21 (SD=3.29) Mean (Higher Levels of Hardiness) — 27.29 (SD=2.49) Lower Levels of Hardiness — 47.1% (n=42) Higher Levels of Hardiness — 57.1% (n=56)	Section 6.4.1. Table 18: DRS-15 At First Admission to DMRC
		Psychological Resilience (CD-RISC-10) n=100	CD-RISC-10 Score Mean (All) = 30.83 (SD=7.405) — Median (All) = 33.00 Mean (Lower Levels of Psychological Resilience) — 24.88 (SD=6.08) Mean (Higher Levels of Psychological Resilience) — 36.55 (SD=2.23) Lower Levels of Psychological Resilience — 47.1% (n=42) Higher Levels of Psychological Resilience — 57.1% (n=56)	Section 6.4.2 Table 19 CD-RISC-10 At First Admission to DMRC
a(i) / b(i)	Significant Associations	Hardiness (DRS-15)	Psychological Resilience — (CD-RISC-10) (X^2(1, n = 98) = 19.679, p = .000), (OR = 2.727, 95% C.I = 1.599 – 4.652)	Section 6.5.1 Table 20: Hardiness and PTSD, CMD, AUD and Psychological Resilience
		Psychological Resilience (CD-RISC-10)	PTSD — (PCL-C) (X^2(1, n = 100) = 6.432, p = .014) (OR = .192, 95% C.I = .044 - .833) Hardiness — (DRS-15) (X^2(1, n = 100) = 19.679, p = .000) (OR = 2.304, 95% C.I = 1.509 – 3.518)	Section 6.5.2 Table 21: Psychological Resilience and PTSD, CMD, AUD and Hardiness
		PTSD (PCL-C)	CMD — (GHQ-12) (X^2(1, n = 100) = 7.205, p = .007) (OR = 1.630, 95% C.I = 1.381 – 1.923)	

* Additional data on AUDIT-10 Subscales is presented in Table 17: AUDIT-10 Scores At First Admission to DMRC

8.8. Potential Risk Factors and Predictors

Within both civilian and general service populations it is well established that exposure to traumatic events carries an increased risk of mental health problems, including anxiety and depression that may in turn lead to suicidal ideation (Blosnich *et al*., 2014), substance-abuse (Roberts *et al*., 2015), sleep disorders (Basta *et al*., 2007; Kim and Dimsdale 2007), aggression (Watkins *et al*., 2017), anger issues (Rona *et al*., 2015) and Posttraumatic Stress Disorder (PTSD). There is a wealth of literature suggesting that that lower educational attainment, rank, and service in the RAF were risk factors for anxiety disorder and depressive illness (Iversen *et al*., 2009) while age (<25 years), relationship status, having no children living with you, being a junior rank and having deployed on military operations, and employed in a ground close combat (GCC) role were risk factors for alcohol use disorder (Fear *et al*., 2007). Higher rates of PTSD are associated with higher levels of direct combat exposure (Osório *et al*., 2017) and minor wounds or injury (Koren *et al.*, 2005). A closer examination of the demographic data reported in the findings suggests that the sample of UKAF personnel participating in this study, by virtue of its demographic characteristics alone, is at higher risk of developing common mental health disorder, PTSD and AUD following combat exposure to traumatic events.

The findings of the systematic literature review confirm that: age (Nasky *et a*l., 2009), ethnicity (Adams *et al*., 2017 and Russo *et al*., 2013), gender (Bandelow *et al*., 2012, Nasky *et a*l., 2009 and Russo *et al*., 2013), parenthood (Adams *et al*., 2017), and education (Bandelow *et al*., 2012; Taymur *et al*., 2014) are statistically significant sociodemographic predictors of risk. While rank (Adams *et al.* 2016, Bandelow *et al.* 2012, and Nasky *et al.* 2009), combat experience (Adams *et al.* 2016), and deployed role (Adams *et al.* 2016) are statistically significant military predictors of risk (see Table 4: Summary of Identified Themes – Potential Risk Factors for CMD and PTI).

In addition to the risk factors identified in earlier literature, the systematic review (see Chapter Two) suggests that there are a number of potential physical health predictors of risk including: pain and phantom pain (Carty *et al.* 2011 and Cook *et al.* 2017), the use of analgesia (Holbrook *et al.* 2010), the nature of the physical injury (Nasky *et al.* 2009, Taymur *et al.* 2014, and Woodruff *et al.* 2017), pre-existing chronic medical conditions (Russo *et al.* 2013), and psychological health predictors of risk including: pre-existing psychiatric disorder (Bandelow *et al.* 2012, Russo *et al.* 2013 and Taymur *et al.* 2014), prior exposure to trauma (Gabert-Quillen *et al.* 2012; Nasky *et al.* 2009), personality type (Fletcher *et al.* 2016), use of alcohol or tobacco (Russo *et al.* 2013) and catastrophizing (Carty *et al.* 2011), (see Tables 4, 5, 6 and 7). As noted above this study was constrained, to some extent, by the data collected by the earlier HCTP study, and consequently was not able to further explore issues relating to the use of analgesia, the presence of phantom pain, pre-existing medical conditions, psychiatric history, personality type or catastrophizing.

Drawing together elements of Chapter Three (the identification of a range of potential predictors of risk for PTI, CMD and AUD within the systematic literature review), Chapter Five (the reported sociodemographic, military, physical health and psychological health characteristics of the sample), and Chapter Six (the reported levels of psychological resilience, PTSD, CMD and AUD) this study identified a range of statistically significant relationships of PTI, CMD and AUD in addition to suggesting some predictors of both hardiness and psychological resilience.

Findings in relation to PTSD were consistent with previous studies that suggest that ethnicity and age are significant risk factors for the development of PTSD, (Nasky *et al*., 2009, Adams *et al*., 2016 and Russo *et al*., 2013). Findings within this study suggest that Black and Asian British participants were five times more likely to meet the diagnostic criteria for PTSD than White British participants and those who were <25 years of age were 8.4 times more likely to have PTSD than those over the age of 25. These findings are consistent with findings within the general service population (Fear *et al*., 2007). There was also a significant association between the use of alcohol and meeting the diagnostic criteria for PTSD and those participants reporting that they abstain from alcohol were 8.3 times more likely to meet the criteria for PTSD than those reporting that they drank alcohol.

In respect of the psychological predictors, sense of comradeship (OR = 5.600, 95% C.I = 1.144 – 27.403, p = .052), perception of emotional support (OR = 7.083, 95% C.I = 1.364 – 36.775, p = .035), distress (OR = 15.459, 95% C.I = 1.912 – 124.997, p = .001) and previous military exposure to traumatic events

(OR = 5.643, 95% C.I = 1.503 – 21.183, p = .016) all appear to be statistically significant predictors of PTSD. These findings appear to support findings within the systematic review in relation to prior exposure to trauma (Gabert-Quillen *et al*., 2012 and Nasky *et al*. 2009) and within the existing literature in relation to combat exposure (Osório *et al*., 2017).

The only statistically significant predictor of CMD identified was the experience of pain in the preceding 30 days ($\mathcal{X}^2$(1, n = 100) = 4.294, p = .043) and those reporting having experienced pain, unrelated to joint swelling and redness within the preceding 30 days were almost three times more likely to meet the criteria for psychiatric caseness (OR = 2.846, 95% C.I = 1.034 – 7.831, p = .043) than those that did not. These findings are also supportive of those papers identified in the systematic review (Carty *et al.* 2011, Cook *et al.* 2017).

From these findings it would also appear that relationship status is a significant predictor of AUD, and those who reported being single, separated or divorced were significantly more likely to meet the criteria for hazardous drinking ($\mathcal{X}^2$(1, n = 89) = .4.298, p = .044) and were over two and a half times more likely to meet the higher AUDIT-10 criteria (Score ≥ 10) than those in relationships (OR = 2.700, 95% C.I. = 1.040 - 7.011, p=.044). Again, these findings support general findings in the UKAF population as a whole (Fear *et al*., 2007).

The findings in relation to hardiness and psychological resilience are less clear. Alcohol consumption appears to be significant in relation to the levels of hardiness demonstrated by the sample. Participants reporting that they abstained from alcohol demonstrated higher levels of hardiness (dispositional resilience), ($\mathcal{X}^2$(1, n = 98) = 6.655, p = .011) and appear to be ten times more likely to demonstrate higher levels of hardiness (OR = 10.022, 95% C.I = 1.239 – 81.061, p = .011) than those UKAF personnel who drink. These findings were not replicated in relation to psychological resilience (assessed by CD-RISC-10) suggesting that there is a difference between dispositional resilience (hardiness) and psychological resilience that is worthy of future study. While the relationship between hardiness and abstinence appears to be a very strong one, caution must be exercised in interpreting this result in a way that suggests that abstinence predicts hardiness and it seems more likely that levels of hardiness may predict the use of alcohol as a coping mechanism in UKAF personnel following physical combat related injury. This relationship bears further study.

Similarly, while those participants who reported not being distressed by the memory of the injurious event were more likely to demonstrate higher levels of psychological resilience ($\mathcal{X}^2$(1, n = 100) = .8.970, p = .005) and appeared three times more likely to demonstrates higher levels of psychological resilience (OR = 3.444, 95% C.I = 1.513 – 7.839, p = .052), it seems likely in this case that rather than distress predicting psychological resilience it is more likely that the high levels of psychological resilience predict levels of distress. A summary of these findings is presented in Table 44: Summary Table of Findings (Chapter Seven).

Table 44: Summary Table of Findings (Chapter Seven)

Research Question	Research Question	Factors*	Summary Findings		Reference
a(ii)	Are there any factors associated with the development of post-traumatic stress disorder, common mental health disorder and hazardous drinking in UKAF personnel admitted to the DMRC following combat injury?	PTSD (PCL-C)	Ethnicity (Black and Asian British)	(χ^2(1, n = 101) = 5.986, p = .034), (OR = 5.063, 95% C.I = 1.245 - 20.589)	Section 7.2.1 / Table 23
			PTSD/Age (<25 years)	(χ^2(1, n = 101) = 9.254, p = .004), (OR = 8.485, 95% C.I. = 1.751 – 41, 109)	Section 7.2.1 / Table 23
			Alcohol Use (Never Drink)	(χ^2(1, n = 101) = 11.54, p = .005), (OR = 8.367, 95% C.I = 2.099 – 33.359)	Section 7.2.3. / Table 25
			Camaraderie (Lack of Comradeship)	(χ^2(1, n = 101) = 5.447, p = .052), (OR = 5.600, 95% C.I = 1.144 – 27.403)	Section 7.5.1. / Table 38
			Emotional Support (Negative Perception)	(χ^2(1, n = 101) = 6.893, p = .035), (OR = 7.083, 95% C.I = 1.364 – 36.775)	Section 7.5.1. Table 38
			Distress (Distressing Memory of Event)	(χ^2(1, n = 101) = 10.640, p = .001), (OR = 15.459, 95% C.I = 1.912 – 124.997)	Section 7.5.1. Table 38
			Military Trauma (Previous Experience)	(χ^2(1, n = 101) = 7.743, p = .016) (OR = 5.643, 95% C.I = 1.503 – 21.183)	Section 7.5.1. Table 38
		CMD (GHQ-12)	Pain (Pain in Last Month)	(χ^2(1, n = 100) = 4.294, p = .043), (OR = 2.846, 95% C.I = 1.034 – 7.831)	Section 7.4.2 / Table 34
		AUD (AUDIT-10)	Relationship Status (Single)	(χ^2(1, n = 89) = .4.298, p = .044), (OR = 2.700, 95% C.I. = 1.040 - 7.011)	Section 7.2.3. / Table 25
b(ii)	Are there any factors associated with higher levels of Hardiness and/or psychological resilience in UKAF personnel admitted to the DMRC following combat injury?	Hardiness (DRS-15)	Use of Alcohol (Never Drink)	(χ^2(1, n = 98) = 6.655, p = .011), (OR = 10.022, 95% C.I = 1.239 – 81.061)	Section 7.4.4. / Table 33
		Psychological Resilience (CD-RISC-10)	Distress (Not Distressed by Memory)	(χ^2(1, n = 100) = 8.970, p = .005)	Section 7.5.5. / Table 42

*Only significant associations are reported

8.9. Limitations

8.9.1. Study Design

While the study was intended overcome many of the well-established methodological problems that impact upon the validity and reliability of military population studies, a number of limitations are related to the study design.

Research participants meeting the selection criteria for this study were asked to complete a series of three participant assessments at baseline, six- and twelve months. The baseline assessment consisted of a 24-page A4-sized booklet containing approximately 325 question or statement items requiring participant response (see Appendix H: Prospective Patient – Baseline Assessment (01PGBA)). The six- and twelve-month assessments took the same general form but contained approximately 315 question items (see Appendix I: Prospective Patient Participant – 6-Month Assessment (01PG6M) and Appendix K: Prospective Patient Participant – Twelve-month Assessment (01PG12M)). In situations where the completion of a large assessment takes considerable time, it is likely that response style bias may be one possible source of error, *i.e.* where participants may respond in a patterned, automatic manner based on initial answers to attitudinal statements, *e.g.* strongly agree without reading the question or scale (Bowling, 2009). There is increasing evidence that there is a "strongly positive association between survey length and measurement error" (Weisberg, 2005, p. 129). Within the main HCTP study, and by extension, this study, the length of the participant assessments is likely to have contributed to the inclusion of error through design bias, *i.e.* where the faulty design of methods, sampling, or analysis can lead to differences between the observed and true values. Additionally, there is evidence to support the conclusion that excessively long questionnaires lead to: faster responding (Galesic and Bosnjak, 2009 and Peytchev, 2007); response style bias, *e.g.* repeatedly selecting the same response option (Herzog and Bachman, 1981); higher non-response in longer surveys (Bogen, 1996; Heberlein and Baumgartner, 1978) and non-response bias (Peychev and Peycheva, 2017). The participant assessments within this study were administered at six-monthly intervals to minimize participant burden, however, the length of the assessments is likely to have led to increased non-response bias and may also have contributed to the attrition rate reported.

8.9.2. Response Rate

This study achieved a healthy recruitment rate of 92.99% *(n*=199), (see Figure 6: Recruitment) and a good response rate of 56.28%. It is likely that the positive recruitment rate was due to the face-to-face approach adopted within the study and subsequent recruitment and induction at the DMRC during the first week of admission.

While low response rates do not necessarily introduce bias into research (Halpern & Asch, 2003), a lower percentage of responders increases the potential for this to occur (Fear *et al*., 2010). Within studies of this type, lower levels of response leading to an effective reduction in the sample size can result in sampling bias, *i.e.* an increasingly non-representative sample leading to error. Increased non-response bias may also result in a loss of precision, *i.*e. the generalizability of the study is affected by the emerging differences between responders and non-responders (see Table 43: Types of bias and error (selected) (Bowling, 2009)).

Previous studies have consistently demonstrated that that the demographic least likely to participate in research is also that most readily represented in military populations, *i.e.* young, unmarried men (Hotopf *et al*., 2006; Tate *et al*., 2007). The majority of participants recruited to this study belong to that demographic (see above). A comparison of responders to non-responders within this study indicated that the Mean age of responders *(n*=112) was 26.12 years while the Mean age of the non-responders *(n*=87) was 24.95 years. In relation to ethnicity, a higher percentage of White British participants were found in the non-responders group (94.3%) as opposed to the responders group (87.5%). Correspondingly, higher percentages of Black and Asian British participants were found in the responders group (4.6% and 3.6% respectively) compared to the non-responders group (2.3% for each).

During the initial approach, potential participants consistently demonstrated considerable willingness to participate in the study and often expressed a strong desire to help 'others injured in the future'. Despite positive recruitment, both in terms of numbers and expressed enthusiasm, the study achieved only a 56.28% response. A number of possible explanations for this phenomenon exist in the literature including: the effects of stigma (Fear *et al*., 2010), and the effects of an 'ill population' where those who are unwell tend to be reticent to participate in research due to a reluctance to accept that they are ill (Hotopf *et al*., 2006), (see below).

Another possible explanation is that the apparent willingness to participate during the initial contact is used to mask a reluctance to disclose actual unwillingness to participate within the first five days of their first admission to the DMRC to a researcher who was also a uniformed senior military officer (see below). Despite providing assurances, both verbally and in writing, that the study described was independent of the Ministry of Defence and of the DMRC, and that neither refusal to participate nor subsequent withdrawal would compromise their care or their military career, (see Appendix F: Prospective Patient Participant - Information Leaflets (01PG)), it may have been difficult for potential participants to disassociate a uniformed senior officer (and nurse) from the clinical setting and from the provision of care at the DMRC.

The difficulties associated with achieving sufficient returns within a military study are well recognized (Fear *et al.,* 2010). In order to achieve a high response rate within this study population, novel targeted research methods are required, *e.g.* increased use of mobile phone applications (see below).

8.9.3. Stigma

This thesis begins by highlighting that, the promotion of positive mental health and psychological well-being within the military is challenging and that there are a number of well-established barriers to mental health (Samele, 2013). Many of these barriers are related to long-standing negative beliefs about mental illness that have their roots in the development of military psychiatry in the twentieth century and the perception of psychiatric casualties as were "weaklings, constitutionally inferior or psychopaths" (Watson, 2008). While there is evidence to suggest that the recognition of the importance of mental health and its role in maintaining operational effectiveness has led to a change in the attitudes of the military towards mental health (Stevelink *et al*., 2019), it would appear that within military cohorts only 29% of those with mental health problems actively seek medical help from military mental health services (Hom *et al.,* 2017). It may be argued that while attitudes may have changed within the military as a whole, stigma still plays a significant role in preventing military personnel seeking help.

While it is now generally accepted that exposure to highly traumatic events is a major risk factor for psychiatric illness (Schreiber *et al*., 2015), military personnel continue to underutilize mental health services designed to assist them in coping with post-traumatic illness and other common mental health problems (Michalopoulou *et al*., 2016). Stigma and label avoidance consistently emerge as barriers to care seeking and service participation (Ben-Zeev *et al*., 2012) and stigma associated with seeking and receiving treatment has been hypothesized to play a significant role in failure to access potentially helpful services and supports. It is likely that this may include participation in studies intended to establish the status of mental health (Schreiber *et al*., 2015).

As part of this study, participants were asked to complete a range of self-report measures designed to assess their mental health and experience of post-traumatic symptoms. The stigma associated with a diagnosis of a mental health disorder is more pronounced in the ''macho'' culture of the Armed Forces (Hoge *et al*., 2004). While the nature and purpose of the research had been explained to the potential participants prior to consent being gained, the presence of a uniformed researcher, where a significant rank differential existed between that researcher and the potential participant, may have been seen by some potential participants as being coercive (see below). There is evidence to support the suggestion that the wearing of uniform in a mental health context is perceived negatively (Wilson *et al*., 2013) and this would fit with the lack of trust or confidence in providers of mental health services.

A mental health diagnosis is seen within the military as being particularly sensitive and as being likely to negatively impact on military career (Fear *et al*., 2010). In respect of participation, the identification of mental health or concerns about the receipt of a mental health diagnosis is known to decrease response rates (Edwards *et al*., 2007). The in-patient ward environment at the DMRC, at the time of the recruitment and data collection phase of the study, consisted predominantly of small bays of four beds and participants would often discuss participation with their colleagues before consenting to take part in the study. While there is data supporting the belief that participants refuse to participate in mental health studies for fear of the negative impact on their military career (Fear *et al*., 2010) and this fear negatively influencing response rates (Edwards *et al*., 2007), future research should investigate whether group decision-making plays a part in non-participation. Additional work should also be undertaken to explore the use of discrete mobile phone applications in the assessment of participants wishing to avoid stigma (see below).

8.9.4. Military Uniform

During the recruitment phase of this study, potential participants were approached in person by the researcher who is a serving military officer. Discussion of the potential nature of the research presence at the DMRC, prior to the pilot phase of the study with the Director of Defence Rehabilitation (DDR) and the Commanding Officer (CO) of Headley Court, had concluded with the positive agreement that, as it was more likely to help establish a credible military relationship with participants and likely to facilitate higher participation rates for the period of the research, the researcher would wear military uniform.

A previous study of UKAF military mental-health clinicians *(n*=70) exploring their perceptions of the impact of wearing military uniform on the therapeutic relationship they had with their clients had been more equivocal (Wilson *et al*., 2007). While military clinicians commented that they felt that the wearing of uniform helped to promote service identity and an image of professionalism, they also commented that the wearing of uniform could be perceived as a 'power issue' by clients and that it was sometimes difficult for higher ranks to identify with lower ranks and vice versa (Wilson *et al*., 2007). Results indicated that while 20% of clinicians were positive about the wearing of uniform, 31% were negative, 37% mixed and 12% gave no answer (Wilson *et al*., 2007). A follow up study of the mental health clients *(n*=282) reported that 63% (n = 178) regarded uniform as negatively influencing their relationship with the clinician. While only 39% (n = 111) of mental health clients believed rank to be a barrier, this is a significant minority (Wilson and McAllister, 2010).

A combination of the effects of stigma and of the wearing of uniform could be an explanation of the relationship between good initial rates of recruitment and later poor response and high attrition and is an example of design bias, where a methodological fault leads to error, and evaluation apprehension, where participants feel that their participation is expected by a perceived authority figure (see Table 43: Types of bias and error (selected) (Bowling, 2009)). Given the rank differential existing between most of the study participants and the researcher, it could be suggested that approaching potential participants in uniform could have been regarded as being coercive. While the wearing of uniform helped to facilitate integration within the DMRC, improved access to the clinical area and facilitated effective interaction with clinical staff, it may have been detrimental to the relationship between researcher and participants and the presence of a significant rank differential may have been experienced as coercive.

8.9.5. Bias and Error Within Positivist Research

Understanding bias within the context of research is central to the success of a researcher and of research studies because, "first, bias exists in all research, across research designs and is difficult to eliminate; second, bias can occur at each stage of the research process; third, bias impacts on the validity and reliability of study findings and misinterpretation of data can have important consequences for practice" (Smith and Noble, 2014, p.100).

There are a number of well-established methodological problems identified with studies of military populations that are observed as having a consistently negative affect upon the validity and reliability of findings (O'Donnell *et al*., 2003; Hotopf & Wessely, 2005). While the design of this study intended to minimise the impact of a number of these limitations by facilitating high participation rates; minimising selection and recall bias through the utilisation of a prospective sample; and by enhancing the interpretation of the relationship between physical combat-related injury and outcome through the use of established standardised measures, the problems of non-response bias, high participant attrition and the challenges posed by recall and self-selection bias remain.

The use of a range of well-tested, reliable and validated measures within this study containing a number of reverse scoring items was intended to minimise the effects of acquiescence response (Moors *et al*., 2014). The effects of analysis bias may still introduce some error and the difficulties of handling outliers, where unusual values in small studies introduce errors, have been observed in the analysis of the PCL-C and CD-RISC-10 data, acknowledged in the text and are accepted as being potential limitations effecting the reliability of the findings of this study (see above).

