TRANSITION AND WELLBEING RESEARCH PROGRAMME

IMPACT OF COMBAT STUDY

Impact of Combat

Summary Report

2019

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Other key organisation

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Context

The Impact of Combat Study is one of three studies in the Transition and Wellbeing Research Programme. It examines changes over time in the mental, physical and neurocognitive health and wellbeing of service men and women who participated in of the Middle East Area of Operations Prospective Health Study (Davy et al., 2012), having deployed to the MEAO between 2010 and 2012. This summary report provides a broad overview of the findings of the technical report. The findings should be considered in the context of previous Australian and international research into mental health and wellbeing in both military and veteran populations, as well as other studies and associated reports arising from the Transition and Wellbeing Research Programme.

Previous studies and reports from the Transition and Wellbeing Research Programme

The Programme responds to important research priorities of the Departments of Defence and Veterans' Affairs in three studies: the Mental Health and Wellbeing Transition Study, the Impact of Combat Study and the Family Wellbeing Study. The first report from the Mental Health and Wellbeing Transition Study, the *Mental Health Prevalence Report* (Van Hooff et al., 2018), detailed the prevalence of mental disorders among Transitioned ADF members (members who had transitioned from full-time service between 2010 and 2014) according to a number of factors – their transition status (that is, whether they were ex-serving or still in some form of Reserve service) and various other demographic, service-related and transition-related factors (Van Hooff et al., 2018).

It is of note that mental disorder morbidity among the Transitioned ADF members was high: 46% were estimated to have a 12-month mental disorder and more than half were found to have at least one mental disorder comorbidity. Furthermore, Ex-Serving ADF members reported higher rates of affective disorders (32.9%) relative to Active Reservists (12.5%; OR = 4.5) and Inactive Reservists (17.0%; OR = 2.0). Ex-Serving ADF members (44.6%) were also more likely to report an anxiety disorder than Active Reservists (31.9%; OR: 2.3) or Inactive Reservists (29.5%; OR: 1.7). Together, these patterns of higher morbidity among Ex-Serving members compared with Reservists suggest that Reservist status is in part a proxy for health: ADF members who were completely discharged were more likely to have mental health problems. These findings are also consistent with the proposal that mental symptoms and disorder emerge with the passage of time, and the further along the path to transition ADF members are the greater the likelihood of disorder emerging.

The second report from the Mental Health and Wellbeing Study, the *Pathways to Care Report* (Forbes et al., 2018), focused on patterns of self-reported help seeking among Transitioned ADF members and members still serving in the Regular (full-time) ADF in 2015. The study found that 64% of Transitioned ADF and 52% of 2015 Regular ADF had had concerns about their mental health in their lifetime. Of those with such concerns, a relatively high proportion, three in four, had sought assistance. Among these help seekers, 41% of Transitioned ADF and 46% of 2015 Regular ADF reported receiving care currently or in the preceding 12 months. Among those with a current probable 30-day disorder, a substantial 84% of Transitioned ADF members with a mental health concern had sought care in their lifetime, and 75% of these members reported receiving care currently or in the preceding 12 months – that is, 63% of the total had a concern or probable 30-day disorder. Among the 2015 Regular ADF, 81% of those with a probable 30-day disorder had sought care in their lifetime. As would be expected, rates of current or recent health service contacts were still substantial but lower in Transitioned ADF and 2015 Regular ADF who reported 'ever' having a mental health concern but no current probable 30-day disorder (38% and 56% respectively).

Overall, the findings reflect high rates of contact with care services for members with mental health concerns – far exceeding the care-seeking rates in the general Australian community for people with mental health problems (Slade et al., 2009) and consistent with the high rates reported in the 2010 Mental Health Prevalence

and Wellbeing Study (McFarlane et al., 2011) and the upper range of care seeking reported in international veteran and military studies.

As for the time taken to seek care after the onset of a mental health concern, 45% of Transitioned ADF members sought care within three months of onset of their concern and another 25% between three months and a year. Somewhat in contrast, in the case of members with a probable 30-day disorder, only 37% sought care within three months of becoming concerned and 18% waited three or more years. Among the implications of delayed care seeking are the potential exacerbation of symptoms or progression of the disorder with time – a factor that may also contribute to delayed-onset posttraumatic stress disorder, which has been shown to be more common in military populations.

Background to this study

It is well documented that a range of mental disorders, as well as physical symptoms and conditions, are associated with military service and in particular deployment and combat exposure (Donoho et al., 2017). Furthermore, there is substantial evidence that military service may be associated with the delayed onset of many conditions, including posttraumatic stress disorder (Andrews et al., 2007; Donoho et al., 2017). In any occupation where there is a likelihood of repeated exposure to stress it is important to document the effects of this in the longer term. Although the majority of people will remain resilient in the face of traumatic exposures, health effects often may not become manifest until many years later (Carty et al., 2006; Grieger et al., 2006; Orcutt et al., 2004; Solomon et al., 1990; Southwick et al., 1995): a number of studies now show that an extensive period can elapse before these delayed health impacts emerge (Eekhout et al., 2016; Marmar et al., 2015; Vasterling et al., 2016).

At the time of the MEAO Prospective Study, Australia had been at war in Afghanistan for over a decade – twice the duration of World War 2 – and more than 24,000 Australian troops had deployed to the MEAO (Middle East Area of Operations), many several times (Davy et al., 2012). War and combat have been shown to be associated with adverse health outcomes beyond just acute combat-related injuries (Hyams et al., 1996), including longer term biological dysregulation and the emergence of health effects many years after exposure. In the past decade a range of non–battle related injuries have been linked to combat stress; these include psychiatric disorders such as depression, PTSD and anxiety, as well as somatic conditions such as chronic fatigue syndrome, fibromyalgia and chronic pain (Holdeman, 2009; McFarlane, 2010).

The MEAO Prospective Study was designed to examine the impacts of deployment and combat exposure on a wide range of health aspects relevant to deployed military populations. By collecting both subjective and objective information and using a longitudinal design, the study sought to redress a number of methodological limitations associated with other studies of this nature and allowed for the examination of health outcomes over time (Davy et al., 2012). The study assessed a cohort of 1871 Regular ADF members before and after an index deployment to the MEAO, establishing a baseline cohort, whereby participants' pre-deployment data could be used as a yardstick against which to measure subsequent change. The data were intended to establish a baseline for future health surveillance. A subgroup of participants who had been deployed in combat roles were also assessed using a range of objective physical measures. Another nested subgroup, with the highest probability of combat exposures, were further assessed using neurocognitive measures. This subgroup was targeted because they had been deployed as part of either the Special Operations Task Group or the Mentoring Task Force and were deemed likely to have extensive combat and blast exposure.

In 2015 the Impact of Combat Study followed up all participants from the MEAO Prospective Study; this represents the third wave of data collection on this cohort. It was up to four years since the previous assessment of the participants. This is a crucial period following deployment: by this time any initial dysregulation of biological systems may have begun to be evident in a decline in health status (McFarlane, 2010). The physical and biological data collected for the MEAO Prospective Study and again for the Impact of Combat Study allowed an examination of such changes and also allowed comparisons to be made between individuals with differing levels of exposure to combat and blast injury. It was hypothesised that the exposures

and stresses related to deployment would lead to a pattern of subclinical dysregulation or shifts in homeostatic regulation of various biological systems that, with the passage of time, could potentially become manifest in emerging physical and psychological symptoms and disorder.

Aims, objectives and scope of this report

The key purpose of the Impact of Combat Study was to follow up on the mental, physical and neurocognitive health and wellbeing of participants who deployed to the MEAO between 2010 and 2012. Thus the study aimed to do the following:

- detect early shifts in and emergence of illness, so that they can be targeted in treatment and prevention strategies. In the early stages of illness, physiological systems are far more amenable to reregulation prior to complications and chronic manifestations of illness being observed. Thus, it is important to detect subsyndromal change and mild illness as early as possible.

- to document the prevalence of traumatic brain injury (TBI) and associated comorbidities through an examination of deployment, combat exposure and exposure to blast injury, and a pilot neuroimaging study of combat troops with exposure to blast and other deployment related traumas.

The Impact of Combat Study addresses these aims through the following objectives:

1. To investigate the longitudinal course of mental disorder in ADF members deployed to the MEAO between June 2010- June 2012;

2. To characterise both the deployment and non-deployment risk factors associated with poor longitudinal mental health outcomes following deployment to the MEAO. This includes an investigation of the role of combat exposure in the development of disorder over time.

3. To examine the long-term trajectory for resilient ADF members following deployment to the MEAO;

4. To examine the interaction between pre-deployment trauma and deployment-related trauma on longitudinal mental and physical health outcomes of MEAO deployed ADF members; and

5. To investigate deployment-related mild traumatic brain injury (mTBI).

To address these objectives, the study examined the following:

- the long-term physical and psychological health consequences of deployment-related traumatic exposure
- psychological, physical and neurocognitive health consequences of combat exposure
- the prevalence of mild traumatic brain injury in the study cohort and additional data obtained from magnetic resonance imaging to verify
  - the presence (or absence) or neural injury/damage
  - whether measurable cognitive deficits and psychological symptoms reflect cortical changes.

The key findings in summary

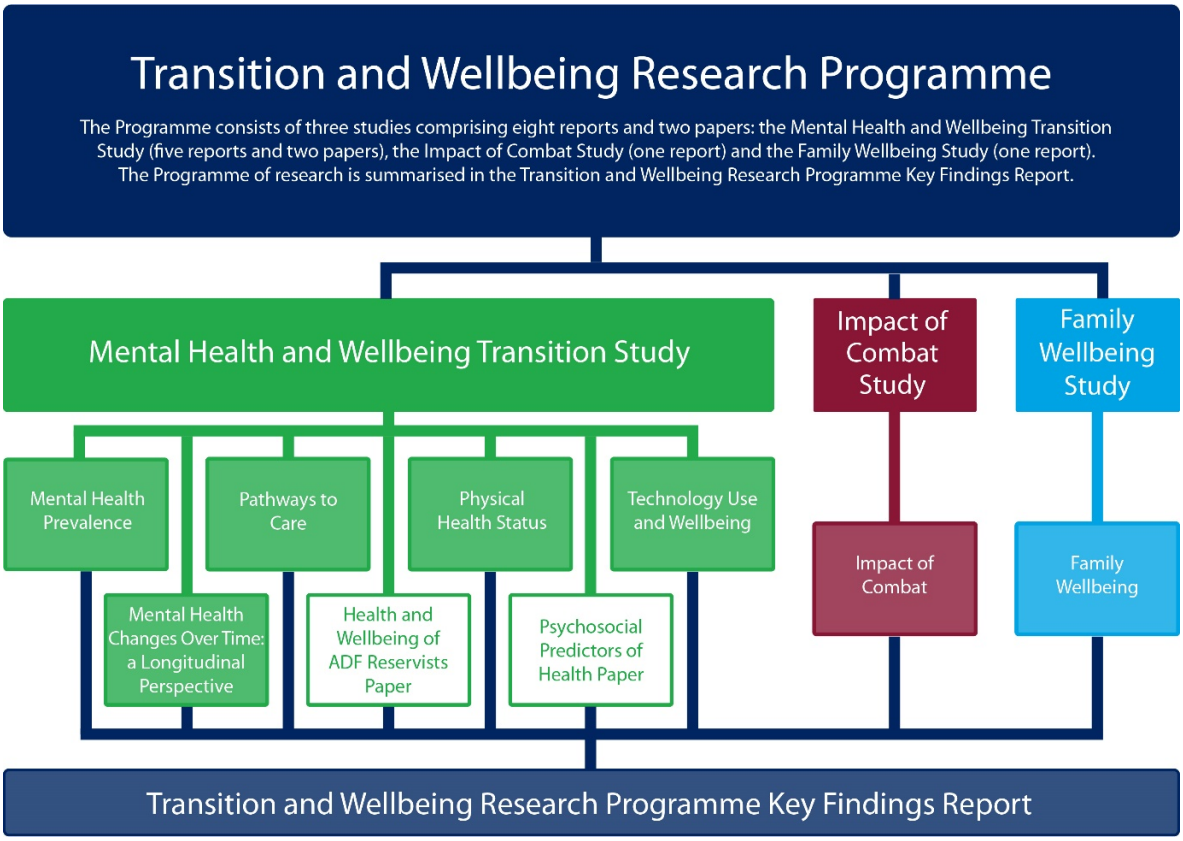
The Impact of Combat Study represents the third wave of data collection on the MEAO Prospective Study cohort. The intent of the Prospective Study was to document the health and functioning of a healthy deploying cohort of ADF members with a view to examining changes in their health over time. It was not anticipated to find shifts towards disease or disorder would be evident immediately post-deployment in more than a small proportion of the personnel. Rather, the study afforded an opportunity to document exposures on deployment, the subsequent minor recruitment of symptoms on repatriation, and how these effects of combat exposure and deployment may develop over time. The Impact of Combat Study represents the second longitudinal follow-up of this cohort post-deployment.

The Impact of Combat Study findings show that the majority of cohort members remain healthy and largely asymptomatic, although this proportion has reduced with time for most health outcomes. Rates of psychological and physical symptoms and disorder have increased with time in the cohort, despite most people remaining below screening thresholds. Of importance, however, are the shifts in symptoms documented and the increased proportion of the cohort scoring above screening thresholds.

In the broader cohort, as well as in the nested subgroups, there were clear differences in the symptom trajectories of members who were more psychologically symptomatic in 2015 compared with members who remained relatively symptom free. In some cases the pattern of change over time was in fact opposite between the symptomatic and healthy subgroups – for example, those with low versus elevated psychological symptoms exhibited contrasting patterns of some biological and neurocognitive markers over time – highlighting the importance of these subgroup examinations. Furthermore, in predictive analyses of self-reported data and in descriptive analyses of objective neurocognitive data, there was evidence of distinct trajectories for subgroups exhibiting elevated psychological distress as opposed to posttraumatic stress symptoms. In relation to the impacts of deployment more specifically, on both self-reported and objective measures even relatively minor shifts at post-deployment could represent earlier indicators of risk for the future emergence of subsyndromal or diagnosable mental disorder.

Taken together, these findings highlight the importance of documenting changes in psychological symptoms and the recruitment of symptoms over time, across multiple domains, rather than focusing only on screening and diagnostic cut-offs. They also underscore the role of cumulative trauma exposure – experienced while on deployment and in service – in affecting longer term mental health outcomes.

1 Background



The Transition and Wellbeing Research Programme is the most comprehensive study undertaken in Australia to examine the impact of military service on the mental, physical and social health of:

- serving and ex-serving Australian Defence Force members, including those who have been deployed in contemporary conflicts, and
- their families.

This research further extends and builds on the findings of the world-leading research conducted with current serving members of the ADF in the 2010 Military Health Outcomes Program, or MilHOP.

The current research, conducted in 2015, arose from a collaborative partnership between the Department of Veterans' Affairs and the Department of Defence. It aims to implement the government's goal of ensuring that current and future policy, programs and services are responsive to the current and emerging health and wellbeing needs of serving and ex-serving ADF members and their families before, during and after transition from military life.

Ten objectives were developed to guide the Programme. These objectives are realised through three studies comprising eight reports: the Mental Health and Wellbeing Transition Study (five reports and two papers), the Impact of Combat Study (one report), the Family Wellbeing Study (one report consisting of quantitative and qualitative parts) and the *Transition and Wellbeing Research Programme Key Findings Report*, which summarises the research, as the diagram above shows. The table below shows which reports deliver on the objectives. This report, the *Impact of Combat Summary Report*, addresses the ninth objective, which was to

follow up on the mental, physical and neurocognitive health and wellbeing of participants who deployed to the Middle East Area of Operations between 2010 and 2012.

Programme objectives	Corresponding reports and papers
1. Determine the prevalence of mental disorders among ADF members who have transitioned from Regular ADF service between 2010 and 2014. 2. Examine self-reported mental health status of Transitioned ADF and the 2015 Regular ADF.	*Mental Health Prevalence Report*
3. Assess pathways to care for Transitioned ADF and the 2015 Regular ADF, including those with a probable 30-day mental disorder.	*Pathways to Care Report*
4. Examine the physical health status of Transitioned ADF and the 2015 Regular ADF.	*Physical Health Status Report*
5. Investigate technology and its utility for health and mental health programmes including implications for future health service delivery.	*Technology Use and Wellbeing Report*
6. Conduct predictive modelling of the trajectory of mental health symptoms/disorder of Transitioned ADF and the 2015 Regular ADF, removing the need to rely on estimated rates.	*Mental Health Changes Over Time: a Longitudinal Perspective Report*
7. Investigate the mental health and wellbeing of currently serving 2015 Ab-initio Reservists.	*The Health and Wellbeing of ADF Reservists Paper*
8. Examine the factors that contribute to the wellbeing of Transitioned ADF and the 2015 Regular ADF.	*Psychosocial Predictors of Health Paper*
9. Follow up on the mental, physical and neurocognitive health and wellbeing of participants who deployed to the Middle East Area of Operations between 2010 and 2012.	*Impact of Combat Report*
10. Investigate the impact of ADF service on the health and wellbeing of the families of Transitioned ADF and the 2015 Regular ADF.	*Family Wellbeing Study*
All objectives	*Transition and Wellbeing Research Programme Key Findings Report*

Two eminent Australian research institutions, one specialising in trauma and the other in families, have led the Programme. The Centre for Traumatic Stress Studies at the University of Adelaide is conducting the Mental Health and Wellbeing Transition Study and the Impact of Combat Study, and the Australian Institute of Family Studies is conducting the Family Wellbeing Study.

The institutions' research expertise is enhanced through partner institutions from Monash University, the University of New South Wales, Phoenix Australia Centre for Posttraumatic Mental Health and, until June 2016, the Young and Well Cooperative Research Centre, the work of which is being continued at the University of Sydney.

Through surveys and interviews the researchers engaged with a range of ex-serving and serving ADF members, including:

- ADF members who transitioned from the Regular ADF between 2010 and 2014 (including Ex-Serving, Active and Inactive Reservists)
- a random sample of Regular ADF members serving in 2015
- a sample of Ab-initio Reservists serving in 2015 (who have never been full-time ADF members)
- 2015 Regular ADF and Transitioned ADF members who participated in MilHOP
- family members nominated by the above.

DVA and Defence thank the current and ex-serving ADF members and their families who participated in this research for sharing your experiences and insights. Your efforts will help inform and assist the ways you, your colleagues, friends and families, as well as those who come after you, can best be supported during and after your military career.

2 Methodology

2.1 Study design

The Impact of Combat Study was rolled out in concert with the Mental Health and Wellbeing Transition Study and served as an interim time point in the longitudinal surveillance of the MEAO Prospective Study cohort. All participants who completed a pre-deployment survey (Time 1) and/or a post-deployment survey (Time 2) as part of the MEAO Prospective Study were invited to complete a survey as part of the current investigation (Time 3). Participants who were identified as having engaged in high-risk roles and were therefore likely to experience deployment-related trauma or blast injury underwent neurocognitive and/or biological testing as part of the MEAO Prospective Study; they were invited to do so again, in addition to the self-report survey. A further subgroup of personnel identified as having self-reported blast injury at Time 1, 2 or 3 were targeted to undergo magnetic resonance imaging testing in addition to the study components just listed. Finally, all three nested subgroups were also invited to participate in a structured diagnostic interview.

2.2 Study sample

The current report uses one of the Programme's six overlapping samples – sample 5, the MEAO Deployed Cohort.

2.2.1 Sample 5: MEAO Deployed Cohort[1]

The study sample consisted of 1350 Regular and Transitioned ADF members who deployed to the MEAO after June 2010, returned before June 2012, completed a pre-deployment and/or post-deployment health survey as part of the MEAO Prospective Study in 2010 to 2012, and were included on the Transition and Wellbeing Research Programme Study Roll.[2] Specifically, the cohort consisted of ADF members who had participated in the MEAO Prospective Study as a Regular ADF member but who had since transitioned (Transitioned ADF), as well as ADF members who participated in the MEAO Prospective Study as a Regular ADF member and remained in the ADF as a Regular member in 2015 (2015 Regular ADF).

All 1350 eligible participants were invited to complete a self-report survey. In order to determine which of the other study components individuals were eligible for – the Composite International Diagnostic Interview (CIDI), blood testing, neurocognitive testing, or magnetic resonance imaging assessment – participants were grouped according to the assessments they completed as part of the MEAO Prospective Study (Time 1 and Time 2) and invited to complete additional assessments dependent on these groupings. That is, if participants completed a study element at Time 1 and/or Time 2, they were invited to do so again at Time 3. Eligible study participants located outside Australia were only invited to complete a survey. No additional exclusion criteria were applied to this sample.

