

CENTRE FOR
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STRESS STUDIES



THE UNIVERSITY
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Childhood determinants of mental health and related outcomes in the Australian Defence Force

Thesis submitted for the degree of
Doctor of Philosophy

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Table of Contents

CHAPTER 1: INTRODUCTION.....	1
BACKGROUND	2
HISTORICAL CONTEXT	2
WHY SOME AND NOT OTHERS.....	4
CURRENT AND CONTINUING CONTROVERSIES	5
CHAPTER 2: OVERALL AIMS AND OBJECTIVES.....	9
CHAPTER 3: LITERATURE REVIEW.....	13
STRATEGY	14
<i>Question:</i>	14
<i>Method</i>	14
<i>Search terms</i>	14
<i>Results</i>	15
CHILDHOOD FACTORS.....	16
<i>Childhood trauma/adversity</i>	16
<i>Childhood disorder</i>	20
RECENT TRAUMA IN THE CONTEXT OF LIFETIME TRAUMA.....	20
CURRENT GAPS IN THE LITERATURE	21
CHAPTER 4: WHAT THE PROPOSED RESEARCH MIGHT ADD.....	23
CHAPTER 5: PAPER 1. CHILDHOOD TRAUMA AND CHILDHOOD MENTAL DISORDER IN MILITARY AND EMPLOYED CIVILIAN MEN.....	26
STATEMENT OF AUTHORSHIP	27



ABSTRACT	31
INTRODUCTION	32
METHODS	35
<i>Military (ADF) sample</i>	35
<i>Civilian (ABS) sample</i>	37
<i>Measures</i>	37
<i>Analysis</i>	39
RESULTS	41
<i>Paper 1: Tables and figures</i>	43
DISCUSSION	48
<i>Strengths</i>	50
<i>Weaknesses</i>	50
<i>Conclusions</i>	51
CHAPTER 6: PAPER 2. ASSOCIATIONS OF CHILDHOOD TRAUMA AND CHILDHOOD MENTAL DISORDER WITH PAST-YEAR MENTAL DISORDER IN MILITARY AND CIVILIAN EMPLOYED MEN	53
STATEMENT OF AUTHORSHIP	54
ABSTRACT	57
INTRODUCTION	58
METHODS	61
<i>Australian Defence Force (ADF) sample</i>	61
<i>Australian Bureau of Statistics (ABS) civilian sample</i>	63

<i>Measures</i>	64
<i>Analysis</i>	66
RESULTS	68
<i>Generalized Structural Equation Modelling</i>	69
<i>Paper 2: Tables and figures</i>	71
DISCUSSION	77
<i>Limitations</i>	79
<i>Conclusion</i>	80
CHAPTER 7: PAPER 3. ASSOCIATIONS OF CHILDHOOD TRAUMA AND CHILDHOOD DISORDER WITH PAST-YEAR PTSD IN MILITARY AND CIVILIAN MEN	82
STATEMENT OF AUTHORSHIP	83
ABSTRACT	86
INTRODUCTION	87
METHOD	90
<i>Participants</i>	90
<i>Procedure</i>	91
<i>Measures</i>	93
<i>Data Analysis</i>	95
RESULTS	99
<i>Paper 3: Tables and figures</i>	102
DISCUSSION	107
<i>Conclusion</i>	112
CHAPTER 8: PAPER 4. CHILDHOOD DETERMINANTS OF SUICIDALITY: COMPARING MALES IN MILITARY AND CIVILIAN EMPLOYED POPULATIONS.....	113
STATEMENT OF AUTHORSHIP	114



ABSTRACT	117
INTRODUCTION	118
METHODS	120
<i>Military study (ADF sample)</i>	121
<i>Civilian study (ABS sample)</i>	123
<i>Measures</i>	124
<i>Analysis</i>	128
RESULTS	129
<i>Childhood factors</i>	130
<i>Adult trauma</i>	130
<i>Service Factors</i>	130
<i>GSEM</i>	132
<i>Paper 4: Tables and figures</i>	133
DISCUSSION	139
<i>Main findings</i>	139
<i>Comparison with other studies</i>	140
<i>Strengths</i>	142
<i>Weaknesses</i>	142
<i>Conclusions</i>	143
CHAPTER 9: PAPER 5. CHILDHOOD DETERMINANTS OF CURRENT PSYCHOLOGICAL DISTRESS AND DAYS OUT OF ROLE IN MILITARY AND CIVILIAN EMPLOYED MEN	145
CHAPTER 10:.....	146

STATEMENT OF AUTHORSHIP	146
ABSTRACT	149
INTRODUCTION	150
METHODS	151
<i>Military study (ADF sample)</i>	151
<i>Civilian study (ABS sample)</i>	154
<i>Measures</i>	154
<i>Analysis</i>	158
RESULTS	159
<i>Paper 5: Tables</i>	161
DISCUSSION.....	166
<i>Strengths</i>	168
<i>Limitations</i>	169
<i>Implications</i>	170
CONCLUSIONS.....	171
CHAPTER 11: PAPER 6. THE IMPACT OF CHILDHOOD TRAUMA ON THE DEVELOPMENT OF MENTAL DISORDER IN DEPLOYING MILITARY MALES.....	172
STATEMENT OF AUTHORSHIP	173
ABSTRACT	176
INTRODUCTION	177
METHODS	179
<i>Procedure</i>	179
<i>Variables (pre-deployment assessment)</i>	180
<i>Pre and post-deployment assessment: Probable mental disorder</i>	182



<i>Post-deployment assessment</i>	184
<i>Analysis</i>	184
RESULTS	187
<i>GSEM</i>	188
<i>Paper 6: Tables and figures</i>	190
DISCUSSION	196
<i>Strengths</i>	198
<i>Limitations</i>	199
<i>Implications</i>	199
<i>Conclusion</i>	200
CHAPTER 12: PAPER 7. CHILDHOOD DETERMINANTS OF PAST-YEAR ANXIETY AND DEPRESSION IN RECENTLY TRANSITIONED MILITARY PERSONNEL	201
STATEMENT OF AUTHORSHIP	202
ABSTRACT	205
INTRODUCTION	206
<i>Aim</i>	208
METHOD	209
<i>Weighting and stratification</i>	210
<i>Sample</i>	211
<i>Measures</i>	211
<i>Analysis</i>	214
RESULTS	216