Low response rates and high participant attrition are often cited as potential sources of bias in military studies (Fear *et al*., 2010) but there are numerous and multiple potential sources of bias and error that may occur within a positivist framework (Bowling, 2009). A number of potential sources of bias and error and their potential application within this study are presented below in the following sections. Potential sources of error represented by non-response and sampling biases are discussed in the context of poor response and high participant attrition. Reporting and non-response bias are discussed in the context of stigma and are considered as being the main methodological weaknesses of this study. Design bias is discussed in the sections on military uniform and assessment design.

Table 45: Types of bias and error (selected) (Bowling, 2009)

Type of Error or Bias	Description / Application to current study
Acquiescence Response Set	Respondents will more frequently endorse a statement than disagree with its opposite form ('Yes' saying).
Bias in Handling Outliers	Can arise from a failure to discard an unusual value occurring in a small sample, or the exclusion of unusual values that should be included.
Design Bias	Derives from faulty design of methods, sampling, analysis which can lead to differences between the observed and true values.
Evaluation Apprehension	Anxiety amongst participants may lead to people giving responses which they think are expected by the investigator.
Mood Bias	People in low spirits may underestimate their health status, level of functioning, support requirements, biasing study results.
Non-Response Bias	Non-response and withdrawing from longitudinal studies reduces effective sample size resulting in loss of precision. Differences between responders and non-responders reduces generalizability.
Reactive Effects	Hawthorne or Observer effect describes people changing their observed behavior due to the research process.
Recall (memory) Bias	Selective memories in recalling past events.
Reporting Bias	Failure of the respondent to reveal full information.
Response Style Bias	A person may respond in a patterned, automatic manner based on initial answers to attitudinal statements, e.g. strongly agree without reading the question or scale. This is countered by varying positive / negative statements.
Sampling Bias	Non-representative selection of participants from a population.

8.10. Strengths

8.10.1. The compatibility and comparability of data

This doctoral study comprised one element of the larger HCTP study (see above). The HCTP utilised a case-control design of both prospective and retrospective groups of patient participants and a parallel study of the partners of patient participants (Alexander *et al*., 2013). As both the HCTP study and this doctoral study utilise a sample of current serving members of the UKAF (at time of first assessment), permission was sought from Professor Simon Wessely to incorporate elements of the Health & Wellbeing Survey of Serving & Ex-serving Members of the UK Armed Forces: Phase 2 study, conducted by King's Centre for Military Health Research (KCMHR) at King's College London on behalf of the Ministry of Defence, to ensure the comparability of data. Consistency in the collection of participant data serves to ensure both the compatibility of the data collected and the comparability of any findings and results from this sample of combat-injured UKAF personnel admitted to the DMRC and the large cohort of current and ex-service personnel included in the Phase II study and subsequent work (Phase III of the KCMHR study is currently underway). This is a considerable strength of this study. The selection of measures used to assess general mental health, post-traumatic symptoms and hazardous alcohol use within this study, *i.e.* the GHQ-12, PCL-C and AUDIT-10 scales was influenced by their use within the KCMHR: Phase II study and the normative thresholds and cut-off points utilized within this study are consistent with those used by that centre.

8.10.2. Study of a Prospective Sample of Combat Injured UKAF Personnel

The inclusion of a prospective sample within this study was primarily intended to minimize the effects of recall (memory) bias but has resulted in the development of a unique opportunity to investigate psychological resilience within a context that is not well researched. It is a considerable strength of this study that it incorporates data drawn from a prospective sample of UKAF personnel in the early stages of their rehabilitation.

8.11. Contribution to the Field of Study

While there are numerous studies of the general UKAF population and of those returning from operational deployments in Iraq and Afghanistan there have been, to date, no prospective cohort studies of the mental health and psychological resilience of UKAF personnel following physical combat-related injury.

It is often reported that the effects that combat injuries have upon the mental health of military personnel are well-documented (Forbes *et al*., 2012). Studies cited in support of this conclusion, however, tend to be dated US and Israeli studies from the early 2000s and before (*e.g.* Kulka *et al*., 1990, Michaels *et al*., 1999, Hoge, *et al*., 2004, Koren *et al*., 2005, Koren, Hemel and Klein, 2006, and MacGregor *et al*., 2009). No reference is made to published studies of UKAF personnel following physical combat-related injury, and this study uniquely contributes to that body of knowledge, in that it is the only study that comprehensively assesses common mental health disorder (as indicated by general psychiatric caseness), PTSD, and Alcohol Use Disorder in a sample of UKAF personnel and does so within the context of their hardiness and psychological resilience.

This study presents a unique contribution the understanding of CMD, PTI and AUD in that population. Further, the identification of specific predictors of CMD, PTI and AUD in the population offer an original opportunity to specifically target early interventions and programmes of education intended to reduce stigma,

Where U.K. studies of the effects of injury and illness on mental health have been population-based studies examining relationships between datasets, *i.e.* the Operational Emergency Department Attendance Register (OpEDAR) records from OP TELIC (Iraq) and OP HERRICK (Afghanistan) and the KCMHR dataset from the Health & Wellbeing Survey of Serving & Ex-serving Members of the UK Armed Forces: Phase 2 study (and associated work), this study significantly adds to the body of knowledge in that it is the first study of a prospective sample of UKAF personnel with combat injury and provides a hitherto unknown assessment of the prevalence of common mental health disorder (as indicated by psychiatric caseness), PTSD and AUD.

8.12. Implications for Practice

Based on the findings of this study there are a number of significant implications for both policy makers and clinicians.

8.12.1. Defence Policy Implications

Defence policy in the UK is made by the Surgeon Generals Department. The Surgeon General is professional head of the Defence Medical Services. He/she commands the Joint Medical Group under Headquarters Joint Forces Command.

Based on the findings in respect of the prevalence of PTSD, CMD and AUD in the sample it appears clear that those with physical combat-related injury are more likely to develop PTI, CMD and AUD. Evidence within the literature suggests that mental health morbidity may develop over time and defence policy makers should consider:

1. Enhanced post-operational screening for injury. The use of health screening on return from military deployments should include an assessment of operational injury in order to facilitate early identification of physical injury (whether or not it is combat related).
2. Post-deployment health questionnaires may benefit from questions that specifically address whether service members experienced an injury during combat.
3. The potential for undetected long-term mental health disability, particularly among UKAF personnel receiving late diagnoses.
4. Further steps to facilitate the reduction of stigma regarding mental health and mental illness in the UK Armed Forces

8.12.2. Clinical Implications

Clinical healthcare in relation to physical injury (both combat and non-combat) of deployed UKAF personnel is undertaken through deployed healthcare settings and, on return to the U.K. at the RCDM in Birmingham. It is also likely that UKAF personnel will be seen in the NHS in their local areas and in the longer term (following potential discharge) solely within the NHS. Based on the findings of this study clinicians within both the NHS and the Defence Medical Services (DMS):

1. Should be educated regarding the factors shown to be associated with PTSD, CMD and AUD within this study Education and awareness may allow for early identification of those more likely to develop or experience poor mental health and may facilitate the triage of patients into a 'risk' category that may benefit from early intervention.
2. Should undertake the longer term monitoring of patients following physical combat-related injury in order to index their mental health. Clinicians and health system administrators may consider opportunities to augment long-term follow-up, monitoring of mental health status, and patient education.
3. Patients who have sustained a physical combat-related injury and their family members should be educated to recognize mental health sequelae and anticipate future behavioural health care needs while considering potential stigma associated with mental health diagnosis and treatment in the military.
4. Given the significant association of PTSD and CMD identified in this study. Clinicians should ensure that they conduct a comprehensive assessment of comorbidity.
5. CPTSD

8.13. Further Research

In relation to the objectives of this study further research is indicated in a number of key areas. Further study of those UKAF personnel presenting with a physical combat-related injury in order to establish the longer term impact of that injury on their mental health and psychological well-being. Additional study of this population should be undertaken over a period of 5-10 years to assess the impact of delayed diagnosis and the emergence of symptoms of PTSD, CMD and AUD in the longer term. Rather than utilising the civilian version of the Post-Traumatic Checklist to assess prevalence of PTSD the International Trauma Questionnaire (ITQ), (Cloitre et al., 2018) should be used. This measure would more effectively estimate prevalence of PTSD and facilitate the collection of data in respect of Complex PTSD (CPTSD). While there is evidence supporting the assertion that CPTSD is more prevalent and more debilitating that PTSD (Murphy et al., 2021) this study does not assess it.

Again, due to the low numbers reported in this study it was impossible to explore the relationship between potential predictors and outcome using logistic regression. Further exploration of these relationships with a larger sample would also facilitate the accounting for confounding variables. Due to the lack of clinical information, the complex nature of physical combat-related injury and the differences in the treatment pathways of participants it has been impossible to account for potentially confounding variables within this study.

In relation to the provision of clinical data, further work needs to be done to more effectively record clinical data from point of wounding to admission at the DMRC and beyond. A comprehensive study of the clinical management of participants would facilitate a clearer understanding of the impact of treatments and care on psychological resilience as well as CMD, PTI and AUD.

There is still a lack of clarity regarding the prediction of both hardiness and psychological resilience within this study and, further exploration of the nature of psychological resilience may assist in the identification of predictors. The construction of a validated tool to measure psychological resilience in the military setting or the consistent use of a measure of resilience pre-deployment may also assist in the identification of changes, challenges and differences in resilience post-injury and beyond.

8.13.1. Development of Novel Data Collection Tools

It is likely that poor response and high participant attrition are linked to the negative impact of stigma in the research of military mental health and the development of data collection tools that assist in the study of military mental health, maximize response and minimize attrition would be of benefit to future studies. Within the literature, there is considerable discussion of the use of non-stigmatizing language, peer-to-peer, and stigma-reduction programs intended to facilitate access to military mental health care (Schrieber *et al*., 2015) as well as the benefits of self-referral mental health services (Brown *et al.*, 2010)

A recent evaluation of a mobile phone application developed by the US Veteran's Administration National Center for PTSD in partnership with the Department of Defense National Center for Telehealth and Technology (PTSD Coach) with a sample of US veterans with PTSD (*n*=45) reported high levels of satisfaction (Kuhn *et al*., 2014) and suggests that the use of novel data collection tools on mobile devices could be a positive way of collecting data while minimizing the impact of stigma. Future research is indicated in the development of additional tools that can be delivered in this way.

8.14. Summary

This chapter presents a discussion of the main findings of the study in relation to the sample demographic, reported levels of hardiness and psychological resilience within the sample, and the prevalence of common mental health disorders (CMD), PTSD and Alcohol Use Disorder (AUD) within the sample and places these in the wider context of the reported levels of hardiness, psychological resilience, and the prevalence of CMD, PTSD and AUD reported in studies of the general UKAF population.

This chapter has also highlighted the homogenous nature of the sample and the main challenges of researching military populations. A brief discussion of bias and error in positivist studies contextualizes the exploration of the limitations and strengths of this study and suggests possible scope for further and future research of this population.

The final chapter will summarize the main points of the thesis and draw a number of conclusions about the hardiness and psychological resilience within the sample and the prevalence of common mental health disorders (CMD), PTSD and Alcohol Use Disorder (AUD).

CHAPTER NINE: CONCLUSION

Over the last two decades, increased use of IEDs as the primary weapon of choice of insurgency forces in Afghanistan has established traumatic amputation and traumatic brain injury as the 'signature injuries' of asymmetric conflict (Shively and Perl, 2012). Improved force-protection and combat-casualty care in the battlespace have, at the same time, significantly impacted on the survivability of physical combat-related injury, and military operations in Afghanistan have seen a significant increase in the numbers of United Kingdom Armed Forces (UKAF) personnel 'unexpectedly survive' what would previously have been regarded as overwhelming injury (Hodgetts and Mahoney, 2009). Unexpected survival following traumatic injury is associated with higher degrees of disability, and the long-term impact of these injuries upon the mental health and psychological well-being of UKAF personnel has yet to be adequately studied.

Adopting a positivist approach, this doctoral study presents a detailed investigation of the mental health and psychological resilience of a sample of UKAF personnel admitted to the Defence Medical Rehabilitation Centre (DMRC) at Headley Court, between January 2009 and October 2010, following physical combat-related injury. The study explores the causal relationships between a range of sociodemographic, military, physical and psychological health factors, and mental health and resilience outcomes in order to identify predictors of risk for common mental health disorder (CMD), post-traumatic illness (PTI) and Alcohol Use Disorder (AUD), hardiness (dispositional resilience) and of psychological resilience. This study makes a significant contribution to the body of knowledge in that it provides a unique insight into the mental health and resilience of this group following physical combat-related injury and identifies a number of statistically significant predictors of risk.

Within a longitudinal, cohort study design, this research utilises a range of validated self-report measures to assess prevalence of psychiatric caseness suggesting common mental health disorder (CMD), Post-Traumatic Stress Disorder (PTSD) and Alcohol Use Disorder (AUD). While there are considerable strengths in the research design the low numbers of participants returning the six- and twelve month assessments is a considerable limitation. Prevalence of CMD, PTSD and AUD are reported at baseline (n=101) for participants with physical combat-related injury and a number of statistically significant predictors of risk are identified, however, the analysis of data (using Pearson's Chi-square and Odds Ratio tests) required the collapsing of data categories and the reduction of specificity of findings. In order to fully explore the causal relationships in greater detail the further study of those UKAF personnel following physical combat-related injury is required in far greater numbers.

9.1. Prevalence of CMD, PTI, AUD and Levels of Psychological Resilience

Using the GHQ-12 as a measure of common mental health disorder this study has identified that, 66.7% *(n*=66) of our sample of UKAF personnel (n=101) met the criteria for psychiatric caseness at baseline. While findings suggest that at six- and twelve-months there had been a decrease in the numbers meeting the criteria for psychiatric caseness (61.4% *(n*=16) and 54.5% *(n*=12) respectively) it should be noted that due to poor response rates at those time points the three samples were independent and no relationship between baseline, six-months and twelve-months should be assumed.

At baseline, 11.9% of participants *(n*=12) met the criteria for PTSD using the PCL-C measure. Assessment of hazardous drinking at baseline suggested that 41.6% met the higher AUDIT-10 threshold *(n*=37). Further investigation of the rates of hazardous alcohol use (97.8%, *n*=87), dependence symptoms (35.9%, *n*=32), and harmful alcohol use (62.9%, *n*=56) at baseline (and beyond) suggest an alarming level of alcohol use in this sample).

While findings related to hardiness (Mean DRS-15 score of 23.83, SD=4.922,) suggest lower levels of resilience at baseline when compared to other military populations, they also suggest that UKAF personnel with a physical combat-related injury report similar levels of psychological resilience as similar military cohorts with a diagnosis of PTSD (Mean CD-RISC-10 score of 30.83 at baseline). These findings suggest a difference in hardiness and psychological resilience that may bear further examination (see below).

9.2. Predictors of CMD, PTI, AUD and Psychological Resilience

An exploration of the relationships between potential predictor variables and the primary outcome measures at baseline identified a number of statistically significant risk factors/predictors of CMD, PTI, AUD, hardiness and psychological resilience. Findings related to sociodemographic characteristics suggest that ethnicity ($\chi^2(1, n = 101) = 5.986, p = .034$) and age ($\chi^2(1, n = 101) = 9.254, p = .004$) are significant risk factors for PTSD and that being Black or Asian British (OR = 5.063, 95% C.I = 1.245 - 20.589) or being under 25 years of age (OR = 8.485, 95% C.I. = 1.751 – 41.109) significantly increases the likelihood of meeting the criteria for a diagnosis of PTSD.

In relation to physical health factors, alcohol consumption was significantly associated with a diagnosis of PTSD ($\chi^2(1, n = 101) = 11.54, p = .005$) and being a non-drinker appeared to significantly increased the likelihood of meeting the criteria for PTSD (OR = 8.367, 95% C.I = 2.099 – 33.359). This relationship may be explained by the masking effects of alcohol consumption and should be considered in conjunction with the findings discussed about in relation to Alcohol Use Disorder.

There were a number of findings related to potential psychological predictors, and perceived lack of comradeship while deployed ($\chi^2(1, n = 101) = 5.447, p = .052$), appeared to significantly increase the likelihood of a diagnosis of PTSD (OR = 5.600, 95% C.I = 1.144 – 27.403). Similarly, in those participants reporting a perceived lack of emotional support from those closest to them ($\chi^2(1, n = 101) = 6.893, p = .035$), the odds of meeting the criteria for PTSD were very significantly increased (OR = 7.083, 95% C.I = 1.364 – 36.775). It seems unsurprising that there appeared to be a significant relationship between the reporting upsetting memories of the injurious event and a diagnosis of PTSD ($\chi^2(1, n = 101) = 10.640, p = .001$). Those with distressing memories were fifteen times more likely to meet the PCL-C criteria for PTSD (OR = 15.459, 95% C.I = 1.912 – 124.997). Likewise, reporting increased levels of previous exposure to military trauma and PTSD were strongly associated ($\chi^2(1, n = 101) = 7.743, p = .016$) and those reporting higher levels of previous exposure were five times more likely to meet the criteria for PTSD (OR = 5.643, 95% C.I = 1.503 – 21.183).

In relation to levels of common mental health disorder, the only statistically significant predictor identified here was, the experience of pain in the 30 days prior to assessment ($\mathcal{X}^2$(1, n = 100) = 4.294, p = .043). Those participants who reported experience of chronic pain in the 30 days prior to the assessment were noted to be almost three times more likely to meet the GHQ-12 criteria for psychiatric caseness (OR = 2.846, 95% C.I = 1.034 – 7.831). In relation to predicting mental health outcomes this is a very significant finding in the sense that close monitoring of pain scores during rehabilitation and the identification of poorly controlled pain may greatly aid in the identification of risk.

In relation to AUD, a significant relation between relationship status and hazardous drinking was identified ($\mathcal{X}^2$(1, n = 89) = .4.298, p = .044). Those participants who reported being single, separated or divorced were significantly more likely to meet the criteria for hazardous drinking and were over two and a half times more likely to meet the higher AUDIT-10 criteria (Score ≥ 10) than those in relationships (OR = 2.700, 95% C.I. = 1.040 - 7.011).

Findings in relation to hardiness and psychological resilience are less clear. While this study identified that levels of hardiness were significantly lower at baseline (Mean=23.83 and Mean=30.83 respectively) than in comparable samples of military personnel there was only one potential predictors. Findings suggested that being a non-drinker appeared to significantly predict hardiness ($\mathcal{X}^2$(1, n = 98) = 6.655, p = .011) and those that abstained from alcohol were over ten times more resilient that those that reported drinking alcohol (OR = 10.022, 95% C.I = 1.239 – 81.061). However, it may be that, in this case, levels of hardiness more accurately predict drinking. Similarly, while findings suggest that the absence of upsetting memories regarding the injurious event appear to predict higher levels of psychological resilience ($\mathcal{X}^2$(1, n = 100) = 8.970, p = .005) and that those who reported not having disturbing memories were over three times more resilient (OR = 3.444, 95% C.I = 1.513 – 7.839) this may be misleading. It may be, again, that it is the reverse, and higher levels of psychological resilience explain the lack of disturbing memories. The relationship between potential predictors and resilience also bears further examination.

While this study conclusively shows that physical combat injury significantly impacts upon the mental health and psychological well-being of UKAF personnel. Identifying significant risk factors allows for in order to facilitate early, targeted intervention and this study therefore recommends proactive measures to educate new recruits about mental health to reduce perceived stigma and to facilitate early access to mental health services.

9.3. Promotion of Positive Mental Health and Psychological Wellbeing in UKAF Personnel – Stigma Revisited

Throughout this doctoral thesis a selection of contemporary military art punctuates the discussion. The collection of data on the prevalence of CMD, PTSD and AUD, however, paints an incomplete picture of the difficulties faced by those with higher degrees of disability following physical combat-related injury. Many of these young men and women have considerable challenges ahead. What is missing from a study of this type is the deeper and richer perspective that can be gained through the exploration of the lived experience.

Reflection on the historical development of military psychiatry within the UK, suggests that the focus of military mental health has been primarily on the maintenance of a credible fighting force. Military mental health has, in the main, sought to identify and treat a range of mental health problems and has, from its conception pathologized the management of military mental health (Clack, 2007).

Less than 25% of service personnel with identified mental health problems access professional medical help (Iversen et al., (2010). Despite a change in perspective within the military over the last 20 years, stigma and label avoidance continue to consistently emerge as military cultural barriers to care seeking and service participation in the minds of serving UKAF personnel. A historical review of the development of military psychiatry suggests that many of these cultural barriers are rooted in long-standing negative beliefs about mental illness originating in the Great War and maintained through negative societal perceptions of mental illness in the twentieth century. It seems likely therefore that to address the mental health and psychological well-being in a more effective way in the longer term, the adoption of a model of mental health based on the promotion and maintenance of positive mental health will be required. A move to a model of mental health where military personnel actively seek help will require further work to eliminate the effects of those long-standing negative perceptions of mental illness and the elimination of stigma.

9.4. Recommendations

Based on the findings of this study the following recommendations are offered:

1. Further study of those UKAF personnel presenting with a physical combat-related injury in order to establish the longer term impact of that injury on their mental health and psychological well-being
2. Further exploration of the relationship between potential predictors of both hardiness (dispositional resilience) and psychological resilience which includes the construction of a validated tool to measure psychological resilience in the military setting or the consistent use of that/a measure of resilience pre-deployment that encompasses both hardiness and psychological resilience and that utilises novel data collection methods.
3. Design of a data collection protocol that allows the consistent collection of clinical data from the point of wounding up until admission to the DMRC and beyond in order to facilitate comprehensive assessment of treatment and care pathways.
4. Further long term study of participants at five and 10 years in order to establish the long-term outcomes following physical combat related injury.
5. Feasibility study regarding education of new recruits in basic training to challenge long-standing negative perceptions of mental illness within the UKAF and to facilitate wider access to military mental health services.

REFERENCES

ADAMS, R. S., NIKITIN, R. V., WOOTEN, N. R., WILLIAMS, T. V. & LARSON, M. J. 2016. The association of combat exposure with postdeployment behavioral health problems among U.S. Army enlisted women returning from Afghanistan or Iraq. Journal of Traumatic Stress, 29, 356-364.

AGAIBI, C.E. and WILSON, J.P., 2005. Trauma, PTSD, and resilience: a review of the literature. Trauma, Violence, & Abuse, 6(3), 195–216.

AGUIRRE, M., GREENBERG, N, SHARPLEY, J., SIMPSON, R. and WALL, C., 2014a. A pilot study of an enhanced mental health assessment during routine and discharge medicals in the British Armed Forces. Journal of the Royal Army Medical Corps, 160(1), 27–31.