[1] Note that in the design phase of this study the Impact of Combat Study sample was named the 'Combat Zone Cohort'. This is reflected in some content of other reports in the Programme. This sample has been renamed the 'MEAO Deployed Cohort' for the current report to more accurately reflect the cohort members.

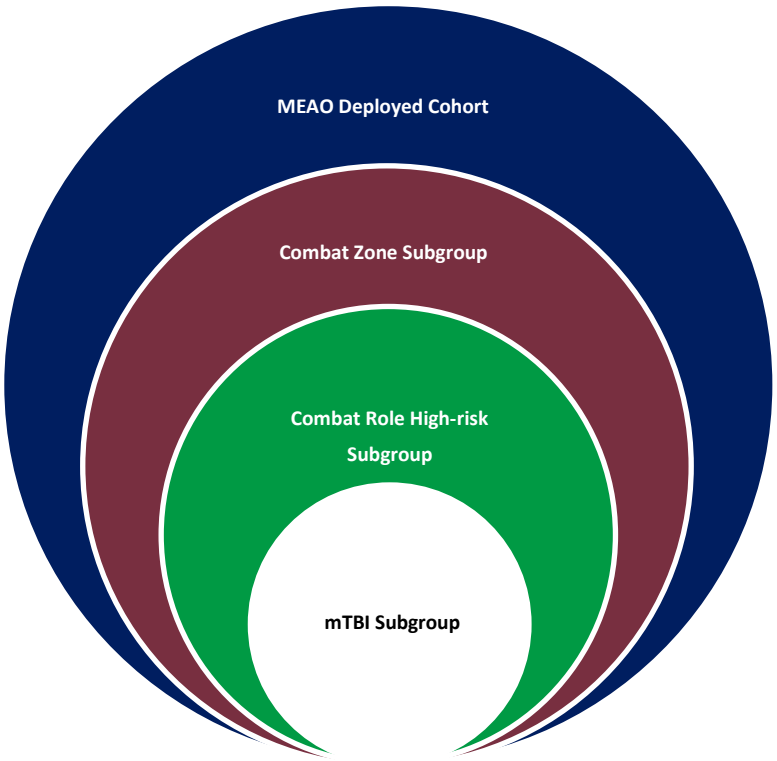
[2] There were a number of individuals who completed the MEAO Prospective Study who were not included on the Study Roll. Various reasons included those who were deceased, those who had requested their details be removed from the MilHOP or Transition and Wellbeing Research Programme Study Roll, those who did not provide consent for future contact at the time of their MilHOP participation, and those who opted out of the Transition and Wellbeing Research Programme.

2.2.2 Impact of Combat Study nested subgroups

Figure 1 shows the Impact of Combat Study nested subgroups.

- *The Combat Zone Subgroup.* This subgroup consisted of individuals within the broader study sample who participated in the physical testing component of the MEAO Prospective Study in addition to the self-report survey. These individuals were invited to participate in a CIDI (phase 2) and blood test (phase 3) in addition to the Impact of Combat Study self-report survey (phase 1).
- *The Combat Role High-risk Subgroup.* This subgroup consisted of individuals within the broader study sample who participated in the physical and neurocognitive testing components of the MEAO Prospective Study in addition to completing the self-report survey. These individuals were invited to participate in a CIDI (phase 2), blood test (phase 3) and neurocognitive assessment battery (phase 4) in addition to the Impact of Combat Study self-report survey (phase 1).
- *The mTBI Subgroup.* A targeted subgroup of individuals from within the Combat Role High-risk Subgroup were also invited to participate in an MRI assessment (phase 5) in addition to the self-report survey (phase 1), CIDI (phase 2), blood test (phase 3) and neurocognitive test battery (phase 4). These individuals were selected because they had previously completed a neurocognitive assessment as part of the MEAO Prospective Study and were identified as having high levels of combat and blast exposure.

Figure 1 Impact of Combat Study nested subgroups



2.3 Study elements

2.3.1 The self-report survey

The Impact of Combat Study, rolled out in concert with the Mental Health and Wellbeing Transition Study, serves as an interim point in the longitudinal surveillance of the MEAO Prospective Study Cohort.

In phase 1 of the research participants belonging to the MEAO Deployed Cohort were invited to complete a 60-minute self-report survey examining mental health problems, psychological distress, physical health problems,

wellbeing factors, pathways to care and occupational exposures; the survey questions had been developed at the beginning of the study period in close consultation with DVA and Defence. This survey was the same as that completed by participants in the wider Transition and Wellbeing Research Programme but with a small number of additional questions (as detailed in Annex A of the *Impact of Combat Technical Report*). The scales and items of relevance to the current report are as follows:

- *Depressive symptoms.* Self-reported depression was examined using the Patient Health Questionnaire-9 (PHQ-9) (Kroenke et al., 2001), the nine items of which are scored from 0 to 3 and summed to give a total score between 0 and 27. The PHQ-9 allows for various levels of diagnostic severity, higher scores indicating higher levels of depression symptoms. In addition to a mean score, two sets of cut-off values derived from the 2010 Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011) were used – an optimal screening cut-off of 6 (subsyndromal disorder) and an optimal epidemiological cut-off of 18 (probable disorder).

- *Psychological distress.* The Kessler Psychological Distress Scale (K10) (Kessler et al., 2002) is a short 10-item screening questionnaire that yields a global measure of psychological distress based on symptoms of anxiety and depression experienced in the most recent four-week period. Items are scored from 1 to 5 and are summed to give a total score between 10 and 50, with higher scores indicating greater levels of psychological distress. In addition to a mean score, two sets of cut-offs derived from the 2010 Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011) were used – an optimal screening cut-off of 17 (subsyndromal disorder) and an optimal epidemiological cut-off of 25 (probable disorder).

- *Posttraumatic stress disorder.* The Post Traumatic Stress Disorder Checklist – civilian version (PCL-C) (Weathers et al., 1993) is a 17-item self-report measure designed to assess the symptomatic criteria of PTSD according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV). The 17 questions of the PCL-C are scored from 1 to 5 and are summed to give a total symptom severity score of between 17 and 85, higher scores indicating increased severity. In addition to mean PCL-C scores, an optimal screening cut-off of 29 (subsyndromal disorder) and an optimal epidemiological cut-off of 53 (probable disorder) were used. These cut-offs were derived from the 2010 Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011).

- *Alcohol use and problem drinking.* Alcohol use and problem drinking were examined using the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993), a brief self-report screening instrument developed by the World Health Organization. This instrument consists of 10 questions designed to determine the quantity and frequency of alcohol consumption, possible symptoms of dependence, and reactions or problems related to alcohol. The first eight questions use a five-item continuous scale (scored 0 to 4), while the last two questions use a three-item scale (scored 0, 2 or 4). A final score is reached by summing across all 10 questions, higher scores being indicative of hazardous and harmful alcohol use as well as possible alcohol dependence. The AUDIT is widely used in epidemiological and clinical practice for defining at-risk patterns of drinking (Babor et al., 2001). In addition to mean AUDIT scores, an optimal screening cut-off of 8 (subsyndromal disorder) and an optimal epidemiological cut-off of 20 (probable disorder) were used. These cut-offs were derived from the 2010 Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011).

- *Anger symptoms.* The five-item Dimensions of Anger Reaction Scale (Forbes et al., 2004) assesses anger frequency, intensity and duration and anger's perceived negative impact on social relationships, as rated over the preceding four weeks. Respondents were instructed to rate the amount of time they had experienced each of the five symptoms of anger in the preceding four weeks on a five-point Likert scale ranging from 1 'none of the time' to 5 'all of the time'. Items are summed to create a total score (range 5 to 25), higher scores indicating a higher frequency of anger. In addition to the total score, a mean score for each of the individual anger items is presented as well as a cut-off of 12 to indicate problematic anger.

- *Twelve-month suicidal ideation and behaviour.* Twelve-month suicidal ideation and behaviour were assessed using four items that looked specifically at suicidal thoughts, plans and attempts. Three of the items were adapted from the National Survey of Mental Health and Wellbeing (Australian Bureau of Statistics, 2008); the fourth was devised by researchers for use in the current study. In addition to presenting the proportion of the cohort who reported each individual item, the proportion reporting any of the items is also presented.

- *Health symptoms.* Items assessing current health symptoms were taken from the 2011 Australian Gulf War Follow up Health Study (Sim et al., 2015). This 67-item adapted version of a self-report symptom questionnaire, originally based on the Hopkins Symptom Checklist (Derogatis et al., 1974), included respiratory, cardiovascular, musculoskeletal, dermatological, gastrointestinal, genitourinary, neurological and cognitive symptoms. For every symptom experienced within the preceding month, participants were required to provide an indication of symptom severity on a three-point Likert scale (mild, moderate, severe). For the purpose of the current report symptoms were dichotomised as present or absent and severity was not assessed. A 'mean number of health symptoms' score was then calculated and used. Individual symptoms were not investigated.

- ***Pain.*** Items assessing pain intensity and disability were taken from the 2011 Australian Gulf War Follow up Health Study (Sim et al., 2015). Participants were asked to answer a series of questions on a scale of 1 to 10 about their current pain, worst pain and average pain in the preceding six months. They were also asked to indicate how much their pain had interfered with their daily activities, their recreational and social activities, and their ability to work in the preceding six months. Using an algorithm developed by Von Korff (Von Korff et al., 1992), scores on these seven items were categorised into the following grades of pain intensity and disability used in the current report: Grade 0, 'pain free'; Grade I, 'low disability – low intensity'; Grade II, 'low disability – high intensity'; Grade III, 'high disability – moderately limiting'; and Grade IV, 'high disability – severely limiting'.

- *Body mass index.* BMI was calculated as a function of respondents' self-reported weight and height – weight (kg) / height $(m)^2$. On the basis of guidelines from the Australian Government Department of Health (Department of Health, 2017), BMI scores were categorised as 'underweight' (<18.5), 'normal' (18.5–24.99), 'pre-obese' (25–29.99), 'obese class 1' (30–34.99), 'obese class 2' (35–39.99) and 'obese class 3' (>40).

- *Length of service.* At Time 1 (the MEAO Prospective Study) participants were asked, 'To the nearest year, how long have/had you served with the Australian Defence Force as a Regular?'. They entered the number of years they had served.

- *Number of deployments.* At Time 1 (the MEAO Prospective Study) participants were asked to report details of all major operations they had been deployed on. This included warlike and non-warlike operations, UN peacekeeping and peacemaking operations, and humanitarian aid and assistance operations. They were asked the country they deployed to, the operation name, the year the deployment started, the number of times they deployed in that year and the total time deployed (in months). The number of deployments was calculated from these variables.

- *Deployment experience.* At Time 1 (the MEAO Prospective Study) participants were asked, 'Have you ever been on an ADF operational deployment (warlike, peacekeeping, peace-monitoring or humanitarian support)?'. They responded yes or no.

- *Lifetime exposure to traumatic events.* Lifetime exposure to trauma was examined at Time 1 (the MEAO Prospective Study) and Time 3 (this Impact of Combat Study) using questions adapted from the CIDI (World Health Organization, 1997) and modified by McFarlane et al. (2011). Participants were asked to indicate whether or not they had experienced the following traumatic events: direct combat; life-threatening accident; fire, flood, natural disaster; witnessed someone badly injured or killed; rape; sexual

molestation; serious physical attack or assault; threatened/harassed without a weapon; threatened with a weapon/held captive/kidnapped; tortured or a victim of terrorists; domestic violence; witnessed domestic violence; found a dead body; witnessed suicide/attempted suicide; child abuse – physical; child abuse – emotional; any other stressful event. If they endorsed a traumatic experience, they were asked the number of times they were exposed and the age of first and last exposure to the event. The experiences considered included potential traumatic exposures encountered in the ADF (for example, direct combat) and events that may have occurred outside the ADF in adulthood (for example, serious assault, terrorism) or in childhood (for example, child physical abuse).

- *Traumatic deployment exposures.* At Time 3 (this Impact of Combat Study) participants were presented with a list of traumatic deployment exposures and asked to indicate how many times they had experienced each one on deployment during their military career and since 2011. Response categories ranged from 'never' to '10+ times'. Examples of events are exposure to serious fear of encountering an improvised explosive device, discharge of weapon in direct combat, and handling or seeing dead bodies. Items in this section were drawn from the MEAO Census Study (Dobson et al., 2012).

- *Environmental deployment exposures.* At Time 3 (this Impact of Combat Study) participants were presented with a list of environmental deployment exposures and asked to indicate how many times they had experienced each one on deployment during their military career and since 2011. Response categories ranged from 'never' to '10+ times'. Examples of events are exposure to smoke and/or dust, fumes or fuels, chemicals, hazardous materials, local food or water, and noise. Items in this section were drawn from the MEAO Census Study (Dobson et al., 2012).

- *Traumatic brain injury.* TBI was assessed using the Ohio State University Traumatic Brain Injury Identification Method (OSU TBI-ID) (Corrigan & Bogner, 2007), which researchers adapted specifically for use in the Programme. The OSU TBI-ID is a standardised measure designed to elicit an individual's lifetime history of TBI. Questions focused on the types of head/neck injuries incurred, the frequency of these injuries, whether the injuries occurred during military service or deployment, the number times since 2011, symptoms experienced (for example, loss of consciousness, being dazed and confused, loss of memory), age the first and last time the symptoms occurred, frequency of symptoms, longest time knocked out or unconscious, loss of consciousness related to a drug overdose or being choked, and the occurrence of multiple blows to the head in relation to a history of abuse, contact sports or ADF training/deployment.

- *Post-concussive symptoms.* The assessment used a modified version of the Post-concussion Syndrome Checklist (Gouvier et al., 1992) that had been used as part of the 2012 MEAO Health Study (Davy et al., 2012). The modified version required participants to indicate the degree to which they had experienced a list of 11 symptoms in the preceding four weeks as a result of an injury to their head or neck.

- *Functioning.* Functional impairment was assessed using the Sheehan Disability Scale (Sheehan, 1983), a five-item self-report measure of disability resulting from mental health symptoms in three interrelated domains – work/school, social life and family life. The three items assessing impairment in the three domains are scored from 0 to 10 and can yield a total global functional impairment score of between 0 and 30.

For a comprehensive listing and description of all the measures used in the Impact of Combat self-report survey, see Annex A in the *Impact of Combat Technical Report*.

2.3.2 The Composite International Diagnostic Interview

Twelve-month and lifetime ICD-10 rates of the following mental disorders were assessed using the CIDI 3.0: depressive episode, dysthymia, bipolar affective disorder, panic attack, panic disorder, agoraphobia, social phobia, specific phobia, generalised anxiety disorder, obsessive–compulsive disorder, posttraumatic stress disorder, adult separation disorder, harmful alcohol use and dependence, suicidal ideation and behaviour, and

intermittent explosive disorder. This range of mental disorders was the same as that used in the 2007 National Survey on Mental Health and Wellbeing (Slade et al., 2009) and included in the 2010 Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011).

In this present report prevalence rates for individual ICD-10 disorders are presented with hierarchy rules applied in order to be consistent with Australian national rates. Lifetime exposure to trauma was also examined as part of the PTSD module of the CIDI (Kessler & Ustun, 2004). All criterion A events listed in the CIDI were examined.

2.3.3 Biological testing

Biological testing for this study was rolled out as part of the larger Transition and Wellbeing Research Programme, with the aim of collecting all data elements within a four- to six-week window for each eligible participant. After having been contacted by the research team, consenting participants were posted the relevant paperwork and directed to the nearest suitable collection centre to have their blood collected. Forty-four millilitres of blood (2 x 4.0 ml EDTA tubes, 1 x 6 ml Li Hep tube, 4 x 8.5 ml serum tubes, 1 x 4 ml K2 EDTA tube) were drawn from each participant in order to assess a range of markers. Only the following markers were examined in the current study:

- liver enzyme – gamma GT
- metabolic – cholesterol, LDL cholesterol, HDL cholesterol, HBA1C, random glucose, triglycerides
- inflammatory and other markers – erythrocyte sedimentation rate, white cell count, interleukin 1b, interleukin 6, interleukin 10, TNF alpha, soluble interleukin-2 receptor alpha (sIL-2Ra), C-reactive protein, brain-derived neurotrophic factor, cortisol.

2.3.4 Neurocognitive assessment

Participants were assessed using the standard suite of LabNeuro and IntegNeuro tests, which were administered by the Brain Dynamics Centre at Westmead Millennium Institute or at various Defence base locations. Tests were performed according to the Brain Resource International Database methodology (Version 3, May 2009) (Brain Resource International Database, 2009).

LabNeuro tests assessed electrophysiological responses to resting and active cognitive states. Tasks were designed to activate specific cognitive functions, with resultant data indicating electrical brain activity in response to the various stimuli. In contrast, IntegNeuro tests assessed outward performance on a range of cognitive tasks (for example, correct answers, number of errors). Importantly, participants may have differed in electrophysiological activation while not differing in observable performance.

A suite of tasks was administered to participants, although only two paradigms are reported on here:

- *Quantitative electroencephalography.* This allows for measurement of cortical arousal in the resting state, which reflects the priming of the individual to deal with an environmental challenge.
- *The working memory task.* This taps into a domain of function that is known to be abnormal in chronic mild traumatic brain injury and psychiatric disorders and allows for the measurement of reaction times.

2.3.5 MRI assessment

A select group of participants who had previously completed a neurocognitive assessment as part of the MEAO Prospective Study and were identified as having high levels of combat and blast exposure (the Combat Zone mTBI nested subgroup) were invited to participate in additional structural and functional magnetic resonance imaging.

The MRI assessments took about an hour to complete and were conducted at the Brain Dynamic Centre, Westmead Millennium Institute, using the standardised Brain Resource International Database protocol (Brain Resource International Database, 2009).

- *Structural MRI.* This measures the volume of grey matter (neurons), white matter (connections) and fluid-filled spaces in the brain, as well as the local magnetic fields of water molecules. Water in different tissue types responds differently to applied magnetic fields, which enables the measurement of structure at the millimetre scale.

  The structural MRI scans were done using parameters that allowed for two specific forms of analysis – diffusion tensor imaging and susceptibility weighted imaging. These two forms of advanced imaging have been found to be differentially sensitive to different aspects of cortical pathology and complement each other.

  – Diffusion tensor imaging is a form of magnetic resonance imaging that is extremely sensitive to subtle brain pathology, including axonal injury (Mac Donald et al., 2011). It provides an objective, non-invasive measure of structural connectivity in the brain and deficits in white matter that can be indicative of brain injury as well as psychopathology (Mac Donald et al., 2011; Song et al., 2014; White et al., 2008).

  – Susceptibility weighted imaging is a similarly sensitive technique for identifying subtle changes in brain pathology. It is particularly sensitive to bleeding in the grey and white matter boundaries, allowing the detection of more subtle injuries (for example, micro-haemorrhages) that may not be picked up using conventional imaging techniques.

- *Functional MRI.* This monitors changes in blood flow in the brain, showing which areas are active during different tasks. It relies on the contrast between the natural magnetic properties of oxygenated compared with deoxygenated flow to provide a measure of blood oxygen level dependent signal change in regions of the brain. Task-related changes in brain activity are measured at a time scale of about two to three seconds and a spatial scale of 1 millimetre.

  Functional MRI was performed during cognitive tasks that paralleled some of the paradigms from the quantitative electroencephalography associated with the neurocognitive testing, thus providing visualisation of processing to complement other measures.

For details of each of the functional MRI tasks administered, see Annex A in the *Impact of Combat Technical Report*.

2.4 Ethics

The study protocol was approved by the DVA Human Research Ethics Committee (E014/018) and was recognised under expedited review processes by Defence and the University of Adelaide Human Research Ethics Committee. The study protocol was also submitted to the Australian Institute of Health and Welfare Ethics Committee, which granted approval (EO 2015/1/163). The study was conducted in accordance with the Australian Code for the Responsible Conduct of Research (https://www.nhmrc.gov.au/guidelines-publications/r39).

3 How to interpret and discuss the findings in this report

A clear understanding of the following terms and concepts is essential to interpreting the findings presented in this summary report.

- *Between-group comparisons.* When comparing outcomes between groups, the overlap in confidence intervals provides an indication of between-group differences. Where there is significant overlap, any apparent difference is more likely to reflect measurement or estimate error.