<i>Paper 7: Tables and figures</i>	218
DISCUSSION	223
CHAPTER 13: PAPER 8: CHILDHOOD DETERMINANTS OF MULTIPLE SOMATIC SYMPTOMS IN RECENTLY TRANSITIONED REGULAR MILITARY PERSONNEL.....	230
STATEMENT OF AUTHORSHIP	231
ABSTRACT	234
INTRODUCTION	235
<i>Aim</i>	236
METHOD	237
<i>Procedure</i>	237
<i>Weighting and stratification</i>	238
<i>Sample</i>	238
<i>Measures</i>	239
<i>Analysis</i>	243
RESULTS	244
<i>Paper 8: Tables and figures</i>	247
DISCUSSION	254
<i>Strengths</i>	256
<i>Limitations</i>	257
<i>Implications</i>	258
<i>Conclusions</i>	258
CHAPTER 14: PAPER 9. CHILDHOOD DETERMINANTS OF SUICIDALITY IN RECENTLY TRANSITIONED MILITARY MEN.....	259
STATEMENT OF AUTHORSHIP	259
ABSTRACT	262



BACKGROUND	264
METHOD	266
<i>Procedure</i>	266
<i>Weighting and stratification</i>	267
<i>Sample</i>	268
<i>Measures</i>	268
<i>Analysis</i>	271
RESULTS	272
<i>Paper 9: Tables and figures</i>	275
DISCUSSION	282
<i>Strengths</i>	284
<i>Limitations</i>	285
<i>Whilst there may appear to be a low response rate, unlike most surveys, the demographic and health status of those who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error.</i>	286
<i>Conclusions</i>	286
CHAPTER 15: PAPER 10. CHILDHOOD TRAUMA AND PROBABLE PTSD IN RECENTLY TRANSITIONED AND CURRENT SERVING REGULAR MILITARY PERSONNEL.....	287
STATEMENT OF AUTHORSHIP	288
ABSTRACT	291
INTRODUCTION	292
METHOD	294
<i>Populations</i>	294

<i>Weighting and stratification</i>	295
<i>Samples for this analysis</i>	297
<i>Variables of interest</i>	297
<i>Analysis</i>	300
RESULTS.....	302
<i>Paper 10: Tables and figures</i>	305
DISCUSSION.....	311
<i>Strengths</i>	313
<i>Weaknesses</i>	313
<i>Conclusion</i>	315
CHAPTER 16: DISCUSSION	316
CONTEXT AND CONTRIBUTION TO KNOWLEDGE.....	317
<i>Key Findings</i>	319
<i>Overview Table 1:</i>	327
<i>Overview Table 2</i>	328
PROBLEMS ENCOUNTERED.....	330
<i>What about women?</i>	331
<i>Delayed onset disorder</i>	331
<i>Complex PTSD</i>	332
IMPLICATIONS.....	333
<i>Possibility of positive effects of military service</i>	333
<i>Are some experiences universally negative?</i>	336
FUTURE DIRECTIONS.....	338
CONCLUDING COMMENTS.....	341



CHAPTER 17: APPENDIX	343
APPENDIX A: SUICIDALITY QUESTIONS	344
APPENDIX B: 26 DEPLOYMENT-RELATED TRAUMA ITEMS AND THEIR NINE RESPECTIVE ‘TRAUMA EXPOSURE’ CATEGORIES	345
APPENDIX C: KESSLER DISTRESS SCALE.....	346
APPENDIX D: DEMOGRAPHICS OF PHASE 1 SURVEY RESPONDENTS AND NON-RESPONDENTS	347
APPENDIX E: CONSENT AND CIDI COMPLETION RATES	350
APPENDIX F: DEMOGRAPHIC PROFILE OF THE CIDI SAMPLE.....	350
CHAPTER 18: REFERENCES	352

LIST OF ABBREVIATIONS

ADF	Australian Defence Force
ABS	Australian Bureau of Statistics
aOR	Adjusted Odds Ratio
CI	Confidence Interval
CIDI	Composite International Diagnostic Interview
DSM	Diagnostic and Statistical Manual of Mental Disorders
ICD-10	International Classification of Diseases 10th Edition
K10	Kessler Psychological Distress Scale
MEC	Medical Employment classification
MHPWS	Mental Health Prevalence and Wellbeing Study
MiLHOP	Military Health Outcomes Program
NSMHWS	National Survey of Mental Health and Wellbeing Study
OR	Odds Ratio
PCL	Posttraumatic stress checklist
PTSD	Posttraumatic stress disorder
UK	United Kingdom
USA	United States of America
WWI	World War 1
WWII	World War 2

ABSTRACT

Background: The impact of military service on mental health has long been a focus of scientific and political debate. Historically, underlying vulnerability (moral weakness) was blamed for the psychological effects of war. Pressure from veteran communities in the aftermath of the Vietnam war saw the advent of a diagnosis to encapsulate the pathological psychological effects of trauma, namely PTSD. This dramatically shifted the focus from underlying vulnerability to a single recent traumatic event, upon which the diagnostic criterion of PTSD depends. Meanwhile, research in civilians demonstrated that childhood adversity is a major determinant of disorder through the lifespan. In addition, childhood adversity was found to be more prevalent in serving and ex-serving military personnel than in civilians. I aimed to conduct a detailed and nuanced analysis of specific childhood factors (trauma and mental disorder) alongside adult factors in determining a broad spectrum of mental disorders (including PTSD, depression and anxiety) and related outcomes (suicidality, somatic symptoms, distress and functioning) in current and ex-serving military populations, and where possible, to compare with other populations.

Methods: I have taken advantage of the unique opportunity to examine data from the extensive health surveillance program in the ADF, specifically the 2010 ADF MHPWS, the ADF MEAO Prospective Study, and the ADF Transition and Wellbeing Research Programme. Where possible, I also compared with populations matched on sociodemographic variables, such as the 2007 ABS NSMHWS. Much of the data were detailed interview data. This allowed for the interrogation of childhood factors.