AGUIRRE, M., GREENBERG, N, SHARPLEY, J., SIMPSON, R. and WALL, C., 2014b. Alcohol consumption in the UK armed forces: are we drinking too much? Journal of the Royal Army Medical Corps, 160(1), 72–73.

AHL, R., LINDGREN, R., CAO, Y., RIDDEZ, L. and MOBSENI, S., 2017. Risk factors for depression following traumatic injury: an epidemiological study from a Scandinavian trauma center. Injury, 48(5), 1082–1087.

ALDWIN, C.M., LEVENSON, M.R. and SPIRO, A., 1994. Vulnerability and resilience to combat exposure: can stress have lifelong effects? Psychology and Aging, 9(1), 34–44.

ALEXANDER, D.A.A., KLEIN, S.T.B. and FORBES, K.J., 2013. The Headley Court Trust Report. Aberdeen Centre for Trauma Research, The Robert Gordon University, Aberdeen.

AMERICAN PSYCHIATRIC ASSOCIATION, 1952. Diagnostic and Statistical Manual: Mental Disorders (DSM-I). 1st ed. Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 1968. Diagnostic and Statistical Manual of Mental Disorders (DSM-II). 2nd ed. Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 1980. Diagnostic and Statistical Manual of Mental Disorders (DSM-III). 3rd ed. Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 1987. Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R). 3rd ed. Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 1994. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). 4th ed. Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 2000. Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR). 4th ed. [Trauma Update], Washington, D.C.: American Psychiatric Association.

AMERICAN PSYCHIATRIC ASSOCIATION, 2013. Diagnostic and Statistical Manual of Mental Disorders (DSM-5). 5th ed. Washington, D.C.: American Psychiatric Association.

ASHTON, E., 2018. From Trauma to Recovery: Treatment at DMRC, Conference presentation at The NATO Centre of Excellence for Military Medicine (NATO MILMED COE) Annual Discipline Conference, Budapest, 25 Jun 2014.

ATKINSON, P.A., MARTIN, C.R. and RANKIN, J., 2009. Resilience revisited. Journal of Psychiatric and Mental Health Nursing, 16(2), 137–145.

BABOR, T.F., HIGGINS-BIDDLE, J.C., SAUNDERS, J.B. and MONTEIRO, M.G., 2001. AUDIT, the Alcohol Use Disorders Identification Test. 2nd ed. Geneva, Switzerland: World Health Organisation.

BANDELOW, B., KOCH, M., ZIMMERMANN, P., BIESOLD, K.-H., WEDEKIND, D. & FALKAI, P. 2012. Posttraumatic stress disorder (PTSD) in the German Armed Forces: A retrospective study in inpatients of a German army hospital. European Archives of Psychiatry and Clinical Neuroscience, 262, 459-467.

BARTONE, P.T., 1999. Hardiness protects against war-related stress in army reserve forces. Consulting Psychology Journal Practice and Research, 51(2), 72–82.

BARTONE, P.T., 2006. Resilience under military operational stress: Can leaders influence hardiness? Military Psychology, 18(Suppl.), S131–S148.

BARTONE, P.T., 2007. Test-retest reliability of the dispositional resilience scale-15, a brief hardiness scale. Psychological Reports, 101(3 Pt 1), 943–944.

BARTONE, P.T., EID, J., HYSTAD, S.W., LABERG, J.C., BORUD, E., JOCOY, K. and JOHNSEN, B.H., 2014. New screening tools for early identification of alcohol abuse risk in the military. Conference: Society for Prevention Research 22nd Annual Meeting, Washington, D.C.

BARTONE, P.T., HYSTAD, S.W., EID, J. and BREVIK, J.I., 2012. Psychological hardiness and coping style as risk/resilience factors for alcohol abuse. Military Medicine, 177(5), 517–524.

BARTONE, P.T., KELLY, D.R. and MATTHEWS, M.D., 2013. Psychological hardiness predicts adaptability in military leaders: a prospective study. International Journal of Selection and Assessment, 21(2), 200–210.

BARTONE, P.T., ROLAND, R.R., PICANO, J.J. and WILLIAMS, T.J., 2008. Psychological hardiness predicts success in US Army special forces candidates. International Journal of Selection and Assessment, 16(1), 78–81.

BASTA, M., CHROUSOS, G.P., VELA-BUENO, A. and VGONTZAS, A.N., 2007. Chronic insomnia and the stress system. Sleep Medicine Clinics, 2, 279-91.

BECK, J. G., & CLAPP, J. D., 2011. A different kind of co-morbidity: Understanding posttraumatic stress disorder and chronic pain. Psychological trauma : theory, research, practice and policy, 3(2), 101–108.

BEN-ZEEV, D., CORRIGAN, P.W., BRITT, T.W. and LANGFORD, L., 2012. Stigma of mental illness and service use in the military. Journal of Mental Health. 21(3), 264-73.

BERGMAN, B.P. and MILLER, S.A.S., 2000. Unfit for further service: trends in medical discharge from the British Army 1861-1998. Journal of the Royal Army Medical Corps, 146(3), 204–211.

BLANCHARD, E.B., JONES-ALEXANDER, J., BUCKLEY, T.C. and FORNERIS, C.A., 1996. Psychometric properties of the PTSD checklist (PCL). Behaviour Research and Therapy, 34(8), 669–673.

BLIESE, P., WRIGHT, K., ADLER, A., and THOMAS, J., 2004. Validation of the 90 to 120 Day Post-Deployment Psychological Short Screen, 1–16. US Army Medical Research Unit–Europe: USAMRU-E, Heidelberg, Germany; 2004.

BLOSNICH, J.R., GORDON A.J. and BOSSARTE, R.M., 2014. Suicidal ideation and mental distress among adults with military service history: Results from 5 US States, 2010. American Journal of Public Health, 104(S4), S595–S602.

BOALS, A., TROST, Z., RAINEY, E., FOREMAN, M.L. and WARREN, A.M., 2017. Severity of traumatic injuries predicting psychological outcomes: a surprising lack of empirical evidence. Journal of Anxiety Disorders, 50, 1–6.

BONANNO, G.A., 2004. Loss, Trauma, and Human Resilience: Have We Underestimated the Human Capacity to Thrive After Extremely Aversive Events? American Psychologist, 59(1), 20–28.

BOWLING, A., 2009. Research Methods in Health: Investigating Health and Health Services. Maidenhead, Open University Press.

BRAY, R.M., BROWN, J.M. and LANE, M.E., 2013. Alcohol misuse prevention in the military. Chapter 78. In MILLER, P.M., 2013. Interventions for Addiction. Academic Press, San Diego, 769-778.

BRAY, R.M., PEMBERTON, M.R., LANE, M.E., HOURANI, L.L., MATTIKO, M.J., and BABEU, L.A., 2009. Substance use and mental health trends among U.S. military active duty personnel: key findings from the 2008 DoD health behavior survey. Military Medicine, 175(6), 390-399.

BREWIN, C.R., ANDREWS, B. and ROSE, S., 2000a. Fear, helplessness, and horror in posttraumatic stress disorder: investigating DSM-IV criterion A2 in victims of violent crime. Journal of Traumatic Stress, 13(3), 499–509.

BREWIN, C.R., ANDREWS, B. and VALENTINE, J.D., 2000b. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. Journal of Consulting and Clinical Psychology, 68(5), 748–766.

BRITT, T., BRINK, S., NGUYEN, Q.B., RATH, J., COX, A., HOGE, C.W., CASTRO, C., 2008. Perceived Stigma and Barriers to Care for Psychological Treatment: Implications for Reactions to Stressors in Different Contexts. Journal of Social and Clinical Psychology, 27, 317-335.

BROWN, E.S., FULTON, M.K., WILKESON, A. and PETTY, F., 2000. The psychiatric sequelae of civilian trauma. Comprehensive Psychiatry, 41(1), 19–23.

BROWN, J.S., BOARDMAN, J., WHITTINGER, N. and ASHWORTH M., 2010. Can a self-referral system help improve access to psychological treatments? British Journal of General Practice, 60:365–371.

BROWNE, T., IVERSEN, A., HULL, L., WORKMAN, L., BARKER, C., HORN, O., JONES, M., MURPHY, D., GREENBERG, N., RONA, R., HOTOPF, M., WESSELY, S. and FEAR, N.T., 2008. How do experiences in Iraq affect alcohol use among male UK armed forces personnel? Occupational and Environmental Medicine, 65(9), 628–633.

BRYANT, R.A., CREAMER, M., O'DONNELL, M., SILOVE, D. and MCFARLANE, A.C. 2010. Sleep disturbance immediately prior to trauma predicts subsequent psychiatric disorder. Sleep, 33, 69–74.

BRYANT, R.A., O'DONNELL, M.L., CREAMER, M., McFARLANE, A.C., CLARK, C.R. and SILOVE, D., 2010. The psychiatric sequelae of traumatic injury. American Journal of Psychiatry, 167(3), 312–320.

CAMPBELL-SILLS, L. and STEIN, M.B., 2007. Psychometric analysis and refinement of the Connor–Davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. Journal of Traumatic Stress, 20(6), 1019–1028.

CARTY, J., O'DONNELL, M., EVANS, L., KAZANTZIS, N. & CREAMER, M. 2011. Predicting posttraumatic stress disorder symptoms and pain intensity following severe injury: The role of catastrophizing. European Journal of Psychotraumatology, 2, 10.

CHAMPION, H.R., BELLAMY, R.F., ROBERTS, P. and LEPPANIEMI, A., 2003. A profile of combat injury. Journal of Trauma, 54(5 Suppl.), S13–S19.

CLACK, J.D., 2007. Psychiatry. Journal of the Royal Army Medical Corps, 153(1), 63–68.

COMSTOCK, S., PANNELL, D., TALBOT, M., COMPTON, L., WITHERS, N. and HOMER, C.T., 2011. Spinal injuries after improvised explosive device incidents: Implications for tactical combat casualty care. Journal of Trauma, 71, S413–S417

CONGER, R.D., RUETER, M.A. and ELDER, G.H., 1999. Couple resilience to economic pressure. Journal of Personality and Social Psychology, 76(1), 54–71.

CONNOR, K.M. and DAVIDSON, J.R.T., 2003. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). Depression and Anxiety, 18(2), 76–82.

COOK, R. A., BROWN, M.-A., ALLAN, C., SCHEPP, K. & VOSS, J. G. 2017. Screening for posttraumatic stress disorder in civilians with mangled hand injury: A practice enhancement approach. Orthopaedic Nursing, 36, 432-438.

CORRIGAN, J.D. and COLE, T.B., 2008. Substance use disorders and clinical management of traumatic brain injury and posttraumatic stress disorder. Journal of the American Medical Association, 300(6), 720–721.

COULTHARD, M., FARRELL, M., SINGLETON, N. and MELTZER, H., 2002. Tobacco, Alcohol and Drug Use and Mental Health. London: HMSO.

CREAMER, M., BURGESS, P. and MCFARLANE, A.C., 2001. Post-traumatic stress disorder: findings from the Australian National Survey of Mental Health and Well-being. Psychological Medicine, 31(7), 1237–1247.

CROCKETT, R.A., WEINMAN, J., HANKINS, M., MARTEAU, T., 2008. Time orientation and health-related behaviour: measurement in general population samples. Psychology & Health. 2008. pp. 1–18.

DEFENCE STATISTICS (HEALTH), 2017. Suicide and Open Verdict Deaths in the UK Regular Armed Forces: Annual Summary and Trends Over Time 1 January 1984 to 31 December 2016. Abbey Wood (North): Ministry of Defence.

DOHERTY, A.M., MASON, C, FEAR, N.T., RONA, R., GREENBERG, N. and GOODWIN, L., 2017. Are brief alcohol interventions targeting alcohol use efficacious in military and veteran populations? A meta-analysis. Drug and Alcohol Dependence, 178, 571–578.

EISEN, S.V., SCHULTZ, M.R., VOGT, D., GLICKMAN, M.E., ELWY, A.R., DRAINONI, M.-L., OSEI-BONSU, P.E. and MARTIN, J., 2012. Mental and physical health status and alcohol and drug use following return from deployment to Iraq or Afghanistan. American Journal of Public Health, 102(S1), 66-73.

ELBOGEN, E.B., SCHULTZ, M.R., VOGT, D., GLICKMAN, M.E., ELWY, A.R., DRAINONI, M., OSEI-BONSU, P.E., and MARTIN, J., 2010. Correlates of anger and hostility in Iraq and Afghanistan war veterans. The American Journal of Psychiatry, 167(9), 1051–1058.

ELDER, G.H. and CLIPP, E.C., 1989. Combat experience and emotional health: impairment and resilience in later life. Journal of Personality, 57(2), 311–341.

ENGELHARD, I.M., VAN DEN HOUT, M.A., WEERTS, J., ARNTZ, A., HOX, J.J.C.M. and MCNALLY, R.J., 2007. Deployment-related stress and trauma in Dutch soldiers returning from Iraq. Prospective study. The British Journal of Psychiatry, 191, 140–145.

ERBES, C.R., ARBISI, P.A., KEHLE, S.M., FERRIER-AUERBACH, A.G., BARRY, R.A. and POLUSNY, M.A., 2011. The distinctiveness of hardiness, positive emotionality, and negative emotionality in National Guard soldiers. Journal of Research in Personality, 45(5), 508–512.

FAUL, F., ERDFELDER, E., BUCHNER, A., & LANG, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behavior Research Methods, 41, 1149-1160.

FAUL, F., ERDFELDER, E., LANG, A.-G., & BUCHNER, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39, 175-191.

FEAR, N.T., IVERSEN, A., MELTZER, H., WORKMAN, L., HULL, L., GREENBERG, N., BARKER, C., BROWNE, T., EARNSHAW, M., HORN, O., JONES, M., MURPHY, D., RONA, R.J., HOTOPF, M. and WESSELY, S., 2007. Patterns of drinking in the UK Armed Forces. Addiction, 102(11), 1749–1759.

FEAR, N.T., JONES, M., MURPHY, D., HULL, L., IVERSEN, A.C., COKER, B., MACHELL, L., SUNDIN, J., WOODHEAD, C., JONES, N., GREENBERG, N., LANDAU, S., DANDECKER, C., RONA, R.J., HOTOPF, M. and WESSELY, S., 2010. What are the consequences of deployment to Iraq and Afghanistan on the mental health of the UK armed forces? A cohort study. The Lancet, 375(9728), 1783–1797.

FEAR, N.T., VAN STADEN, L., IVERSEN, A., HALL, J. and WESSELY, S., 2010. 50 ways to trace your veteran: increasing response rates can be cheap and effective. European Journal of Psychotraumatology, 1(1), 5516.

FIELD, A., 2018. Discovering statistics using IBM SPSS statistics: and sex and drugs and rock 'n' roll. London: Sage

FIGLEY, C.R. and NASH, W.P. (Eds.). (2007). Routledge psychosocial stress series. Combat stress injury: Theory, research, and management. Routledge/Taylor & Francis Group.

FIKRETOGLU, D. and MCCLEARY, D.R., 2012. Psychological Resilience. Toronto: Defence R&D Canada.

FLETCHER, K., 2007. Combat Stress (The Ex-Services Mental Welfare Society), Veterans and Psychological Trauma. In: H Lee & E Jones (eds) War and Health: Lessons from the Gulf War. John Wiley & Sons Ltd, Chapter 5.

FLETCHER, S., O'DONNELL, M. & FORBES, D. 2016. Personality and trajectories of posttraumatic psychopathology: A latent change modelling approach. Journal of Anxiety Disorders, 42, 1-9.

FONTANA, A. and ROSENHECK, R.A., 1999. A model of war zone stressors and posttraumatic stress disorder. Journal of Traumatic Stress, 12(1), 111–126.

FORBES, H.J., BOYD, C.F.S., JONES, N., GREENBERG, N., JONES, E., WESSELY, S., IVERSEN, A. and FEAR, N.T., 2013. Attitudes to Mental Illness in the U.K. Military: a comparison with the general population. Military Medicine, 178(9), 957–965.

FORBES, H.J., JONES, N., WOODHEAD, C., GREENBERG, N., HARRISON, K., WHITE, S., WESSELY, S. and FEAR, N.T., 2012. What are the effects of having an illness or injury whilst deployed on post deployment mental health? A population based record linkage study of UK Army personnel who have served in Iraq or Afghanistan. BMC Psychiatry, 12(1), 178.

FORD, J.D. and RUSSO, E., 2006. Trauma-focused, present-cantered, emotional self-regulation approach to integrated treatment for posttraumatic stress and addiction: trauma adaptive recovery group education and therapy (TARGET). American Journal of Psychotherapy, 60(4), 335–355.

FREDRICKSON, B.L., TUGADE, M.M., WAUGH, C.E. and LARKIN, G.R., 2003. What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. Journal of Personality and Social Psychology, 84(2), 365–376.

GABERT-QUILLEN, C. A., IRISH, L. A., SLEDJESKI, E., FALLON, W., SPOONSTER, E. & DELAHANTY, D. L. 2012. The impact of social support on the relationship between trauma history and posttraumatic stress disorder symptoms in motor vehicle accident victims. International Journal of Stress Management, 19, 69-79.

GOFF, B.S.N., CROW, J.R., REISBIG, A.M.J. and HAMILTON, S., 2007. The impact of individual trauma symptoms of deployed soldiers on relationship satisfaction. Journal of Family Psychology, 21(3), 344–353.

GOLDBERG, D.P. and WILLIAMS, P., 1988. A User's Guide to the General Health Questionnaire. Windsor, Berks.: NFER-Nelson.

GOLDBERG, D.P., GATER, R., SARTORIUS, N., USTUN, T.B., PICCINELLI, M., GUREJE, O. and RUTTER, C., 1997. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. Psychological Medicine, 27(1), 191–197.

GONZALEZ, S. P., MOORE, E. W. G., NEWTON, M., & GALLI, N. A., 2016. Validity and reliability of the Connor-Davidson resilience scale (CD-RISC) in competitive sport. Psychology of Sport and Exercise, 23, 31-39.

GREAT BRITAIN CABINET OFFICE, 2015. National Security Strategy and Strategic Defence Review 2015. London: HMSO

GREEN, K.T., BECKHAM, J.C., YOUSSEF, N. and ELBOGEN, E.B., 2014. Alcohol misuse and psychological resilience among U.S. Iraq and Afghanistan era veterans. Addictive Behaviors, 39(2), 406–413.

GREENBERG, N. and WESSELY, S., 2008. Gulf War syndrome: an emerging threat or a piece of history? Emerging Health Threats Journal, 1(1), 7071.

GREENBERG, N., 2011. Managing traumatic stress at work. Occupational Health at Work, 7(5), 22–26.

GREENBERG, N., BROOKS, S. and DUNN, R., 2015. Latest developments in post-traumatic stress disorder: diagnosis and treatment. British Medical Bulletin. 114(1), 147-55.

GREENBERG, N., IVERSEN, A., HULL, L., BLAND, D. and WESSELY, S., 2008a. Getting a peace of the action: measures of posttraumatic stress in UK military peacekeepers. Journal of the Royal Society of Medicine, 101(2), 78–84.

GREENBERG, N., JONES, E., JONES, N., FEAR, N.T. and WESSELY, S., 2011. The injured mind in the UK Armed Forces. Philosophical Transactions of the Royal Society B: Biological Sciences, 366(1562), 261–267.

GREENBERG, N., LANGSTON V. and JONES, N., 2008. Trauma risk management (TRiM) in the UK Armed Forces. Journal of the Royal Army Medical Corps, 154(2), 124–127.

GREENE-SHORTRIDGE, T.M., BRITT, T.W. and CASTRO, C.A., 2007. The stigma of mental health problems in the military. Military Medicine, 172(2), 157-61.

GRIEGER, T., COZZA, S.J., URSANO, R.J., HOGE, C., MARTINEZ, P.E., ENGEL, C.C. and WAIN, H.J., 2006. Posttraumatic stress disorder and depression in battle-injured soldiers. American Journal of Psychiatry, 163(10), 1777.

HAGLUND, M.E.M., NESTADT, P.S., COOPER, N.S., SOUTHWICK, S.M. and CHARNEY, D.S., 2007. Psychobiological mechanisms of resilience: Relevance to prevention and treatment of stress-related psychopathology. Development and Psychopathology, 19(03), 889–32.

HANKINS, M., 2007. Questionnaire discrimination: (re)-introducing coefficient Delta. BMC Medical Research Methodology. 7(19).

HART, C., 1998. Doing a Literature Review : Releasing the Social Science Research Imagination. London: Sage Publications.

HAUTAMAKI, A. and COLEMAN, P.G., 2001. Explanation for pow Prevalence of PTSD among older Finnish war veterans: Social solidarity and continued significance given to Wartime Sufferings. Aging and Mental Health, 5(2), 165–174.

HEALTHCARE COMMISSION, 2009. Defence Medical Services: A review of the clinical governance of the Defence Medical Services in the UK and overseas. London: Commission for Healthcare Audit and Inspection.

HENDERSON, A., LANGSTON V. and GREENBERG, N., 2009. Alcohol misuse in the Royal Navy. Occupational Medicine, 59(1), 25–31.

HINES, L.A., GRIBBLE, R., WESSELY, S., DANDECKER, C. and FEAR, N.T., 2014a. Are the Armed Forces understood and supported by the public? a view from the United Kingdom. Armed Forces & Society, 41(4), 688–713.

HINES, L.A., SUNDIN J. and RONA, R.J., 2014. Posttraumatic stress disorder post Iraq and Afghanistan: prevalence among military subgroups. Canadian Journal of Psychiatry, 59(9), 468-79.

HOCKEY, J., 1986. Squaddies. University of Exeter Press.

HODGETTS, T.J. and MAHONEY, P.F., 2009. Military pre-hospital care: why is it different? Journal of the Royal Army Medical Corps, 155(1), 4–8.

HOGE, C.W., CASTRO, C.A., MESSER, S.C., McGURK, D., COTTING, D.I. and KOFFMAN, R.L., 2004. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. New England Journal of Medicine, 351(1), 13–22.

HOGE, E.A., AUSTIN, E.D. and POLLACK, M.H., 2007. Resilience: research evidence and conceptual considerations for posttraumatic stress disorder. Depression and Anxiety, 24(2), 139–152.

HOLBROOK, T. L., GALARNEAU, M. R., DYE, J. L., QUINN, K. & DOUGHERTY, A. L. 2010. Morphine use after combat injury in Iraq and post-traumatic stress disorder. The New England Journal of Medicine, 362, 110-117.

HOOPER, R., RONA, R.J., JONES, M., FEAT, N.T., HULL, L. and WESSELY, S., 2008. Cigarette and alcohol use in the UK Armed Forces, and their association with combat exposures: A prospective study. Addictive Behaviors, 33(8), 1067–1071.