- *Confidence intervals.* Confidence intervals express the degree of uncertainty associated with a statistic. Where the value of interest is a rate, the confidence intervals show the range of error for that rate. In general, confidence intervals that are close to the rate value reflect the precision of the rate, while those that are very wide reflect imprecision. Where the confidence intervals are wide, the associated rates should be interpreted cautiously, the upper and lower limits being considered the top and bottom range of possible precise values.

- *Methodological considerations.* A key methodological limitation that should be noted concerns the response rate. For the survey component of the study, at Time 3 there was a response rate of 26.5% for Transitioned ADF members and 49.9% for the 2015 Regular ADF members. There were substantial between-group differences for some demographic and Service groups for the Transitioned ADF and the 2015 Regular ADF and a typically observed finding of lower participation among lower ranks. One of the implications of this is the potential for bias, especially in groups with low participation rates. Although there was no formal examination of participation bias in the study, these potential sources of bias – transition and low rank tend to be associated with poorer health status – were countered by the observation that the medical fitness classification of both responders and non-responders in the study was similar. The low participation rate also meant that the number of cases for some health outcomes of interest was small, so there was limited statistical power to investigate differences between groups in relation to those health outcomes, and in the study populations directly, than might have been achieved with a higher participation rate.

- *Odds ratios.* When examining a specific health outcome, there can be differences in the rates between two groups (for example, 2015 Regular ADF and Transitioned ADF) because of differences in factors other than transition status – such as sex, age, Service or rank – particularly if other factors are associated with the health outcome. If this is the case, these factors are potentially confounders, and one method of reducing confounding is to employ a logistic regression model that controls (adjusts) for these factors. The statistical output from a logistic regression model is an odds ratio, or OR, which denotes the odds of a particular group (for example, the Transitioned ADF) having a specific health outcome compared with a reference group (for example, the 2015 Regular ADF).

  An OR greater than 1 indicates increased odds of having a particular health outcome compared with the reference group, and an OR less than 1 suggests less likelihood of having a particular health outcome. For example, an OR of 1.7 for the Transitioned ADF (compared with the 2015 Regular ADF) suggests that members of the Transitioned ADF have 70% increased odds of having that particular health outcome. Conversely, an OR of 0.7 suggests that Transitioned ADF members are 30% less likely than 2015 Regular ADF members to have a particular health outcome. When an OR is greater than 2, we can say that Transitioned ADF members are twice as likely as 2015 Regular ADF members to have a particular health outcome. Similarly, if the OR is greater than 3, they would be three times more likely to have a particular health outcome, and so forth. In the case of the predictive modelling in this report, the key outcome variable has two levels (low symptoms as opposed to elevated symptoms). In all models the reference

category is low symptoms, with the odds of having elevated symptoms being compared with having low symptoms. Where the predictor has three levels (that is, Service – Navy, Army, Air Force), a reference category is selected for each analysis, and the odds of prediction of the outcome are for the specified group in comparison with that reference. For example, where Air Force is the reference category and the specified group is Army, the OR will reflect the odds of having elevated symptoms for Army compared with Air Force.

- *Rates of disorder.* Except where noted to the contrary, all analyses were conducted using raw totals, means and proportions, with no statistical weighting used. Similarly, except where noted to the contrary, standard errors were produced using linearisation.

- *Significance.* When a between-group difference is referred to as significant, this means that the difference between groups was statistically tested, adjusting for sex, age and Service, and the associated confidence intervals had no overlap between groups. For continuous outcomes that were assessed at all three time points, repeated ANOVAs were conducted to examine whether mean scores significantly changed over time. When Mauchly's Test of Sphericity showed that the assumption of sphericity was violated, the Greenhouse–Geisser adjusted p value is presented. Statistical significance was assessed at the $p < .05$ level. For the purpose of analyses, when outcomes were examined longitudinally data were limited to those individuals with outcomes of interest at all three time points.

- *Standard errors.* Like confidence intervals, standard errors indicate the range of error in an average score that is presented.

Chapter 5 provides definitions of key terms used in this report.

4 Response rates and demographics

4.1 Response rates and basic cohort characteristics

A total of 1350 individuals who participated in the MEAO Prospective Study (Times 1 and 2) were invited to participate in the Impact of Combat Study (Time 3). Of those who were invited, 486 had transitioned from the ADF in the interim and 864 remained in the Regular ADF. For the survey component of the Impact of Combat Study, there was a response rate of 26.5% for the Transitioned ADF members of the cohort and a much higher rate of 49.9% for the 2015 Regular ADF members. A similar pattern emerged for each of the nested subgroups.

Impact of Combat Study responders were slightly older than non-responders and, among responders, those who remained in the Regular ADF were slightly older than those who had transitioned (M = 38.1 vs M = 35.6). The Service distribution was similar for responders and non-responders, although transitioned responders were more likely to be from the Army compared with Regular serving responders (87.1% vs 63.6%), while Regular serving responders were more likely to be from the Air Force (29.0% vs 10.0%). Similarly, the distribution of sex was similar for responders compared with non-responders; among responders, slightly more females remained in the Regular ADF in 2015 (9.2% vs 5.0%).

The distribution of rank among responders compared with non-responders was similar for those who remained in the Regular ADF, the majority of these responders being Non-Commissioned Officers (63.4%), followed by Officers (26.7%) then Other Ranks (9.9%). For those who had transitioned, the distribution of rank was different for responders compared with non-responders: responders were more likely to be Non-Commissioned Officers (51.4% vs 28.6%) or Officers (11.4% vs 4.6%) and less likely to be from Other Ranks (37.1% vs 63.9%).

The distribution of medical fitness for responders compared with non-responders was also similar: the majority of Transitioned ADF (83.6%) and 2015 Regular ADF (86.6%) responders were classified as fit.

4.2 Demographic characteristics

The majority of cohort members were in a relationship and living together (68.0%) and had completed educational qualifications at certificate level or above (58.8%). About one-third had completed primary or secondary school only.

Of those who had transitioned, 71.3% were in full- or part-time work, just under 10% were on a sickness allowance or disability support pension, and 7.0% were students. Only 3.5% were retired. The main source of income among the Transitioned ADF was a wage or salary (69.6%), and about 10% reported receiving some kind of pension or compensation. Ninety per cent of the cohort reported being in stable housing at the time of the survey; this figure was slightly lower among members who had transitioned (87.0%).

Overall, 27.1% of cohort members were DVA clients, although among cohort members who had transitioned the proportion was much higher, at 45.2%. The majority of cohort members had served in the Regular ADF for eight or more years; 20.7% had served for less than eight years. The distribution of years of service in the Regular ADF was markedly different among cohort members who had transitioned: about half had served less than eight years.

4.3 Transitioned cohort members

The Transitioned ADF cohort consisted of 44.3% Inactive Reservists, 30.4% Ex-Serving members and 24.3% Active Reservists. The largest proportion of individuals (34.8%) reported transitioning three years before the survey, 20.0% reported transitioning two years before, and nearly one-quarter reported transitioning a year or less before. The majority of individuals (68.7%) discharged at their own request; 8.7% reported a medical discharge. The most commonly reported reasons for transition were better civilian employment prospects (9.6%) and the impact of service life on family (9.6%).

About two-thirds (65.2%) of the Transitioned ADF members were employed, the majority of them working between 21 and 60 hours a week. The most common employment industries were construction (17.3%) and government administration and Defence (17.3%). Just over one in three Transitioned ADF members (34.8%) reported a period of unemployment of at least three months since their transition.

In the case of DVA support, one in three Transitioned ADF members (34.8%) reported treatment support of some kind (White or Gold Card). Almost half reported no involvement with an ex-service organisation, while 17.4% reported a single contact. Similarly, 53.0% had had no involvement with a voluntary organisation, while 16.6% had been involved with at least one voluntary group.

5 Key terms used in this report

A clear understanding of the following terms is necessary for an accurate reading of the information presented in this summary report.

- *2015 Regular ADF.* ADF members who were serving full-time in the ADF in 2015.
- *Cumulative trauma.* This refers to repeated exposure to traumatic events over a period of time, which has been shown to increase the risk of morbidity and even mortality.
- *Deployment exposures.* Study participants were asked about traumatic and environmental deployment exposures at Time 3 using items drawn from the MEAO Census Study (Dobson et al., 2012). They were presented with a list of 12 traumatic exposures and six environmental exposures and asked to indicate how many times they had experienced each one on deployment during their military career. Traumatic and environmental deployment exposures were summed separately and then categorised according to the level of exposure (very low, low, moderate, high, very high).
- *Elevated psychological distress or posttraumatic stress symptoms.* For the purpose of subgroup analyses, study participants were grouped according to their scores on the PCL-C or K-10 at Time 3. They were classified as having elevated psychological distress or posttraumatic stress symptoms if their scores were above the established screening cut-off.
- *Impact of Combat Study (Time 3).* The Impact of Combat Study was rolled out in concert with the Mental Health and Wellbeing Transition Study and served as an interim time point in the longitudinal surveillance of the MEAO Prospective Study cohort. All individuals who participated at pre-deployment (Time 1) and/or post-deployment (Time 2) as part of the MEAO Prospective Study were eligible to participate in the Impact of Combat Study (Time 3).
- *Inflammatory markers.* An immune response is triggered when the body encounters a stimulus threat to the system (injury, illness, stress/trauma). In response to this exposure T-cell lymphocytes and macrophages (types of immune cells) secrete into the bloodstream proteins that have pro- and anti-inflammatory effects. The levels of these proteins, measured in serum for this study, are referred to as 'inflammatory markers'.
- *MEAO Prospective Study.* The Middle East Area of Operations Prospective Study was the first study to examine the health of deployed Australian military personnel from a longitudinal perspective. All ADF members who deployed to the MEAO after June 2010 and returned from deployment by June 2012 were eligible to participate in the self-report questionnaire component of this Impact of Combat Study.
- *MEAO Prospective Study Pre-deployment (Time 1) and Post-deployment (Time 2) Assessments.* All data from the MEAO Prospective Study were collected at two time points for each participant. Participants provided data not more than four months before their index deployment (Time 1, pre-deployment) and then again on average 4.2 months after they returned home (Time 2, post-deployment).
- *Mild traumatic brain injury*. In this current study self-reported mild traumatic brain injury was classified according to responses on the self-report version of the Ohio State University Traumatic Brain Injury Identification Method (OSU TBI-ID) (Corrigan & Bogner, 2007), which researchers adapted for use in the Transition and Wellbeing Research Programme. The OSU TBI-ID is a standardised measure designed to elicit an individual's lifetime history of traumatic brain injury. Participants were asked whether they had

experienced a head injury in a range of contexts in their lifetime. If they responded 'yes' to any of these and they had also experienced loss of consciousness, being dazed and confused, and/or loss of memory in relation to that injury, this was classed as a traumatic brain injury. Mild traumatic brain injury was any TBI with a loss of consciousness of less than 30 minutes or an experience of being dazed and confused with loss of memory.

- *Optimal epidemiological cut-off.* Two sets of cut-offs on the K10 and PCL-C were developed as part of the Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011) and are used in this current report. The optimal epidemiological cut-off gives the 'closest estimate of the true prevalence of 30-day ICD-10 disorder as measured by the CIDI' (McFarlane et al., 2011, p. 103).

- *Optimal screening cut-off.* The K10 and PCL-C screening cut-offs reflect a broader spectrum of moderate to severe symptoms rather than diagnosable disorder, allowing for potential early intervention. These screening cut-offs maximise potential identification of true cases but include a larger proportion of 'false positives' than the epidemiological cut-offs.

- *Probable disorder.* Study participants were classified as having probable disorder if their K10 or PCL-C scores were above the optimal epidemiological cut-off.

- *Quantitative electroencephalography.* qEEG is a method of measuring electrical brain activity via electrode sensors placed on the scalp. Electrodes are positioned at locations corresponding to differential regions of the underlying cerebral cortex. Through high-powered computer analytics, the electrical brain signals can be deconstructed into specific spectral frequency bands – beta, alpha, theta and delta. Each rhythm varies in frequency and amplitude. 'Frequency' refers to how often the signal occurs (fast through to slow) and 'amplitude' refers to its strength (low through to high).

- *Subsyndromal disorder.* Study participants were classified as having subsyndromal disorder if their K10 or PCL-C scores fell above the optimal screening cut-off but below the optimal epidemiological cut-off.

- *Transitioned ADF members.* The population of ADF members who transitioned from full-time ADF service between 2010 and 2014, consisting of those who transitioned into the Active and Inactive Reserves and those who discharged completely (Ex-Serving members).

- *Working memory.* Working memory is assessed through the P3wm event-related potential, or ERP, component. Another electrophysiological measure of cognitive function, ERPs are an extension of electroencephalography. This method measures brief (sub-second) fluctuations in electrical brain activity that are directly associated with specific sensory and cognitive processing events. The P3wm component of ERP, provides a physiological measure associated with attentional and working memory operations during cognitive tasks. In broad terms, lower P3 amplitudes are shown to be associated with deficits of attention and/or memory, whereas higher amplitudes are conversely associated with superior cognitive function (Luck & Kappenman, 2011).

6 Key findings

Longitudinal health status

Mental health

- For all mental health measures, there were small to moderate increases in symptoms over time and correspondingly small to moderate increases in the proportion of the cohort with subsyndromal or probable disorder.

Depressive symptoms

- Average depressive symptoms were low in the cohort at all time points but did increase over time, the largest change occurring between Times 2 and 3 (M = 2.5 vs M = 5.1).
- The majority of the cohort scored below both screening and epidemiological cut-offs for probable depressive episodes at Time 1 (91.5%), Time 2 (86.2%) and Time 3 (66.7%), with a steady increase in the proportion with subsyndromal and probable disorder over time. At Time 3, 27.9% of cohort members were subsyndromal and 5.4% had probable depressive episodes.

Psychological distress

- Average psychological distress symptoms were low in the cohort at all time points. They were relatively stable between Time 1 (M = 13.4) and Time 2 (M = 13.8) but increased at Time 3 (M = 16.6).
- The majority of cohort members scored below both screening and epidemiological cut-offs for probable psychological distress at Time 1 (84.1%), Time 2 (79.4%) and Time 3 (69.6%). The proportion of cohort members who were subsyndromal increased from Time 1 (12.1%) to Time 2 (16.6%) then remained stable at Time 3 (16.4%).
- In the case of probable disorder a different pattern was observed: the proportion of cohort members with probable psychological distress did not change between Time 1 (3.7%) and Time 2 (4.0%) but increased significantly at Time 3 (14.0%).

Posttraumatic stress symptoms

- There were small increases in mean posttraumatic stress symptoms in the cohort from Time 1 (M = 20.0) to Time 2 (M = 22.3) and again at Time 3 (M = 25.3).
- The majority of cohort members scored below subsyndromal and probable disorder cut-offs at Time 1, Time 2 and Time 3.
- The proportion of cohort members with subsyndromal posttraumatic stress symptoms nearly doubled from Time 1 (7.1%) to Time 2 (13.4%) and increased again, to 21.7%, at Time 3. The proportion of the cohort with probable PTSD was very low at all three time points, although it showed the same pattern of increase over time (Time 1, 0.2%; Time 2, 1.7%; Time 3, 3.6%).

Alcohol use and problem drinking

- There was very little change in mean AUDIT scores over time in the cohort, with no change from Time 1 (M = 6.3) to Time 2 (M = 6.3) and only a small increase at Time 3 (M = 6.6).
- Almost three-quarters of cohort members scored below subsyndromal and probable alcohol disorder cut-offs at Time 1 (71.2%) and Time 2 (72.1%); the proportion fell slightly, to 67.5%, at Time 3. Almost one-third of the cohort scored above the screening cut-off on the AUDIT at Time 1 (28.1%), Time 2 (26.0%) and Time 3 (29.6%).
- Rates of probable alcohol disorder were extremely low in the cohort but showed a pattern of increasing with time (Time 1, 0.7%; Time 2, 1.9%; Time 3, 2.9%).

Anger symptoms

- Mean anger scores increased over time (Time 1, M = 6.7; Time 2, M = 7.3; Time 3,: M = 8.5). The proportion of participants who had problematic anger also increased steadily (Time 1, 5.5%; Time 2, 11.6%; Time 3, 19.2%).

Suicidality

- The proportion of cohort members with any suicidality increased slightly from Time 1 (2.2%) to Time 2 (3.6%) and increased dramatically at Time 3 (12.7%).
- No members of the cohort reported formulating a suicide plan or attempting suicide at Time 1 or Time 2; at Time 3, however, 2.6% of the cohort reported making a plan and 1.0% had made an attempt.

Lifetime and 12-month ICD-10 disorder

- Overall, members of the cohort who had transitioned reported higher lifetime and 12-month rates of each ICD-10 mental disorder class compared with members who remained in the Regular ADF in 2015.
- Almost 80% of cohort members who had transitioned by 2015 met criteria for any lifetime ICD-10 mental disorder; this compares with 66.7% of those who remained in the Regular ADF in 2015.
- One in two members of the cohort who had transitioned met criteria for a mental disorder in the preceding 12 months; this compares with about one in five of members who remained in the Regular ADF in 2015.
- Alcohol (Transitioned ADF, 59.7%; 2015 Regular ADF, 47.4%) and anxiety disorders (Transitioned ADF, 55.6%; 2015 Regular ADF, 32.5%) were the most prevalent lifetime disorder classes for the cohort, the rates of affective disorders being lower (Transitioned ADF, 37.5%; 2015 Regular ADF, 18.4%).
- Lifetime rates of PTSD among cohort members were 29.2% for those who had transitioned and 13.2% for those who remained in the Regular ADF.
- Anxiety disorders were the most prevalent 12-month disorders in the cohort: 41.7% of members who had transitioned and 18.4% of members who remained in the Regular ADF in 2015 met ICD-10 criteria.
- Rates of 12-month alcohol disorders were low and were more commonly reported among cohort members who had transitioned. The most common 12-month alcohol disorder class was alcohol dependence (Transitioned ADF, 9.7%; 2015 Regular ADF, 3.5%).

Physical health

- The mean number of physical health symptoms reported increased from Time 1 (M = 7.7, SE = 0.4) to Time 2 (M = 10.4, SE = 0.5) and was higher again at Time 3 (M = 12.8, SE = 0.5).
- A higher proportion of cohort members who had transitioned (9.7%) reported the highest grade of pain intensity and disability (Grade IV); this compares with only 5.9% of members who remained in the Regular ADF in 2015.
- More than 50% of participants fell within the pre-obese range (53.7%) at Time 1. This proportion increased to almost 60% (58.9%) at Time 2 and was higher still at Time 3 (66.3%).

Biological measures

- Overall, biological measures were well within the normal ranges for a healthy population; only small changes were observed and for a number of markers no changes were found. There were, however, some consistent patterns of change across groups of measures.
- A number of markers – interleukin 6 (IL-6), tumour necrosis factor alpha (TNF alpha), C-reactive protein (CRP), cortisol, and brain-derived neurotrophic factor (BDNF) – showed a pattern of increase between Time 1 and Time 2 but a decrease at Time 3.

Predicting long-term mental health

Psychological distress

- Previous deployments and career deployment exposure history were associated with elevated psychological distress at Time 3.
  - The more deployments cohort members had before the index deployment, the greater the likelihood of having elevated psychological distress at Time 3.
  - Cohort members with high or very high levels of deployment exposure were three times more likely to have elevated psychological distress at Time 3 compared with members who had very low or low exposure.

Posttraumatic stress

- The number of lifetime trauma exposure types and career deployment exposure history were associated with elevated posttraumatic stress symptoms at Time 3.
  - The number of lifetime trauma exposure types at Time 1 was a significant predictor of elevated posttraumatic stress symptoms at Time 3.
  - Cohort members with medium, high or very high levels of deployment exposure were three to five times more likely than members with very low exposure to have elevated posttraumatic stress symptoms at Time 3.

Physical health correlates of long-term mental health

- Cohort members with elevated psychological distress or posttraumatic stress symptoms at Time 3 reported greater numbers of physical health symptoms at all three time points.
- In general, pro-inflammatory markers were lower at all three time points among members with elevated psychological distress or posttraumatic stress symptoms at Time 3.

Neurocognitive function

Neurocognitive function over time

The overall pattern of findings suggests that initial deployment and combat exposure may have lasting impacts on resting brain states and attentional and memory processes.

Quantitative electroencephalography

- Beta power and alpha power showed reductions from Time 1 to Time 2 and these were sustained at Time 3. This is indicative of reduced cognitive engagement and reduced relaxed wakefulness. In contrast, theta and delta power increased from Time 1 to Time 2 and the elevations were sustained at Time 3, suggesting an increase in memory processing.