Results: There was a higher prevalence of childhood trauma in ADF than civilian employed men, particularly non-interpersonal childhood trauma in the oldest age groups.

In ADF and civilian employed men, childhood interpersonal trauma (which was more prevalent in ADF than civilian employed men), was not just associated with PTSD, but also the whole spectrum of past-year mental disorders. However, all of these associations were mediated by the spectrum of childhood mental disorders, with the exception of suicidality which was fully mediated by childhood anxiety alone. In the Transition population, childhood anxiety was not only an important determinant of adult outcomes (PTSD, anxiety, suicidality and multiple symptoms) it also appeared to fully mediate the relationship between childhood trauma and these outcomes (with the exception of suicidality).

Conclusion These analyses have enabled us to develop a rich and nuanced understanding of the childhood determinants of adult health and associated outcomes along with mediator pathways in different populations. A lifetime perspective has shed light on the relationships between childhood factors and more proximal adult factors in determining poor outcomes. It has highlighted the importance of evaluating childhood trauma profile in determining adult vulnerabilities and of the impact of trauma across the spectrum of mental disorders (not solely PTSD), allowing a rare glimpse, albeit retrospective, of reactivity to previous traumatic events. This has proved exceedingly fruitful and lays the groundwork for further prospective research to better inform early prevention and intervention strategies. These studies highlight both the utility and necessity for continued consistent epidemiological surveillance of these populations.

THESIS DECLARATION

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I acknowledge the support I have received for my research through the provision of an Australian Rotary Health Scholarship.

Rebecca J Syed Sheriff

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Date: 27th Sept 2019

I believe this thesis is properly presented and conforms to the specifications for the degree of sufficient standard to be, prima facie, worthy of examination

Signed: _____

Date: Oct 2019

Professor Alexander Cowell McFarlane

Principal Supervisor

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Chapter 1: Introduction

Background

The psychological impact of military service has long been the subject of scientific, as well as political debate. To date, the lens examining the psychological impact of war, and trauma more generally, has swung between focusing on vulnerability factors (context, culture and environment) and proximal factors (military/occupational factors and recent traumatic events). However, in order to understand current uncertainties and controversies, a historical context is invaluable.

Historical Context

In the WWI era, the important question was whether an individual's inability to function at war was a psychological illness or a sign of moral weakness (McFarlane, 2015). Often, medical officers found that prioritizing the overwhelming necessity of maintaining a fighting force, came above the needs of the individual. However, the medical profession in general was caught between empathy for the soldiers and pressure from military authorities to resist the concept of psychological injury.

It is essential to bear in mind when considering this, that the scale and the suffering experienced by soldiers during WWI was unprecedented (Jones and Wessely, 2014). Australia suffered some of the greatest losses, with the 58,961 deaths representing 14% of those who enlisted. It was estimated that 113,370 of those who returned were unfit on repatriation. Therefore, those who survived were considered the lucky ones (McFarlane, 2015).

However, the rates of people unable to function after prolonged and unrelenting combat became undeniable. WWI gave birth to the term ‘Shellshock’ and to the treatment ‘Forward Psychiatry’. The term ‘shellshock’ encapsulated the experience of shell bombardment. Whilst it arose spontaneously, it was first seen in the scientific literature in 1915 (Myers, 1915) and described a plethora of somatic symptoms such as exhaustion, dizziness and palpitations. It also included problems concentrating, nightmares and a startle reaction. It was not, however, diagnostically identical to PTSD (Jones *et al.*, 2003b).

Forward Psychiatry was designed to treat psychosomatic disorders near the front-line, removing the necessity for referral to base hospitals. Commanders believed that the further a serviceman was evacuated from the trenches, the less likely his return to a front-line unit. This made Forward Psychiatry an attractive option. During the manpower crises in WWII, Forward Psychiatry continued to be adopted. However, pressure on medical officers to return soldiers to the front-line may have led to inflated estimates of its success (Jones and Wessely, 2014).

In the aftermath of Vietnam, united efforts by the veteran’s community meant that a disorder that described the psychological impact of trauma was finally recognized, and PTSD finally appeared in the third edition of the DSM III in 1980. However, even with its inclusion in the DSM, along with investment in epidemiological methodologies to further elucidate its prevalence and aetiology, the debate surrounding PTSD continues to be politically charged. As Stein *et al* put it ‘Striking a balance between a focus on heroism and resilience versus victimhood and pathological change is a crucial and constant issue after trauma for both clinicians and society.’ (Stein *et al.*, 2007).

Why some and not others

In the WW era, mass suggestion (public debates between doctors were seen as a menace by military authorities) and secondary gain (removal from the front-line and the potential for financial compensation), were thought to be responsible for the otherwise unexplained illnesses of war (McFarlane, 2015). In the novel *Catch 22* (Heller, 1996), Joseph Heller was able to describe very eloquently the real and impossible situation faced by airmen flying in the Italian campaign. A tour of duty of 30 missions was based on a calculation that this was the half-life of an aircrew i.e. by the end of 30 missions there was a 50% chance of dying. The sane person would have a rational fear of operations. However, he would have to prove himself crazy not to fly, but in doing so would inadvertently demonstrate a rational mind.

In the civilian world, 'litigation neurosis', 'post-concussional syndrome' and 'compensation-itis' were labels used by twentieth-century physicians, to describe the phenomena that followed traffic and occupational accidents. In 1961, a series of studies by the influential neurologist Henry Miller formed the basis of the two Milroy lectures presented at the Royal College of Physicians, in which he described 'Accident Neurosis'. His findings were consistent with the commonly held view that the unexplained illnesses (which had varying degrees of distress and somatic symptomology) that followed traumatic events were almost entirely driven by financial compensation, the symptoms reportedly disappearing after this was achieved (Ross, 2019).

In light of the dominance of psychodynamic theory, the medical fraternity had historically viewed the psychological impact of war through the lens of underlying vulnerability (McFarlane, 2000, 2015). However, screening people out of military service on the basis of psychological vulnerability was found to be of questionable value. For example, during

WWII, psychological screening based on interviews assessing personality was used on a massive scale in the United States. By 1944, two million men had been rejected on the basis of this screening. The program had to be discontinued because of the disastrous impact on manpower. Many of the individuals originally rejected were later reenlisted, with the majority being satisfactory soldiers (Wessely, 2005).