HOTOPF, M. and WESSELY, S., 2005. Can epidemiology clear the fog of war? Lessons from the 1990-91 Gulf War. International Journal of Epidemiology, 34(4), 791–800.

HOTOPF, M., HULL, L., FEAR, N.T., BROWNE, T., HORN, O., IVERSEN, A., JONES, M., MURPHY, D., BLAND, D., EARNSHAW, M., GREENBERG, N., HACKER-HUGHES, J., TATE, A.R., DANDECKER, C., RONA, R. and WESSELY, S., 2006. The health of UK military personnel who deployed to the 2003 Iraq war: a cohort study. The Lancet, 367(9524), 1731–1741.

HYLAND, P., SHEVLIN, M., ELKLIT, A., MURPHY, J., VALLIÈRES, F., GARVERT, D.W., CLOITRE, M. 2017. An assessment of the construct validity of the ICD-11 proposal for complex posttraumatic stress disorder. Psychol Trauma. Jan;9(1):1-9.

IVERSEN, A., WATERDRINKER, A., FEAR, N., GREENBERG, N., BARKER, C., HOTOPF, M., HULL, L. and WESSELEY, S., 2007. Factors associated with heavy alcohol consumption in the U.K. Armed Forces: Data from a health survey of Gulf, Bosnia, and era veterans. Military Medicine, 172(9), 956–961.

IVERSEN, A.C. and GREENBERG, N., 2009. Mental health of regular and reserve military veterans. Advances in Psychiatric Treatment, 15(2), 100–106.

IVERSEN, A.C., FEAR, N.T., EHLERS, A., HACKER HUGHES, J., HULL, L., EARNSHAW, M., GREENBERG, N., RONA, R., WESSELY, S. and HOTOPF, M., 2008. Risk factors for post-traumatic stress disorder among UK Armed Forces personnel. Psychological Medicine, 38(04), 511–522.

IVERSEN, A.C., VAN STADEN, L., HACKER HUGHES, J., BROWNE, T., GREENBERG, N., HOTOPF, M., RONA, R.J., WESSELY, S., THORNICROFT, G. and FEAR, N.T., 2010. Help-seeking and receipt of treatment among UK service personnel. The British Journal of Psychiatry, 197(2), 149–155.

IVERSEN, A.C., VAN STADEN, L., HACKER HUGHES, J., BROWNE, T., HULL, L., HALL, J., GREENBERG, N., RONA, R.J., HOTOPF, M., WESSELY, S. and FEAR, N.T., 2009. The prevalence of common mental disorders and PTSD in the UK military: using data from a clinical interview-based study. BMC Psychiatry, 9(1), 1576–12.

IVERSEN, A.C., VAN STADEN, L., HACKER HUGHES, J., GREENBERG, N., HOTOPF, M., RONA, R.J., THORNICROFT, G., WESSELY, S. and FEAR, N.T., 2011. The stigma of mental health problems and other barriers to care in the UK Armed Forces. BMC Health Services Research, 11(1), 31.

JACKSON, C., 2007. The General Health Questionnaire. Occupational Medicine, 57:79.

JACOBSEN, L.K., SOUTHWICK, S.M. and KOSTEN, T.R., 2014. Substance use disorders in patients with posttraumatic stress disorder: A review of the literature. American Journal of Psychiatry. 158(8), 1184–1190.

JACOBSON, I.G., RYAN, M.A., HOOPER, T.I., SMITH, T.C., AMOROSO, P.J., BOYKO, E.J., GACKSTETTER, G.D., WELLS, T.S. and BELL, N.S., 2008. Alcohol use and alcohol-related problems before and after military combat deployment. Journal of the American Medical Association, 300(6), 663–675.

JENSEN, T.K., SKÅRDALSMO, E.M.B. and FJERMESTAD, K.W., 2014. Development of mental health problems - a follow-up study of unaccompanied refugee minors. Child and Adolescent Psychiatry and Mental Health, 8(1), 1–10.

JOHNSEN, B.H., HYSTAD, S.W., BARTONE, P.T., LABERG, J.C. and EID, J., 2014. Hardiness profiles: defining clusters of the dispositional resilience scale and their relation to soldiers' health. Military Behavioral Health, 2(2), 123–128.

KARDINER, A. and SPEIGEL H., 1947. War Stress and Neurotic Illness, 2nd ed. London: Paul B Hoeber.

KESSLER, D., BENNEWITH, O., LEWIS, G. and SHARP, D., 2002. Detection of depression and anxiety in primary care: follow up study. British Medical Journal (Clinical Research ed.), 325(7371), 1016–1017.

KESSLER, R.C., SONNEGA, A., BROMET, E., HUGHES, M. and NELSON, C.B., 1995. Posttraumatic stress disorder in the National Comorbidity Survey. Archives of General Psychiatry, 52(12), 1048–1060.

KILLGORE, W.D.S., COTTING, D.I., THOMAS, J.L., COX, A.L., MCGURK, D., VO, A.H., CASTRO, C.A. and HOGE, C.W., 2008. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. Journal of Psychiatric Research, 42(13), 1112–1121.

KIM, E.-J. and DIMSDALE, J.E., 2007. The effect of psychosocial stress on sleep: a review of polysomnographic evidence. Behavioral Sleep Medicine, 5(4), 256–278.

KLINE, P., 2000. The handbook of psychological testing. 2nd ed., London: Routledge.

KOBASA, S.C., 1979. Stressful life events, personality, and health: An inquiry into hardiness. Journal of Personality and Social Psychology, 37(1), 1–11.

KOREN, D., HEMEL D. and KLEIN, E.M., 2006. Injury increases the risk for PTSD: an examination of potential neurobiological and psychological mediators. CNS Spectrums, 11(8), 616–624.

KOREN, D., KLEIN E.M. and ARNON, I., 1999. Acute stress response and posttraumatic stress disorder in traffic accident victims: A one-year prospective, follow-up study. The American Journal of Psychiatry, 156(3), 367-373.

KOREN, D., NORMAN, D., COHEN, A., BERMAN, J. and KLEIN, E.M., 2005. Increased PTSD risk with combat-related injury: a matched comparison study of injured and uninjured soldiers experiencing the same combat events. American Journal of Psychiatry, 162(2), 276–28.

KUHN, E., GREENE, C., HOFFMAN, J., NGUYEN, T., WALD, L., SCHMIDT, J., RAMSEY, K.M. and RUZEK, J., 2014. Preliminary evaluation of PTSD coach, a smartphone app for post-traumatic stress symptoms. Military Medicine, 179, 1-12.

KUIPER, N.A., 2012. Humor and resiliency: towards a process model of coping and growth. Europe’s Journal of Psychology, 8(3), 475–491.

KULKA, R.A., SCHLENGER, W.E., FAIRBANK, J.A., HOUGH, R.L., JORDAN, B.K., MARMAR, C.R. and WEISS, D.S., 1990. Brunner/Mazel psychosocial stress series, No. 18. Trauma and the Vietnam war generation: Report of findings from the National Vietnam Veterans Readjustment Study. Philadelphia, PA, US: Brunner/Mazel.

LANGSTON, V., GREENBERG, N., FEAR, N., IVERSEN, A., FRENCH, C. and WESSELY, S., 2010. Stigma and mental health in the Royal Navy: a mixed methods paper. Journal of Mental Health, 19(1):8-16.

LEPORE, S. J. and REVENSON, T. A., 2006. Resilience and posttraumatic growth: Recovery, resistance, and reconfiguration. In CALHOUN, L.G. and

TEDESCHI, R.G., eds. Handbook of posttraumatic growth, research and practice (pp. 24-46). Mahwah, NJ: Routledge.

LUSKIN, F., REITZ, M., NEWELL, K., QUINN, T.G and HASKELL, W., 2002. A controlled pilot study of stress management training of elderly patients with congestive heart failure. Preventive Cardiology, 5(4), 168–172.

LUTHAR, S.S. and CICCHETTI, D., 2000. The construct of resilience: implications for interventions and social policies. Development and Psychopathology, 12(4), 857–885.

LUTHAR, S.S., CICCHETTI, D. and BECKER, B., 2000. The construct of resilience: a critical evaluation and guidelines for future work. Child Development, 71(3), 543–562.

MACGREGOR, A.J. CORSON, K.S., LARSON, G.E., SHAFFER, R.A., DOUGHERTY, A.L., GALARNEAU, M.R., RAMA, R., BAKER, D.G., LINDSAY, S.P. and GOLOMB, B.A., 2009. Injury-specific predictors of posttraumatic stress disorder. Injury, 40(9), 1004–1010.

MADDI, S.R., 2007. Relevance of hardiness assessment and training to the military context, Military Psychology, 2007, 19(1), 61–70.

MAGUEN, S., TURCOTTE, D. M., PETERSON, A. L., DREMSA, T. L., GARB, H. N., MCNALLY, R. J. and LITZ, B. T., 2008. Description of risk and resilience factors among military medical personnel before deployment to Iraq. Military Medicine, 173, 1–9.

MAKIKANGAS, A., FELDT, T., KINNUNEN, U., TOLVANEN, A., KINNUNEN, M.L., PULKKINEN, L. 2006. The factor structure and factorial invariance of the 12-item General Health Questionnaire (GHQ-12) across time: evidence from two community-based samples. Psychol Assess, 06(18), 444–451.

MANOHAR, N., MACMILLAN, F., STEINER, G., and ARORA, A., 2018. Recruitment of Research Participants. 10.1007/978-981-10-2779-6_75-1.

MARTIN, C.R. and NEWELL, R.J., 2005. Is the 12-item General Health Questionnaire (GHQ-12) confounded by scoring method in individuals with facial disfigurement? Psychology and Health. 20, 651–659.

MASTEN, A.S., BEST, K.M. and GARMEZY, N., 1990. Resilience and development: Contributions from the study of children who overcome adversity. Development and Psychopathology, 2(04), 425.

MATTIKO, M.J., OLMSTED, K.L.R., BROWN, J.M. and BRAY, R.M., 2011. Alcohol use and negative consequences among active duty military personnel. Addictive Behaviors, 36(6), 608–614.

MCCRATY, R., ATKINSON, M. and TOMASINO, D., 2003. Impact of a workplace stress reduction program on blood pressure and emotional health in hypertensive employees. The Journal of Alternative and Complementary Medicine, 9(3), 355–369.

MCCRATY, R., ATKINSON, M., TILLER, W.A., REIN, G and WATKINS, A.D., 1995. The effects of emotions on short-term power spectrum analysis of heart rate variability. The American Journal of Cardiology, 76(14), 1089–1093.

MEREDITH, L.S., SHERBOURNE, C.D., GAILLOT, S.J., HANSELL, L., RITSCHARD, H.V., PARKER, A.M. and WRENN, G., 2011. Promoting Psychological Resilience in the U.S. Military. Rand Corporation.

MICHAEL, M., MEDDINGS, D.R., RAMEZ, S. and GUTIÉRREZ-FISAC, J.L., 1999. Incidence of weapon injuries not related to interfactional combat in Afghanistan in 1996: prospective cohort study. British Medical Journal (Clinical Research ed.), 319(7207), 415–417.

MICHAELS, A.J., MICHAELS, C.E., MOON, C.H., SMITH, J.S., ZIMMERMAN, M.A., TAHERI, P.A. and PETERSON, C., 1999. Posttraumatic stress disorder after injury: impact on general health outcome and early risk assessment. Journal of Trauma, 47, 460–7.

MICHALOPOULOU, L.E., WELSH, J.A., PERKINS, D.F. and ORMSBY, L., 2016. Stigma and Mental Health Service Utilization in Military Personnel: A Review of the Literature. Military Behavioral Health, 5(1), 12-25.

MINISTRY OF DEFENCE, 2015. NATO standard AJP-3.14: allied joint doctrine for force protection. Edition A Version 1. NATO Standardization Office (NSO).

MINISTRY OF DEFENCE, 2016. Interim report on the health risks to women in ground close combat roles: WGCC/Interim-Report/10/2016. Andover: Department of Manning (Army).

MINISTRY OF DEFENCE, 2016. Shaping a Stable World: the Military Contribution (JDP 05) [online] Available from: www.gov.uk/mod/dcdc: Accessed Jan 2018.

MOORS, G., KIERUJ, N.D. and VERMUNT, J.K. 2014. The Effect of Labeling and Numbering of Response Scales on the Likelihood of Response Bias, Sociological Methodology. 44(1), 369 – 399.

MURPHY, D., SHEVLIN, M., PEARSON, E. J., GREENBERG, N., WESSELY, S., BUSUTILL, W., AND KARATZIAS, T. (2020). A validation study of the International Trauma Questionnaire to assess ICD-11 posttraumatic stress disorder (PTSD) and complex PTSD in military personnel. British Journal of Psychiatry, 216(3), 132–137.

MURPHY, D, KARATZIAS, T, BUSUTTIL, W, GREENBERG, N & SHEVLIN, M (2021). ICD-11 Posttraumatic Stress Disorder (PTSD) and Complex PTSD (CPTSD) in Treatment Seeking Veterans: Risk factors and comorbidity, *Social Psychiatry and Psychiatric Epidemiology*, vol. 56, no. 7, pp. 1289-1298. https://doi.org/10.1007/s00127-021-02028-6

NASKY, K. M., HINES, N. N. & SIMMER, E. 2009. The USS Cole bombing: Analysis of pre-existing factors as predictors for development of post-traumatic stress or depressive disorders. Military Medicine, 174, 689-694.

NAVARRO SUAY, R., HERNANDEZ ABADÍA, A., GUTIÉRREZ-ORTEGA, C., ÇELA, E., LAM, D. and GILSANZ, F., 2012. Gunshot and Improvised Explosive Casualties: A Report from the Spanish Role 2 Medical Facility in Herat, Afghanistan. Military Medicine, 177, 326-32.

NERIA, Y., DIGRANDE, L., and ADAMS, B.G., 2011. Posttraumatic stress disorder following the September 11, 2001, terrorist attacks: a review of the literature among highly exposed populations. The American Psychologist, 66(6), 429–446.

NEWINGTON, L., & METCALFE, A., 2014. Factors influencing recruitment to research: qualitative study of the experiences and perceptions of research teams. BMC medical research methodology, 14, 10.

O'DONNELL, M., ALKEMADE, N., NICKERSON, A., CREAMER, M., MCFARLANE, A., SILOVE, D. and FORBES, D., 2014. Impact of the diagnostic changes to post-traumatic stress disorder for DSM-5 and the proposed changes to ICD-11. British Journal of Psychiatry, 205(3), 230-235.

O'DONNELL, M.L., ALKEMADE, N., CREAMER, M., McFARLANE, A.C., SILOVE, D., BRYANT, R.A., FELMINGHAM, K., STEEL, Z. and FORBES, D., 2016. A Longitudinal Study of Adjustment Disorder After Trauma Exposure. The American Journal of Psychiatry, 173(12), 1231–1238.

O'DONNELL, M.L., BRYANT, R.A., CREAMER, M. and CARTY, J., 2008. Mental health following traumatic injury: Toward a health system model of early psychological intervention. Clinical Psychology Review, 28(3), 387–406.

O'DONNELL, M.L., CREAMER, M., BRYANT, R.A., SCHNYDER, U., SHALEV, A., 2003. Posttraumatic disorders following injury: an empirical and methodological review. Clinical Psychology Review, 23(4), 587–603.

O'DONNELL, M.L., CREAMER, M., MCFARLANE, A.C., SILOVE, D. and BRYANT, R.A., 2010. Should A2 be a diagnostic requirement for posttraumatic stress disorder in DSM-V? Psychiatry Research, 176(2-3), 257–260.

O'DONNELL, M.L., CREAMER, M.C. and PATTISON, P., 2004a. Posttraumatic stress disorder and depression following trauma: understanding comorbidity. American Journal of Psychiatry, 161(8), 1390–1396.

O'DONNELL, M.L., CREAMER, M.C. and PATTISON, P., 2004b. Psychiatric morbidity following injury. American Journal of Psychiatry, 161(3), 507–514

O'DONNELL, M.L., ELLIOTT, P., LAU, W. and CREAMER, M., 2007. PTSD symptom trajectories: From early to chronic response. Behaviour Research and Therapy, 45(3), 601–606.

OSÓRIO, C., JONES, N., JONES, E., ROBBINS, I., WESSELY, S., GREENBERG, N., 2017. Combat experiences and their relationship to post-traumatic stress disorder symptom clusters in U.K. military personnel deployed to Afghanistan. Behavioral Medicine, 44(2), 131–140.

OZER, E.J., BEST, S.R., LIPSEY, T.L. and WEISS, D.S., 2003. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. Psychological Bulletin, 129(1), 52–73.

PALMER, I.P., 2004. Psychological briefing, prevention or priming? or, How many psychiatrists does it take to change a mind? Journal of the Royal Army Medical Corps, 150(2), 84–90.

PATON, D., 2006. Critical incident stress risk in police officers: Managing resilience and vulnerability. Traumatology, 12(3), 198–206.

PIETRZAK, R.H., JOHNSON, D.C., GOLDSTEIN, M.B., MALLEY, J.C., RIVERS, A.J., MORGAN, C.A., SOUTHWICK, S.M., 2010. Psychosocial buffers of traumatic stress, depressive symptoms, and psychosocial difficulties in veterans of Operations Enduring Freedom and Iraqi Freedom: The role of resilience, unit support, and post-deployment social support. Journal of Affective Disorders, 120(1), 188–192.

RAMASAMAY, A., HILL, A.M. and CLASPER, J.C., 2009a. Improvised explosive devices: pathophysiology, injury profiles and current medical management. Journal of the Royal Army Medical Corps, 155(4), 265–272.

RAMASAMAY, A., HILL, A.M., HEPPER, A.E., BULL, A.M. and CLASPER, J.C., 2009b. Blast mines: physics, injury mechanisms and vehicle protection. Journal of the Royal Army Medical Corps, 155(4), 258–264.

RIDDLE, J.R., SMITH, T.C., SMITH, B., CORBEIL, T.E., ENGEL, C.C., WELLS, T.S., HOGE, C.W., ADKINS, J., ZAMORSKI, M. and BLAZER, D., 2007. Millennium Cohort: The 2001–2003 baseline prevalence of mental disorders in the U.S. military. Journal of Clinical Epidemiology, 60(2), 192–201.

ROBERTS, N.P., ROBERTS, P.A., JONES, N. and BISSON, J.I., 2015. Psychological interventions for post-traumatic stress disorder and comorbid substance use disorder: A systematic review and meta-analysis. Clinical Psychology Review, 38, 25–38

ROBSON, C., 2011. Real world research. Chichester: John Wiley & Sons Ltd.

ROMEIS, J.C., WATERMAN, B., SCHERRER, J.F., GOLDBERG, J., EISEN, S.A., HEATH, A.C., BUCHOLZ, K.K., SLUTSKE, W.S., LYONS, M.J., TSUANG, W.J., AND TRUE, W.R., 1999. The impact of sociodemographics, comorbidity and symptom recency on health-related quality of life in alcoholics. Journal of Studies on Alcohol, 60(5), 653–662.

RONA, R., JONES, M., FRENCH, C., HOOPER, R., WESSELY, S., 2004. Screening for physical and psychological illness in the British Armed Forces: I: The acceptability of the programme. Journal of Medical Screening, 11, 148-52.

RONA, R.J., BURDETT, H., BULL, S., JONES, M., JONES, N., GREENBERG, N., WESSELY, S. and FEAR, N.T., 2016. Prevalence of PTSD and other mental disorders in UK service personnel by time since end of deployment: a meta-analysis. BMC Psychiatry, 16(1), 1–9.

RONA, R.J., HYAMS, K.C. and WESSELY, S., 2005. Screening for psychological illness in military personnel. Journal of the American Medical Association, 293(10), 1257–1260.

RONA, R.J., JONES, M., FEAR, N.T., HULL, L., HOTOPF, M., WESSELY, S., 2010. Alcohol misuse and functional impairment in the UK Armed Forces: A population-based study. Drug and Alcohol Dependence, 108(1-2), 37–42.

RONA, R.J., JONES, M., HULL, L., MACMANUS, D., FEAR, N.T. and WESSELY, S., 2015. Anger in the UK Armed Forces: strong association with mental health, childhood antisocial behavior, and combat role. The Journal of Nervous and Mental Disease, 203(1), 15–22.

RONA, R.J., JONES, M., IVERSEN, A., HULL, L., GREENBERG, N., FEAR, N.T., HOTOPF, M. and WESSELY, S., 2009. The impact of posttraumatic stress disorder on impairment in the UK military at the time of the Iraq war. Journal of Psychiatric Research, 43(6), 649–655.

ROSNER, R., POWELL, S. and BUTOLLO, W., 2002. Posttraumatic Stress Disorder three years after the siege of Sarajevo. Journal of Clinical Psychology, 59(1), 41–55.

RUBIN, D.C., 2011. The coherence of memories for trauma: Evidence from posttraumatic stress disorder. Consciousness and Cognition, 20(3), 857–865.

RUSSELL, R.J., HODGETTS, T., OLLERTON, J., MASSETTI, P., SKEET, J., BRAY, I. and HARRISON, K., 2007. The Operational Emergency Department Attendance Register (OPEDAR): A new epidemiological tool. Journal of the Royal Army Medical Corps, 153(4), 244–250.

RUTTER, M.L., KREPPNER, J.M. and O'CONNOR, T.G., 2001. Specificity and heterogeneity in children's responses to profound institutional privation. The British Journal of Psychiatry, 179, 97–103.

SAHKER, E., LANCIANESE, D. A., & ARNDT, S., 2017. Stability of the alcohol use disorders identification test in practical service settings. Substance abuse and rehabilitation, 8, 1–8.

SAMELE, C., 2013. The Mental Health of Serving and Ex-Service Personnel: a Review of the Evidence and Perspectives of Key Stakeholders. A report prepared by the Mental Health Foundation on behalf of the Forces in Mind Trust. London: Forces in Mind Trust.

SAMPSON, L., COHEN, G.H., CALABRESE, J.R., FINK, D.S., TAMBURRINO, M., LIBERZON, I., CHAN, P. and GALEA, S., 2015. Mental health over time in a military sample: the impact of alcohol use disorder on trajectories of psychopathology after deployment. Journal of Traumatic Stress, 28(6), 547–555.

SCHREIBER, M. and MCENANY, G.P., 2015. Stigma, American military personnel and mental health care: challenges from Iraq and Afghanistan, Journal of Mental Health, 24(1), 54-59.

SCOTT, J.N., 2005. Diagnosis and outcome of psychiatric referrals to the field mental health team, 202 Field Hospital, OP TELIC I. Journal of the Royal Army Medical Corps, 151(2), 95–100.