Working memory

- Reductions in P3wm amplitudes were observed over time, with successive reductions from Time 1 to Time 2 then to Time 3. These reductions were most notable at frontal and central electrodes. This component provides an objective measure of working memory functioning, and its amplitude is a measure of the efficiency of processing, greater amplitude reflecting greater efficiency. The observed reductions are thus consistent with reduced efficiency of memory processes.

Neurocognitive function and elevated psychological distress and posttraumatic stress

Deployment appears to have an acutely altering effect on functioning within attentional orientation networks, the findings indicating the following:

- functional decrements in attentional networks among members with low psychological symptoms at Time 3 and among those with elevated posttraumatic stress symptoms at Time 3
- attentional hypervigilance among those with elevated psychological distress symptoms at Time 3
- acute deployment-related effects appearing to resolve in those with low symptoms or elevated psychological distress symptoms at Time 3
- acquired functional decrements appearing to be progressively exacerbated in those with elevated posttraumatic stress, with evidence of executive memory network impairments also becoming apparent over the long term.

Quantitative electroencephalography

- Together, the findings suggest that individuals who manifest psychological symptoms over time exhibit a range of distinct qEEG characteristics, the beta and theta power bands bearing the closest association with current psychological symptom status at Time 3. It appears that higher beta and theta power levels at Time 1 could be vulnerability markers for the emergence of future psychological symptoms.

Working memory

- ERP (event-related potential) indices may serve as a marker of emerging subsyndromal distress in this population, the findings being indicative of acutely acquired (that is, deployment-related) attentional network impairments, followed by progressive exacerbation of these in the longer term. While deployment appears to predominantly affect anterior attentional network functions, there could be progressive impacts on posterior executive memory network functions in the longer term. The findings also provide evidence that fronto-central amplitude reductions may pre-exist PTSD symptom onset, although these deficits may reflect higher cumulative trauma exposure and early signs of symptom development.

Injuries to the head and traumatic brain injury

Reported traumatic brain injury in Transitioned ADF and 2015 Regular ADF

Injuries to the head

- Similar proportions of Transitioned ADF members and 2015 Regular ADF members reported experiencing all types of injuries to the head except for injuring their head or neck in a fall/being hit by something (a lower proportion of Transitioned ADF) and being nearby when an explosion/blast occurred (a higher proportion).
- Similar proportions of Transitioned ADF and 2015 Regular ADF reported that their injuries occurred during military service.
- The most commonly reported context for experiencing a head injury in their lifetime was being nearby when an explosion or blast occurred (Transitioned ADF, 69.7%; 2015 Regular ADF, 49.9%).

Reported lifetime traumatic brain injury and mild traumatic brain injury

- Similar proportions of Transitioned ADF members and 2015 Regular ADF members reported experiencing any TBI (mild, moderate or severe) in their lifetime (49.1% vs 47.4%).
- 2015 Regular ADF members reported a higher mean number of lifetime TBIs than Transitioned ADF (M = 4.9 vs M = 3.4).
- The great majority of reported lifetime TBI was mTBI; only four Transitioned ADF members (3.7%) and eleven 2015 Regular ADF members (2.9%) reported moderate or severe lifetime TBI.

Mental health, functional outcomes and post-concussive symptoms in those with reported lifetime TBI

- Transitioned ADF members generally had higher posttraumatic stress symptoms, psychological distress and depressive symptoms than 2015 Regular ADF members; this pattern was similar when comparing those with and without reported TBI.
- Among both the Transitioned ADF and the 2015 Regular ADF posttraumatic stress symptoms, psychological distress and depressive symptoms were similar for those with and without reported TBI.
- Transitioned ADF members and 2015 Regular ADF members who reported lifetime TBI showed slightly higher scores on total global functioning impairment compared with those with no TBI (Transitioned ADF, M = 10.7 vs M = 8.8; 2015 Regular ADF, M = 7.5 vs M = 4.9) and for all three domains of disability.
- Transitioned ADF members generally had higher scores for total global functioning impairment than 2015 Regular ADF members; the pattern was similar when comparing those with reported TBI and those without reported TBI in the two groups, as seen for the psychological disorders.
- Mean post-concussive symptoms were greater among Transitioned ADF with a reported TBI (M = 6.2) compared with those with no reported TBI (M = 3.0). Mean post-concussive symptoms were similar among 2015 Regular ADF with a reported TBI compared with those with no reported TBI.
- Mean post-concussive symptoms were higher among the Transitioned ADF (those with reported TBI and those without TBI) compared with the respective subgroups in the 2015 Regular ADF.

7 Longitudinal health status of the MEAO Deployed Cohort

7.1 Mental health outcomes

This chapter summarises the patterns of self-reported depression, psychological distress, posttraumatic stress symptoms, alcohol consumption and problems, anger and suicidality in the MEAO Deployed Cohort at three time points:

- the MEAO Prospective Study pre-deployment assessment (Time 1)
- the MEAO Prospective Study post-deployment assessment (Time 2)
- the Impact of Combat Study follow-up (Time 3).

In relation to the mental health of the MEAO Deployed Cohort the findings arising from the present study showed that cohort members who had transitioned were experiencing significantly worse mental health than those who remained in the Regular ADF in 2015. In view of the findings from the earlier *Mental Health Prevalence Report* (Van Hooff et al., 2018), this is not surprising. Furthermore, it is probable that it reflects a 'healthy worker effect', which is not unexpected given the fitness requirements for deployment. Importantly, when considered together, for all mental health measures there were small to moderate increases in symptoms with time and, correspondingly, small to moderate increases in the proportion of the cohort with subsyndromal or probable disorder at Time 3. The specific findings for each mental health outcome are summarised in the following sections and in Table 1.

7.1.1 Depressive symptoms

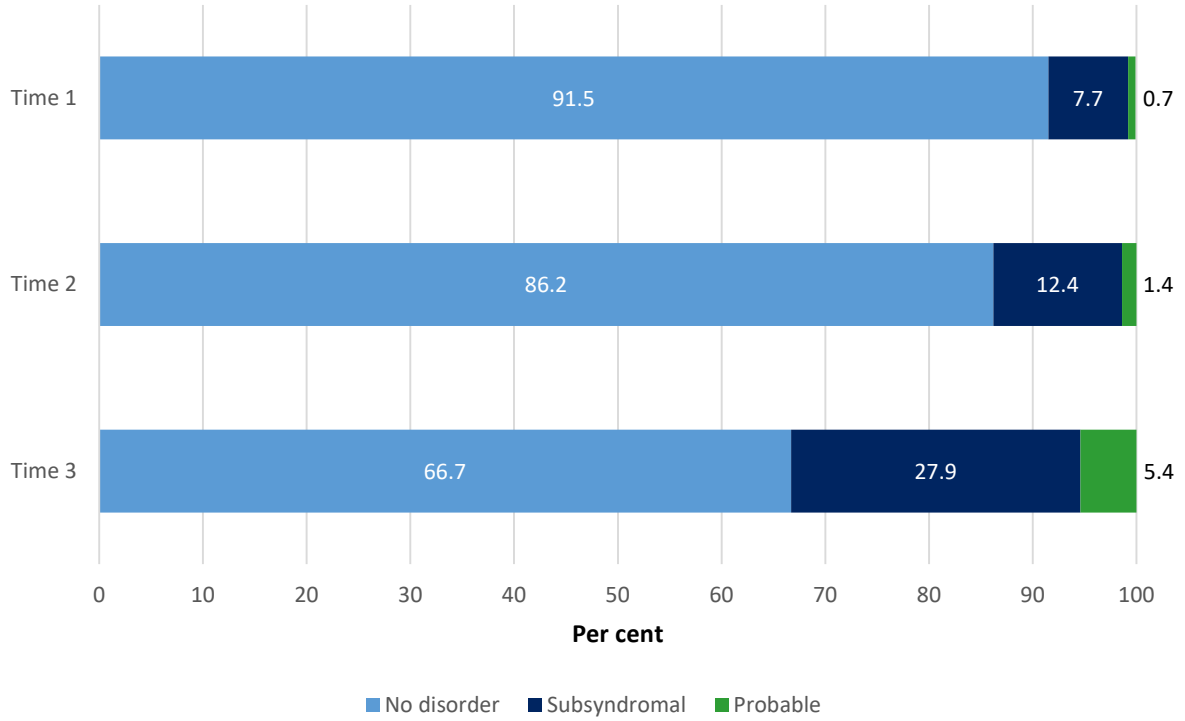
As Table 1 shows, average depressive symptoms were low but increased slightly from Time 1 to Time 2 (M = 1.6, SE = 0.1 and M = 2.5, SE = 0.2) and more than doubled again at Time 3 (M = 5.1, SE = 0.3). Figure 2 shows that the vast majority of the MEAO Deployed Cohort scored below both the screening and the epidemiological cut-off points at Time 1 (91.5%), Time 2 (86.2%) and Time 3 (66.7%), there being a steady increase in the proportion of people with subsyndromal and probable disorder over time. At Time 3, 27.9% of the cohort members were subsyndromal and 5.4% exhibited symptomatology indicative of probable depressive episodes.

Table 1 Depressive symptoms, psychological distress, posttraumatic stress symptoms, alcohol use, anger and suicidality over time in the MEAO Deployed Cohort

		Time 1 (Prospective pre-deployment)	Time 2 (Prospective post-deployment)	Time 3 (Impact of Combat follow-up)
	n	M (SE)	M (SE)	M (SE)
Depressive symptoms (PHQ)	426	1.6 (0.1)	2.5 (0.2)	5.1 (0.3)
Psychological distress (K10)	432	13.4 (0.2)	13.8 (0.2)	16.6 (0.4)
Posttraumatic stress symptoms (PCL-C)	411	20.0 (0.3)	22.3 (0.4)	25.3 (0.5)
Alcohol use and problem drinking (AUDIT)	416	6.3 (0.2)	6.3 (0.2)	6.6 (0.3)
Anger	422	6.7 (0.1)	7.3 (0.2)	8.5 (0.2)
Any suicidality (%)	417	2.2 (0.8–3.6)	3.6 (1.8–5.4)	12.7 (9.5–15.9)

Note: Total scores for Prospective Study included only those with scores on all variables. Impact of Combat had mean scores imputed for missing values.

Figure 2 **Depressive symptom status in the MEAO Deployed Cohort over time**



7.1.2 Psychological distress

There was a significant increase in mean K10 scores over time ($F(2,430) = 40.93$, $p < .0001$) (see Table 1). Mean K10 scores were similar at Time 1 and Time 2 ($M = 13.4$, $SE = 0.2$ and $M = 13.8$, $SE = 0.2$ respectively) and were higher at Time 3 ($M = 16.6$, $SE = 0.4$). When psychological distress was examined according to subsyndromal and probable disorder cut-offs (see Figure 3) a similar pattern was apparent. The majority of MEAO Deployed Cohort members were below the K10 screening cut-off at both Time 1 and Time 2 (84.3% and 79.4% respectively); by Time 3 this proportion had fallen to 69.7%.

At Time 1, 12.0% of members had subsyndromal symptom levels, while a further 3.7% had symptom levels indicative of probable disorder. The proportion of those who were subsyndromal increased to 16.7% at Time 2, then remained relatively stable at Time 3, at 16.4%. The proportion of the cohort with symptom levels indicating probable disorder did not increase at Time 2 (3.9%) but had increased dramatically by Time 3, to 13.9%.

7.1.3 Posttraumatic stress symptoms

As Table 1 shows, there was a significant increase in mean PCL-C scores over time ($F(2,409) = 102.73$, $p < .0001$). Mean PCL-C scores increased slightly from Time 1 ($M = 20.0$, $SE = 0.3$) to Time 2 ($M = 22.3$, $SE = 0.4$) and then again at Time 3 ($M = 25.3$, $SE = 0.5$). When symptoms were examined according to subsyndromal and probable disorder cut-off points (see Figure 4) a similar pattern emerged. The proportion of the cohort with subsyndromal posttraumatic stress symptoms nearly doubled from Time 1 (7.1%) to Time 2 (13.4%) and increased again, to 21.7%, at Time 3. The proportion of the cohort with probable PTSD was very low at all three time points, although it showed the same pattern of increase over time (Time 1, 0.2%; Time 2, 1.7%; Time 3, 3.6%).

Figure 3 **Psychological distress status in the MEAO Deployed Cohort over time**

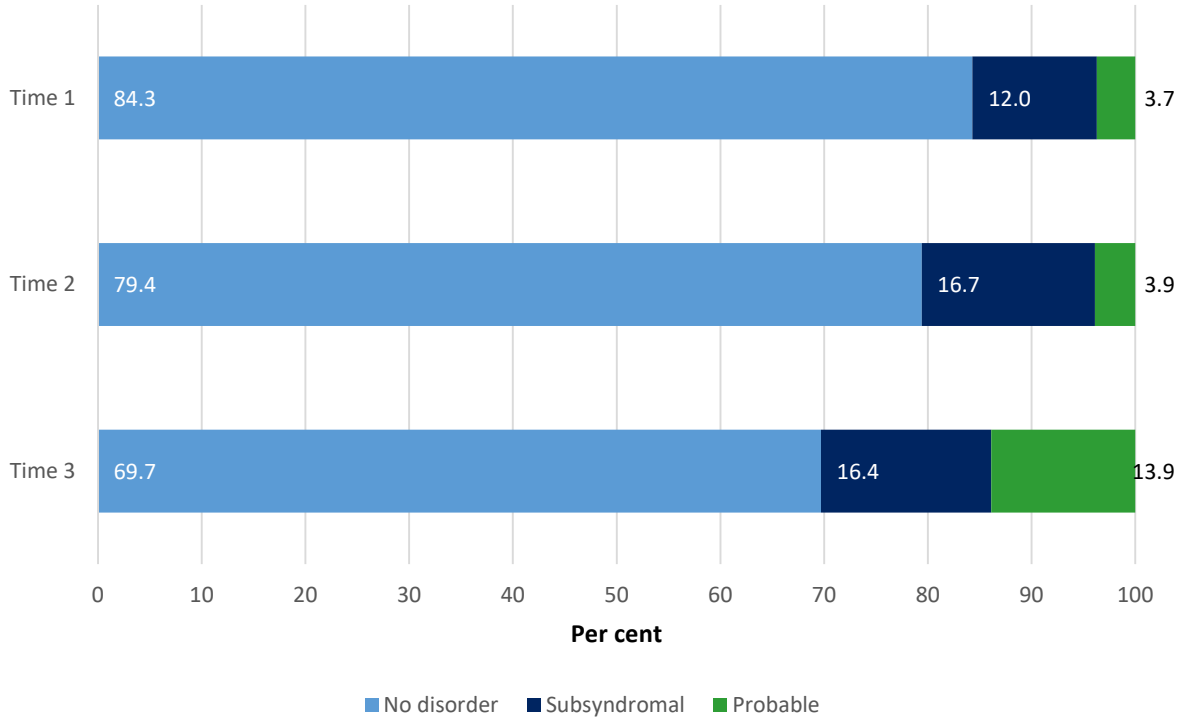
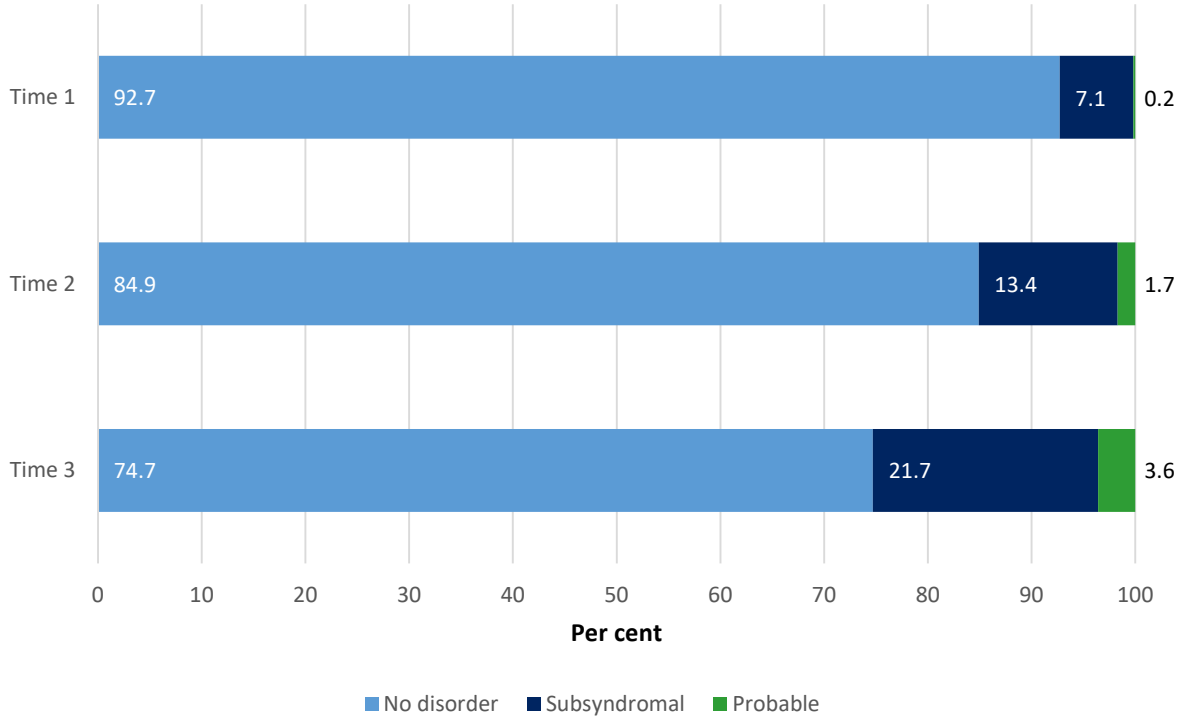


Figure 4 **Posttraumatic stress symptom status in the MEAO Deployed Cohort over time**

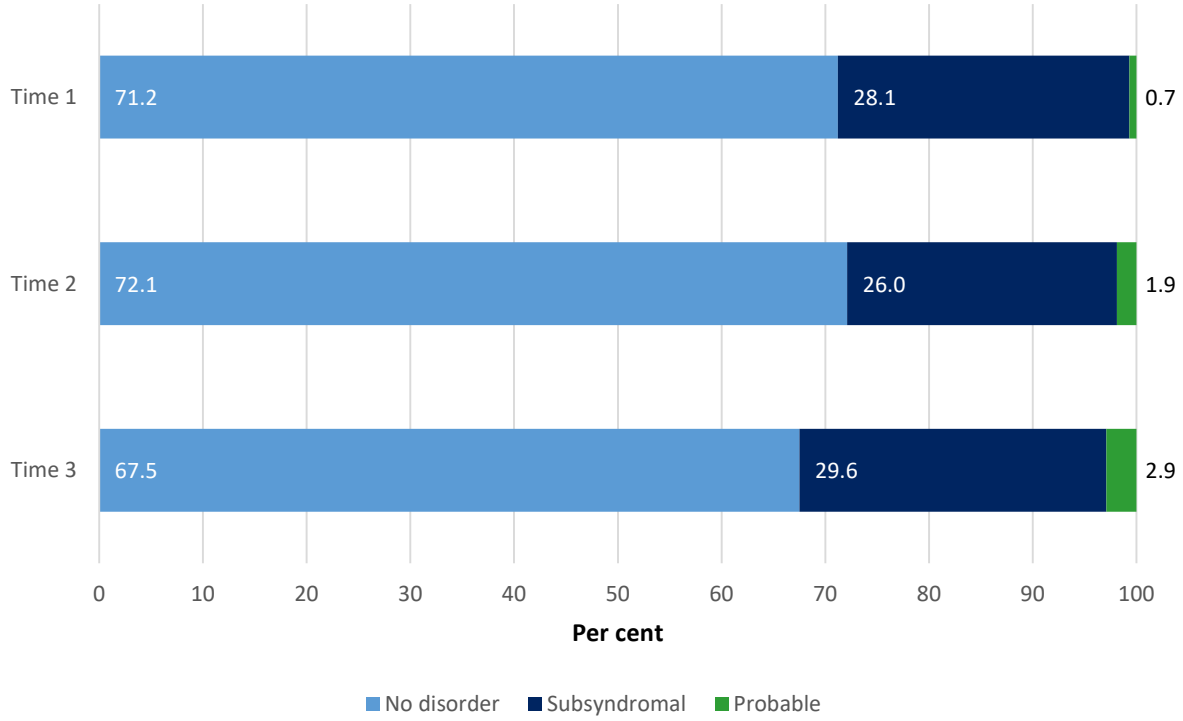


7.1.4 Alcohol use and problem drinking

Although there was a significant increase in mean AUDIT scores over time ($F(2,414) = 6.72$, $p = 0.002$) (Table 1) the increase was very small. Mean AUDIT scores were the same at Time 1 and Time 2 (M = 6.3, SE = 0.2) and similar at Time 3 (M = 6.6, SE = 0.2).