Current and continuing controversies

Controversies and uncertainties regarding PTSD rage on into the modern era. As ever, the question of the psychological impact of trauma is highly politicised. From the point of view of veterans, the existence of a diagnosable illness attributable to proximal, military factors has obvious appeal in terms of adding validity to their distress and in gaining understanding, compassion and compensation for their suffering. Some argue, however, that overall it disadvantages those who experience traumatic events, not just allowing but sometimes also encouraging the medicalisation of suffering and increasing loss of functioning and symptomatology in individuals (Summerfield, 2001). However, others argue that whilst the concept of PTSD as a diagnosable medical disorder may well be intrinsically imperfect, conceptualising PTSD has at least offered a framework for developing research which has led to effective interventions (Stein *et al.*, 2007).

Some experts continue to question the validity of PTSD as a medical diagnosis. For example, the medical anthropologist Allan Young concluded: *“The disorder is not timeless, nor does it possess an intrinsic unity. Rather, it is glued together by the practices, technologies, and narratives with which it is diagnosed, studied, treated, and represented and by the various interests, institutions, and moral arguments that mobilised these efforts and*

resources.”(Young, 1995). The Psychiatrist, Derek Summerfield, holds the view that the concept of PTSD needs to be understood in its social and historical context, as the ‘*rise of expressive psychologically minded individualism, personal rights, entitlement and grievance*’(Bland, 2017). Ross argues that even conceptualizing PTSD has distorted historical accounts, as he puts it, allowing narratives to *leak into, or retroactively animate each other* (Ross, 2019).

Many argue that the concept of PTSD puts the emphasis of the aftermath of trauma onto illness rather than resilience. As Shephard elegantly put it, how does society “*discourage the mass of the population from developing psychiatric problems while simultaneously behaving fairly and humanely to those who do break down?*” It has been proposed that the introduction of PTSD to the DSM has renewed interest in the concept of resilience (Stein, 2009) in an attempt to counterbalance concerns about the psychological cost of trauma (Yehuda and McFarlane, 1995).

PTSD is unique in that its diagnostic criterion specifies aetiology. Unlike other mental disorders in which the diagnostic criteria are based on patterns of symptoms and behaviours, the criterion for PTSD is such that it can only be diagnosed in the context of an index traumatic event. Whilst this might be seen as attractive in some quarters, this does not explain why after a specific traumatic event only a minority of people develop PTSD, whilst others do not. However, the dependence on a proximal index event ignores mounting evidence that the psychological sequelae of trauma is best understood in terms of multiple traumas over the course of a lifetime, a concept known as cumulative trauma (Utzon-Frank *et al.*, 2014). Neither does it explain the concept of delayed-onset PTSD (Utzon-Frank *et al.*, 2014).

With the advent of PTSD and epidemiological military health research, the focus shifted from underlying vulnerability and onto the impact of proximal military factors, such as military deployment or combat (Creamer *et al.*, 2011). However, a rationale was still needed for why some people developed PTSD whilst the majority did not, despite experiencing similar or worse traumatic events. Even with huge research investment, even in the modern era, screening has been of questionable value because individual risk factors, although statistically significant, are relatively weak on an individual level, at predicting future problems (Brewin *et al.*, 2000).

PTSD has been the focus of military research in recent years. However, anxiety, depression and alcohol use disorders as well as somatic syndromes, are common in military populations (Zamorski *et al.*, 2016). They are also likely to be associated with trauma, however, their diagnostic criteria are not dependent on the presence of an index traumatic event. Therefore, the overall picture of the mental health consequences of military service and trauma may be obfuscated when research is too narrowly focused on PTSD (Mobbs and Bonanno, 2018). Whilst classified as an anxiety disorder in the DSM-IV and in the ICD-10, in the latest edition of the DSM (DSM-5), PTSD was reclassified and put in the section ‘Trauma- and stress-related disorder’. Further controversies are whether complex PTSD is a valid separate diagnosis from classic PTSD. Some argue that there is a growing literature that demonstrates that complex PTSD can be distinguished from classic PTSD on clinical grounds and is characterised by affect, interpersonal and identity dysregulation (Ford, 2019). Therefore, it’s inclusion in the forthcoming version of the ICD (ICD-11) appears justified (Jowett *et al.*, 2019). However, complex PTSD does have a significant anxiety element and given that it affects those with repeated exposure to trauma, (Brewin *et al.*, 2017) is likely to be particularly relevant to high stress occupations such as the military. Further complications

include delayed-onset PTSD which, given that it does not follow the timescale traditionally associated with the appearance of symptoms following a traumatic event, may be missed by cross-sectional epidemiological studies.

Chapter 2: **Overall Aims and Objectives**

A body of research in civilian populations has demonstrated childhood adversity to be a major risk factor for mental and physical disorders as well as suicidality and a whole range of outcomes relating to increased mortality (Felitti *et al.*, 1998). More recently, this has been echoed in military research where not only is childhood adversity more highly prevalent than in the community (Blosnich *et al.*, 2014), childhood adversity has been found to be an important determinant of health and related outcomes (Afifi *et al.*, 2016, Cabrera *et al.*, 2007, Iversen *et al.*, 2007b, Jones *et al.*, 2013, Sareen *et al.*, 2013b).

To date, research has tended to focus on specific childhood experiences (such as abuse) or childhood adversity, usually measured as a score based on the number of adversities experienced. However, there is a lack of research taking a broad perspective on the different types of childhood trauma experienced. In addition, there has been no previous consideration of the impact of childhood mental disorder, either alone, or in the context of childhood trauma in military populations. Finally, whilst specific outcomes such as PTSD and suicidality have been the focus of much of the epidemiological trauma research in military populations, broad outcomes such as common mental disorders have been relatively neglected (Creamer *et al.*, 2011).