SCOTT, T., 2007. Sudden traumatic death: caring for the bereaved. Trauma, 9(2), 103–109.

SCOTT, W., 2017. The Politics of Readjustment: Vietnam Veterans since the War (Social Problems and Social Issues). Routledge; New York.

SHARP, M. L., BUSUTTIL, W., MURPHY, D., 2019. Examining physical health conditions and associations of pain, obesity, and function of UK Veterans diagnosed with PTSD and other mental health conditions. Journal of Military, Veteran and Family Health, 5(2), 75-87.

SHIVELY, S.B. and PERL, D.P., 2012. Traumatic brain injury, shell shock, and posttraumatic stress disorder in the military—past, present, and future. Journal of Head Trauma Rehabilitation, 27(3), 234–239.

SILVERMAN, M.N. and DEUSTER, P.A., 2014. Biological mechanisms underlying the role of physical fitness in health and resilience. Interface Focus, 4(5), 1-12.

SINCLAIR, R.R.E. and BRITT, T.W.E., eds., 2013. Building Psychological Resilience in Military Personnel: Theory and Practice. Washington: American Psychological Association.

SMITH, J. and NOBLE, H., 2014. Bias in research, Evidence Based Nursing, 17(4), 100-101.

SOLOMON, Z., BLEICH, A., SHOHAM, S., NARDI, C. and KOTLER, M., 1992. The 'Koach' project for treatment of combat-related PTSD: Rationale, aims, and methodology. Journal of Traumatic Stress, 5(2), 175–193.

SOLOMON, Z., MIKULINCER, M. and AVITZUR, E., 1988. Coping, locus of control, social support, and combat-related posttraumatic stress disorder: A prospective study. Journal of Personality and Social Psychology, 55(2), 279–285.

STAHRE, M.A., BREWER, R.D., FONSECA, V.P. and NAIMI, T.S., 2009. Binge drinking among U.S. active-duty military personnel. American Journal of Preventative Medicine, 36(3), 208–217.

STALKER, A., OLLERTON, J., EVERINGTON, S., RUSSELL, R., WALKER, C. and WHITE, C., 2011. A three-year review of emergency department admissions--Op HERRICK 4 to 9. Journal of the Royal Army Medical Corps, 157(3), 213–217.

STEVELINK, S.A.M., JONES, M., HULL, L., PERNET, D., MACCRIMMON, S., GOODWIN, L., RONA, R.J., 2018. Mental health outcomes at the end of the British involvement in the Iraq and Afghanistan conflicts: a cohort study. The British Journal of Psychiatry, 1-8

STREINER, D.L., NORMAN, G.R. and CAIRNEY, J., 2015. Health Measurement Scales: A practical guide to their development and use. 5th ed., Oxford: Oxford University Press.

SULLIVAN, E., SHELLEY, J., RAINEY, E., BENNETT, M., PRAJAPATI, P., POWERS, M.B., FOREMAN, M. and WARREN, A.M., 2017. The association between posttraumatic stress symptoms, depression, and length of hospital stay following traumatic injury. General Hospital Psychiatry, 46, 49–54.

SUNDIN, J., FEAR, N.T., IVERSEN, A., RONA, R.J. and WESSELY, S., 2010. PTSD after deployment to Iraq: conflicting rates, conflicting claims. Psychological Medicine, 40(3), 367-82.

TANIELIAN, T.L. and JAYCOX, L., 2008. Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery. Santa Monica, CA : RAND.

TATE, A.R., JONES, M., HULL, L., FEAR, N.T., RONA, R., WESSELY, S. and HOTOPF, M., 2007. How many mailouts? Could attempts to increase the response rate in the Iraq war cohort study be counterproductive? BMC Medical Research Methodology, 7, 51–51.

TAYLOR, M.K., PIETROBON, R. TAVERNIERS, J., LEON, M.R. and FERN, B.J., 2011. Relationships of hardiness to physical and mental health status in military men: a test of mediated effects. Journal of Behavioral Medicine, 36(1), 1–9.

TAYMUR, İ., SARGIN, A. E., ÖZDEL, K., TÜRKÇAPAR, H. M., ÇALıŞGAN, L., ZAMKI, E. & DEMIREL, B. 2014. Endüstriyel bir patlama sonrasında akut stres bozukluğu ve travma sonrası stres bozukluğu gelişiminde olası risk faktörleri. Nöropsikiyatri Arşivi, 51, 23-29.

TRAVAGLINI, L., COSGRAVE, J. AND KLINGAMAN, E., 2019. Pain and Sleep Problems Predict Quality of Life for Veterans with Serious Mental Illness. Psychiatric Rehabilitation Journal. 42. 10.1037.

TRIPEPI, G., JAGER, K.J., DEKKER, F.W., AND ZOCCALI, C., 2010. Selection Bias and Information Bias in Clinical Research, Nephron Clinical Practice. 115, 94–99.

TUGADE, M.M. and FREDRICKSON, B.L., 2004. Resilient individuals use positive emotions to bounce back from negative emotional experiences. Journal of Personality and Social Psychology, 86(2), 320–333.

VASTERLING, J.J., VERFAELLIE, M. and SULLIVAN, K.D., 2009. Mild traumatic brain injury and posttraumatic stress disorder in returning veterans:

Perspectives from cognitive neuroscience. Clinical Psychology Review, 29(8), 674–684.

VERRALL, N., 2011. A review of military research into alcohol consumption. Journal of the Royal Army Medical Corps, 157(2), 164–169.

WALD, J., TAYLOR, S., ASMUNDSON, G.J.G., JANG, K.L. and STAPLETON, J., 2006. Literature Review of Concepts: Psychological Resiliency. Toronto: Defence R&D Canada.

WALKER, R.L., CLARK, M.E., NAMPIAPARAMPIL, D.E., MCILVRIED, L., GOLD, M.S., OKONKWO, R. and KERNS, R.D., 2010. The hazards of war: blast injury headache. Journal of Pain, 11(4), 297-302.

WALSH, K., KOENEN, K.C., COHEN, G.H., URSANO, R., GIFFORD, R.K., FULLERTON, C.S. and GALEA, S., 2013. Sexual violence and mental health symptoms among National Guard and Reserve Soldiers. Journal of General Internal Medicine, 29(1), 104–109.

WATKINS, L.E., SIPPEL, L.M., PIETRZAK, R.H., HOFF, R. and HARPAZ-ROTEM, I., 2017. Co-occurring aggression and suicide attempt among veterans entering residential treatment for PTSD: The role of PTSD symptom clusters and alcohol misuse. Journal of Psychiatric Research, 87, 8–14.

WATSON, A., 2008. Enduring the Great War: Combat, Morale and Collapse in the German and British Armies, 1914–1918 (Cambridge Military Histories). Cambridge: Cambridge University Press.

WEATHERS F.W., LITZ B.T. and KEANE T.M., 1995. Military Trauma. In: FREEDY J.R., HOBFOLL S.E. (eds.) Traumatic Stress. Springer Series on Stress and Coping. Springer, Boston, MA.

WEATHERS, F.W., BLAKE, D.D., SCHNURR, P.P., KALOUPEK, D.G., MARX, B.P., & KEANE, T.M., 2013. The Life Events Checklist for DSM-5 (LEC-5). Instrument available from the National Center for PTSD at www.ptsd.va.gov

WERNER, E.E. and SMITH, R.S., 1982. Vulnerable but Invincible. McGraw-Hill Companies.

WESSELY, S. and JONES, E., 2004. Psychiatry and the 'Lessons of Vietnam': what were they, and are they still relevant? War & Society, 22(1), 89–103.

WESSELY, S., 2005a. Risk, psychiatry and the military. The British Journal of Psychiatry, 186, 459–466.

WESSELY, S., 2005b. War stories: Invited commentary on...: Documented combat exposure of US veterans seeking treatment for combat-related post-traumatic stress disorder. The British Journal of Psychiatry, 186(6), 473–475.

WILLIAMS, A., HAGERTY, B.M. and YOUSHA, S.M., 2004. Psychosocial effects of the BOOT STRAP intervention in Navy recruits. Military Medicine, 169(10), 814-20.

WILSON, M.M. and MCALLISTER, P.D., 2010. The Clients' Perspective – Do military uniform and rank impact on the therapeutic relationship between military mental health clients and clinicians. Journal of the Royal Army Medical Corps, 156(2), 97–99.

WILSON, M.M., MCALLISTER, P.D., HACKER HUGHES, J.H.G and FEAR, N.T., 2007, Do military uniform and rank impact on the therapeutic relationship between military mental health clients and clinicians? Journal of the Royal Army Medical Corps, 153(3), 170-171.

WILSON, R.M., 1916. The irritable heart of soldiers. BMJ (Clinical research ed.), 1(2873), 119–120.

WINDLE, G., 2010. What is resilience? A review and concept analysis. Reviews in Clinical Gerontology, 21(02), 152–169.

WINDLE, G., BENNETT, K.M. and NOYES, J., 2011. A methodological review of resilience measurement scales. Health and Quality of Life Outcomes, 9(1), 1–18.

WOODRUFF, S. I., GALARNEAU, M. R., MCCABE, C. T., LUU, B. N., SACK, D. I. & HAN, P. P. 2017. Body-region-specific injuries as predictors of psychosocial outcomes among those injured in combat: Results from the Wounded Warrior Recovery Project. Military Psychology, 29, 590-600.

WOODRUFF, S. I., GALARNEAU, M. R., MCCABE, C. T., SACK, D. I. & CLOUSER, M. C. 2018. Health-related quality of life among US military personnel injured in combat: Findings from the Wounded Warrior Recovery Project.

Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation, 27, 1393-1402.

WORLD HEALTH ORGANISATION, 1992. The ICD-10 classification of mental and behavioural disorders: Clinical description and diagnostic guidelines (ICD-10). Geneva, Switzerland: WHO Office of Publications.

WORLD HEALTH ORGANISATION, 1994. Lexicon of Alcohol and Drug Terms. Geneva, Switzerland: WHO Office of Publications.

WORLD HEALTH ORGANISATION, 2017. The ICD-11 classification of mental and behavioural disorders: Clinical description and diagnostic guidelines (ICD-11). Geneva, Switzerland: WHO Office of Publications.

ZINZOW, H.M., GRUBAUGH, A.L., MONNIER, J., SUFFOLETTA-MAIERLE, S. and FRUEH, B.C., 2007. Trauma among female veterans: a critical review. Trauma, Violence, & Abuse, 8(4), 384–400.

APPENDICES

APPENDIX A: AUTHORATATIVE SUBJECT DATABASES

ProQuest: Health & Medical Collection

The ProQuest Health & Medical Collection is a comprehensive resource providing access to full-text journal content, reference eBooks, and evidence-based resources, including dissertations and systematic reviews across all domains of health research. ProQuest provides access to 1,500 publications with almost 1,300 of these available in full text. It includes MEDLINE, which contains journal citations and abstracts for biomedical literature from around the world.

ProQuest: Military Database

The ProQuest Military Collection™ provides access to resources across a full range of U.S. government and military branches and includes around 550 titles (more than 400 available in full-text) and includes literature specifically related to military and defence, military branches and impact of war from 1916 to present day.

ProQuest: Nursing & Allied Health Database

The ProQuest Nursing & Allied Health Database provides access to 2,002 publications from all health domains including (amongst others): nursing, allied health, physical therapy, occupational therapy, traumatology and rehabilitation. In addition to published journals this database also provides access to full-text dissertations across the identified fields of study. The ProQuest Nursing & Allied Health Database provides access to literature published from 1857 onwards.

ProQuest: APA PsycARTICLES

The American Psychiatric Association (APA) subject database PsycARTICLES contains an authoritative bibliographic record of articles published behavioural and social science research, in 110 APA published journals. PsycARTICLES contains over 204,000 records from 1894 to present day.

ProQuest: Psychology Journals

The ProQuest Psychology Database provides access to abstracts and full-text articles and dissertations/theses and covers behavioural, clinical, cognitive, industrial and social psychology, along with personality, psychobiology and psychometrics. The database provides access to 1,316 scholarly journals (908 in full-text) although there is no clear indication of the date range of indexed publications. Many titles are indexed in PsycINFO.

ProQuest: PsycINFO

The APA PsycINFO database provides access to a wide range of international literature in psychology and related disciplines including psychiatry, medicine, nursing, and social work. The database contains over 1,800 professional journals, chapters, books, reports, theses and dissertations and more than 8 million cited references to other works. The PsycINFO database contains literature published from 1806 to present day.

ProQuest: PTSDpubs

The PTSDpubs subject database is sponsored by the U.S. Department of Veterans Affairs (and was formerly PILOTS: Published International Literature on Traumatic Stress). It provides citations and abstracts to the international literature on Post-Traumatic Stress Disorder (PTSD) and other mental health sequelae of traumatic events from 1871 onwards. In addition to published work, the PTSDpubs database provides access to a comprehensive PTSD and trauma-focused thesaurus to aid literature searching, and a listing of available tests and measures, and each database record contains information on instruments used within the publication. The PTSDpubs database also allows searches to be conducted by specific test or measure. PTSDpubs provides access to literature published from 1871 to present day.

EBSCO: The Cumulative Index to Nursing and Allied Health Literature (CINAHL)

The Cumulative Index to Nursing and Allied Health Literature (CINAHL) provides indexing for more than 5,500 nursing and allied health journals. The database contains more than 7.5 million records dating back to 1981 and indexes articles from a range of health disciplines including nursing, biomedicine, health sciences and 17 allied health disciplines. The database also contains cited references for more than 1,300 journals and full-text materials from more than 70 journals.

EBSCO: MEDLINE

MEDLINE is maintained by the National Center for Biotechnology Information (NCBI), at the U.S. National Library of Medicine (NLM), and comprises over 25 million references to journal articles in life sciences and biomedicine. In addition, the database contains citations to over 5,200 international journals published from 1809 to present day. MEDLINE with full-text provides access to 660 active full-text journals from 1949 to present day.

APPENDIX B: SEARCH STRATEGY (PROQUEST AND EBSCO)

Search Strategy - ProQuest

Set #	Search String	Databases
S1 S SAMPLE	noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs
S2 P and I PHENOMENON of INTEREST	noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs
S3 D DESIGN	noft(cohort OR "case control") AND PEER(yes)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs
S4 E EVALUATION	noft(risk* OR predict*) AND PEER(yes)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs
S5 R RESEARCH TYPE	noft(quantitative) AND PEER(yes)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs
S6 S1 AND S2	(noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs These databases are searched for part of your query.
S7 S3 OR S4	(noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs These databases are searched for part of your query.
S8 (S3 OR S4) AND S5	((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes))	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES,

		Psychology Database, PsycINFO, PTSDpubs These databases are searched for part of your query.
S9 [S1 AND S2] AND[(S3 OR S4) AND S5]	((noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))) AND (((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes)))	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs These databases are searched for part of your query.
S10 [S1 AND S2] AND [(S3 OR S4) AND S5] LIMITED TO 10 Years	((noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))) AND (((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes))) AND pd(20090717-20190717)	Health & Medical Collection, Military Database, Nursing & Allied Health Database, PsycARTICLES, Psychology Database, PsycINFO, PTSDpubs

Search Strategy - EBSCO

Set #	Search String	Databases
S1 S SAMPLE	noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S2 P and I PHENOMENON of INTEREST	noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes)	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S3 D DESIGN	noft(cohort OR "case control") AND PEER(yes)	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S4 E EVALUATION	noft(risk* OR predict*) AND PEER(yes)	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S5 R RESEARCH TYPE	noft(quantitative) AND PEER(yes)	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S6 S1 AND S2	(noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma")	CINAHL Health Source: Nursing/Academic Edition MEDLINE

	AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))	
S7 S3 OR S4	(noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S8 (S3 OR S4) AND S5	((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes))	CINAHL Health Source: Nursing/Academic Edition MEDLINE PsycINFO, PTSDpubs
S9 [S1 AND S2] AND [(S3 OR S4) AND S5]	((noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))) AND (((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes)))	CINAHL Health Source: Nursing/Academic Edition MEDLINE
S10 [S1 AND S2] AND [(S3 OR S4) AND S5] LIMITED TO 10 Years	((noft("military personnel" OR "service personnel" OR "combat injured population" OR "combat injuries" OR "combat injury" OR "physical trauma") AND PEER(yes)) AND (noft("common mental health disorder" OR CMD OR "post traumatic" OR PTSD OR posttraumatic OR "post-traumatic") AND noft("psychological resilience" OR hardiness) AND PEER(yes))) AND (((noft(cohort OR "case control") AND PEER(yes)) OR (noft(risk* OR predict*) AND PEER(yes))) AND (noft(quantitative) AND PEER(yes))) AND pd(20090717-20190717)	CINAHL Health Source: Nursing/Academic Edition MEDLINE

APPENDIX C: McMASTER UNIVERSITY: CRITICAL REVIEW FORM

Critical Review Form – Quantitative Studies
©Law, M., Stewart, D., Pollock, N., Letts, L. Bosch, J., & Westmorland, M.
McMaster University
- Adapted Word Version Used with Permission –

The EB Group would like to thank Dr. Craig Scanlan, University of Medicine and Dentistry of NJ, for providing this Word version of the quantitative review form.

Instructions: Use tab or arrow keys to move between fields, mouse or spacebar to check/uncheck boxes.

CITATION	Provide the full citation for this article in APA format:
STUDY PURPOSE Was the purpose stated clearly? ☐ Yes ☐ No	Outline the purpose of the study. How does the study apply to your research question?
LITERATURE Was relevant background literature reviewed? ☐ Yes ☐ No	Describe the justification of the need for this study:
DESIGN ☐ Randomized (RCT) ☐ cohort ☐ single case design ☐ before and after ☐ case-control ☐ cross-sectional ☐ case study	Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.): Specify any biases that may have been operating and the direction of their influence on the results:
SAMPLE N = Was the sample described in detail? ☐ Yes ☐ No Was sample size justified? ☐ Yes ☐ No ☐ N/A	Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?: Describe ethics procedures. Was informed consent obtained?:

1

OUTCOMES Were the outcome measures reliable? ☐ Yes ☐ No ☐ Not addressed Were the outcome measures valid? ☐ Yes ☐ No ☐ Not addressed	Specify the frequency of outcome measurement (i.e., pre, post, follow-up): Outcome areas:	List measures used.:
INTERVENTION Intervention was described in detail? ☐ Yes ☐ No ☐ Not addressed Contamination was avoided? ☐ Yes ☐ No ☐ Not addressed ☐ N/A Cointervention was avoided? ☐ Yes ☐ No ☐ Not addressed ☐ N/A	Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?	
RESULTS Results were reported in terms of statistical significance? ☐ Yes ☐ No ☐ N/A ☐ Not addressed Were the analysis method(s) appropriate? ☐ Yes ☐ No ☐ Not addressed	What were the results? Were they statistically significant (i.e., $p < 0.05$)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?	

2

Clinical importance was reported? ☐ Yes ☐ No ☐ Not addressed	What was the clinical importance of the results? Were differences between groups clinically meaningful? (if applicable)
Drop-outs were reported? ☐ Yes ☐ No	Did any participants drop out from the study? Why? (Were reasons given and were drop-outs handled appropriately?)
CONCLUSIONS AND IMPLICATIONS Conclusions were appropriate given study methods and results ☐ Yes ☐ No	What did the study conclude? What are the implications of these results for practice? What were the main limitations or biases in the study?

APPENDIX D: ETHICAL APPROVAL (MODREC)

science | innovation | technology

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Faculty of Health & Social Care,
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Garthdee Road,
Aberdeen AB10 7QG.

Ref: 62/Gen/09

1st October2009

Dear Professor Alexander,

Re: The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners. (Patient Group) (62/Gen/09)

Thank you for submitting this interesting research protocol for ethical review.

I am now happy to confirm ethical approval for this research and should be grateful if you would send me a copy of your final report on completion of the study. Please would you also send me a brief interim report in one year's time if the study is still ongoing.

This approval is conditional upon adherence to the protocol – please let me know if any amendment becomes necessary.

I hope the work goes well.

Yours sincerely,

Robert Linton

Dr Robert Linton
Chairman MoD Research Ethics Committee (General)

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Ref: 63/Gen/09

1st October2009

Dear Professor Alexander,

Re: The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners. (Partner Group) (63/Gen/09)

Thank you for submitting this interesting research protocol for ethical review.

I am now happy to confirm ethical approval for this research and should be grateful if you would send me a copy of your final report on completion of the study. Please would you also send me a brief interim report in one year's time if the study is still ongoing.

This approval is conditional upon adherence to the protocol – please let me know if any amendment becomes necessary.

I hope the work goes well.

Yours sincerely,

Robert Linton

Dr Robert Linton
Chairman MoD Research Ethics Committee (General)

APPENDIX E: ETHICAL APPROVAL (NRES)

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NHS

Grampian

29 July 2009

Professor David A Alexander
Director (Aberdeen Centre for Trauma Research); Professor of Mental Health
The Robert Gordon University
Aberdeen Centre for Trauma Research
Faculty of Health and Social Care
Garthdee Road, Aberdeen
AB10 7QG

Dear Professor Alexander

Study Title:	**The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners**
REC reference number:	**09/S0801/47**

Thank you for your email20 July 2009, responding to the Committee's request for further information on the above research and submitting revised documentation

The further information was considered by the Chair of Committee 1.

Since our accreditation it is now a condition of the Committee that all documentation have version numbers and dates on all paperwork. Can you please forward to the office new copies of the following documents with version numbers and dates:

Clinical Referral Form
Your Health and Well-being Survey
Participant Consent Form
Participant Information Sheet
GP/Consultant Information Sheets
Letter of invitation to participant
Questionnaire
Interview Schedules/Topic Guides

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

Ethical review of research sites

The favourable opinion applies to all NHS sites taking part in the study, subject to management permission being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

The favourable opinion applies to the following research site(s):

Research Site	Principal Investigator / Local Collaborator
Defence Medical Rehabilitation Centre, Headley Court Military Hospital	Professor David A Alexander

Conditions of the favourable opinion

The favourable opinion is subject to the following conditions being met prior to the start of the study.

Management permission or approval must be obtained from each host organisation prior to the start of the study at the site concerned.

For NHS research sites only, management permission for research ("R&D approval") should be obtained from the relevant care organisation(s) in accordance with NHS research governance arrangements. Guidance on applying for NHS permission for research is available in the Integrated Research Application System or at http://www.rdforum.nhs.uk.