When proportions were examined according to subsyndromal and probable disorder (see Figure 5), several patterns emerged. Almost three-quarters of the MEAO Deployed Cohort scored below both the cut-off points at Time 1 (71.2%) and Time 2 (72.1%); this proportion reduced slightly at Time 3, to 67.5%. In all, 28.8% of the cohort scored above the screening cut-off at Time 1; the overwhelming majority of these individuals reported subsyndromal symptom levels (28.1%) and a further 0.7% reported symptom levels indicative of probable disorder. The proportion of individuals with subsyndromal symptomatology was relatively stable at Time 2 (26.0%) and Time 3 (29.6%).The proportion of the cohort with symptom levels indicating probable alcohol disorder, although low, increased over time (Time 1, 0.7%; Time 2, 1.9%; Time 3, 2.9%).

Figure 5 Alcohol use and problem drinking status in the MEAO Deployed Cohort over time



7.1.5 Anger symptoms

As Table 1 shows, mean anger scores increased over time (Time 1, M = 6.7, SE = 0.1; Time 2, M = 7.3, SE = 0.2; Time 3, M = 8.5, SE = 0.2). The proportion of cohort members with problematic anger also increased steadily from Time 1 through to Time 3 (Time 1, 5.5%; Time 2, 11.6%; Time 3, 19.2%).

7.1.6 Suicidality

The proportion of participants who endorsed any of the suicide items listed in the survey ('any suicidality') increased from Time 1 (2.2%) to Time 2 (3.6%) and then increased dramatically at Time 3, to 12.7% (see Table 1). At Time 1, 1.9% of participants reported that their life was not worth living. This proportion had almost doubled, to 3.6% by Time 2 and noticeably increased at Time 3, to 12.2%. A smaller proportion of participants reported that they felt so low they thought about committing suicide at Time 1 (1.0%). This proportion had increased slightly by Time 2 (1.4%) and increased again at Time 3 (7.7%). Although no one reported formulating a suicide plan or attempting suicide at either Time 1 or Time 2, at Time 3 2.6% of members reported making a suicide plan and 1.0% of members reported attempting suicide.

7.1.7 Summary

Together, these results highlight the significance of subsyndromal symptoms as an indicator of risk for future progression to diagnosable disorder. The 2010 ADF Mental Health Prevalence and Wellbeing Study (McFarlane et al., 2011) similarly identified the predictable trajectory from subsyndromal symptoms through to disorder across the spectrum of mental health measures. These findings also highlight the importance of early identification of symptoms of depression, psychological distress and PTSD in particular. The pattern of symptom recruitment over time is consistent with a substantial body of literature identifying subsyndromal PTSD as a significant risk factor for the later emergence of diagnosable disorder (Smid et al., 2009).

7.1.8 Lifetime and 12-month ICD-10 disorder

This section examines lifetime and 12-month ICD-10 mental disorders in the MEAO Deployed Cohort according to whether members had transitioned or remained in the Regular ADF in 2015.

Rates for three classes of ICD-10 mental disorder are presented – anxiety disorder, affective disorder and alcohol disorder. PTSD is presented separately to demonstrate how it differs from other anxiety disorders. (Although PTSD is classed with anxiety disorders in the ICD-10 classification system, it is now a separate category in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (McFarlane, 2014).)

The findings relating to symptomatic distress on the self-report measures just discussed are further elucidated by the results of the CIDI interviews, which characterised diagnosable mental disorder in the Combat Study population. Overall, members of the cohort who had transitioned reported higher lifetime and 12-month rates of each ICD-10 mental disorder class compared with those who remained in the Regular ADF in 2015.

Table 2 shows the lifetime and 12-month unweighted rates of ICD-10 anxiety disorders, affective disorders, alcohol disorders and PTSD for the MEAO Deployed Cohort according to whether members had transitioned or remained in the Regular ADF in 2015. In all, 79.2% of those who had transitioned met criteria for any ICD-10 mental disorder in their lifetime; this compares with 66.7% of cohort members who remained in the Regular ADF.

Alcohol (59.7%) and anxiety disorders (55.6%) were the most prevalent lifetime disorder classes for members of the cohort who had transitioned, the rates of affective disorder (37.5%) and PTSD (29.2%) being lower. This was also the case for members who remained in the Regular ADF in 2015, with 47.4% of participants reporting any alcohol disorder, 32.5% reporting any anxiety disorder, and lower rates for both affective disorder (18.4%) and PTSD (13.2%). Members who had transitioned reported higher rates of each disorder class compared with those who remained in the Regular ADF in 2015.

Table 2 Prevalence of lifetime and 12-month ICD-10 anxiety, affective and alcohol disorders in the MEAO Deployed Cohort

	Lifetime						12-month					
	Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186		Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186	
ICD-10 disorder	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Anxiety disorder (incl. PTSD)	40	55.6 (44.1–67.0)	37	32.5 (23.9–41.1)	77	41.4 (34.3–48.5)	30	41.7 (30.3–53.1)	21	18.4 (11.3–25.5)	51	27.4 (21.0–33.8)
Affective disorder	27	37.5 (26.3–48.7)	21	18.4 (11.3–25.5)	48	25.8 (19.5–32.1)	14	19.4 (10.3–28.6)	8	7.0 (2.3–11.7)	22	11.8 (7.2–16.5)
Alcohol disorder	43	59.7 (48.4–71.1)	54	47.4 (38.2–56.5)	97	52.2 (45.0–59.3)	12	16.7 (8.1–25.3)	5	4.4 (0.6–8.1)	17	9.1 (5.0–13.3)
PTSD	21	29.2 (18.7–39.7)	15	13.2 (7.0–19.4)	36	19.4 (13.7–25.0)	16	22.2 (12.6–31.8)	8	7.0 (2.3–11.7)	24	12.9 (8.1–17.7)
Any disorder	57	79.2 (69.8–88.5)	76	66.7 (58.0–75.3)	133	71.5 (65.0–78.0)	36	50.0 (38.5–61.5)	25	21.9 (14.3–29.5)	61	32.8 (26.0–39.5)

Note: A description of each of the ICD-10 disorder classes is provided in the glossary.

One in two cohort members who had transitioned met criteria for a mental disorder in the preceding 12 months compared with about one in five of the members who remained in the Regular ADF in 2015.

Anxiety disorders were the most prevalent 12-month disorder class among members who had transitioned (41.7%) and members who remained in the Regular ADF in 2015 (18.4%), the rates of affective disorder (Transitioned ADF, 19.4%; 2015 Regular ADF, 7.0%) and alcohol disorder (Transitioned ADF, 16.7%; 2015 Regular ADF, 4.4%) being lower. A total of 22.2% of those who had transitioned met criteria for 12-month PTSD compared with only 7.0% among those who remained in the Regular ADF in 2015. Again, those who had transitioned had higher rates of each 12-month disorder class compared with those who remained in the Regular ADF in 2015.

The most common lifetime affective disorder for both transitioned ADF and 2015 Regular ADF in the MEAO Deployed Cohort was depressive episodes (20.8% and 11.4% respectively); this was followed by bipolar affective disorder (Transitioned ADF, 15.3%; 2015 Regular ADF, 7.0%) and dysthymia (Transitioned ADF, 1.4%; 2015 Regular ADF, 0.0%). Similarly, the most common 12-month affective disorder class for both groups was depressive episodes (Transitioned ADF, 9.7%; 2015 Regular ADF, 4.4%); this was followed by bipolar affective disorder (Transitioned ADF, 8.3%; 2015 Regular ADF, 2.6%) and very low rates of dysthymia (Transitioned ADF, 1.4%; 2015 Regular ADF, 0.0%). Members of the cohort who had transitioned reported higher rates of every 12-month and lifetime affective disorder class listed, as well as 12-month (19.4 vs 7.0%) and lifetime (37.5% vs 18.4%) affective disorder overall, when compared when those who remained in the Regular ADF in 2015.

Table 3 Lifetime and 12-month ICD-10 affective disorders in the MEAO Deployed Cohort

ICD-10 affective disorder	Lifetime						12-month					
	Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186		Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Depressive episodes	15	20.8 (11.5–30.2)	13	11.4 (5.6–17.2)	28	15.1 (9.9–20.2)	7	9.7 (2.9–16.6)	5	4.4 (0.6–8.1)	12	6.5 (2.9–10.0)
Dysthymia	1	1.4 (0.0–4.1)	0	0.0	1	0.5 (0.0–1.6)	1	1.4 (0.0–4.1)	0	0.0	1	0.5 (0.0–1.6)
Bipolar affective disorder	11	15.3 (7.0–23.6)	8	7.0 (2.3–11.7)	19	10.2 (5.9–14.6)	6	8.3 (1.9–14.7)	3	2.6 (0.0–5.6)	9	4.8 (1.8–7.9)
Any affective disorder	27	37.5 (26.3–48.7)	21	18.4 (11.3–25.5)	48	25.8 (19.5–32.1)	14	19.4 (10.3–28.6)	8	7.0 (2.3–11.7)	22	11.8 (7.2–16.5)

Note: A description of each of the ICD-10 disorder classes is provided in the glossary.

With the exception of panic disorder, members who had transitioned reported higher rates of every lifetime anxiety disorder class compared with those in the Regular ADF in 2015. As expected, this was the trend for anxiety disorders overall, Transitioned ADF reporting higher rates of any lifetime anxiety disorder (55.6%) compared with those who remained in the Regular ADF (32.5%).

The most common lifetime anxiety disorder class for both groups was panic attack (Transitioned ADF, 33.3%; 2015 Regular ADF, 25.4%); this was followed by PTSD (Transitioned ADF, 29.2%; 2015 Regular ADF, 13.2%).

The most common 12-month disorder category for members who had transitioned was PTSD (22.2%); this was followed by panic attack (15.3%) and agoraphobia (12.5%). Rates of 12-month anxiety disorders among members who remained in the Regular ADF in 2015 were generally quite low: the most commonly reported 12-month anxiety disorder categories for cohort members who remained in the Regular ADF were panic attack (10.5%) and PTSD (7.0%).

Table 4 Lifetime and 12-month ICD-10 anxiety disorders in the MEAO Deployed Cohort

ICD-10 anxiety disorder	Lifetime						12-month					
	Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186		Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Panic attack	24	33.3 (22.4–44.2)	29	25.4 (17.4–33.4)	53	28.5 (22.0–35.0)	11	15.3 (7.0–23.6)	12	10.5 (4.9–16.2)	23	12.4 (7.6–17.1)
Panic disorder	4	5.6 (0.3–10.8)	7	6.1 (1.7–10.5)	11	5.9 (2.5–9.3)	3	4.2 (0.0–8.8)	5	4.4 (0.6–8.1)	8	4.3 (1.4–7.2)
Agoraphobia	20	27.8 (17.4–38.1)	10	8.8 (3.6–14.0)	30	16.1 (10.8–21.4)	9	12.5 (4.9–20.1)	5	4.4 (0.6–8.1)	14	7.5 (3.7–11.3)
Social phobia	13	18.1 (9.2–26.9)	10	8.8 (3.6–14.0)	23	12.4 (7.6–17.1)	7	9.7 (2.9–16.6)	3	2.6 (0.0–5.6)	10	5.4 (2.1–8.6)
Specific phobia	7	9.7 (2.9–16.6)	9	7.9 (2.9–12.8)	16	8.6 (4.6–12.6)	4	5.6 (0.3–10.8)	5	4.4 (0.6–8.1)	9	4.8 (1.8–7.9)
Generalised anxiety disorder	3	4.2 (0.0–8.8)	2	1.8 (0.0–4.2)	5	2.7 (0.4–5.0)	1	1.4 (0.0–4.1)	1	0.9 (0.0–2.6)	2	1.1 (0.0–2.6)
Obsessive compulsive disorder	7	9.7 (2.9–16.6)	0	0.0	7	3.8 (1.0–6.5)	5	6.9 (1.1–12.8)	0	0.0	5	2.7 (0.4–5.0)
Posttraumatic stress disorder	21	29.2 (18.7–39.7)	15	13.2 (7.0–19.4)	36	19.4 (13.7–25.0)	16	22.2 (12.6–31.8)	8	7.0 (2.3–11.7)	24	12.9 (8.1–17.7)
Any anxiety disorder	40	55.6 (44.1–67.0)	37	32.5 (23.9–41.1)	77	41.4 (34.3–48.5)	30	41.7 (30.3–53.1)	21	18.4 (11.3–25.5)	51	27.4 (21.0–33.8)

Note: A description of each of the ICD-10 disorder classes is provided in the glossary.

Although the rate of lifetime alcohol harmful use was comparable for both populations (Transitioned ADF, 38.9%; 2015 Regular ADF, 37.7%), the rate of alcohol dependence was higher among members who had transitioned (20.8%) compared with those who remained in the Regular ADF 2015 (11.4%). In the case of lifetime alcohol disorders overall, those who had transitioned reported higher rates of any lifetime alcohol disorder (59.7%) compared with those who remained in the Regular ADF (47.4%).

The rates of 12-month alcohol disorder classes were fairly low for both populations, although alcohol harmful use and alcohol dependence were more commonly reported among members of the cohort who had transitioned (6.9% and 9.7% respectively) compared with members of the cohort who remained in the Regular ADF (0.9% and 3.5% respectively). Further, those who had transitioned also reported higher rates of any 12-month alcohol disorder (16.7%) compared with those who remained in the Regular ADF (4.4%).

Table 5 Lifetime and 12-month ICD-10 alcohol disorders in the MEAO Deployed Cohort

ICD-10 alcohol disorder	Lifetime						12-month					
	Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186		Transitioned ADF n = 72		2015 Regular ADF n = 114		Total n = 186	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Alcohol harmful use	28	38.9 (27.6–50.1)	43	37.7 (28.8–46.6)	71	38.2 (31.2–45.2)	5	6.9 (1.1–12.8)	1	0.9 (0.0–2.6)	6	3.2 (0.7–5.8)
Alcohol dependence	15	20.8 (11.5–30.2)	13	11.4 (5.6–17.2)	28	15.1 (9.9–20.2)	7	9.7 (2.9–16.6)	4	3.5 (0.1–6.9)	11	5.9 (2.5–9.3)
Alcohol disorder	43	59.7 (48.4–71.1)	54	47.4 (38.2–56.5)	97	52.2 (45.0–59.3)	12	16.7 (8.1–25.3)	5	4.4 (0.6–8.1)	17	9.1 (5.0–13.3)

Note: A description of each of the ICD-10 disorder classes is provided in the glossary.

The findings for rates of diagnosable anxiety disorders and PTSD in particular characterise the burden of psychological morbidity in this population that occurs as a consequence of combat-related deployments. When considered along with the self-report symptom findings, they further highlight the delayed onset of many mental disorders, as well as the crucial importance of following the combat-exposed population over time to optimally detect the emergence of this morbidity. A series of studies have followed cohorts that have served in the Middle East Area of Operations, and they all demonstrate a similar pattern of increasing PTSD morbidity with time. For example, Vasterling et al. (2016) followed a cohort of 598 US Marines and found that rates of PTSD increased from 7.4% at a pre-deployment measurement to 24.7% at long-term follow-up

(approximately eight years after the index deployment). Similarly, a longitudinal follow-up study of a cohort of Dutch combat troops identified an increase in the levels of symptomatic distress over a five-year follow-up period (Eekhout et al., 2016).

In the case of other disorder classes and disorders, the most common 12-month affective disorder in the cohort was depressive episodes (Transitioned ADF, 9.7%; 2015 Regular ADF, 4.4%); this was followed by bipolar affective disorder (Transitioned ADF, 8.3%; 2015 Regular ADF, 2.6%). Again, these rates are similar to those presented in the *Mental Health Prevalence Report* (Van Hooff et al., 2018). In general, alcohol disorders were not highly prevalent in the Combat Study population. The most common 12-month alcohol disorder class was alcohol dependence, this being reported by 9.7% of the Transitioned ADF and a substantially smaller 3.5% of the 2015 Regular ADF. This pattern of increased alcohol consumption among Transitioned ADF members was also observed in the Mental Health Prevalence Study (Van Hooff et al., 2018). Furthermore, the 2010 Mental Health Prevalence and Wellbeing Study documented extremely low rates of alcohol use disorders among Regular ADF members – lower in fact than among the general Australian community (McFarlane et al., 2011).

It is hypothesised that the structure and discipline of the military environment probably assist in modulating alcohol use; this beneficial impact is then lost as the individual transitions from active service to the civilian environment. The increased levels of alcohol dependence observed among the transitioned members of the cohort may also reflect the use of alcohol to self-medicate their higher levels of disorder. In particular, alcohol has been shown to attenuate symptoms of hypervigilance and an exaggerated startle response (Davis et al., 2013). Changing patterns of alcohol consumption have also been shown in a number of settings to be a marker for risk of PTSD (Crum et al., 2013; Kline et al., 2014).

Together, the patterns of change in mental health over time, as well as 12-month diagnosable mental disorder, indicate that overall this cohort is psychologically healthy, with low rates of mental disorder in the preceding month and similar rates of 12-month disorder among the transitioned subset. This is consistent with a healthy worker effect and, in the case of 30-day probable disorder, it appears that the healthy worker effect may extend somewhat into the transitioned subset of the cohort. When considering mental health symptoms more generally, however, overall there was a general decline in the mental health of the cohort, consistent with a process of time-dependent sensitisation.

7.2 Physical health outcomes

Like their mental health, the cohort's physical health declined with the passage of time, in particular reflecting non-specific somatic distress. There were increasing complaints of non-specific physical health symptoms, with the number of symptoms reported nearly doubling between Time 1 and Time 3. While pain was measured only at Time 3, the results are consistent with the increasing physical symptom burden across time in the cohort – particularly among members who transitioned. A substantially greater proportion of members who had transitioned by Time 3 (9.7%) reported the highest grade of pain intensity and disability (Grade IV) compared with only 5.9% of those who remained in the Regular ADF in 2015.

In the case of the more objective measure of body mass index, over 50% of participants fell within the pre-obese range at Time 1. This proportion increased to almost 60% at Time 2 and was higher still at Time 3, at 66.3%. Obesity is associated with many other physical health problems, including cardiovascular disease, diabetes, a range of cancers and arthritis (Australian Institute of Health and Welfare, 2002).

Together, physical health symptoms and biological markers are an important domain to document and monitor over time –especially because of the importance of managing the emergence of mortality in this population. At the cohort level there does not appear to be evidence of systemic dysregulation in physiological stress response systems, but in view of the observed shifts in psychological and somatic symptoms over time it is possible that shifts in physiological systems, and the development of physical conditions, will emerge as further time passes. There is some evidence that the relationship between psychological distress and shifts in

the physiological stress regulation system are bi-directional (Renoir et al., 2013): thus, with the further recruitment of symptoms over time, it is possible that biological systemic dysregulation may emerge.

Following are the specific findings.

7.2.1 Health symptoms

As Table 6 shows, there was a significant increase in mean health symptoms over time ($F(2,422) = 66.51$, $p < .0001$). The mean number of symptoms reported by participants increased from Time 1 (M = 7.7, SE = 0.4) to Time 2 (M = 10.4, SE = 0.5) and was higher again at Time 3 (M = 12.8, SE = 0.5).

Table 6 Mean number of health symptoms in the MEAO Deployed Cohort (n = 424) over time

	Time 1 (Prospective pre-deployment)		Time 2 (Prospective post-deployment)		Time 3 (Impact of Combat follow-up)	
	M	SE	M	SE	M	SE
Mean number of conditions	7.7	0.4	10.4	0.5	12.8	0.5

7.2.2 Pain intensity and disability

Table 7 shows that the majority of cohort participants across both populations reported experiencing Grade I pain intensity and disability (Transitioned ADF, 55.9%; 2015 Regular ADF, 62.6%). When considering the higher pain intensity and disability categories, though, a similar proportion of those who had transitioned and those who remained in the Regular ADF in 2015 reported Grade III pain intensity and disability (9.7% and 10.6% respectively); a higher proportion of members who had transitioned (9.7%) reported the highest grade of pain intensity and disability (Grade IV) compared with only 5.9% of those who remained in the Regular ADF.