In order to complete this PhD I have taken advantage of the unique opportunity to examine data from the extensive health surveillance program in the Australian Defence Force (ADF) (Van Hooff M, 2018, Van Hooff *et al.*, 2014). Unlike most previous military health surveillance across the world (with the exception of the Canadian Forces Mental Health Survey) (Sareen *et al.*, 2013a), which is predominately based on survey data, the data collected in the ADF were detailed interview data. This included a one-to-one interview assessment of lifetime traumatic experiences and lifetime mental disorder

as well as current disorder. As data regarding the age of first onset for trauma and disorder variables were collected, it was possible to separate childhood-onset from adult-onset factors. This allowed for the interrogation of childhood factors alongside more proximal adult factors, and their association with a range of mental disorders and related outcomes.

My overall aim was to investigate childhood trauma and childhood disorder in determining adult health and related outcomes. In this context, I utilized detailed lifetime interview data from the 2010 ADF MHPWS and the ADF Transition and Wellbeing Research Programme (the Programme). I also utilized self-report data from the ADF MEAO Prospective Study.

My objectives were to assess childhood trauma and formulate categories to allow meaningful comparison of trauma types across populations. In addition, I aimed to assess childhood mental disorder and the association between childhood trauma and childhood disorder. Moreover, I aimed to compare the association of childhood factors (trauma and disorder) with adult disorder and related outcomes (distress, functioning and suicidality). Where possible, I aimed to compare military with demographically matched civilian populations. I also aimed to investigate the association of childhood trauma with the development of new post-deployment disorder.

In a population who had left regular military service within the previous five years (Transition), I aimed to investigate the associations of childhood trauma and disorder on past-year anxiety and depression, PTSD, self-reported suicidality and multiple somatic

symptoms. In addition, I aimed to analyse whether these associations were independent of military/deployment factors.

I hypothesized that, taking a lifetime perspective to encompass the impact of a wide range of childhood experiences (trauma and disorder) on a wide range of adult outcomes, whilst also observing proximal factors such as adult trauma and deployment, would allow a more nuanced understanding of the determinants of health and related outcomes. In particular, I aimed to shed light on the particular problem of understanding the underlying context when assessing the association of health outcomes with more proximal factors such as deployment. In addition, I hypothesized that reactivity to childhood trauma might aid prediction to reactions to future trauma. Overall, I hypothesized that this detailed analysis would provide vital clues to early signs relating to risk and resilience. Therefore, findings from this research would have the potential to lay the groundwork for further prospective studies to better inform prevention and early intervention strategies.

Chapter 3: Literature Review

Strategy

Question: What is the impact of childhood factors in military personnel?

Method

All abstracts identified by the search (below) were screened for relevance. In papers deemed relevant, reference lists were interrogated for further potentially relevant papers.

I aimed to be as inclusive as possible and therefore did not exclude according to publication date. However, due to resource issues (ie not having access to a translator) I did exclude non-English language publications.

Search terms

(adverse child[tw] OR adverse childhood[tw]) OR childhood adversity[tw] OR "child abuse"[MeSH Terms] OR child abuse[tw] OR (abused child[tw] OR abused children[tw]) OR child maltreatment[tw] OR (maltreated child[tw] OR maltreated children[tw]) OR childhood maltreatment[tw])

AND

("military personnel"[MeSH Terms] OR military[tw] OR "combat disorders"[MeSH Terms] OR (veteran[tw] OR veteran'[tw] OR veteran'i[tw] OR veteran's[tw] OR veterana[tw] OR veteranen[tw] OR veterani[tw] OR veterans[tw] OR veterans'[tw] OR veterans'dyads[tw] OR veterans'perceived[tw] OR veterans'survey[tw] OR veteransl[tw] OR veteransamprsqo[tw] OR veteranus[tw]) OR Armed conflicts[mh] OR armed conflict*[tiab] OR warfare [mh] OR soldier [tw] OR marin* [tw] OR infantry [tw])

AND

english[la]

Results

The search yielded 384 papers of which 57 were deemed relevant by abstract screening. Further papers were identified from the reference lists. Some of the literature identified was in civilian populations but were deemed relevant, especially where there was limited data in military populations. The literature is summarised in this chapter.

Childhood factors

Childhood factors, such as early adversity/traumatic experiences (Felitti *et al.*, 1998) and mental health problems (Fryers and Brugha, 2013) are important determinants of adult health and related outcomes. Those in the military have been identified as being at high risk of mental disorder, particularly PTSD, due to the occupational trauma relating to deployment (Creamer *et al.*, 2011). More recently it has become apparent that there are high rates childhood adversity in military personnel (Blosnich *et al.*, 2014), which might, in part, explain some of the psychopathology in military populations (Iversen *et al.*, 2007b). Childhood factors may be the earliest identifiable risk factors for poor outcomes and therefore aid in the early identification of people at risk.

Childhood trauma/adversity

Civilian studies

Childhood adversity (including trauma) has an important and lasting impact on health not only in childhood but extending into adulthood. This was convincingly demonstrated in a landmark study in the late 1990's (Felitti *et al.*, 1998). A graded relationship was found between the breadth of childhood adversity and health, the strongest of which was with mental health. Those who had experienced four or more types of childhood adversity were at a 4-12 fold increased risk of the following outcomes in comparison to those who had experienced no childhood adversity; alcoholism, drug abuse, depression, and suicide attempt. Strong associations were also found with risk factors for physical health such as smoking, physical inactivity and obesity, as well as the presence of adult diseases such as ischemic heart disease, cancer and chronic lung disease.

As one might expect, the various types of childhood adversity, including neglect and abuse, were found to be interrelated. For example, if one type of adversity was experienced, the probability of having experienced at least one other was about 80% (Felitti *et al.*, 1998). The impact of childhood adversity on morbidity and mortality was originally postulated to be via psychosocial mechanisms; emotional and cognitive impairment, leading to the adoption of health risk behaviours leading to disease, disability and social problems and finally to early death (Felitti *et al.*, 1998). However, there is increasing attention to neurobiological models linking childhood experiences with adult outcomes. For example, chronic inflammation, which is implicated in the pathophysiology of depression as well as other disorders, has gained recent attention as a possible link between childhood adversity and adult health (Berk *et al.*, 2013).