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Letter from A J Stables to Emma Gillibrand		11 January 2009
Arrangements for the payment of no-fault compensation to human volunteers	1.0	23 March 2006
Clinical Referral Form		07 May 2009
Information Technology Security Policy	1	03 January 2001
Your Health and Well-being Survey		07 May 2009
Participant Consent Form		07 May 2009
GP/Consultant Information Sheets		07 May 2009
Letter of invitation to participant		07 May 2009
Questionnaire		07 May 2009
Interview Schedules/Topic Guides		07 May 2009
Peer Review		10 May 2009
Letter from Sponsor		06 May 2009
Protocol		08 May 2009*
Investigator CV		08 May 2009*
Application		07 May 2009
Rejoinder		17 July 2009

Covering Letter		17 July 2009
email from Dr S Klein		20 July 2009
Participant Information Sheet: Partners of Prospective Patient Group		17 July 2009
Participant Information Sheet: Partners of Retrospective Patient Group		17 July 2009
Response to Request for Further Information		20 July 2009

* date received, no date given

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Now that you have completed the application process please visit the National Research Ethics Service website > After Review

You are invited to give your view of the service that you have received from the National Research Ethics Service and the application procedure. If you wish to make your views known please use the feedback form available on the website.

The attached document *"After ethical review – guidance for researchers"* gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Progress and safety reports
- Notifying the end of the study

The NRES website also provides guidance on these topics, which is updated in the light of changes in reporting requirements or procedures.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email referencegroup@nres.npsa.nhs.uk.

09/S0801/47	**Please quote this number on all correspondence**

Yours sincerely

Irene Allan

pp **Dr Angus J Thompson**
Chair

Enclosures: "After ethical review – guidance for researchers"

Copy to: *Professor Peter Robertson*

North of Scotland Research Ethics Committee (1)

LIST OF SITES WITH A FAVOURABLE ETHICAL OPINION

For all studies requiring site-specific assessment, this form is issued by the main REC to the Chief Investigator and sponsor with the favourable opinion letter and following subsequent notifications from site assessors. For issue 2 onwards, all sites with a favourable opinion are listed, adding the new sites approved.

REC reference number:	09/S0801/47	**Issue number:**	1	**Date of issue:**	29 July 2009
Chief Investigator:	Professor David A Alexander				
Full title of study:	The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners				

This study was given a favourable ethical opinion by North of Scotland Research Ethics Committee (1) on 28 May 2009. The favourable opinion is extended to each of the sites listed below. The research may commence at each NHS site when management approval from the relevant NHS care organisation has been confirmed.

Principal Investigator	*Post*	*Research site*	*Site assessor*	*Date of favourable opinion for this site*	*Notes* (1)
Professor David A Alexander	*Director/Professor of Mental Health*	*Defence Medical Rehabilitation Centre, Headley Court Military Hospital*		*29 July 2009*	

Approved by the Chair on behalf of the REC:

................Irene Allan.................. *(Signature of/Co-ordinator)*
(delete as applicable)

.....................Irene Allan .... (Name)

(1) *The notes column may be used by the main REC to record the early closure or withdrawal of a site (where notified by the Chief Investigator or sponsor), the suspension of termination of the favourable opinion for an individual site, or any other relevant development. The date should be recorded.*

APPENDIX F: PROSPECTIVE PATIENT PARTICIPANT - INFORMATION LEAFLET

Will my records be kept confidential?

Any information that is collected about you during the course of the research will be kept confidential as to your identity. All assessments will be issued with a study number, and the answers you give will be stored in secure conditions in accordance with the Data Protection Act (1998) and analysed anonymously.

The information collected will be destroyed 100 years after completion of the study. Other than the members of the research team, only the clinical consultants will be aware that you have taken part in this study (should you report any personal difficulties). No personally identifying information will be reported in publications or presented at meetings.

What will happen to the results of this study?

On completion of the study, the information provided will be analysed in the ACTR by the research team. The findings will be presented in a final report for the Headley Court Trust prior to being published and presented at meetings. The purpose of reporting and presenting the findings from the study will be for the benefit of others. Some of the information provided will be written up as a PhD thesis. You may ask the Principal Investigator for copies of all papers, reports, transcripts, summaries and other published or presented material.

You will not be personally identified in any report, publication, or presentation based on the findings from this study.

Further information and contact details

Should you want any further information about this study, please do not hesitate to contact either the Principal Investigator the Research Supervisor as follows:

Principal Investigator
Professor David A Alexander,
Director, Aberdeen Centre for Trauma Research,

Tel no: 01224 263 100/1;
E-mail: d.a.alexander@rgu.ac.uk

Research Supervisor
Dr Susan Klein,
Reader in Trauma Research,
Aberdeen Centre for Trauma Research,

Tel: 01224 263102;
E-mail: s.klein@rgu.ac.uk

Independent Medical Officer:
Surg Cdr Neil Greenberg,
Senior Lecturer in Military Psychiatry
Academic Centre for Defence Mental Health,
Weston Education Centre,
Cutcombe Road,
London SE5 9RJ.

Tel no: 0208 848 5351;
Mobile no: 07747 101 459;
E-mail: sososanta@aol.com

ROBERT GORDON UNIVERSITY•ABERDEEN

Headley Court Trust Project

Who is organising and funding the research?

This study is funded by the Headley Court Trust, and is being organised and sponsored by The Robert Gordon University with the support of the Ministry of Defence. Although this study is being conducted in collaboration with Headley Court, the research team is independent of DMRC and the Defence Medical Services. No member of the research team is being paid for including patients and partners in this study.

Who has reviewed the study?

All research on MoD/Service personnel is looked at by an independent group of people, called a Research Ethics Committee which has been engaged to protect your safety, rights, well-being and dignity. This study has been reviewed and approved by the Ministry of Defence Ethics Committee (MoDREC), the North of Scotland Research Ethics Committee (NoSREC) and the Robert Gordon University Research Ethics Committee. This study complies, and at all times will comply, with the Declaration of Helsinki.

actr
Aberdeen Centre for Trauma Research

Aberdeen Centre for Trauma Research,
Faculty of Health & Social Care,
The Robert Gordon University,
Garthdee Road,
ABERDEEN
AB10 7QG

Tel no: +44 (0)1224 263100
Fax no: +44 (0)1224 263109

The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners.

Participants Information
Prospective Group

Invitation

We would like to invite you to take part in a research study that is being carried out by a team of researchers based at the Aberdeen Centre for Trauma Research (ACTR). The team conducts high quality studies to investigate the impact of different types of trauma on individuals and their families in order to find ways to improve trauma-related care.

Before you decide whether you want to take part in this study, it is important for you to understand why this research is being carried out and what it will mean for you. Please take the time to read the following information carefully and to discuss it with others if you wish. We would be pleased to explain anything that is not clear and/or provide further information.

If you would like to take part, please let us know if you have been involved in any other study during the last year.

What is the purpose of the research?

Previous research studies have shown that traumatic injury can have a considerable impact on the lives of individuals and their families. The purpose of this study is for us to gain a better understanding of the impact of combat-related injury and to identify things which could help military personnel and their partners in the longer term.

Very little is currently known about the extent to which rehabilitation and follow-up care meet the needs of patients and their partners once they have been discharged from centres like Headley Court. It is particularly important to identify ways to ensure the provision of necessary support required by patients and their partners following combat-related injury. Because we also want to find out about the needs of patients with other types of injury, we will also be including a comparison group of patients admitted to Headley Court with non combat-related injuries. The study will last for 36 months.

Why have I been invited to take part?

You have been invited to take part in this study because you have been admitted to Headley Court for the first time, as an inpatient, for treatment of injuries that you've sustained as a member of the armed forces. These injuries may be combat related or they may be injuries you've sustained non-operationally, e.g. on exercise or during training.

Overall, we will be inviting 340 patients who have received treatment at Headley Court to take part in this study.

Do I have to take part?

No, it is up to you to decide whether or not to take part in the study. If you decide to take part, you will be given a more detailed information sheet to keep and you will be asked to sign a consent form.

Even if you agree to take part now and change your mind later, you can still withdraw at any time without giving any reason. It is important to know that a decision to withdraw later on, or a decision not to take part now, will not affect the care you receive; neither will it have any effect on your career.

If you do not want to answer some of the questions we ask, you are free to ignore those that you do not feel comfortable with.

If you have a partner whom you feel would also be interested in taking part in this study, you will be asked to give consent for us to contact them to explain the purpose of the study, and to invite them to participate. However, if you do not have a partner or you do not wish your partner to be invited to participate this does not prevent you from taking part.

By "partner" we mean somebody to whom you are married or with whom you have a committed relationship.

What will I be asked to do?

If you wish to take part in this study, the first thing that you will be asked to do is to sign the consent form and to hand it back to us. You will also be asked to provide consent if you wish your partner to be invited to participate in this study. You will be given a copy of the signed consent section for you to keep.

Once you have consented to participate, we will provide you with the first of the study questionnaires. The questionnaire should be completed at a time convenient to yourself before you are discharged from Headley Court. At most, the completion of the questionnaires will take no more than 60 minutes.

As we want to find out how things have been for you following your discharge from Headley Court, we will contact you again in 6- and 12-months to ask you to complete a further questionnaire. It will take no more than 60 minutes of your time to complete each follow-up questionnaire.

What kind of questions will be asked?

Questions in the questionnaires will cover the effects of your injury in relation to your physical and emotional health, quality of life, ability to resume normal function, your relationship with partner, and the support received. There are no 'right' or 'wrong' answers to these questions, and the information provided by everyone who participates will be regarded as equally important. The interviews will be conducted by a fully trained and experienced healthcare practitioner with a military background under the supervision of the Principal Investigator and the clinical consultants to the study.

What are the possible disadvantages and risks of taking part?

We have asked these types of questions and used these questionnaires in many of our previous studies without causing harm or distress. However, if for any reason you are distressed due to answering any of the questions in this study, please let us know in order that we can relay this information to the clinical supervisors of the project. They will decide the most appropriate way to help you, should they have concerns about your health and functioning, this may include referral to an appropriate professional.

What are the possible benefits of taking part?

Some people find it helpful to take part in this type of research because it gives them a chance to help others and/or because they have an opportunity to describe the impact of injuries and how they have coped. Naturally, we hope that this will be the case for you.

Although we cannot promise that your taking part in this study will help you directly, the information you provide will help with the care and support given to future patients (and their partners) following discharge from a rehabilitation facility such as Headley Court.

What happens if I suffer any harm?

If you feel that you have suffered harm by participating in this study, you should report this to the Principal Investigator or to the Independent Medical Officer.

Whom do I contact if I have any questions or a complaint?

You can discuss your concerns about the study with the research team at any time. Should you have concerns about the study which either you do not want to discuss with the research team or if you feel that the research team cannot help you, you can contact the Principal Investigator or the Independent Medical Officer.

The Principal Investigator is responsible for the overall conduct of the study and the Independent Medical Officer acts independently of the study team to ensure your safety and well-being.

The Independent Medical Officer may terminate your participation in the study on medical grounds at any time if he thinks it is necessary, and you may consult with him at any time.

APPENDIX G: CONTACT INFORMATION FORM – PATIENTS

PARTICIPANT CONTACT INFORMATION

This page will be removed and will be filed separately from your questionnaire

Personal Information

Surname: .... First name: ....

Date of Birth: .... Maiden name: ....
(if applicable)

Rank: .... Service Number: ....
(if applicable) (if applicable)

Preferred contact address

....

....

....

.... Postcode ....

Email address ....

Telephone numbers

Home ....

Work ....

In order to help us keep in touch with you to continue this important work, please provide the name and address of one person (other than your own or your partner's address) who is likely to know where you are in the future.

Best contact

Surname .... First name ....

Address ....

....

....

....

Postcode .... Telephone ....

Relationship to you .... Mobile ....

Email address ....

APPENDIX H: CLINICAL DATA SHEET – PATIENTS

CLINICAL DATA SHEET

PATIENT DETAILS

Gender: Male ☐[1] Female ☐[2]

Surname .... Date of birth ....

First name .... Service number ....

Maiden name *(if applicable)* .... Rank ....

INCIDENT DETAILS

Date of incident: ..../........../..........

Type of incident Combat-related ☐[1] Non combat-related ☐[2]

Incident involved....

Explosion/Blast (IED, RPG, land mine, grenade etc)	☐[1]	Vehicle	☐[5]
Fragment	☐[2]	Sport	☐[6]
Bullet	☐[3]	Other *(please specify)*	☐[7]
Fall	☐[4]	....	

Incident: Alone ☐[1] With others ☐[2]

Memory retention of incident: Full ☐[1] Partial ☐[2] None ☐[3]

How much does the memory of the incident upset you now?

Not upset ☐[1] A little upset ☐[2] Moderately upset ☐[3] Considerably upset ☐[4]

ADMISSION DETAILS

Date of admission: ..../........../..........

Reason for admission (e.g., RTA, combat-related injury etc) and injuries sustained:

....

....

....

....

Operational Injury ☐[1] Non-Operational Injury ☐[2]

CLINICAL DATA FORM 2

APPENDIX I: CONSENT FORMS – PATIENT

CONSENT FORM FOR PARTICIPANTS IN RESEARCH STUDIES

Title of Study: The identification of factors which conduce to and prevent rehabilitation and adjustment in military personnel following combat-related injury: a pragmatic evaluation of patients and their partners.

Ministry of Defence Research Ethics Committee Reference: 62/Gen/09

- The nature, aims and risks of the research have been explained to me. I have read and understood the Participant Information Sheet and understand what is expected of me. All my questions have been answered fully to my satisfaction.
- I understand that if I decide at any time during the research that I no longer wish to participate in this project, I can notify the researchers involved and be withdrawn from it immediately without having to give a reason for my withdrawal. I also understand that I may be withdrawn from it at any time, and that in neither case will this be held against me in subsequent dealings with the Ministry of Defence.
- I consent to the processing of my personal information for the purposes of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998.
- I consent to a referral being made to an appropriate professional should there be concerns about my health and functioning.
- I agree to volunteer as a subject for the study described in the information sheet and I give full consent to my participation in this study.
- This consent is specific to the particular research described in the Participant Information Sheet attached and shall not be taken to imply my consent to participate in any subsequent research or deviation from that detailed here.

Participant's Statement:

I ____

agree that the research project named above has been explained to me to my satisfaction and I agree to take part in the study. I have read both the notes written above and the Participant Information Sheet about the project, and understand what the research study involves.

Signed **Date**

Witness **Name**

Signature

Investigator's Statement:

I Kevin J Forbes

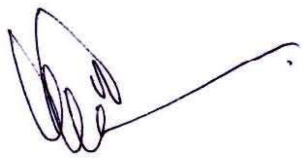
confirm that I have carefully explained the nature, demands and any foreseeable risks (where applicable) of the proposed research to the Participant.

Signed **Date**

AUTHORISING SIGNATURES

The information supplied above is to the best of my knowledge and belief accurate. I clearly understand my obligations and the rights of research participants, particularly concerning recruitment of participants and obtaining valid consent.

Signature of Principal Investigator



………………………………………………… **Date**

Name and contact details of Independent Medical Officer (if appropriate):
Surg Cdr Neil Greenberg, Senior Lecturer in Military Psychiatry,
Academic Centre for Defence Mental Health, Weston Education Centre, Cutcombe Road, London SE5 9RJ.
Tel no: 0208 848 5351; Mobile no: 07747 101 459; E-mail: sososanta@aol.com

Name and contact details of Principal Investigator:
Professor DA Alexander, Director, ACTR, Faculty of Health & Social Care,
The Robert Gordon University, Garthdee Road, Aberdeen AB10 7QG
Tel no: 01224 263 100/1; E-mail: d.a.alexander@rgu.ac.uk

APPENDIX J: ADDITIONAL CONSENT FORM – PATIENT

ADDITIONAL CONSENT FORM

It is essential that we gain accurate and complete information. We may need to clarify some of the information you provide in this study or obtain additional details from your records (perhaps about your injuries) to help our research. We need your permission to do this.

All information will be treated totally confidentially, as with all personal information you give us. All the information will be stored in strict security and no one other than the study team will have access to it now or in the future. We would also like to contact you again to continue this important work.

I agree to allow the research team access to my medical records	Yes ☐ 1	No ☐ 2
I agree to allow the research team access to my resettlement records*	Yes ☐ 1	No ☐ 2
I agree to allow the research team to contact my partner	Yes ☐ 1	No ☐ 2

***If appropriate, this includes the record of your resettlement interview, your resettlement provision and any records of your resettlement held by the Career Transition Partnership/Right Management.**

PLEASE SIGN YOUR NAME

SIGNATURE: ....

Print name: .... Date: ....

All information collected about you during the course of the research will be kept confidential as to your identity. All assessments will be issued with a study number, and the answers you give will be stored in secure conditions in accordance with the Data Protection Act (1998) and analysed anonymously. The information will be destroyed 100 years after completion of the study. Other than the members of the research team, only the clinical consultants will be aware that you have taken part in this study (should you report any personal difficulties).

No personally identifying information will be reported in publications or presented at meetings.

Participation is voluntary and you are still free to withdraw *at any time and without giving a reason*. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive. Moreover, taking part or not taking part will have no effect on your Service Career. If you do not want to answer all of the questions asked, you are free to ignore those that you do not feel comfortable with.

APPENDIX K: PROSPECTIVE PATIENT – BASELINE ASSESSMENT

01 – PG – BA

Aberdeen Centre for Trauma Research

In cooperation with

The Defence Medical Rehabilitation Centre (DMRC) Headley Court
and
The Kings Centre for Military Health Research (KCMHR)

ROBERT GORDON UNIVERSITY·ABERDEEN

STUDY INFORMATION

Thank you for agreeing to participate in this study. Previous research has shown that traumatic injury can have a considerable impact on the lives of individuals, and those around them, in terms of both physical and emotional adjustment. The purpose of this study is to gain a better understanding of the impact of combat-related injury and to identify things which help military personnel and their partners adjust to life in the longer term.

You have been invited to take part in this study because you have been admitted to DMRC: Headley Court as an inpatient for the first time for treatment of injuries that you've sustained as a member of the armed forces. These injuries may be combat related or they may be injuries you've sustained non-operationally, e.g. on exercise or during training. Overall, we will be inviting up to 340 patients who have received treatment at Headley Court to take part in this study.

Very little is currently known about the extent to which rehabilitation and follow-up care meet the needs of patients and their partners once they have been discharged from hospitals like Headley Court. This study seeks to identify ways to ensure the effective provision of the necessary support required by patients and their partners following traumatic injury. As we will want to find out how things have been for you following your discharge from Headley Court, we will contact you again in 6 and in 12 months to ask you a further set of questions over the telephone. We will also send you another one of these self-report questionnaires at each of these times for you to complete and to send back to us in the postage paid envelope provided.

Questions in this self-report questionnaire are divided into seven different sections. Section one asks questions about your background. Section two asks some general questions about your military service. Section three asks about your experience of traumatic events. Section four asks about the ways you cope with different life stresses in general. Section five asks about your general health. Section six asks more specific questions about common health problems and symptoms that you may, or may not, be experiencing and the extent to which they may affect you. Section seven closes this questionnaire by asking about your lifestyle and partner. This self-report questionnaire should take you no more than 30-45 minutes to complete.

If you have any queries about the study you can initially discuss these with the Headley Court Trust Fellow (Maj. Forbes) who can be contacted on 01224 262912 or by email at k.forbes@rgu.ac.uk. Should you have any other questions about the study which either you do not want to discuss with the research team or if you feel that the research team cannot help you, you can contact the Principal Investigator, the Independent Medical Officer, or the MoD Research Ethics Committee (MoDREC) secretariat (SIT-StrategyCollabISTA2@mod.uk or by telephone on 02072182512) and they will deal with your queries to the best of their ability.

Principal Investigator
Professor D.A. Alexander,
Director, Aberdeen Centre for Trauma Research,
Faculty of Health & Social Care,
The Robert Gordon University,
Garthdee Road,
ABERDEEN AB10 7QG

Tel no: 01224 263 100/1
E-mail: d.a.alexander@rgu.ac.uk

Independent Medical Officer
Surg Cdr Neil Greenberg,
Senior Lecturer in Military Psychiatry,
Academic Centre for Defence Mental Health,
Weston Education Centre,
Cutcombe Road,
LONDON SE5 9RJ.

Tel no: 0208 848 5351
Mobile no: 07747 101 459
E-mail: sososanta@aol.com

PARTICIPANT CONTACT INFORMATION

This page will be removed and will be stored separately from your questionnaire.

Personal Information

Surname: .... First name: ....

Date of Birth: .... Maiden name: ....
(if applicable)

Rank: .... Service Number: ....
(if applicable) (if applicable)

Preferred contact address

....

....

....

.... Postcode ....

Email address ....

Telephone numbers

Home ....

Work ....

In order to help us keep in touch with you to continue this important work, please provide the name and address of one person (other than your own or your partner's address) who is likely to know where you are in the future.

Best contact

Surname .... First name ....

Address ....

....

....

....

Postcode .... Telephone ....

Relationship to you .... Mobile ....

Email address ....

Study number: ....01/PG/........BA
Date of interview: ..../........./..........
Mode of interview: ....
Place of interview: ....

SECTION ONE – BACKGROUND INFORMATION

Thank you for agreeing to participate in this study. To begin with it would be helpful if you could provide some background information about yourself.

1.1 What is your approximate weight? *Please specify in either stones and pounds or kilograms.*

.... Stones + ... Pounds **or** .... Kilograms

1.2 What is your current relationship status? *Please place an 'X' in the appropriate box.*

Married	☐ 1	Separated	☐ 5
Living with a partner (cohabiting)	☐ 2	Divorced	☐ 6
In a long term relationship	☐ 3	Widowed	☐ 7
Single (never married)	☐ 4		

1.3 What is your highest level of education? *Please place an 'X' in the appropriate box.*

Left school before age 16 (No formal qualifications)	☐ 1	University degree	☐ 5
Left school with GCSE/CSE/O-Level or equivalent	☐ 2	Higher university degree (e.g. MSc, PhD)	☐ 6
Left school with A-Level or equivalent qualification(s)	☐ 3	Other (*please state below*)	☐
College certificate or diploma	☐ 4	....	

1.4 Do you have any children who are financially dependent on you?
If you do have financially dependent children, please specify the age, gender and whether or not they live with you by placing an 'X' in the appropriate boxes.