Table 7 Pain intensity and disability in Transitioned ADF and 2015 Regular ADF in the MEAO Deployed Cohort

	Transitioned ADF n = 93		2015 Regular ADF n = 321		Total n = 414	
Pain intensity and disability	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Grade 0 'pain free'	10	10.8 (4.5–17.0)	32	10.0 (6.7–13.2)	42	10.1 (7.2–13.1)
Grade I 'low disability – low intensity'	52	55.9 (45.8–66.0)	201	62.6 (57.3–67.9)	253	61.1 (56.4–65.8)
Grade II 'low disability – high intensity'	13	14.0 (6.9–21.0)	35	10.9 (7.5–14.3)	48	11.6 (8.5–14.7)
Grade III 'high disability – moderately limiting'	9	9.7 (3.7–15.7)	34	10.6 (7.2–14.0)	43	10.4 (7.4–13.3)
Grade IV 'high disability – severely limiting'	9	9.7 (3.7–15.7)	19	5.9 (3.3–8.5)	28	6.8 (4.3–9.2)

7.2.3 Body mass index

Over half the cohort came within the pre-obese range (53.7%) at Time 1 (see Table 8). This proportion increased to 58.9% at Time 2 and 66.3% at Time 3. Further, just over a third of participants (34.7%) were in the normal weight range at Time 1. This proportion decreased to 26.3% at Time 2 and 24.2% at Time 3.

Table 8 BMI in the MEAO Deployed Cohort (n = 95) over time

	Time 1 (Prospective pre-deployment)		Time 2 (Prospective post-deployment)		Time 3 (Impact of Combat follow-up)	
BMI categories	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Underweight	0	0.0	0	0.0	0	0.0
Normal range	33	34.7 (25.2–44.3)	25	26.3 (17.5–35.2)	23	24.2 (15.6–32.8)
Pre-obese	51	53.7 (43.7–63.7)	56	58.9 (49.1–68.8)	63	66.3 (56.8–75.8)
Obese class 1	11	11.6 (5.1–18.0)	13	13.7 (6.8–20.6)	7	7.4 (2.1–12.6)
Obese class 2	0	0.0	1	1.1 (0.0–3.1)	1	1.1 (0.0–3.1)
Obese class 3	0	0.0	0	0.0	1	1.1 (0.0–3.1)
Mean score (M, SE)		26.4 (0.3)		27.0 (0.3)		27.2 (0.5)

7.3 Biological outcomes

As part of this Impact of Combat Study, a range of biological markers were also assessed on a limited subset of the cohort. This included measures of liver function, metabolic function and blood glucose, as well as inflammatory markers. There is now a large body of literature demonstrating the utility of measures of low-level inflammation in contributing to the prediction of long-term health outcomes – particularly in relation to chronic conditions such as diabetes and cardiovascular and metabolic conditions (Raison & Miller, 2011; Renoir et al., 2013). There is also a rapidly emerging field of neuro-immunology that has found evidence of associations between low-level inflammation and psychological symptoms, with evidence of bi-directional effects (Raison & Miller, 2011; Rohleder & Karl, 2006; Zannas & West, 2014).

Overall, for this study biological outcomes were well within the normal ranges for a healthy population and only small changes were observed in the biological outcomes measured; for a number of markers no changes were found, although there were some consistent patterns of change across groups of measures (see Table 9).

The liver enzyme gamma GT showed a significant change in mean scores over time, increasing from Time 1 to Time 2 then decreasing at Time 3. Of the metabolic indices, there was a small but significant increase in mean LDL cholesterol over time, while mean total HDL cholesterol and triglycerides remained stable at all three time points. There was a significant decrease in mean HBA1C over time, with incremental decreases at each time point, while random glucose remained relatively stable.

A number of inflammatory and other markers (IL-6, TNF alpha, CRP, cortisol and BDNF) showed a pattern of increase between Time 1 and Time 2 and a decrease at Time 3.

Table 9 Biological outcomes in the MEAO Deployed Cohort over time

		Time 1 (Prospective pre-deployment) n = 64		Time 2 (Prospective post-deployment) n = 64		Time 3 (Impact of Combat follow-up) n = 64	
Biological outcome	n	M	SE	M	SE	M	SE
Liver enzyme							
Gamma-glutamyl transferase (gamma GT)	64	20.6	1.7	25.2	2.5	22.5	1.4
Metabolic							
LDL cholesterol	56	2.6	0.1	2.7	0.1	3.0	0.1
HBA1C – NGSP	64	5.5	0.0	5.3	0.0	5.1	0.0
Random glucose	63	5.1	0.1	5.1	0.1	5.0	0.1
Total HDL cholesterol	57	1.3	0.0	1.3	0.0	1.3	0.0
Triglycerides	57	1.4	0.1	1.4	0.1	1.4	0.1
Inflammation							
Erythrocyte sedimentation rate (ESR)	60	2.5	0.2	2.6	0.4	3.3	0.3
White cell count	62	6.5	0.2	6.6	0.2	6.7	0.2
Interleukin 1b	44	556.4	289.2	444.6	248.3	240.5	150.9
Interleukin 6	45	1025.1	427.5	1277.9	289.6	524.8	141.8
Interleukin 10	45	690.9	259.2	442.4	105.9	347.4	134.0
TNF alpha	45	4683.9	2437.0	5979.1	2331.2	2875.1	1193.1
C-reactive protein (CRP)	64	0.8	0.2	1.6	0.4	1.4	0.3
Cortisol	46	13776.1	1231.6	13024.2	1100.3	10424.6	1141.2
SIL-2RA	44	1025.2	59.2	923.0	64.0	781.0	46.8
Other							
Brain-derived neurotrophic factor (BDNF)	42	38.7	1.4	42.0	1.8	35.2	1.8

In general, that the biological outcomes were well within the normal ranges for a healthy population was expected, not only because of the relatively young age of the cohort but also as a reflection of members' exceptional health at the time of recruitment into the study. This is also consistent with the cohort remaining relatively healthy at the Time 3 follow-up. It is to be expected given their age and their high levels of physical fitness at baseline.

While the more general biological indicators showed very little change over time, shifts were documented for the inflammatory markers. The measures of acute infection and inflammatory response showed little movement – again in line with the cohort being relatively healthy at each time point. For the pro-inflammatory markers (IL-6, TNF alpha, CRP and cortisol), however, there was a trend towards increasing levels at Time 2 and a subsequent decrease at Time 3. This pattern is in keeping with what might be expected from an adaptive immune response to stress (Dhabhar, 2014; Lovallo, 2015), whereby the HPA axis mounts an immune response to the stressor, in this case deployment, which reduces once the stressor has past, returning the system to homeostasis (McEwen, 1998, 2000). This finding not only indicates that broadly, while the experience of deployment may lead to shifts in physiological indicators of stress, these are not sustained in the long term. It also suggests, though, that there may be practical utility in documenting shifts in immune response in relation to stress.

8 Predicting long-term mental health in the MEAO Deployed Cohort

In addition to examining the longitudinal course of mental, physical and biological health indices, this Impact of Combat Study explored the contribution of various factors to mental health at Time 3.

The results of multivariate predictive modelling showed differential patterns of predictors for psychological distress and posttraumatic stress over time. In particular, deployment experience at Time 1 and the number of combat exposures experienced during an individual's military career were significant predictors of elevated psychological distress at Time 3. In contrast, the strongest predictors of elevated posttraumatic stress at Time 3 were lifetime traumatic events and the number of types of traumatic deployment exposures during the person's career. This suggests there may be more trauma-specific effects for posttraumatic stress disorder, while other factors have additional impact on the development of psychological distress over time. Psychological distress is by its nature more general, so this difference is perhaps not surprising. Evidence to support this was also found in a descriptive analysis of objective biological neurocognitive markers in those with and without psychological distress and posttraumatic stress at Time 3. These findings are summarised later in this report.

Importantly, in both models the contribution of deployment trauma to subsequent psychological symptoms is clear, and it appears there is a dose–response association, with a threshold at which the effects of exposure begin to emerge. Exposure measures are captured routinely in post-operational screening, which affords an opportunity to monitor the dose, noting that the risk appears to be cumulative across the career, rather than just the consequence of a single deployment. Furthermore, the finding of the significant univariate predictive power of low-level posttraumatic stress and psychological distress symptoms following deployment (at Time 2) is important: the vast majority of cohort members were below screening cut-offs on these measures at Time 2 and so would not have been identified as at risk during post-operation psychological screening, which suggests that scoring above the recommended screening cut-off may not be optimal for detecting individuals at risk of disorder emergence later.

Limited descriptive analyses examining the patterns of physical health indices over time among those with and without elevated psychological distress or posttraumatic stress at Time 3 were also performed, and self-reported physical health symptoms and key inflammatory markers were examined. Although preliminary and descriptive in nature, the results were somewhat consistent with the findings observed for psychological symptoms insofar as groups exhibiting elevated psychological symptoms at Time 3 had differential physical health symptom patterns over time and exhibited a distinct pattern of inflammatory marker levels.

The specific findings are summarised in the following sections.

8.1 Predictors of psychological distress over time

Multivariate predictive modelling showed that the mean number of prior deployments at Time 1 and the number of traumatic deployment exposures reported by cohort members for their military career were associated with elevated psychological distress symptoms at Time 3. Specifically, the greater the number of previous deployments cohort members had before the index deployment, the greater the likelihood of having elevated psychological distress at Time 3 (OR 1.10, 95% CI 1.00, 1.20). For traumatic deployment exposure types, those with high or very high exposures were three times more likely to have elevated psychological distress compared with those with very low exposure (high, OR 3.76, 95% CI 1.39, 10.20; very high, OR 3.91, 95% CI 1.41, 10.79) or low exposure (high, OR 2.93, 95% CI 1.19, 7.19; very high, OR 3.04, 95% CI 1.22, 7.57).

Other significant univariate predictors of elevated psychological distress symptoms at Time 3 were rank, Service, problematic anger at Time 2, and mean psychological distress symptoms at both Time 1 and Time 2.

Cohort members who were from Other Ranks (compared with Officers) (38.9% vs 20.2%; OR 2.54, 95% CI 1.26, 5.12) or Army (compared with Air Force) (31.4% vs 23.2%; OR 1.78, 95% CI 1.00, 3.17) at the time of the index deployment were more likely to have elevated psychological distress at Time 3.

Members with problematic anger at Time 2 were significantly more likely to have elevated distress at Time 3 (59.5% vs 25.3%; OR 2.92, 95%CI 1.36, 6.26). Mean psychological distress symptoms were higher at pre-deployment (Time 1) for those who had elevated compared with low psychological distress symptoms at Time 3 (M = 14.3, SE = 0.4 vs M = 12.8, SE = 0.2; OR 1.09, 95% CI 1.03, 1.16). Following the index deployment (Time 2) this difference was larger and again significant (M = 15.8, SE = 0.6 vs M = 13.0, SE = 0.3; OR 1.14, 95% CI 1.08, 1.20).

8.2 Predictors of posttraumatic stress over time

Multivariate predictive modelling showed that the mean number of lifetime trauma types at Time 1 and the number of traumatic deployment exposures reported by cohort members for their military career were associated with elevated posttraumatic stress symptoms at Time 3. Specifically, a higher mean number of lifetime trauma exposure types reported at Time 1 predicted longer term posttraumatic stress symptom status at Time 3 (OR 1.16, 95% CI 1.03, 1.31). In the case of traumatic deployment exposure types, compared with members with very low exposure members with high exposures were three times more likely (OR 3.31, 95% CI 1.00, 10.89) to have elevated posttraumatic stress symptoms at Time 3. Similarly, compared with those with low levels of exposure those with medium exposure were nearly four times more likely (OR 3.87, 95% CI 1.32, 11.34), those with high exposure were nearly five times more likely (OR 4.84, 95% CI 1.60, 14.63) and those with very high exposures were about four times more likely (OR 4.17, 95% CI 1.36, 12.75) to have elevated posttraumatic stress symptoms at Time 3.

Other significant univariate predictors of elevated posttraumatic stress symptoms at Time 3 were sex, rank, Service, environmental exposure types experienced on deployment, problematic anger at Time 2, and mean posttraumatic stress symptoms at both Time 1 and Time 2.

Males (as opposed to females) (25.6% vs 10.3%; OR 4.26, 95% CI 1.14–15.95), members who were from Other Ranks (as opposed to Officers) (32.9% vs 15.7%; OR 2.56, 95% CI 1.17, 5.59) and Army (as opposed to Air Force) (28.6% vs 15.1%; OR 2.21, 95% CI 1.13, 4.31) at the time of the index deployment were more likely to have elevated posttraumatic stress at Time 3.

The mean number of environmental exposure types (M = 18.0, SE = 0.6 vs M = 15.1, SE = 0.4; OR 1.10, 95% CI 1.04, 1.16) experienced during a member's career was higher among those who had elevated compared with low posttraumatic stress symptoms at Time 3. Those with problematic anger at Time 2 were significantly more likely to have elevated posttraumatic stress at Time 3 (55.6% vs 20.6%, OR 2.67; 95%CI 1.16, 6.18). Posttraumatic stress symptoms at pre-deployment (Time 1) were slightly higher among those who had elevated compared with low posttraumatic stress symptoms at Time 3 (M = 22.0, SE = 0.7 vs M = 19.2, SE = 0.2; OR 1.12, 95% CI 1.07, 1.18), while after the index deployment (Time 2) symptoms were substantially higher (M = 27.0, SE = 1.2 vs M = 20.5, SE = 0.3; OR 1.12, 95% CI 1.08, 1.17).

8.3 Physical health correlates of long-term mental health

This section presents a descriptive examination of two key physical health outcomes over time according to mental health status at Time 3 – the number of physical health symptoms and biological outcomes limited to inflammatory markers. As with the predictive modelling, results for psychological distress are presented first and these are followed by the results for posttraumatic stress.

8.3.1 Psychological distress

Table 10 shows levels of key inflammatory markers over time among cohort subgroup members with low as opposed to elevated psychological distress at Time 3.

Both pro-inflammatory and anti-inflammatory markers were lower at Time 1 among those with elevated psychological distress at Time 3. This pattern continued at Time 2. At Time 3 there was some convergence for IL6 and CRP, but the other markers remained lower. In contrast, cortisol was higher at Time 1 in the elevated psychological distress group, but this difference dissipated at the Time 2 and Time 3 follow-ups.

Table 10 Biological outcomes in the MEAO Deployed Cohort across time, by Time 3 K10 screening cut-off

			Time 1 (Prospective pre-deployment)		Time 2 (Prospective post-deployment)		Time 3 (Impact of Combat follow-up)	
Biological outcome	n	K10 screening cut-off	M	SE	M	SE	M	SE
Interleukin 1b	31	Below screening cut-off	0.7	0.4	0.6	0.4	0.3	0.2
	13	Above screening cut-off	0.2	0.2	0.1	0.0	0.0	0.0
Interleukin 6	32	Below screening cut-off	1340.6	593.6	1489.4	399.7	539.8	196.5
	13	Above screening cut-off	248.3	88.4	757.1	129.2	487.9	97.1
Interleukin 10	32	Below screening cut-off	885.0	359.4	479.0	145.3	402.5	186.1
	13	Above screening cut-off	213.4	70.5	352.2	85.0	211.6	76.1
TNF alpha	32	Below screening cut-off	5623.6	3340.9	7495.5	3235.5	3413.4	1652.0
	13	Above screening cut-off	2371.0	1944.2	2246.3	882.3	1549.9	712.9
C-reactive protein (CRP)	38	Below screening cut-off	0.9	0.3	1.8	0.7	1.2	0.3
	16	Above screening cut-off	0.3	0.2	1.3	0.5	2.0	0.7
Cortisol	32	Below screening cut-off	12,849.9	1534.6	13,406.2	1433.6	10,443.7	1448.4
	14	Above screening cut-off	15,893.3	1979.9	12,150.8	1575.7	10,380.8	1838.0

Table 11 shows the mean number of health symptoms over time according to psychological distress status at Time 3. The subgroup with elevated psychological distress at Time 3 reported greater numbers of symptoms at all three time points, the difference increasing over time. Interestingly, the mean number of health symptoms reported by the subgroup with low psychological distress remained relatively stable.

Table 11 Mean number of health symptoms reported by MEAO Deployed Cohort across time points, by K10 screening cut-off

	Time 1 (Prospective pre-deployment)		Time 2 (Prospective post-deployment)		Time 3 (Impact of Combat follow-up)					
	n = 422		n = 422		Transitioned ADF n = 130		2015 Regular ADF n = 292		Total n = 422	
K10 screening cut-off	M	SE	M	SE	M	SE	M	SE	M	SE
Below screening cut-off	7.0	0.4	8.4	0.5	9.4	0.8	9.5	0.5	9.5	0.4
Above screening cut-off	9.5	0.8	14.9	1.0	23.7	1.6	19.1	1.3	20.5	1.0

Note: Total scores for Prospective Study included only those with scores on all variables. Impact of Combat had mean scores imputed for missing data.

8.3.2 Posttraumatic stress

Table 12 shows levels of key inflammatory markers over time among cohort subgroup members with low as opposed to elevated posttraumatic stress at Time 3. All pro-inflammatory markers with the exception of CRP (IL1b, IL6, TNF) were lower in those with elevated posttraumatic stress at Time 3. Interestingly, levels of the anti-inflammatory marker IL10 were higher in this subgroup, as were those for cortisol. The difference in cortisol levels and, to a lesser extent, IL6 levels dissipated over time.

Table 12 Biological outcomes in the MEAO Deployed Cohort across time, by Time 3 PCL screening cut-off

Biological outcome	n	PCL screening cut-off	Time 1 (Prospective pre-deployment)		Time 2 (Prospective post-deployment)		Time 3 (Impact of Combat 5-year follow-up)	
			M	SE	M	SE	M	SE
Interleukin 1b	29	Below screening cut-off	808.2	433.0	572.5	368.3	339.4	227.6
	13	Above screening cut-off	76.7	60.8	216.2	180.3	56.7	36.3
Interleukin 6	30	Below screening cut-off	1236.5	631.9	1313.9	406.9	585.9	208.3
	13	Above screening cut-off	641.3	256.0	1244.7	372.7	440.5	99.7
Interleukin 10	30	Below screening cut-off	610.6	257.3	387.7	113.9	249.6	59.9
	13	Above screening cut-off	950.4	688.1	612.0	256.9	626.1	445.2
TNF alpha	30	Below screening cut-off	6419.3	3618.8	7462.9	3432.2	3800.1	1751.4
	13	Above screening cut-off	626.2	318.2	2226.6	943.4	1156.8	676.4
C-reactive protein (CRP)	34	Below screening cut-off	0.8	0.3	1.8	0.7	1.4	0.4
	17	Above screening cut-off	0.8	0.4	1.7	0.5	1.9	0.4
Cortisol	30	Below screening cut-off	12,566.9	1613.2	12,185.8	1230.1	10,236.0	1474.6
	14	Above screening cut-off	16,990.5	1884.4	14,940.0	2413.9	10,133.5	1903.6

Table 13 shows mean physical health symptoms over time among cohort members with low as opposed to elevated posttraumatic stress at Time 3. Among those with low posttraumatic stress, the overall number of physical health symptoms was lower and remained relatively stable over time. Physical health symptoms were higher among those with elevated posttraumatic stress at all three time points, and the difference increased with time.

Table 13 Mean number of health symptoms reported by MEAO Deployed Cohort across time points, by PCL screening cut-off

PCL screening cut-off	Time 1 (Prospective pre-deployment) n = 421		Time 2 (Prospective post-deployment) n = 421		Time 3 (Impact of Combat 5-year follow-up) Transitioned ADF n = 117		2015 Regular ADF n = 304		Total n = 421	
	M	SE	M	SE	M	SE	M	SE	M	SE
Below screening cut-off	6.7	0.4	8.0	0.4	10.3	1.0	9.1	0.5	9.3	0.4
Above screening cut-off	10.5	0.9	16.6	1.1	23.4	1.6	21.8	1.3	22.4	1.0

Note: Total scores for Prospective Study included only those with scores on all variables. Impact of Combat had mean scores imputed for missings.

9 Neurocognitive function in the Combat Role High-risk Subgroup

9.1 Neurocognitive measures

9.1.1 Quantitative electroencephalography

The change in resting-state cortical activity over time was captured using quantitative electroencephalography. qEEG offers a method of measuring brain electrical activity that involves high-powered computer analytic systems deconstructing signals from multi-channel EEG into power frequency spectra (Kropotov, 2010). Spectral analysis of qEEG has been used to define a set of basic EEG rhythms that are associated with particular physiological and functional states. Four basic rhythms, each associated with particular physiological and functional states, were examined: beta rhythms are high frequency and low amplitude and are present during active cognitive engagement; alpha rhythms are slightly lower frequency and higher amplitude, are present during relaxed wakefulness and as such are reflective of a resting idle state; theta rhythms are slower again, of a higher amplitude and associated with memory processes, also appearing during deep meditation and hypnosis; delta rhythms are the slowest, have the greatest amplitude and are most prominently associated with sleep and dreaming states.