It is now estimated that up to 30% of adult psychopathology in the general US population can be attributed to adverse childhood experiences (McLaughlin *et al.*, 2012). However, due to the co-occurrence of different types of adversity (Finkelhor *et al.*, 2007) it is likely that there is significant interplay between trauma/adversity types in determining mental health in adulthood, in addition, the timing and number of experiences is likely to be significant (Carr *et al.*, 2013). It has also been found that the severity, course and treatability of psychiatric disorders is impaired in those with a history of childhood adversity, leading some researchers to question whether it represents a different subtype of disorder (Teicher and Samson, 2013).

Military studies

Historically, the medical fraternity tended to view mental disorder in the military as a sign of underlying vulnerability, perhaps due to the dominance of psychodynamic theory or in the context of prioritizing the fighting force over the needs of the individual. For example, in the official history of the Australian Imperial Forces, underlying vulnerability and character traits were cited as the main determinants of nervous breakdown over the severity of prolonged or intense combat (McFarlane, 2015).

However, in the modern era, military epidemiological studies have tended to focus on military and particularly deployment factors and their relationship with mental health, and specifically PTSD (Creamer *et al.*, 2011). However, it is becoming increasingly apparent that pre-military factors, and particularly childhood adversity, are important determinants of military mental health (Cabrera *et al.*, 2007, Iversen *et al.*, 2007b, Jones *et al.*, 2013).

Childhood adversity is highly prevalent in military and ex-military populations. Recent research suggests that military and ex-military populations may be more likely to have experienced adversities in childhood compared with civilians. For example a US community study demonstrated that men with a history of military service, particularly in the voluntary era of conscription had higher odds of having experienced childhood adversity (Blosnich *et al.*, 2014). Differences were less marked in women. In a Canadian study, child abuse exposure was higher in a representative sample of the Regular Forces (47.7%; 95% CI, 46.4%-49.1%) 95% CI, 46.3%-51.5%) compared with a matched sample from the Canadian general population (33.1%; 95% CI, 31.8%-34.4%). (Afifi *et al.*, 2016). Whilst both childhood adversity and suicidality were higher in the military population, the strength of the association was weaker than in the civilian population

(Afifi *et al.*, 2016). However, the reason for this difference was beyond the scope of that study and notably, mental health over time was not reported (Afifi *et al.*, 2016). Whilst there is some variation, this is consistent with evidence that military services and particularly the Army recruit from areas of social disadvantage (Wessely, 2005).

In military personnel, as in civilians, adverse childhood experiences have been linked to poor mental health, including drug and alcohol use (Trent *et al.*, 2007) (Afifi *et al.*, 2014, Iversen *et al.*, 2007b) and, as mentioned above, suicidality (Afifi *et al.*, 2016). In addition, in military populations childhood adversity has also been linked to poor physical health and occupational functioning (Iversen *et al.*, 2007b, Katon *et al.*, 2015), leaving the military early (Buckman *et al.*, 2013b, Patrick *et al.*, 2011), homelessness (Tsai and Rosenheck, 2015) as well as risky driving (Sheriff *et al.*, 2015), relationship difficulties (Keeling *et al.*, 2015) and interpersonal violence (Merrill *et al.*, 2004).

There is some evidence that those in the military who have experienced childhood trauma/adversity are more likely to experience adult trauma. A UK study which compared Iraq veterans and non-deployed UK military males demonstrated that those with childhood adversity are at a higher risk of PTSD and other poor health outcomes, but also at a higher risk of experiencing combat (Iversen *et al.*, 2007b). However, a study comparing male troops post-deployment to Iraq with non-deployed soldiers found that adverse childhood experiences predicted trauma and PTSD independently of combat exposure (Cabrera *et al.*, 2007). In a study of Australian military veterans deployed to the Bougainville or East Timor, both childhood adversity and deployment trauma were associated with poor mental health after deployment but there was no evidence of interaction (Zheng *et al.*, 2016). Therefore, although it appears that there is an association

between childhood trauma and adult trauma in military populations, the relationship with poor adult mental health appears to be independent of this.

Childhood disorder

Civilian studies

Studies in civilian populations have demonstrated that childhood disorders are the single most important determinants of adult mental health (Fryers and Brugha, 2013, Reef *et al.*, 2009). However, there is limited disorder specificity and different childhood emotional and behavioural problems are predictive of a range of psychopathologies into adulthood (Reef *et al.*, 2009).

Military studies

Although some studies from the US (Ursano *et al.*, 2015) and Canada (Beliveau *et al.*, 2019) have investigated previous mental disorder, neither specifically analysed childhood mental disorder. I was unable to identify any studies that investigated childhood mental disorder in military populations. Therefore, the role of childhood mental health alone, and within the relationships between childhood trauma and later outcomes remains unknown.

Recent trauma in the context of lifetime trauma

As previously noted, childhood adversity is associated with adult trauma in military populations but independently of this appears to have a direct association with some adult mental disorder and related outcomes. However, I now address the issue of whether antecedent trauma impacts on the effects of later trauma. Some research suggests that previous trauma reduces an individual's mental health response to further trauma

(inoculation) (Cabrera *et al.*, 2007). However, other research suggests that previous trauma increases mental health reactions to further trauma (sensitisation) (King *et al.*, 1996). Still other studies suggest no effect (Van Voorhees *et al.*, 2012).

Research in military populations mainly observe the relationship between childhood adversity and deployment related trauma on PTSD and depression. Findings are that adverse childhood experiences increase the impact of trauma on adult mental health. A prospective study in currently-serving military personnel deployed to Afghanistan demonstrated that antecedent trauma increased the mental health impact of deployment trauma through antecedent mental health symptoms (Searle *et al.*, 2017). Moreover, in a US prospective study of military personnel deployed in support of the conflicts in Iraq and Afghanistan, pre-existing mental disorders impacted on the mental health response to deployment trauma, for example, deployment-related physical injury (Sandweiss *et al.*, 2011).

In keeping with this, a more nuanced picture emerges in civilian studies. Some studies have demonstrated that is not necessarily trauma per se that predicts later reactions to trauma but rather mental health reactions to trauma that predicts PTSD in response to subsequent trauma. This was demonstrated in a prospective epidemiological study of young adults (Breslau *et al.*, 2008) and also in relation to trauma in an occupational sample of bus drivers (Brunet *et al.*, 2001).