Not applicable ☐ 99 (*IF 'NOT APPLICABLE', PLEASE GO TO QUESTION 1.5*)

	Age[1] (years)	Gender[2] Male[1]	Female[2]	Lives with you?[3] Yes[1]	No[2]
Child 1	______	☐	☐	☐	☐
Child 2	______	☐	☐	☐	☐
Child 3	______	☐	☐	☐	☐
Child 4	______	☐	☐	☐	☐
Child 5	______	☐	☐	☐	☐
Child 6	______	☐	☐	☐	☐

1.5 **Are you currently?** *Please place an 'X' in the appropriate box.*

A Regular or on Full-Time Reserve Service (FTRS)	☐ 1
A volunteer reserve, e.g. TA, RAuxAF, RNR or RMR (mobilized or not)	☐ 2
A recalled Ex-Regular	☐ 3
Ex-Forces	☐ 4

1.6 **To the <u>nearest year</u>, how long have you served?** *Please state number of years for the appropriate category. If not applicable, please place an 'X' in the 'Not applicable' box.*

As a regular/FTRS[1]	______	Years	Not applicable	☐ 99
As a volunteer reservist[2]	______	Years	Not applicable	☐ 99

1.7 **What is your <u>current rank or equivalent</u>?** *Please place an 'X' in the appropriate box.*

Royal Navy[1]		**Army & Royal Marines**[2]		**Royal Air Force**[3]	
AB	☐ 1	Pte	☐ 6	AC/LAC/SAC/JT	☐ 11
LR	☐ 2	L/Cpl to Cpl	☐ 7	L/Cpl to Cpl	☐ 12
PO to WOI	☐ 3	Sgt to WO1	☐ 8	Sgt to WO	☐ 13
Mid to Lt Cdr	☐ 4	2Lt to Capt	☐ 9	Plt Off to Sqn Ldr	☐ 14
Cdr & above	☐ 5	Maj, Lt Col & above	☐ 10	Wg Cdr & above	☐ 15
Other *(please specify)*		Other *(please specify)*		Other *(please specify)*	
--		--		--	

NOW GO TO SECTION TWO

SECTION TWO – OPERATIONAL HISTORY

This section of the questionnaire asks about your service history and your deployment with the armed forces into operational theatres of warfare. The first part of this section asks about your military career up until now.

2.1 **Thinking about your whole career in the military up until now, have you been deployed on operations (not exercises) at any time?**

Yes ☐ 1 No ☐ 2 *(GO TO QUESTION 3.2)*

2.2 **PRIOR TO THE BEGINNING OF 2004 were you deployed on operations (not exercises) at any time?**

Yes ☐ 1

No ☐ 2 *(GO TO QUESTION 2.4)*

Not applicable ☐ 99 *(GO TO QUESTION 2.4)*

2.3 *IF 'YES', please specify which operation(s) and give approximate dates.*

....

2.4 **SINCE THE BEGINNING OF 2004, have you been deployed on operations (not exercises) at any time (including OP TELIC 3 – Nov 2003 to Apr 2004)?**

Yes ☐ 1 No ☐ 2 *(GO TO QUESTION 2.7)*

2.5 **SINCE THE BEGINNING OF 2004, which of the following major operations have you been deployed on?** *Please consider each of the options below and indicate your response by placing an 'X' in the appropriate boxes.*

Afghanistan	OP HERRICK 1 *(Oct 2004-Apr 2005)*	☐ 1
	OP HERRICK 2 *(Apr 2005-Oct 2005)*	☐ 1
	OP HERRICK 3 *(Oct 2005-Apr 2006)*	☐ 1
	OP HERRICK 4 *(Apr 2006-Oct 2006)*	☐ 1
	OP HERRICK 5 *(Oct 2006-Apr 2007)*	☐ 1
	OP HERRICK 6 *(Apr 2007-Oct 2007)*	☐ 1
	OP HERRICK 7 *(Oct 2007-Apr 2008)*	☐ 1
	OP HERRICK 8 *(Apr 2008-Oct 2008)*	☐ 1

Continued over...

2.5 ...Continued

	OP HERRICK 9 *(Oct 2008-Apr 2009)*	☐[1]
	OP HERRICK 10 *(Apr 2009-Oct 2009)*	☐[1]
	OP HERRICK 11 *or later*	☐[1]
Bosnia & Kosovo	OP OCULUS *(from 2004 onwards)*	☐[1]
Bosnia-Herzegovina	OPs RESOLUTE/LODESTAR/PALATINE *(from 2004 onwards)*	☐[1]
Gulf	OP CALASH *(from 2004 onwards)*	☐[1]
Ivory Coast	OP PHILLIS *(2004)*	☐[1]
Iraq/TELIC	OP TELIC 3 *(Nov 2003-Apr 2004)*	☐[1]
	OP TELIC 4 *(May 2004-Oct 2004)*	☐[1]
	OP TELIC 5 *(Nov 2004-Apr 2005)*	☐[1]
	OP TELIC 6 *(May 2005-Oct 2005)*	☐[1]
	OP TELIC 7 *(Nov 2005-Apr 2006)*	☐[1]
	OP TELIC 8 *(May 2006-Nov 2006)*	☐[1]
	OP TELIC 9 *(Nov 2006-May 2007)*	☐[1]
	OP TELIC 10 *(Jun 2007-Oct 2007)*	☐[1]
	OP TELIC 11 *(Nov 2007-Apr 2008)*	☐[1]
	OP TELIC 12 *(May 2008-Oct 2008)*	☐[1]
	OP TELIC 13 *(or later)*	☐[1]
Kosovo	OP AGRICOLA *(from 2004 onwards)*	☐[1]
	Deployment of Operational Readiness Force to Kosovo *(2004)*	☐[1]
Lebanon	OP HIGHBROW *(2006)*	☐[1]
Northern Ireland	OP BANNER *(from 2004 onwards)*	☐[1]
Pakistan	OP MATURIN *(2005)*	☐[1]
Other (Please specify and give approximate dates)	....	☐

SECTION TWO – OPERATIONAL HISTORY 7

2.6 SINCE THE BEGINNING OF 2004, how many months in total would you estimate that you have been on deployment?

......................months

THE REST OF THE QUESTIONS IN THIS SECTION ASK ABOUT YOUR <u>MOST RECENT</u> EXPERIENCE OF OPERATIONS.

2.7 Which was the <u>most recent</u> operation in which you were involved?
Please specify which operation(s).

....

2.8 In terms of your <u>most recent</u> operation, when did you enter theatre? *(Day/month/year)*

............/............/............

2.9 When did you exit from theatre? *(Day/month/year)*

............/............/............

2.10 In terms of your <u>most recent</u> operation, did you deploy with your parent unit?
Please place an 'X' in the appropriate box.

Yes	☐ 1	No, I didn't deploy with anyone from my unit	☐ 3
No, but I deployed with some members from my unit	☐ 2	Not applicable, did not have a parent unit	☐ 4

2.11 What was your MAIN duty during your <u>most recent</u> deployment?
Please place an 'X' in the appropriate box.

Combat	☐ 1	Military Police	☐ 12
Medical mainly Role 1 / RAP in a forward area	☐ 2	Flight Operations	☐ 13
Medical mainly in Role 2/3 facility/ Field Hospital	☐ 3	Training local army/police	☐ 14
EOD (bomb disposal)	☐ 4	CIMIC	☐ 15
Logistics/supply	☐ 5	Administrative	☐ 16
Aircrew	☐ 6	Driver	☐ 17
Engineering	☐ 7	Warfare Branch	☐ 18
Catering/chef	☐ 8	Force Protection	☐ 19
Intelligence	☐ 9	Other *(please specify below)*	☐
Communications	☐ 10		
Welfare	☐ 11	---	

2.12 Did you feel the work asked of you in theatre generally matched your trade experience and ability? *Please place an 'X' in the appropriate box.*

- Yes ☐ 1
- No, work was generally **above** my trade experience and ability ☐ 2
- No, work was generally **beneath** my trade experience and ability ☐ 3

2.13 During the deployment, how long in total were you outside your base in a hostile area? *Please place an 'X' in the appropriate box.*

- Not at all ☐ 1
- Up to one week ☐ 2
- One week to one month ☐ 3
- More than a month ☐ 4

2.14 Thinking of your most difficult experience on the deployment, do you feel that: *Please place an 'X' in the appropriate box for each of the three statements.*

Your superiors did what was expected of them[1]	Yes	☐ 1	No	☐ 2
Your colleagues did what was expected of them[2]	Yes	☐ 1	No	☐ 2
You did what was expected of you[3]	Yes	☐ 1	No	☐ 2

2.15 To what extent do you agree or disagree with the following statements with regard to how you felt during your most recent deployment? *Please indicate your responses by considering each statement and placing an 'X' in the appropriate boxes.*

	Strongly agree 1	Agree 2	Neither agree nor disagree 3	Disagree 4	Strongly disagree 5
I felt a sense of comradeship (or closeness) between myself and other people in my unit[1]	☐	☐	☐	☐	☐
I could have gone to most people in my unit if I had a personal problem[2]	☐	☐	☐	☐	☐
My seniors were interested in what I did or thought[3]	☐	☐	☐	☐	☐
I felt well informed about what was going on in my unit[4]	☐	☐	☐	☐	☐

2.16 Please indicate whether you agree or disagree with the following statements about any major problems that you may have experienced during your most recent deployment (e.g. financial or family problems at home) *Please indicate your responses by considering each statement and placing an 'X' in the appropriate boxes.*

	Agree [1]	Disagree [2]	Not Applicable [99]
I did not receive enough personal support from my family[1]	☐	☐	
I had serious financial problems[2]	☐	☐	
My partner/spouse left me[3]	☐	☐	☐
There were problems with my children[4]	☐	☐	☐
I was concerned I might lose my civilian job[5]	☐	☐	☐
I faced other major problems at home whilst deployed[6]	☐	☐	

2.17 Did the military provide any support to your spouse/partner whilst you were deployed? *(e.g. phone calls or visits, arranging 'get together' with other service families, newsletters) Please place an 'X' in the appropriate box.*

Yes, and it was enough	☐ [1]	Not applicable	☐ [99]
Yes, but it was not enough	☐ [2]	Don't know	☐ [98]
No, no support was provided	☐ [3]		

NOW GO TO SECTION THREE

SECTION THREE – YOUR EXPERIENCE OF TRAUMA

The next few questions are about traumatic events that you might have been involved in, witnessed or heard about at some time in your life. These could be traumatic events you have experienced either in a military and/or in a civilian context and that have put *you or someone close to you* at risk of serious harm or death.

3.1 **Thinking about your MOST RECENT deployment, have you had experience of the following and, if you have, how often would you estimate having had this experience?** *PLEASE CONSIDER EACH OF THE EVENTS LISTED and indicate your response by placing an 'X' in the appropriate boxes.*

CODE	EVENT	Never [1]	Once [2]	2-4 times [3]	5-9 times [4]	10+ [5]
A1	Clear/search buildings	☐	☐	☐	☐	☐
B1	Give aid to wounded	☐	☐	☐	☐	☐
C1	See personnel seriously wounded or killed	☐	☐	☐	☐	☐
D1	Come under small arms/RPG fire	☐	☐	☐	☐	☐
E1	Come under mortar/artillery fire/rocket attack	☐	☐	☐	☐	☐
F1	Experience a landmine strike	☐	☐	☐	☐	☐
G1	Experience hostility from civilians	☐	☐	☐	☐	☐
H1	Discharge your weapon in direct combat	☐	☐	☐	☐	☐
I1	Experience an IED	☐	☐	☐	☐	☐
J1	Handle bodies	☐	☐	☐	☐	☐
K1	Had a mate shot/hit who was near you	☐	☐	☐	☐	☐
L1	Encounter sniper fire	☐	☐	☐	☐	☐
M1	Experience a threatening situation and was unable to respond due to rules of engagement	☐	☐	☐	☐	☐

3.2 ***Please indicate whether you have ever experienced any of the following traumatic events as a CIVILIAN by placing an 'X' in the appropriate box.***

PLEASE CONSIDER EACH OF THE EVENTS LISTED and indicate your response (for all) by placing an 'X' in the appropriate boxes. Mark only one item for any single traumatic event you have experienced. For events that might fit more than one description, choose the one that fits best. **(**Life Events Checklist (National Centre for PTSD)**)**

Please consider your entire life (growing up as well as adulthood) and go through the whole list of events and decide whether EACH event: (a) happened to you personally, (b) was witnessed by you and happened to someone else, (c) you came to learn about it happening to someone close to you, (d) you're not sure if it fits, or (e) it doesn't apply to you.

CODE	Event	Happened to me[1]	Witnessed it[2]	Learned about it[3]	Not Sure[97]	Doesn't apply[99]
A2	Natural disaster (e.g. flood, hurricane, tornado or earthquake)	☐	☐	☐	☐	☐
B2	Fire or explosion	☐	☐	☐	☐	☐
C2	Transportation accident (e.g. car accident, boat accident, train wreck or plane crash)	☐	☐	☐	☐	☐
D2	Serious accident at work, home, or during recreational activity	☐	☐	☐	☐	☐
E2	Exposure to toxic substance (e.g. dangerous chemicals, radiation)	☐	☐	☐	☐	☐
F2	Physical assault (e.g. being attacked, hit, slapped, kicked, beaten up)	☐	☐	☐	☐	☐
G2	Assault with a weapon (e.g. being shot, stabbed, threatened with a knife, gun, bomb) **as a civilian**	☐	☐	☐	☐	☐
H2	Sexual assault (e.g. rape, attempted rape, made to perform any type of sexual act through force or threat of harm)	☐	☐	☐	☐	☐
I2	Other unwanted or uncomfortable sexual experience	☐	☐	☐	☐	☐

Continued over...

3.2 ...Continued

CODE	Event	Happened to me[1]	Witnessed it[2]	Learned about it[3]	Not Sure[97]	Doesn't apply[99]
J2	Combat or exposure to a war-zone (**as a civilian**)	☐	☐	☐	☐	☐
K2	Captivity (e.g. being kidnapped, abducted, held hostage or imprisoned)	☐	☐	☐	☐	☐
L2	Life-threatening illness or injury	☐	☐	☐	☐	☐
M2	Severe human suffering	☐	☐	☐	☐	☐
N2	Sudden, violent death (e.g. homicide, suicide)	☐	☐	☐	☐	☐
O2	Sudden, unexpected death of someone close to you	☐	☐	☐	☐	☐
P2	Serious injury, harm, or death you caused to someone else	☐	☐	☐	☐	☐
Q2	Any other very stressful event or experience	☐	☐	☐	☐	☐

3.3 In thinking about all of the traumatic events you have experienced (both military and/or civilian) which SINGLE EVENT would you consider being the WORST overall?

Please use the CODE in the left hand column of each table in questions 3.1 and 3.2 to indicate which was your 'worst' event (e.g. if the worst event for you was 'Clearing/Searching Buildings then write 'A1' below or if the worst event for you was being involved in a 'Transportation Accident' (e.g. car accident,) then please write 'C2' below.

CODE FOR WORST EVENT ....

3.4 How long ago did your worst event occur?

........................Years ....Months ....Weeks

3.5 How did you experience the worst event? *Please place an 'X' in the appropriate box.*

Happened to me ☐1 Learned about it ☐3

Witnessed it ☐2

3.6 Was anyone's life in danger? *Please place an 'X' in more than one box if appropriate.*

Yes, my life ☐1

Yes, someone else's life ☐2

No ☐3

3.7 Was anyone seriously injured or killed?
Please place an 'X' in more than one box if appropriate.

Yes, I was seriously injured ☐1

Yes, someone else was seriously injured or killed ☐2

No ☐3

3.8 Was anyone threatened with serious physical harm, even if they weren't actually injured or killed? *Please place an 'X' in more than one box if appropriate.*

Yes, I was ☐1

Yes, someone else was ☐2

No ☐3

3.9 Were there moments when you had difficulty in 'TAKING IN' what was going on or what had happened? *Please place an 'X' in the appropriate box.*

Yes, to some extent ☐1 Yes, considerably ☐2

Yes, Greatly ☐3 No ☐4

3.10 Were you trapped at any point during this event? *Please place an 'X' in the appropriate box.*

Yes ☐1 No ☐2 (*IF 'NO', PLEASE GO TO QUESTION 3.13*)

3.11 IF 'YES', for how long were you trapped? *Please specify in terms of hours and minutes.*

........................Hours ....Minutes

3.12 IF 'YES', were you alone, or with others, while you were trapped?
Please place an 'X' in the appropriate box.

Alone ☐1 With others ☐2

3.13 Did you feel terrified or horrified at what was happening?
Please place an 'X' in the appropriate box.

Yes, as the event was happening ☐[1]

Not at the time, but I did when I thought about it later ☐[2]

No ☐[3]

3.14 Did you feel completely helpless to change the situation?
Please place an 'X' in the appropriate box.

Yes ☐[1] No ☐[2]

3.15 How many times have you experienced an event as stressful as this? *Please place an 'X' in the appropriate box if the worst event was the only time, otherwise please specify the total number of times that you have experienced an event as stressful as this.*

Worst event was the only time ☐

Total Number of times......................

3.16 Below are listed a number of problems and complaints that people sometimes have in relation to stressful experiences. How much have you been bothered by these problems in the LAST MONTH? *Please indicate your response by placing an 'X' in the appropriate box.* (PTSD Checklist – Civilian Version (Blanchard et. al., 1996))

	Not at all[1]	A little bit[2]	Moderately[3]	Quite a bit[4]	Extremely[5]
Repeated, disturbing memories, thoughts, or images of a stressful experience?[1]	☐	☐	☐	☐	☐
Repeated, disturbing dreams of a stressful experience?[2]	☐	☐	☐	☐	☐
Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?[3]	☐	☐	☐	☐	☐
Feeling very upset when something reminded you of a stressful experience?[4]	☐	☐	☐	☐	☐
Having physical reactions (e.g. heart pounding, trouble breathing, sweating) when something reminded you of a stressful experience?[5]	☐	☐	☐	☐	☐

Continued over...

3.16 ...Continued

	Not at all[1]	A little bit[2]	Moderately[3]	Quite a bit[4]	Extremely[5]
Avoiding thinking about or talking about a stressful experience?[6]	☐	☐	☐	☐	☐
Avoiding activities or situations because they reminded you of a stressful experience?[7]	☐	☐	☐	☐	☐
Trouble remembering important parts of a stressful experience?[8]	☐	☐	☐	☐	☐
Loss of interest in activities that you used to enjoy?[9]	☐	☐	☐	☐	☐
Feeling distant or cut-off from other people?[10]	☐	☐	☐	☐	☐
Feeling emotionally numb or being unable to have loving feelings to those who are close to you?[11]	☐	☐	☐	☐	☐
Feeling as if your future will somehow be cut short?[12]	☐	☐	☐	☐	☐
Having trouble falling or staying asleep?[13]	☐	☐	☐	☐	☐
Feeling irritable or having angry outbursts?[14]	☐	☐	☐	☐	☐
Having difficulty concentrating?[15]	☐	☐	☐	☐	☐
Being super alert, watchful or on-guard?[16]	☐	☐	☐	☐	☐
Feeling jumpy or easily startled?[17]	☐	☐	☐	☐	☐

IF YOU HAVE ANSWERED 'NOT AT ALL' TO EVERY PROBLEM LISTED IN THE TABLE ABOVE, PLEASE PLACE AN 'X' IN THE BOX BELOW AND GO TO SECTION FOUR.

☐

IF YOU HAVE EXPERIENCED ONE OR MORE OF THE PROBLEMS LISTED IN THE TABLE ABOVE, PLEASE CONTINUE TO ANSWER THE REMAINING QUESTIONS IN THIS SECTION BY PLACING AN 'X' IN THE APPROPRIATE BOX FOR EACH QUESTION.

3.17 How difficult have the problems you have identified in table (3.16) made it for you to:

a) do your work?

Not applicable	☐ 99	Very difficult	☐ 3
Not difficult at all	☐ 1	Extremely difficult	☐ 4
Somewhat difficult	☐ 2		

b) take care of things at home?

Not applicable	☐ 99	Very difficult	☐ 3
Not difficult at all	☐ 1	Extremely difficult	☐ 4
Somewhat difficult	☐ 2		

c) get along with other people?

Not applicable	☐ 99	Very difficult	☐ 3
Not difficult at all	☐ 1	Extremely difficult	☐ 4
Somewhat difficult	☐ 2		

NOW GO TO SECTION FOUR

SECTION FOUR – COPING

4.1 **To what extent would you agree with the following statements as they apply to you over the LAST MONTH?** *If a particular situation has not occurred recently, answer accordingly to how you think you would have felt. Please indicate by placing an 'X' in the appropriate box.* (Connor Davidson Resilience Scale-10 (Conner and Davidson, 2003))

	Not true at all[0]	Rarely true[1]	Sometimes true[2]	Often true[3]	True nearly all of the time[4]
I am able to adapt when changes occur[1]	☐	☐	☐	☐	☐
I can deal with whatever comes my way[2]	☐	☐	☐	☐	☐
I try to see the humorous side of things when I am faced with problems[3]	☐	☐	☐	☐	☐
Having to cope with stress can make me stronger[4]	☐	☐	☐	☐	☐
I tend to bounce back after illness, injury, or other hardships[5]	☐	☐	☐	☐	☐
I believe I can achieve my goals, even if there are obstacles[6]	☐	☐	☐	☐	☐
Under pressure, I stay focused and think clearly[7]	☐	☐	☐	☐	☐
I am not easily discouraged by failure[8]	☐	☐	☐	☐	☐
I think of myself as a strong person when dealing with life's challenges and difficulties[9]	☐	☐	☐	☐	☐
I am able to handle unpleasant or painful feelings like sadness, fear and anger[10]	☐	☐	☐	☐	☐

We acknowledge contributions as works made for hire by Laura Campbell-Sills, Ph. D. and Murray Stein MD.