9.1.2 Working memory: event-related potential

Another electrophysiological measure of cognitive function, event-related potential, or ERP, is an extension of electroencephalography. This method is used to measure brief (sub-second) fluctuations in electrical brain activity, which are directly associated with specific sensory and cognitive processing events. The change in working memory function over time was measured by P3wm amplitudes. The P3 component is a later latency positive-going amplitude deflection that typically peaks 250 to 500 milliseconds after stimulus. P3 amplitude deflections elicited during a stimulus task are used as an index of cognitive processing events associated with working memory updating. The P3 amplitude deflection elicited during working memory updating tasks is commonly referred to as the 'P3wm component'.

9.2 Neurocognitive function over time

Overall, the qEEG and ERP indices of neurocognitive function in the Combat Role High-risk Subgroup of the MEAO Deployed Cohort suggest that initial deployment and combat exposure may have lasting impacts on resting brain states and attentional and memory processes. Beta power and alpha power showed reductions from Time 1 to Time 2 and these were sustained at Time 3. This is indicative of reduced cognitive engagement and reduced relaxed wakefulness. In contrast, theta and delta power increased from Time 1 to Time 2 and the elevations were sustained at Time 3, suggesting an increase in memory processing. ERP indices of working memory showed reduced efficiency of memory processes over time.

Changes in resting-state qEEG power levels and working memory function over time were also examined among cohort members with elevated psychological distress or elevated posttraumatic stress symptoms at Time 3 (scoring above the K10 or PCL screening cut-off) and compared with a healthy subgroup (those scoring below K10 and PCL-C screening cut-offs at Time 3). Although a number of consistent trends were observed in both groups over time, when considering individuals with elevated psychological distress or posttraumatic stress and those who remained psychologically healthy at Time 3, the groups exhibited numerous distinct qEEG characteristics that have the potential to prove useful in the prediction and monitoring of long-term mental health trajectories. In particular, beta and theta power bands appear to bear the closest association with current psychological symptom status at Time 3. Higher beta and theta power levels at Time 1 also appear

to potentially be vulnerability factors for the prediction of future symptom status at Time 3, while alpha power may be more closely associated with the actual symptom profile.

Working memory is of particular interest in military populations because military-specific factors such as deployment have been found to be associated with deficits in a variety of areas of cognitive functioning and have the potential to disrupt information processing (Johnson et al., 2013). Disturbances in cognitive function are also associated with a range of psychiatric disorders that tend to be prevalent in military populations – among them depression, panic disorder, generalised anxiety disorder and PTSD (Castaneda et al., 2008; Rose & Ebmeier, 2006) – and may also be compromised in people who have suffered a mild traumatic brain injury (Lagarde et al., 2014). In the current study, working memory was assessed using ERP data. Although there were some overall trends in the population, when considering subgroups with elevated psychological distress or posttraumatic stress and those who remained psychologically healthy, the subgroups with elevated psychological distress or posttraumatic stress exhibited varying patterns of working memory efficiency that could potentially prove useful in the prediction and monitoring of long-term mental health trajectories.

There were decreases in working memory efficiency after deployment among cohort members who remained psychologically healthy over time. This finding is consistent with behavioural measures that demonstrate declines in working memory among combat troops after deployment, independent of PTSD (Vasterling et al., 2006a, 2006b). Importantly, these decreases were followed by recovery trends at Time 3, suggesting a recovery in working memory function over time. The findings appear consistent with an acutely acquired (that is, deployment-related) impairment in fronto-central attention networks, followed by functional recovery over the longer term. Thus, while deployment appears to have an acutely detrimental impact on attentional network function, such impairments, if present, do not appear to be enduring among those who fail to develop symptoms of psychopathology over time.

Better working memory function at Time 1 also appeared to be a particular marker of positive long-term mental health trajectories. The effects of military deployment on ERP indices have not been widely examined, but this finding is highly consistent with previous neuropsychological evidence of symptom-independent attentional deficits in recently deployed military personnel (Vasterling et al., 2006a, 2006b). In contrast with trends observed among those who remained psychologically healthy, members with elevated psychological distress at Time 3 had lower working memory efficiency at Time 1. They exhibited robust increases in attentional processing between Times 1 and 2, but these were followed by a decrease at Time 3. Although speculative, this finding appears to suggest an acute deployment-related acquisition of attentional vigilance to target detection in this group followed by subsequent regression towards pre-existing attentional network function. Thus, while deployment appears to have a robust impact on attentional network function in individuals who develop symptoms of depression/anxiety, these acute effects are not long lasting.

Cohort members with elevated posttraumatic stress symptoms exhibited working memory deficits between Times 1 and 2. In contrast with the non-symptomatic subgroup, however, these deficits were followed by pronounced additional decrements in function at Time 3. This suggests acutely acquired attentional network impairments on deployment followed by a progressive exacerbation of these impairments in the longer term.

In sum, it is possible that pre-existing attentional network impairments, as indexed by lower front-to-central amplitudes, reflect a vulnerability marker of future PTSD symptom development, whereas executive memory impairments, as indexed by parietal amplitude reductions, may develop in conjunction with, or subsequent to, development of psychological distress symptoms.

These findings extend the earlier conclusions of the MEAO Prospective Study (Davy et al., 2012) and demonstrate the long-term shifts in arousal that accumulate following deployment. Davy et al. highlighted the role of antecedent deployments in cortical arousability. The current investigation demonstrates the enduring consequence of that shift and that the passage of time – in those who become symptomatic particularly – is associated with further escalations of these abnormalities.

Although the current findings are highly consistent with the results of previous cross-sectional research, it must be stressed that small sample sizes precluded statistical significance testing in the current investigation. As a consequence, these preliminary findings are descriptive and should be interpreted with caution. Nonetheless, the prospective design of the current investigation represents a crucial step towards identifying objective neural markers that may assist in the prediction and monitoring of long-term mental health trajectories in the military context. Further investigation in a larger military population therefore appears warranted. Finally, the current findings indicate that measuring of working memory by event-related potential has utility as an objective measure of potential risk factors and emerging correlates of mental disorder in combat troops.

10 Detailed examination of head injury and TBI in the MEAO Deployed Cohort

As part of the broader Impact of Combat Study, a focused cross-sectional analysis of traumatic brain injury was conducted (including both self-reported prevalence and correlates), as was a pilot neuroimaging investigation.

10.1 Injuries to the head and traumatic brain injury

Self-reported injuries to the head were assessed as part of the Ohio State University TBI inventory (Corrigan & Bogner, 2007). Self-reported lifetime TBI was also captured in this measure and was classified according to one of six categories ranging from no TBI to severe TBI. The assessment of head injury and TBI in the present study used an instrument that has been used in overseas studies of military populations (Schwab et al., 2017), although one limitation is that assessment was based on self-reporting, rather than a documented head injury or loss of consciousness, and refers to an event that might have occurred several years previously. Recall bias could be a factor that influences the accurate recall of a head injury. This is recognised as a problem inherent in the study of TBI and mTBI. In fact, recent research by Bailie et al. (2017) found that self-report measures of TBI may significantly underestimate true rates.

When considering the findings detailed in this chapter, it is also important to note that the great majority of cases were mild traumatic brain injury: only a very small proportion of both Transitioned ADF members and 2015 Regular ADF members reported moderate or severe TBI (3.8% and 2.9% respectively) and the great majority of reported lifetime TBI was mTBI. The proportions of reported lifetime moderate and severe TBI were too small for specific comparisons and so were combined with the much larger mTBI categories in the dichotomised TBI variable used for further analyses.

10.2 Injuries to the head

Study results showed that similar proportions of Transitioned ADF and 2015 Regular ADF reported experiencing all types of injuries to the head other than injuring their head or neck in a fall/being hit by something (a lower proportion) or being nearby when an explosion/blast occurred (a higher proportion). Similar proportions of Transitioned ADF and 2015 Regular ADF reported that their injuries had occurred during military service. A greater proportion of Transitioned ADF compared with 2015 Regular ADF reported emergency room attendance following injury to the head or neck, injuring their head or neck in a car accident/crash with another moving vehicle, or injuring their head or neck in a fight/being hit by someone/shaken violently/shot in the head or neck during deployment. The most commonly reported context for experiencing a head injury in their lifetime was being nearby when an explosion or blast occurred (Transitioned ADF, 69.7%; 2015 Regular ADF, 49.9%) and the least commonly reported context was injuring their head/neck in a fight, being hit by someone, being shaken violently or being shot in the head or neck (Transitioned ADF, 18.7%; 2015 Regular ADF, 17.0%).

10.3 Traumatic brain injury

Similar proportions of Transitioned ADF members and 2015 Regular ADF members reported experiencing any traumatic brain injury (mild, moderate or severe) in their lifetime (49.1% vs 47.4%). Members of the 2015 Regular ADF reported a higher mean number of lifetime TBIs than Transitioned ADF members (M = 4.9 vs M = 3.4). The great majority of reported lifetime TBI was mTBI: only four Transitioned ADF (3.7%) and eleven 2015 Regular ADF (2.9%) reported moderate or severe lifetime TBI. A higher proportion of 2015 Regular ADF reported mild TBI with loss of consciousness for less than 30 minutes (29.2% vs 19.4%) and a slightly higher

proportion reported no TBI (27.1% vs 21.3%) compared with Transitioned ADF; reporting of mTBI and TBI in other categories was similar.

10.3.1 Mental health, functional outcomes and post-concussive symptoms in reported lifetime TBI

Transitioned ADF generally had higher posttraumatic stress symptoms, psychological distress and depressive symptoms than 2015 Regular ADF, and this pattern was similar when comparing those with reported TBI and those without TBI in the two groups. Within both the Transitioned ADF and the 2015 Regular ADF posttraumatic stress symptoms, psychological distress and depressive symptoms were similar between those with reported TBI and those without. Transitioned ADF (M = 10.7) and 2015 Regular ADF (M = 7.5) who reported lifetime TBI showed slightly higher scores on total global functioning impairment compared with those with no TBI (M = 8.8 and M = 4.9) and for all three domains of disability. Transitioned ADF generally had higher scores on total global functioning impairment than 2015 Regular ADF, and this pattern was similar when comparing those with reported TBI and those without reported TBI in the two groups, as was seen for the psychological disorders. Mean post-concussive symptoms were greater in Transitioned ADF with a reported TBI (M = 6.2) compared with those with no reported TBI (M = 3.0). Mean post-concussive symptoms were similar in 2015 Regular ADF with a reported TBI compared with those with no reported TBI. Mean post-concussive symptoms were higher in Transitioned ADF (for those with reported TBI and those without) compared with the respective subgroups in the 2015 Regular ADF.

Table 14 Lifetime TBI in Transitioned ADF and 2015 Regular ADF in the MEAO Deployed Cohort

	Transitioned ADF n = 108		2015 Regular ADF n = 384	
Lifetime TBI	n	% (95% CI)	n	% (95% CI)
No TBI	23	21.3 (13.6–29.0)	104	27.1 (22.6–31.5)
Head injury but no LOC and not dazed or confused	32	29.6 (21.0–38.2)	98	25.5 (21.2–29.9)
Mild TBI, no LOC but were dazed or confused	28	25.9 (17.7–34.2)	59	15.4 (11.8–19.0)
Mild TBI with LOC (<30 min)	21	19.4 (12.0–26.9)	112	29.2 (24.6–33.7)
Moderate TBI with LOC (30 min – 24 hr)	3	2.8 (0.0–5.9)	8	2.1 (0.7–3.5)
Severe TBI with LOC (>24 hr)	1	0.9 (0.0–2.7)	3	0.8 (0.0–1.7)
Dichotomous (no TBI vs any TBI)	53	49.1 (39.6–58.5)	182	47.4 (42.4–52.4)
Number of times TBI (M (SE))		3.4 (0.5)		4.9 (0.5)

Note: LOC = loss of consciousness.

10.4 Pilot neuroimaging findings

With a single exception, overall findings from the pilot neuroimaging study of white matter integrity in a subset of high-combat and blast-exposed ADF members yielded no significant associations with psychological, neurocognitive or exposure-related indices. The exception was that, in terms of structural findings, greater self-reported exposure to blast/explosions was associated with reduced thickness of the left precentral gyrus.

Situated in the posterior section of the frontal lobe, the precentral gyrus is known as the primary motor cortex because it is a brain region implicated in motor coordination. Previous studies of sports injuries have reported a thinner precentral gyrus in people with a history of concussion when compared with people without such a history (Meier et al., 2016). Interestingly, a recent study of combat veterans found that, regardless of PTSD status, they had poorer connectivity between the left precentral gyrus and the caudal anterior cingulate than controls who had not seen combat (Kennis et al., 2015). Kennis et al. suggested that the experience of combat, including exposure to explosions, might affect the functional capacity of the precentral gyrus. It is thus plausible that in the sample for this current study greater exposure to blast/explosions affected the thickness of the neural structure implicated in how voluntary motor skills are coordinated. It must be emphasised, however, that this is a highly speculative suggestion.

There are several important caveats to and possible methodological explanations to consider in understanding the neuroimaging findings. First, correlations suggest an association and not a causal relationship between observed factors. Second, many correlations were conducted in the analyses of the study, and very few

associations passed the strict significance level. This underscores why the single significant correlation observed should be considered very cautiously because it could be a result of chance. A third factor is that the limited sample size reduces the statistical power to identify possible associations. A fourth limitation is the absence of a comparison condition: whereas many other studies have directly compared military personnel who have sustained a TBI with those who have not, the current design did not have such a comparator. A fifth factor that needs to be considered is that a significant proportion of the current sample were Special Forces personnel. Such personnel are not representative of the broader military population. Although they are very exposed to high-risk combat situations, they are by definition highly screened and have undergone many strict selection procedures in order to achieve Special Forces status. Accordingly, their capacity to achieve that status and maintain such a high level of functioning in the face of rigorous training and deployment demands limits the generalisability of the findings to most ADF personnel.

Finally, it needs to be understood that in this study the assessment of traumatic brain injury was based on self-reporting and was retrospective in nature. This is a limitation inherent the Impact of Combat Study because definitive assessment of traumatic brain injury requires objective documentation at the time of injury and, ideally, verification by proper medical assessment in the hours and days after the injury.

11 Implications and future directions

A number of clinical and policy implications for Defence and DVA emerge from the findings of the Impact of Combat Study.

The weight of evidence points to the value of investing in continued longitudinal surveillance of this and other cohorts. As demonstrated in the findings of the current study and in *Mental Health Changes Over Time: a Longitudinal Perspective* (Bryant et al., 2019), surveillance of this cohort is facilitating the identification of risk and protective factors for good and poor mental and physical health outcomes as they develop over time. This provides vital information for the development of risk mitigation and early intervention strategies to protect this cohort, as well as future cohorts of ADF personnel. In addition to allowing for the ongoing monitoring of the ADF workforce during service and after transition, longitudinal surveillance presents an opportunity to use the data collected to date to examine broader impacts of policy change, interventions and cultural shifts. Furthermore, throughout the Transition and Wellbeing Research Programme studies the risk of transition has been emphasised. Continued surveillance of the existing cohorts will also allow for prospective examination of transition outcomes in future follow-ups.

Together, the findings presented in this report highlight the importance of regular monitoring for changes in psychological and physical health and the need for this to occur not only in the period immediately following deployment but also throughout the individual's military career and after transition. The ADF has recently upgraded its mental health screening continuum to include a Periodic Mental Health Screen, administered in a primary health care setting. This will ensure that the psychological wellbeing of ADF personnel is being monitored more frequently – not just after deployment or exposure to a critical incident. Health and mental health professionals administering these screening tools or the regular physical health screens, or both, need to be adequately trained in the identification of key subsyndromal markers and how to effectively monitor the longitudinal course of disorders.

In relation to opportunities for early identification of risk, internationally there have been important advances in understanding the neurobiological underpinnings of exposure to traumatic stress and the emergence of PTSD (see, for example, Bonanno et al., 2012; Eekhout et al., 2016; Eraly et al., 2014; Fikretoglu & Liu, 2012; Goodwin et al., 2012; Yehuda et al., 2015). It is important that monitoring programs and the development of predictive models for PTSD embrace this substantial emerging body of neuroscience. Of relevance to this are the pathology and neurocognitive findings, which warrant further detailed investigation. The pattern of dysregulation observed in inflammatory markers is of importance in view of the role of inflammation in the aetiology of cardiovascular disease and auto-immune disease, as well as psychiatric disorders. The demonstrated alteration in inflammatory response in subcohorts that was identified warrants further investigation because of its potential long-term implications for the health of this cohort.

The findings detailed in this report also further highlight the neurocognitive impacts of combat exposure. In view of the extensive evidence about the neuropathology of PTSD and its effects on working memory and cognitive functioning more generally, this is a domain that deserves further investigation. It is particularly relevant in the context of the continuing concern about and increasing focus on the role of mild traumatic brain injury in the long-term health of military cohorts. Nor should it be forgotten that PTSD is a condition associated with decreased total brain volume: these findings should be part of any ongoing assessment and monitoring of ADF members and veterans (Hedges & Woon, 2010).

To date the data collected on this study cohort have undergone minimal analysis. It is crucial that the available data are extensively explored because of the potential for different genetic risks between militaries. Additionally, the use of epigenetics to predict the risk of PTSD is being embraced in other military populations.

If Defence and DVA are to be able to respond to emerging concerns in this area, it is suggested that these dimensions of the impacts of combat exposure should be assessed into the future. The value of establishing baseline measures before and after deployment in this cohort should not be underestimated. With emerging developments and technology in neuroscience, the further investigation of this cohort, and the stored serum, has potentially significant contributions to make for a better understanding of the future health and welfare of ADF members.

In conclusion, the findings reported here reinforce the importance of the work being done by Defence and DVA to link ADF personnel to available support services at the time of transition and to facilitate pathways to care as required after transition. Consideration should be given to increasing opportunities for ongoing and proactive monitoring of the psychological and physical health of former members of the ADF, including those who are not exhibiting disorders. This should be done by trained, military-aware health and mental health professionals.

Glossary

12-month prevalence. Meeting diagnostic criteria for a lifetime ICD-10 mental disorder and then having reported symptoms in the 12 months before the interview.

Affective disorders. A class of mental health disorders. The Mental Health and Wellbeing Transition Study examined three types of affective disorder: depressive episodes, dysthymia and bipolar affective disorder. A central feature of these mental disorders is mood disturbance.

Agoraphobia. Marked fear or avoidance of situations such as crowds, public places, travelling alone or travelling away from home, which is accompanied by palpitations, sweating, shaking or dry mouth as well as other anxiety symptoms such as chest pain, choking sensations, dizziness, and sometimes feelings of unreality, fear of dying, losing control or going mad.

Alcohol dependence. Characterised by an increased prioritisation of alcohol in a person's life. The defining feature is a strong, overwhelming desire to use alcohol despite experiencing a number of associated problems. A diagnosis was given if the person reported three or more of the following symptoms in the preceding 12 months:

- a strong and irresistible urge to consume alcohol
- a tolerance to the effects of alcohol
- an inability to stop or reduce alcohol consumption
- withdrawal symptoms upon cessation or reduction of alcohol intake
- continuing to drink despite it causing emotional or physical problems
- reduction in important activities because of or in order to drink.

Alcohol harmful use. Diagnosis requires not only high levels of alcohol consumption, but also that the alcohol use is damaging to the person's physical or mental health. Each participant was initially asked if they consumed 12 or more standard alcoholic drinks in a 12-month period. If so, they were then asked a series of questions about their level of consumption. A diagnosis of alcohol harmful use was applied if the alcohol interfered with work or other responsibilities, caused arguments with their family or friends, was consumed in a situation where the person could be hurt, resulted in being stopped or arrested by police, or if the participant continued to consume alcohol despite experiencing social or interpersonal problems as a consequence of their drinking during the preceding 12-months. A person could not meet criteria for alcohol harmful use if they met criteria for alcohol dependence.

Alcohol Use Disorders Identification Test (AUDIT). Alcohol consumption and problem drinking were examined using the Alcohol Use Disorders Identification Test (Saunders et al., 1993), a brief self-report screening instrument developed by the World Health Organization. This instrument consists of 10 questions designed to examine the quantity and frequency of alcohol consumption, possible symptoms of dependence, and reactions or problems related to alcohol. The AUDIT is widely used in epidemiological and clinical practice for defining at-risk patterns of drinking.