Current gaps in the literature

A major gap in the current literature is the lack of data on childhood mental disorder in military populations. In addition, whilst there are numerous previous studies investigating

childhood adversity in military populations, they tend to focus on particular types of traumatic experience on specific disorders such as PTSD or depression (Creamer *et al.*, 2011). However, the impact of different trauma exposures has proved difficult to decipher due to clustering, i.e. those who have experienced childhood trauma/adversity have generally been exposed to more than one type (Finkelhor *et al.*, 2007). In addition, people may not stay true to a disorder throughout the lifespan (Goodkind *et al.*, 2015).

Whilst previous research has investigated the impact of antecedent trauma on post-deployment mental disorder, none have looked specifically at childhood trauma, which is likely to have different etiological implications (Pechtel *et al.*, 2014). In addition, the period of transition from military to civilian life is becoming recognised as a stressful period in the life of military personnel, and a time at which there is a vulnerability to mental disorder yet it remains an emerging field of international research (Shields, 2016).

In this context, I set out to investigate the association of adverse childhood experiences with the spectrum of mental disorder across the lifespan in order to provide invaluable information regarding risk and resilience. I aimed to reinforce this, wherever possible, by investigating the same factors in a comparison population.

Chapter 4: What the proposed research might add

To the best of our knowledge, the prevalence of childhood disorders has not been assessed within a representative military population, neither has childhood mental disorder been compared between civilian and military populations. However, differences may elucidate differential vulnerabilities to disorder within these two populations.

In addition, potential differences in the relationship between childhood trauma and childhood disorder in military and civilian populations might give some indication as to prior sensitivity/resilience to traumatic experiences. For example, those with certain childhood trauma/disorder profiles might be more likely to enlist in the military, however these might impact uniquely on future risk/resilience. Whilst it seems likely that once within the military, people are more likely to be exposed to potentially traumatic events, it is not clear if those with certain childhood trauma/disorder profiles are more likely to experience adult trauma, if they are more sensitive to this trauma and how this differs between populations.

Military and civilian populations have different healthcare provision and help-seeking behaviours which may impact on the relationship between childhood factors and adult outcomes. Childhood traumatic exposures could have an effect on childhood disorder which might not translate into the same type of disorder in adulthood, therefore including all types of mental disorder is likely to be more informative.

In addition, this research will add significantly to the current body of literature regarding the impact of childhood trauma on the impacts of military deployment. Detailed interview data in the Transitioned population will allow the identification of the childhood

[Type here]

determinants of poor outcomes, anxiety and depression, PTSD, suicidality and multiple health symptoms.

In assessing the influence of a range of childhood trauma and childhood disorder alongside more proximal adult stressors (such as combat and deployment) on a range of outcomes, is likely to provide us with essential information as to the earliest identifiable signs of vulnerability. In addition, taking a broad and long-term perspective will provide unique insights and help redress the balance of understanding proximal stressors in the context of underlying vulnerabilities. This will provide essential information in order to better inform early intervention and prevention strategies.

**Chapter 5: Paper 1. Childhood trauma
and childhood mental disorder in
military and employed civilian men**

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff		
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper for publication. I amended the paper according to supervisor/co-author comments.		
Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/2019

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis;
and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Abstract

We aimed to retrospectively investigate childhood trauma and childhood mental disorder in military and employed civilian men aged 18-54. Data, derived from the 2010 Australian Defence Force (ADF) Mental Health Prevalence and Wellbeing Study and the 2007 Australian Bureau of Statistics National Survey of Mental Health and Wellbeing Study, were analysed and compared using direct age-standardization and logistic regression. A greater proportion of ADF reported childhood trauma, multiple trauma types, trauma onset below 12 years of age and interpersonal trauma, than civilian employed men. A greater proportion of ADF reported childhood non-interpersonal trauma, such as accidents, than civilian employed men, with a marked difference in those aged 45-54. In both populations, childhood disorder was associated with childhood trauma, however, childhood depression was not associated with childhood non-interpersonal trauma in either population. A deeper understanding of the longer-term risk and resilience conferred by different childhood trauma profiles is needed.

Key Words: epidemiology; military; childhood trauma; childhood mental disorder

Introduction

Childhood factors are critical in determining adult health and functioning. Childhood adversity has been linked to adult mental and physical health problems (Felitti *et al.*, 1998, Gilbert *et al.*, 2015, Wade *et al.*, 2016), as well as poor social outcomes, such as criminality (Fox *et al.*, 2015, Roos *et al.*, 2016), unemployment (Liu *et al.*, 2013) and homelessness (Roos *et al.*, 2013). Childhood adversity is a somewhat broad term encompassing child abuse, neglect and household dysfunction (Felitti *et al.*, 1998) but not childhood mental disorder.

Military research in the UK (Iversen *et al.*, 2007b), US (Blosnich *et al.*, 2014, Cabrera *et al.*, 2007) and Canada (Afifi *et al.*, 2016) has demonstrated that those in the military have high rates of childhood adversity and that this is an important determinant of military mental health (Cabrera *et al.*, 2007, Iversen *et al.*, 2007b, Jones *et al.*, 2013). For example, one UK study suggested that the mental health impact of deployment is determined as much by childhood adversity as by deployment factors (Jones *et al.*, 2013).

It has proved challenging to decipher the impact of trauma by type from that of load.

Research suggests that individuals who are exposed to childhood trauma are often exposed to multiple different types, an effect known as clustering (Finkelhor *et al.*, 2007). In addition, it is suggested that there are critical periods during childhood in which traumatic events have greater effects on brain development and consequently later reactions to trauma (McLaughlin *et al.*, 2014). However, there is little research characterizing childhood trauma in military populations or comparing this with civilians.

The most reliable childhood predictor of adult mental disorder is childhood mental health, (Fryers and Brugha, 2013) but with limited disorder specificity (Reef *et al.*, 2009, Reef *et al.*, 2010a, Reef *et al.*, 2010b). In addition, research in civilian populations has demonstrated that it is not necessarily trauma per se, but rather, the mental health reaction to trauma that predicts the impact of subsequent trauma. This was demonstrated in a prospective epidemiological study of young adults (Breslau *et al.*, 2008) and in an occupational sample of bus drivers (Brunet *et al.*, 2001).