4.2 **Listed below are a number of statements about life that people often feel differently about.** *Please indicate how much you think each one is true (by placing an 'X' in the appropriate box). Give your own honest opinions. There are no 'right' or 'wrong' answers.*
(Dispositional Resilience Scale-15 (Bartone, 2007))

	Not at all[1]	A little true[2]	Quite true[3]	Completely true[4]
Most of my life gets spent doing things that are meaningful[1]	☐	☐	☐	☐
Planning ahead can help avoid most future problems[2]	☐	☐	☐	☐
I don't like to make changes in my regular activities[3]	☐	☐	☐	☐
I feel that my life is somewhat empty of meaning[4]	☐	☐	☐	☐
Changes in routine are interesting to me[5]	☐	☐	☐	☐
By working hard you can nearly always achieve your goals[6]	☐	☐	☐	☐
I really look forward to my work activities[7]	☐	☐	☐	☐
If I'm working on a difficult task, I know when to ask for help[8]	☐	☐	☐	☐
I don't think there's much I can do to influence my own future[9]	☐	☐	☐	☐
Trying your best at work is really worth it in the end[10]	☐	☐	☐	☐
It bothers me when my daily routine gets interrupted[11]	☐	☐	☐	☐
Most days, life is really interesting and exciting for me[12]	☐	☐	☐	☐
I enjoy the challenge when I have to do more than one thing at a time[13]	☐	☐	☐	☐
I like having a daily schedule that doesn't change very much[14]	☐	☐	☐	☐
When I make plans I'm certain I can make them work[15]	☐	☐	☐	☐

NOW GO TO SECTION FIVE

SECTION FIVE – YOUR GENERAL HEALTH

5.1 **Here are some general questions about your health in the LAST MONTH.** *Please answer the questions by CIRCLING the responses which you think most closely apply to you.*
(General Health Questionnaire-12 (Goldberg and Williams, 1988))

Within the LAST MONTH have you:	**0**	**1**	**2**	**3**
Been able to concentrate on whatever you're doing?[1]	Better than usual	Same as usual	Less than usual	Much less than usual
Lost much sleep over worry?[2]	Not at all	No more than usual	Rather more than usual	Much more than usual
Felt that you are playing a useful part in things?[3]	More so than usual	Same as usual	Less useful than usual	Much less useful
Felt capable of making decisions about things?[4]	More so than usual	Same as usual	Less so than usual	Much less capable
Felt constantly under strain?[5]	Not at all	No more than usual	Rather more than usual	Much more than usual
Felt you couldn't overcome your difficulties?[6]	Not at all	No more than usual	Rather more than usual	Much more than usual
Been able to enjoy your normal day to day activities?[7]	More so than usual	Same as usual	Less so than usual	Much less than usual
Been able to face up to your problems?[8]	More so than usual	Same as usual	Less able than usual	Much less able
Been feeling unhappy and depressed?[9]	Not at all	No more than usual	Rather more than usual	Much more than usual
Been losing confidence in yourself?[10]	Not at all	No more than usual	Rather more than usual	Much more than usual
Been thinking of yourself as a worthless person?[11]	Not at all	No more than usual	Rather more than usual	Much more than usual
Been feeling reasonably happy, all things considered?[12]	More so than usual	About the same as usual	Less so than usual	Much less than usual

NOW GO TO SECTION SIX

SECTION SIX– SPECIFIC HEALTH PROBLEMS

6.1 *Please indicate (by placing an 'X' in the appropriate box) whether you have had any of the following symptoms in the LAST MONTH. We would also like to know how bad the symptom has been.* (PHYSICAL SYMPTOM CHECKLIST (Unwin *et al*, 1999))

Have you had this symptom in the past month? [a]			If **yes**, how bad has it been? [b]		
	Yes[1]	No[2]	Mild[1]	Moderate[2]	Severe[3]
Chest pain[1]	☐	☐	☐	☐	☐
Headaches[2]	☐	☐	☐	☐	☐
Rapid heartbeat[3]	☐	☐	☐	☐	☐
Irritability/outbursts of anger[4]	☐	☐	☐	☐	☐
Unable to breathe deeply enough[5]	☐	☐	☐	☐	☐
Faster breathing than normal[6]	☐	☐	☐	☐	☐
Feeling short of breath at rest[7]	☐	☐	☐	☐	☐
Wheezing[8]	☐	☐	☐	☐	☐
Sleeping difficulties[9]	☐	☐	☐	☐	☐
Feeling jumpy/easily startled[10]	☐	☐	☐	☐	☐
Feeling un-refreshed after sleep[11]	☐	☐	☐	☐	☐
Fatigue[12]	☐	☐	☐	☐	☐
Double vision[13]	☐	☐	☐	☐	☐
Intolerance to alcohol[14]	☐	☐	☐	☐	☐
Itchy or painful eyes[15]	☐	☐	☐	☐	☐
Shaking[16]	☐	☐	☐	☐	☐
Tingling in fingers and arms[17]	☐	☐	☐	☐	☐
Tingling in legs and toes[18]	☐	☐	☐	☐	☐
Numbness in fingers/toes[19]	☐	☐	☐	☐	☐
Feeling distant or cut off from others[20]	☐	☐	☐	☐	☐
Constipation[21]	☐	☐	☐	☐	☐
Flatulence or burping[22]	☐	☐	☐	☐	☐
Stomach cramp[23]	☐	☐	☐	☐	☐
Diarrhoea[24]	☐	☐	☐	☐	☐

Continued…

6.1 ...Continued

Have you had this symptom in the past month? [a]			If **yes**, how bad has it been? [b]		
	Yes[1]	No[2]	Mild[1]	Moderate[2]	Severe[3]
Dry mouth[25]	☐	☐	☐	☐	☐
Persistent cough[26]	☐	☐	☐	☐	☐
Lump in throat[27]	☐	☐	☐	☐	☐
Sore throat[28]	☐	☐	☐	☐	☐
Forgetfulness[29]	☐	☐	☐	☐	☐
Dizziness[30]	☐	☐	☐	☐	☐
Feeling disorientated[31]	☐	☐	☐	☐	☐
Loss of concentration[32]	☐	☐	☐	☐	☐
Pain on passing urine[33]	☐	☐	☐	☐	☐
Passing urine more often[34]	☐	☐	☐	☐	☐
Burning sensation in the sex organs[35]	☐	☐	☐	☐	☐
Loss of interest in sex[36]	☐	☐	☐	☐	☐
Increased sensitivity to noise[37]	☐	☐	☐	☐	☐
Increased sensitivity to light[38]	☐	☐	☐	☐	☐
Ringing in the ears[39]	☐	☐	☐	☐	☐
Avoiding doing things/situations[40]	☐	☐	☐	☐	☐
Pain, without swelling or redness in several joints[41]	☐	☐	☐	☐	☐
Joint stiffness[42]	☐	☐	☐	☐	☐
Night sweats which soak the bedsheets[43]	☐	☐	☐	☐	☐
Feeling feverish[44]	☐	☐	☐	☐	☐
Loss or decrease in appetite[45]	☐	☐	☐	☐	☐
Nausea[46]	☐	☐	☐	☐	☐
Vomiting[47]	☐	☐	☐	☐	☐
Distressing dreams[48]	☐	☐	☐	☐	☐
Stomach bloating[49]	☐	☐	☐	☐	☐
Unintended weight gain greater than 10lbs[50]	☐	☐	☐	☐	☐
Unintended weight loss greater than 10lbs[51]	☐	☐	☐	☐	☐

NOW GO TO SECTION SEVEN

SECTION SEVEN– YOUR HEALTH AND LIFESTYLE

This section of the questionnaire asks a number of questions about your lifestyle and its effects on your health. *Please consider each of the questions below. It is important that you provide as truthful answers as possible. Remember that responses to these questions are confidential and no one other than the research team will have access to this data.*

7.1 How often do you have a drink containing alcohol?
Please place an 'X' in the appropriate box.

Never	☐ 1	2 times a week	☐ 4
Monthly or less	☐ 2	3 times a week	☐ 5
2-4 times per month	☐ 3	4 times or more a week	☐ 6

IF YOU ANSWERED 'NEVER' TO QUESTION 7.1, PLEASE GO TO QUESTION 7.11 OTHERWISE PLEASE CONTINUE BY ANSWERING THE FOLLOWING QUESTIONS.

7.2 How many UNITS of alcohol do you have on a typical day when you are drinking?
Please place an 'X' in the appropriate box.

1 or 2	☐ 1	10 to 14	☐ 5
3 or 4	☐ 2	15 to 19	☐ 6
5 or 6	☐ 3	20 to 29	☐ 7
7 to 9	☐ 4	30 or more	☐ 8

A pint of standard beer / lager = 2 units	A single measure of spirit / small glass of wine = 1 unit
A pint / can of strong beer / lager = 3 units	A bottle of alcopop (e.g. Smirnoff Ice) = 1.5 units

7.3 How often do you have six or more units on one occasion?
Please place an 'X' in the appropriate box.

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.4 How often during the PAST YEAR have you found that you were not able to stop drinking once you had started? *Please place an 'X' in the appropriate box.*

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.5 How often during the PAST YEAR have you failed to do what was normally expected of you because of drinking? *Please place an 'X' in the appropriate box.*

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.6 How often during the PAST YEAR have you needed a first drink in the morning to get yourself going after a drinking session? *Please place an 'X' in the appropriate box.*

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.7 How often during the PAST YEAR have you had a feeling of guilt or remorse after drinking? *Please place an 'X' in the appropriate box.*

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.8 How often during the PAST YEAR have you been unable to remember what happened the night before because you had been drinking? *Please place an 'X' in the appropriate box.*

Never	☐ 1	Weekly	☐ 4
Less than monthly	☐ 2	Daily / almost daily	☐ 5
Monthly	☐ 3		

7.9 Have you or someone else been injured as a result of your drinking?
Please place an 'X' in the appropriate box.

Yes, I have, but not in the past year	☐ 1	Yes, someone else has, but not in the past year	☐ 3
Yes, I have during the past year	☐ 2	Yes, someone else has during the past year	☐ 4
No	☐ 5		

7.10 Has a relative / friend / health worker been concerned about your drinking / suggested you cut down? *Please place an 'X' in the appropriate box.*

No ☐1

Yes, but not in the past year ☐2

Yes, during the past year ☐3

7.11 Do you currently smoke? *Please place an 'X' in the appropriate box.*

Yes ☐1 No ☐2 *(IF 'NO', PLEASE GO TO QUESTION 7.13)*

7.12 IF 'YES', how many cigarettes, cigars or rollups do you smoke a day? **............**per day

THE NEXT SET OF QUESTIONS IS ABOUT YOUR SOCIAL LIFE AND RELATIONSHIPS BEFORE YOUR INJURY.

7.13 Before your injury, which of the following organisations did you belong to or which social activities did you regularly choose to do outside of work?
Please place an 'X' in the appropriate boxes.

Team sports or outdoor pursuits	☐1	Going to pubs/clubs	☐7
Further education	☐2	Going to watch sporting events with friends	☐8
Religious gatherings / societies	☐3	Going to the gym with friends	☐9
Social or hobby-related clubs	☐4	Other*(please specify)*	☐
Voluntary services	☐5		
Visiting family/friends	☐6	--	

7.14 Were most of the people you socialised with involved with the military?
Please place an 'X' in the appropriate box.

Yes ☐1 No ☐2

7.15 Overall how satisfied were you with your marriage/relationship?
Please place an 'X' in the appropriate box.

Extremely satisfied	☐1	Dissatisfied	☐4
Satisfied	☐2	Extremely dissatisfied	☐5
Neither satisfied or dissatisfied	☐3	Not applicable	☐99

7.16 Have you or your spouse/partner seriously suggested the idea of divorce or permanent separation within the LAST YEAR?

Yes	☐ 1
No	☐ 2
Not applicable	☐ 99

THESE FINAL TWO QUESTIONS ARE CONCERNED WITH HOW YOU CURRENTLY VIEW YOUR MARRIAGE/ RELATIONSHIP.

7.17 Overall how satisfied are you with your marriage/relationship?
Please place an 'X' in the appropriate box.

Extremely satisfied	☐ 1	Dissatisfied	☐ 4
Satisfied	☐ 2	Extremely dissatisfied	☐ 5
Neither satisfied or dissatisfied	☐ 3	Not applicable	☐ 99

7.18 *Please read each question carefully. You will notice that below the question is a line with two extreme answers, one at each end. Please place an 'X' on the line which represents how you feel about the question.*

How critical of you is the person closest to you? [1]

Very Critical											Not at all

How critical are you of the person closest to you? [2]

Very Critical											Not at all

How satisfactory is the emotional support you get from those closest to you? [3]

Very Good											Very Poor

How satisfactory is the practical support you get from those closest to you? [4]

Very Good											Very Poor

What type of support do you expect to get following your trauma? [5]

Very Good											Very Poor

THANK YOU FOR COMPLETING THIS QUESTIONAIRE
WE WILL BE IN CONTACT WITH YOU AGAIN IN SIX MONTHS

[redacted]

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[redacted]

[redacted]

APPENDIX L: SUMMARY OF SOCIODEMOGRAPHIC CHARACTERISTICS

Overall study sample (*n*=112)	n	(%)
Gender		
Male	111	(99.10)
Female	1	(0.10)
Ethnicity		
White: British	98	(87.50)
Black or Black British: African	5	(4.46)
Asian or Asian British: Other	4	(3.57)
White: Irish	4	(3.57)
White: Other	1	(0.89)
Age (Years) (Mean=26.21 years)		
<20	7	(6.25)
20-24	39	(34.82)
25-29	41	(36.60)
30-34	16	(14.29)
35-39	6	(5.36)
40-44	1	(0.89)
45-49	1	(0.89)
50-54	0	(0.00)
55-59	1	(0.89)
>60	0	(0.00)
Highest Level of Educational Attainment		
Left school with GCSE/CSE/O-Level or equivalent	43	(38.39)
College certificate or diploma	21	(18.75)
Left school before age 16 (No formal qualifications)	17	(15.18)
Left school with A-Level or equivalent qualification(s)	17	(15.18)
University degree	10	(8.93)
Higher university degree (e.g. MSc, PhD)	1	(0.89)
City and Guilds Certificate	1	(0.89)
Overseas Qualification (Nepal)	1	(0.89)
Certificate of Higher Education	1	(0.89)
Relationship Status		
Single (never married)	33	(29.50)
In a long term relationship	32	(28.60)
Married	30	(26.80)
Living with a partner (cohabiting)	12	(10.70)
Separated	2	(1.80)
Divorced	3	(2.70)
Financially Dependent Children		
No Children	83	(74.10)
One Child	15	(13.40)
Two Children	9	(8.00)
Three Children	3	(2.70)
Four Children	1	(0.90)
Five Children	0	(0.00)
Six Children	1	(0.90)

APPENDIX M: SUMMARY OF MILITARY CHARACTERISTICS

Overall study sample (*n*=112)	n	(%)
Type of Service		
Regular / Full-Time Reserve Service (FTRS)	104	(92.9)
Reserve Service	8	(7.1)
Branch of Service		
Army and Royal Marines	109	(97.3)
Royal Air Force	3	(2.7)
Royal Navy	0	(0.0)
Military Rank		
Other Ranks – Private/ AC/LAC/SAC/JT	55	(49.1)
Junior Non-Commissioned Officers (JNCOs)	35	(31.3)
Senior Non-Commissioned Officers (SNCOs)	11	(9.8)
Commissioned Officers	11	(9.8)
Length of Service		
Regular		
<5 Years	54	(48.2)
5 to 9 Years	33	(29.5)
10 to 14 Years	16	(14.3)
15 to 19 Years	5	(4.5)
>20 Years	4	(3.6)
Reserve		
<5 Years	3	(2.7)
5 to 9 Years	1	(.9)
10 to 14 Years	1	.(9)
>20 Years	2	(1.8)
Number of Operational Deployments		
Regular		
Never Deployed	3	(2.9)
One Tour	48	(46.2)
Two Tours	30	(28.8)
Three Tours	14	(13.5)
Four Tours	5	(4.8)
Five Tours	4	(3.8)
Reserves		
One Tour	5	(62.5)
Two Tours	1	(12.5)
Three Tours	2	(25.0)
Deployed Role (Did it match your trade Experience?)		
Yes	98	(87.5)
No, Work was generally ABOVE my trade experience	7	(6.3)
No, Work was generally BENEATH my trade experience.	5	(4.5)

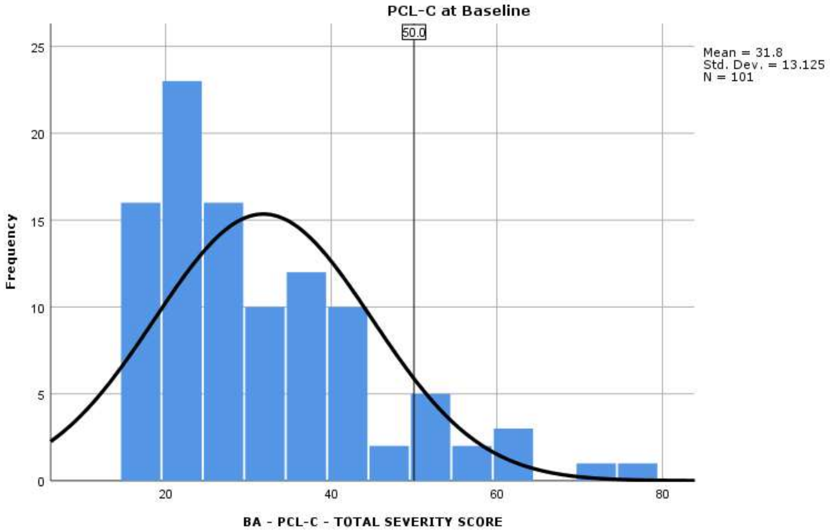
APPENDIX N: SUMMARY OF PHYSICAL HEALTH CHARACTERISTICS

Overall study sample (*n*=112)	n	(%)
Type of Incident		
Combat related	(98)	(87.5)
Non-combat related	(14)	(12.5
Nature of Incident		
Explosion / Blast (IED, RPG, APM, Grenade)	(75)	(67.0)
Bullet	(24)	(21.4)
Vehicle	(7)	(6.3)
Fall	(2)	(1.8)
Sport	(1)	(.9)
Alcohol Related	(1)	(.9)
Other	(2)	(1.8)
Pain		
Have not experienced pain in the last month	79	(70.5)
Have experienced pain in the last month	33	(29.5)
Experience of pain in the last month		
Mild	10	(8.9)
Moderate	15	(13.4)
Severe	8	(7.1)
Tobacco Use		
Never Smoked	72	(71.3)
<5 cigarettes, cigars or roll-ups per day	3	(2.9)
5-9 cigarettes, cigars or roll-ups per day	4	(4.0)
10 - 19 cigarettes, cigars or roll-ups per day	16	(15.8)
>20 cigarettes, cigars or roll-ups per day	3	(3.0)
Alcohol Use (See Chapter Seven)		
Drink Alcohol	69	(67.3)
Never Drink Alcohol	22	(21.8)
No Response	11	(10.9)

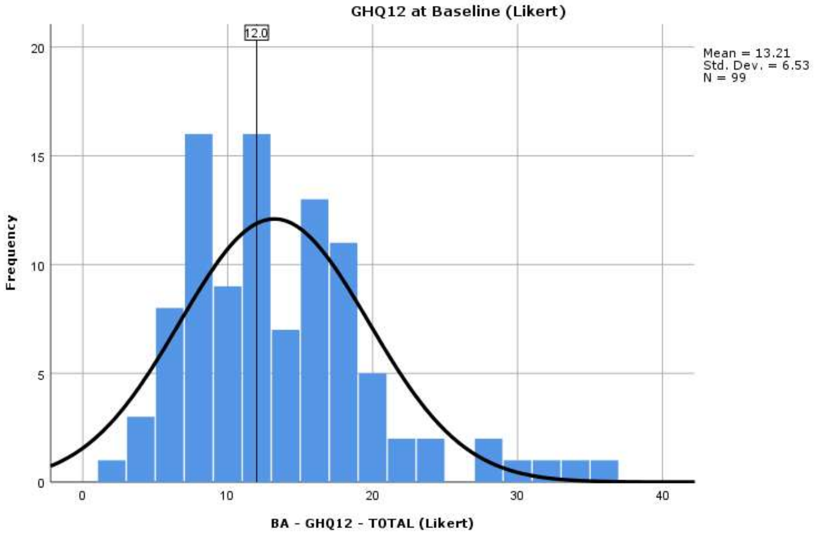
APPENDIX O: SUMMARY OF PSYCHOLOGICAL HEALTH CHARACTERISTICS

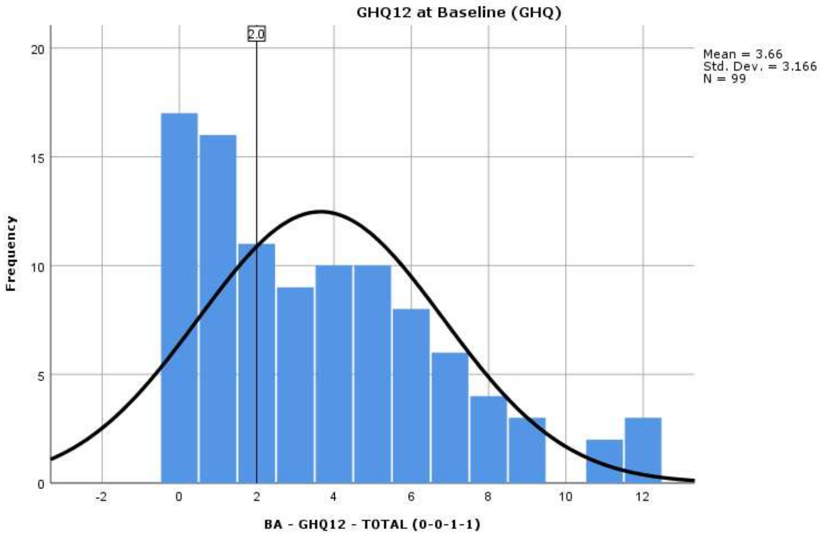
Overall study sample (*n*=112)	n	(%)
Comradeship, "I felt a sense of comradeship"		
Strongly agree	71	(70.3)
Agree	21	(20.8)
Neither agree or disagree	4	(4.0)
Disagree	2	(2.0)
Strongly disagree	1	(1.0)
Social Support (Score 1 = 'Very Good', Score 9 = 'Very Poor'		
1 = 'Very Good'	49	(48.5)
2	19	(18.8)
3	9	(8.9)
4	5	(5.0)
5	5	(5.0)
6	1	(1.0)
8	1	(1.0)
7	0	(0.0)
9 = 'Very Poor'	1	(1.0)

APPENDIX P: PCL-C DISTRIBUTION

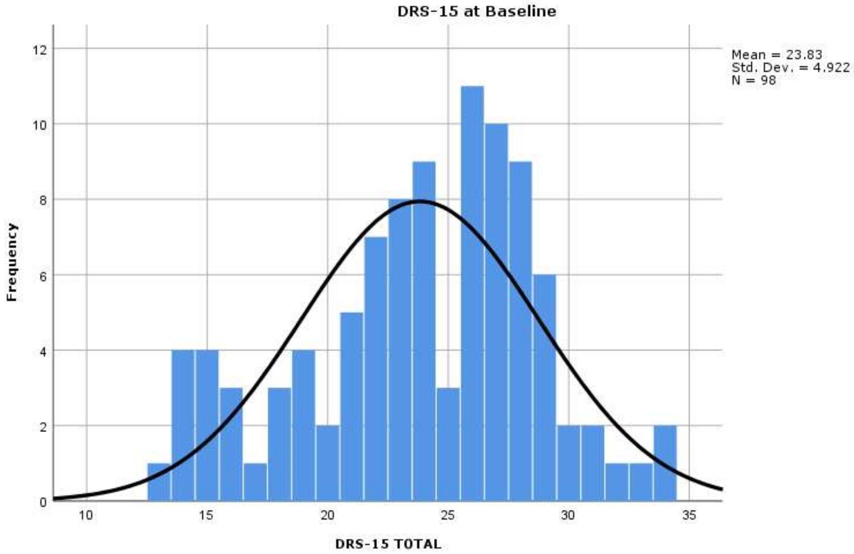


APPENDIX Q: GHQ-12 DISTRIBUTION





APPENDIX R: DRS-15 BASELINE



APPENDIX S: CD-RISC-10 BASELINE