Anxiety disorders. A class of mental health disorder that involves the experience of intense and debilitating anxiety. The anxiety disorders covered in the survey were panic attacks, panic disorder, social phobia, specific phobia, agoraphobia, generalised anxiety disorder, posttraumatic stress disorder and obsessive–compulsive disorder.

Australian Defence Force. The ADF, or Defence, is constituted under the *Defence Act 1903* (Cth). Its mission is to defend Australia and its national interests. In fulfilling this mission, Defence serves the government of the day and is accountable to the Commonwealth Parliament, which represents the Australian people to efficiently and effectively carry out the Government's defence policy. The Transition and Wellbeing Research Programme seeks to examine the mental, physical and social health of Serving and Ex-Serving Australian Defence Force members and their families. It builds on previous research to inform effective and evidence-based health service provision for contemporary service members and veterans.

Bipolar affective disorder. A class of mental disorder associated with fluctuations of mood that are significantly disturbed. These fluctuations of mood can be markedly elevated on some occasions (hypomania or mania) and markedly lowered on other occasions (depressive episodes). A diagnosis of bipolar affective disorder was applied in this study if the individuals met criteria for mania or hypomania in the preceding 12-months

Centre for Traumatic Stress Studies. This centre at the University of Adelaide seeks to improve evidence-based practice by informing and applying scientific knowledge in the field of trauma, mental disorder and wellbeing in at-risk populations. The current research was conducted by a consortium of Australia's leading research institutions led by the CTSS and the Australian Institute of Family Studies.

Composite International Diagnostic Interview (CIDI). The World Mental Health Survey Initiative version of the World Health Organization's Composite International Diagnostic Interview, version 3 (WMH-CIDI 3.0)(Kessler & Ustun, 2004) provides an assessment of mental disorders based on the definitions and criteria of two classification systems – the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) and the World Health Organization International Classification of Diseases, 10th revision (ICD-10) (World Health Organization, 1994). This instrument was used in phase 2 of the current program of research.

Confidence interval. This measurement gives an estimated range of values that is likely to include an unknown population parameter, the estimated range being calculated from a given set of sample data.

Department of Veterans Affairs. The department delivers government programs for war veterans and members of the ADF and the Australian Federal Police and their dependants. In 2014, DVA, in collaboration with the Department of Defence, commissioned the Transition and Wellbeing Research Programme, one of the largest and most comprehensive military research projects undertaken in Australia.

Deployment status. The Mental Health and Wellbeing Transition Study defined deployment status, based on survey responses, as:

- *Never deployed.* Individuals who did not endorse any deployments listed in the self-report survey (Your Military Career: Deployments) and did not endorse any deployment exposures (Your Military Career: Deployment Exposure)

- *Deployed*. Individuals who endorsed one or more of the listed deployments (Your Military Career: Deployments) or endorsed one or more of the deployment exposures (Your Military Career: Deployment Exposure).

Deployment trauma. This can be referred to as traumatic deployment exposures, traumatic events that occur on deployment, deployment-related traumas, combat exposure, or war-related trauma.

Depressive episodes. Characteristic of a major depressive disorder, a depressive episode requires that an individual has suffered from depressed mood lasting a minimum of two weeks, with associated symptoms or feelings of worthlessness, lack of appetite, difficulty with memory, reduction in energy, low self-esteem, concentration problems and suicidal thoughts. Depressive episodes can be mild, moderate or severe. All three are included here under the same heading. Hierarchy rules were applied to depressive episodes, such that a person could not have met criteria for either a hypomanic or a manic episode.

Diagnostic criteria. The survey was designed to estimate the prevalence of common mental health disorders defined according to clinical diagnostic criteria, as directed by the International Classification of Diseases 10th Revision (ICD-10). Diagnostic criteria for a disorder usually involve specification of the following:

- the nature, number and combination of symptoms
- the period over which the symptoms have been continuously experienced
- the level of distress or impairment experienced
- the circumstances for exclusion of a diagnosis; for example, it being due to a general medical condition or the symptoms being associated with another mental disorder.

Dimensions of Anger Reactions Scale (DAR-5). A concise measure of anger consisting of five items covering anger frequency, intensity, duration, aggression and interference with social functioning. Items are scored on a five-point Likert scale, generating a severity score ranging from 5 to 25, with higher scores indicating worse symptomatology. This scale has been used previously to assess Australian Vietnam veterans, as well as US Afghanistan and Iraq veterans, and shows strong unidimensionality and high levels of internal consistency and criterion validity.

DVA client. A term used when referring to DVA clients for the purpose of analysis. In the construction of the DVA dataset for the Study Roll, DVA created an indicator of confidence against each veteran with respect to the level of interaction DVA had with each them for assessing how confident DVA was about the accuracy of their address. Members of each of the following groups were considered DVA client:

- *High.* Where a veteran is in receipt of a fortnightly payment (such as income support or a compensation pension) from DVA it was a sign of regular ongoing contact with the client and therefore DVA would have a high level of confidence that their address would be up to date and correct.
- *Medium.* Where a veteran only holds a treatment card (that is, does not also receive an ongoing payment) there is a lower level of ongoing contact with the department and therefore the level of confidence DVA can assign to the accuracy of the client's address is lower.
- *Low.* Not all veterans who have their illness/injury liability claim accepted as service related by DVA automatically receive a treatment card or pension payment, yet they would still be considered DVA clients.

For the purposes of this report, any individual in the study population who met the criteria above, was flagged as a 'DVA client'. Those with this flag were compared against those without this flag.

Dysthymia. Characterised as a chronic or pervasive disturbance of mood lasting several years that is not sufficiently severe or in which the depressive episodes are not sufficiently prolonged to warrant a diagnosis of a recurrent depressive disorder. Hierarchy rules were applied to dysthymia such that, to have this disorder, a person could not have met criteria for either a hypomanic or manic episode and could not have reported episodes of severe or moderate depression within the first two years of dysthymia.

Ex-service organisation. Organisations that provide assistance to current and former ADF members. Services can include but are not necessarily limited to welfare support, help with DVA claims, and employment programs and social support.

Generalised anxiety disorder. A generalised and persistent worry, anxiety or apprehension about everyday events and activities lasting a minimum of six months and accompanied by anxiety symptoms as described in 'agoraphobia'. Other symptoms may include symptoms of tension (such as inability to relax and muscle tension) and other non-specific symptoms (such as irritability and difficulty concentrating).

Generalised Anxiety Disorder 7-item Scale (GAD-7). A brief seven-item screening measure based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) criteria for generalised anxiety disorder. Originally validated for use in primary care, the GAD-7 performs well in detecting probable cases of the disorder, with a sensitivity of 89% and a specificity of 82%.

Gold Card. A DVA health card for all conditions. Gold Card holders are entitled to DVA funding for services for all clinically necessary healthcare needs and all health conditions, whether or not they are related to war service. The card holder may be a veteran or the widow/widower or dependant of a veteran. Only the person named on the card is covered.

Hypomanic episodes. Episodes that last at least four consecutive days and are considered abnormal to the individual. These episodes are characterised by increased activity, talkativeness, elevated mood, disrupted concentration, decreased need for sleep and disrupted judgment manifesting as risk-taking (for example, mild spending sprees). In a subgroup of people, these disorders are particularly characterised by irritability. To meet criteria for the 'with hierarchy' version, the person cannot have met criteria for an episode of mania.

Index deployment. The MEAO Prospective Study surveyed and tested participants before and after a deployment that occurred between 2010 and 2012. This is referred to as the 'index deployment'.

Kessler Psychological Distress Scale (K10). A short 10-item screening questionnaire that yields a global measure of psychological distress based on symptoms of anxiety and depression experienced in the most recent four-week period. Items are scored from 1 to 5 and are summed to give a total score between 10 and 50. Various methods have been used to stratify the scores of the K10. The categories of low (10–15), moderate (16–21), high (22–29) and very high (30–50) that are used in this report are derived from the cut-offs of the K10 that were used in the 2007 Australian Bureau of Statistics National Survey of Mental Health and Wellbeing (Slade et al., 2009).

Lifetime prevalence. A prevalence that meets diagnostic criteria for a mental disorder at any point in the respondent's lifetime.

Lifetime trauma. Exposure questions used in this study were drawn from the posttraumatic stress disorder module of the CIDI (Haro et al., 2006). Participants were asked to indicate whether or not they had experienced the following traumatic events: combat (military or organised non-military group); being a peacekeeper in a war zone or a place of ongoing terror; being an unarmed civilian in a place of war, revolution, military coup or invasion; living as a civilian in a place of ongoing terror for political, ethnic, religious or other reasons; being a refugee; being kidnapped or held captive; being exposed to a toxic chemical that could cause serious harm; being in a life-threatening automobile accident; being in any other life-threatening accident; being in a major natural disaster; being in a man-made disaster; having a life-threatening illness; being beaten by a spouse or romantic partner; being badly beaten by anyone else; being mugged, held up or threatened with a weapon; being raped; being sexually assaulted; being stalked; having someone close to you die; having a child with a life-threatening illness or injury; witnessing serious physical fights at home as a child; having someone close experience a traumatic event; witnessing someone badly injured or killed or unexpectedly seeing a dead body; accidentally injuring or killing someone; purposefully injuring, torturing or killing someone; seeing atrocities or carnage such as mutilated bodies or mass killings; experiencing any other traumatic event.

Mania. Similar to hypomania but more severe in nature. Lasting slightly longer (a minimum of a week), these episodes often lead to severe interference with personal functioning. In addition to the symptoms outlined under 'hypomania', mania is often associated with feelings of grandiosity, marked sexual indiscretions and racing thoughts.

Medical Employment Classification. An administrative process designed to monitor physical fitness and medical standards in the ADF. MEC was divided into four levels (either current or on discharge from Regular ADF service):

- *MEC 1.* Members who are medically fit for employment in a deployed or seagoing environment without restriction.
- *MEC 2.* Members with medical conditions that require access to various levels of medical support or employment restrictions. They remain, however, medically fit for duty in their occupation in a deployed or seagoing environment. In allocating sub-classifications of MEC 2, access to the level of medical support will always take precedence over specified employment restrictions.
- *MEC 3.* Members who are medically unfit for duty in their occupation in a deployed or seagoing environment. The member so classified should be medically managed towards recovery and should be receiving active medical management with the intention of regaining MEC 1 or 2 within 12 months of allocation of MEC 3. After a maximum of 12 months their MEC is to be reviewed. If still medically unfit for military duties in any operational environment, they are to be downgraded to MEC 4 or, if appropriate, referred to a Medical Employment Classification Review Board for consideration of an extension to remain MEC 3.
- *MEC 4.* Members who are medically unfit for deployment or seagoing service in the long term. Members who are classified as MEC 4 for their military occupation will be subject to review and confirmation of their classification by a Medical Employment Classification Review Board.

Medical fitness. A status defined as follows:

- *Fit*. Those who are categorised as fully employable and deployable, or deployable with restrictions. Participants are classified as 'fit' if they fall into MEC 1 or 2, as described, or are assigned a perturbed MEC value of 'fit'.
- *Unfit***.** Those not fit for deployment, their original occupation and/or further service. This can include those undergoing rehabilitation or transitioning to alternative return-to-work arrangements or in the process of medically separating from the ADF. Participants were classified as 'unfit' if they fell into MEC 3 or 4 as described, or were assigned a perturbed MEC value of 'unfit'.

Medical discharge. The involuntary termination of the client's employment by the ADF on the grounds of permanent or at least long-term unfitness to serve or unfitness for deployment to operational (warlike) service.

Mental health disorders. Defined according to the detailed diagnostic criteria in the World Health Organization International Classification of Diseases. This publication reports data for ICD-10 criteria.

Mental Health Prevalence and Wellbeing Study. This 2010 study is part of the Military Health Outcomes Program, or MilHOP, the first comprehensive investigation of the mental health of serving ADF members.

Middle East Area of Operations. Australia's military involvement in Afghanistan and Iraq is often referred to as the Middle East Area of Operations, or MEAO. Thousands of members have deployed to the MEAO since 2001, with many completing multiple tours of duty. The Transition and Wellbeing Research Programme builds on the Military Health Outcomes Program, which detailed the prevalence of mental disorder in service women and men.

Military Health Outcomes Program. MilHOP detailed the prevalence of mental disorders among serving ADF members in 2010 as well as deployment-related health concerns for those deployed to the Middle East Area of Operations. The Transition and Wellbeing Research Programme addresses a number of gaps identified

following MilHOP, including the mental health of Reservists, Ex-Serving members and ADF members in high-risk roles, as well as the trajectory of disorder and pathways to care for individuals previously identified as having a mental disorder in 2010.

Obsessive compulsive disorder. A disorder characterised by obsessional thoughts (ideas, images, impulses) or compulsive acts (ritualised behaviour). These thoughts and acts are often distressing and typically cannot be avoided, despite the sufferer recognising their ineffectiveness.

Optimal epidemiological cut-off. The value that brings the number of false positives (mistaken identifications of a disorder) and false negatives (missed identifications of a disorder) closest together, thereby counterbalancing these sources of error most accurately. Therefore, this cut-off would give the closest estimate to the true prevalence of a 30-day ICD-10 disorder as measured by the CIDI and should be used to monitor disorder trends.

Optimal screening cut-off. The value that maximises the sum of sensitivity and specificity (the proportion of those with and without a disease who are correctly classified). This cut-off can be used to identify individuals who might need further care.

Panic attack. Sudden onset of extreme fear or anxiety, often accompanied by palpitations, chest pain, choking sensations, dizziness, and sometimes feelings of unreality, fear of dying, losing control or going mad.

Panic disorder. Recurrent panic attacks that are unpredictable in nature.

Patient Health Questionnaire-9. Self-reported depression was examined using the Patient Health Questionnaire – 9, or PHQ-9. The nine items of the PHQ-9 are scored from 0 to 3 and summed to give a total score between 0 and 27. The PHQ-9 provides various levels of diagnostic severity with higher scores indicating higher levels of depression symptoms.

Posttraumatic stress disorder. PTSD is characterised by a stress reaction to an exceptionally threatening or traumatic event that would cause pervasive distress in almost anyone. Symptoms are categorised into three groups – re-experiencing memories or flashbacks, avoidance symptoms and either hyperarousal symptoms (increased arousal and sensitivity to cues) or inability to recall important parts of the experience.

The Posttraumatic Stress Disorder Checklist – civilian version (PCL-C). A 17-item self-report measure designed to assess the symptomatic criteria of PTSD according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV). The 17 questions of the PCL-C are scored from 1 to 5 and are summed to give a total symptom severity score of between 17 and 85. An additional four items from the newly released PCL-5 were also included, giving researchers flexibility to also measure PTSD symptoms according to the most recent definitional criteria.

Prevalence of mental disorders. The proportion of people in a given population who meet diagnostic criteria for any mental disorder in a given time frame. (See also '12-month prevalence' and 'lifetime prevalence'.)

Probable mental disorder. Where probable rates of mental health disorder are presented, these are based on self-report epidemiological cut-offs.

Psychopathology. The scientific study of mental disorders.

Rank status. Three levels of rank were used in the Mental Health and Wellbeing Transition Study:

- *Commissioned Officer (OFFR).* Senior Commissioned Officers (Commander (CMDR), Lieutenant Colonel (LTCOL), Wing Commander (WGCDR) and above) and Commissioned Officers (Lieutenant Commander (LCDR), Major (MAJ), Squadron Leader (SQNLDR) and more junior ranks).

- *Non-Commissioned Officer (NCO)***.** Senior Non-Commissioned Officers (Petty Officer (PO), Sergeant (SGT) and more senior ranks), and Junior Non-Commissioned Officers (Leading Seaman (LS), Corporal (CPL) and more junior ranks).

- *Other Ranks.* Able Seaman (AB), Seaman (SMN), Private (PTE), Leading Aircraftman (LAC), Aircraftman (AC) or equivalent.

Reason for discharge. The reason for transitioning out of the ADF. In the Programme, the reason for discharge was derived from responses to the self-report survey and classified thus:

- *Medical discharge.* Involuntary termination of the client's employment by the ADF on the grounds of permanent or at least long-term unfitness to serve, or unfitness for deployment to operational (war-like) service.

- *Other***.** All other types of discharge including compulsory age retirement, resignation at own request, assessed as unsuitable for further training, end of fixed-period engagement, end of initial enlistment period or return of service obligation, end of limited-tenure appointment, not offered re-engagement, accepted voluntary redundancy, compassionate grounds, and non-voluntary administrative discharge.

Service status. The ADF consists of the following Services:

- *Royal Australian Navy.* A maritime force that contributes to regional security, supports global interests, shapes the strategic environment and protects national interests.

- *Australian Army*. The military land force, a potent, versatile and modern army that contributes to the security of Australia, protecting its interests and people.

- *Royal Australian Air Force***.** An air force that provides immediate and responsive military options across the spectrum of operations as part of a whole-of-government joint or coalition response, either from Australia or on deployment overseas. It does this through its key air power roles – control of the air; precision strikes; intelligence, surveillance and responses; and air mobility – enabled by combat and operational support.

Social phobia. The marked fear or avoidance of being the centre of attention or in situations where it is possible to behave in a humiliating or embarrassing way, accompanied by anxiety symptoms, as well as either blushing, fear of vomiting, or fear of defecation or micturition.

Specific phobia. The marked fear or avoidance of a specific object or situation (such as animals, birds, insects, heights, thunder, flying, small enclosed spaces, the sight of blood or injury, injections, dentists or hospitals) accompanied by anxiety symptoms as described for 'agoraphobia'.

Stratification. Grouping outcomes by variables of interest. In Report 1, 12-month diagnosable mental disorder and self-reported suicidality were stratified by age, sex, rank, Service, years of service in the Regular ADF, deployment status, transition status, years since transition, reason for transition and DVA client status.

Study Roll. Participants' contact details and demographic information were obtained via the creation of a Study Roll by the Australian Institute of Health and Welfare. This process involved integrating contact information from the following sources:

- the Defence Personnel Management Key System database

- DVA client databases

- the National Death Index

- the ComSuper member database
- the Military Health Outcomes Program (MilHOP) dataset.

Subsyndromal disorder. Characterised by or exhibiting symptoms that are not severe enough for diagnosis as a clinically recognised syndrome.

Suicidal ideation. Serious thoughts about taking one's own life.

Suicidality. Suicidal ideation (serious thoughts about taking one's own life), suicide plans and attempts.

Transitioned ADF members. ADF members who have left military service. For the purpose of the current study, this included all ADF members who transitioned from the Regular ADF between 2010 and 2014, including those who transitioned into the Active Reserve and Inactive Reserve.

Transitioned status. Transitioned ADF members were categorised into one of three groups, which broadly represented their level of continued association and contact with Defence and their potential access to support services provided by Defence:

- *Ex-serving.* A person who was a Regular ADF member before 2010, has since transitioned out of the ADF and is no longer engaged with Defence in a Reservist role. The individual is classified as discharged from Defence.
- *Inactive Reservist.* A person who was a Regular ADF member before 2010, but has since transitioned into an Inactive Reservist role.
- *Active Reservist.* A person who was a Regular ADF member before 2010, but has since transitioned into an Active Reservist role.

White Card. A DVA health card for specific conditions. A White Card entitles the holder to care and treatment for:

- injuries or conditions that are accepted as being caused by war or service related
- malignant cancer, pulmonary tuberculosis, posttraumatic stress disorder, anxiety and/or depression, whether or not it was caused by war
- symptoms of unidentifiable conditions that arise within 15 years of service (other than peacetime service).

Services covered by a White Card are the same as those for a Gold Card, but must be for treatment of conditions that are accepted as being caused by war or service-related.

World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview – version 3 (CIDI). The CIDI (Kessler & Ustun, 2004) provides an assessment of mental disorders based on the definitions and criteria of two classification systems: the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) and the International Statistical Classification of Diseases and Related Health Problems – 10th Revision (ICD-10) (World Health Organization, 1994). This instrument was used in phase 2 of the Programme.

Years since transition. To ascertain the number of years since transition from Regular Service, participants were asked to indicate what year they transitioned to Active Reserves or Inactive Reserves or were discharged out of the Service (Ex-Serving). Options were zero, one, two, three, four or five years.

Years of Regular Service. Six categories were used in the Mental Health and Wellbeing Transition Study to define the number of years of Regular Service: 3 months – 3.9 years, 4–7.9 years, 8–11.9 years, 12–15.9 years, 16–19.9 years and 20+ years.

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