Childhood mental disorders are generally associated with broad outcomes such as substance abuse, poor psychological and social functioning (Birmaher *et al.*, 1996), low academic achievement, nicotine dependence, unemployment and early parenthood (Fergusson and Woodward, 2002). Given these consistent associations, it is somewhat remarkable that so few studies (in either civilian or military populations) have explored both childhood trauma and childhood disorder simultaneously (Fryers and Brugha, 2013). Furthermore, evidence is emerging that mental disorders are on a continuum and that individuals move between categories of disorder over the lifespan (Goodkind *et al.*, 2015, McGorry and Nelson, 2016). Thus, studies assessing the psychological impact of childhood trauma would need to observe mental disorder across diagnostic categories.

This current study examines retrospectively reported childhood trauma and childhood mental disorder in ADF and employed civilians. Our objectives were to investigate childhood trauma and childhood mental disorder, by type, number of types and age of onset, and the association between them, in military and employed civilians aged 18-54 years. We did not have sufficient female responders in the ADF for a meaningful separate analysis or for stratification by gender, as well as by age. Therefore, due to important gender differences in

military populations (Rona *et al.*, 2007) and evidence of differences in the association between childhood trauma and disorder according to gender in military and civilian populations (Evans *et al.*, 2018), as in other similar studies (Dorresteijn *et al.*, 2019), we have limited this analysis to men.

We hypothesized that a critical analysis of childhood trauma and childhood disorder across these populations would be valuable in gaining an understanding of vulnerabilities and resilience. This research lays the groundwork for further studies (Syed Sheriff *et al.*, 2018, 2019) to investigate childhood factors in determining social, occupational and health outcomes into adulthood, in order to better inform early intervention and prevention strategies.

Methods

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis.

Military (ADF) sample

The 2010 ADF Mental Health Prevalence and Wellbeing Study (MHPWS) employed a two-phase design to estimate the prevalence of ICD-10 mental disorders across all serving regular ADF personnel (Van Hooff *et al.*, 2014). This two-phase design is well accepted for investigating mental disorder prevalence (Dunn *et al.*, 1999).

- At Phase 1, all current serving ADF personnel (N= 50049), excluding trainees and Reservists, were invited to complete a self-report questionnaire, which is economical of time and resources. This included basic demographics, the Kessler Distress Scale (K10), (Andrews and Slade, 2001) the Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C) (Ventureyra *et al.*, 2002) and the Alcohol Use Disorders Identification Test (AUDIT). (Conigrave *et al.*, 1995)
- At Phase 2, a stratified sub-sample of Phase 1 respondents were invited to complete a more accurate but costly and time-consuming structured diagnostic interview, the CIDI.

In all, 24481 participants provided usable data at Phase 1. Fifteen percent of the eligible participants from Phase 1 were stratified and selected for participation in Phase 2.

Participants were selected for Phase 2 with the joint aims of ensuring sufficient power within key demographic groups and of ensuring that participants had a reasonable chance of a positive diagnosis. Therefore, eligibility for Phase 2, was based on service, sex, and scores on the PCL and AUDIT.

The World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) was utilized at Phase 2, conducted as a telephone interview. Of the 3688 participants selected for Phase 2, 1798 (49%) completed a CIDI interview. Taylor series linearization was used to estimate variance (Deville, 1999; Ravva *et al.*, 2014).

Weighting

Detailed descriptions of stratification procedures and weighting are available elsewhere (Hodson *et al.*, 2011; Van Hooff *et al.*, 2014). In brief, mental disorder prevalence estimates were calculated using a robust two-stage weighting procedure which attenuated selection and responder bias, as well as the impact of low response rates. In the first step, a weight was assigned which was equal to the inverse of the probability of an individual being selected for an interview. This accounted for the differential probability of being selected for a CIDI based on scores on the PCL and AUDIT, sex and service. In the second step, representative ‘weight’ was applied to each survey responder, using age, sex, rank, and medical fitness, to indicate how many ‘like’ individuals in the entire population (based on those characteristics) each responder represented. These weights were applied to correct for differential non-response to the survey. The two weights were combined to give each responder a single weight within the data, enabling data from responders to be adjusted so that it was representative of the entire ADF. For the purposes of this study, output for men was achieved by post-stratification to adjust the weights so that known population totals were reproduced by the estimates. 1301 men aged 18–54 had a CIDI interview which was weighted to represent all 41,928 regular ADF men aged 18–54.

Civilian (ABS) sample

The 2007 National Survey of Mental Health and Wellbeing (Slade *et al.*, 2009a) was based on a stratified, multistage area probability sample of residents aged 16–85 years across all states and territories in Australia.

The final sample of 8841 represented a 60% response rate at the national level (Slade *et al.*, 2009a). Person weights were calibrated to independent estimates of population benchmarks in order to minimize sampling error of estimates and the level of non-response bias. Population benchmarks (obtained from the 2006 Australian Census, as well as from the 2007 Australian Survey of Education and Work) allowed weighting of the sample according to the probability of being selected.

All employed males aged 18-54 were selected for this study. Those who had served in the ADF, received a DVA pension or been exposed to combat were excluded. A total of 1900 employed civilian males in the general population (ABS) had a CIDI interview which was weighted to represent all employed civilian males aged 18-54. Person and replicate weights were applied to this data to ensure that subpopulation weighting was correct.

Measures

Both studies utilized the CIDI 3.0 (Kessler and Ustun, 2004) which is a structured diagnostic assessment of lifetime, 12-month and 30-day ICD-10 disorder, with ICD hierarchical rules

applied. In the ABS study this interview was conducted in the participants home and in the ADF by telephone. In the ADF the participants were informed that the interview was neither conducted by, nor shared with, Defence personnel. In both studies the participants were informed that the aim of the study was to investigate the prevalence of disorder within the population

Childhood mental disorder

Childhood disorder was defined as any lifetime mental disorder with age of onset below age 18 years, therefore this could include adult disorders that started in childhood or disorders that were confined to childhood. Disorder types were grouped as follows: any depression (mild, moderate or severe depressive episode), any anxiety (social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD) and any alcohol use disorder (abuse or dependence).

Childhood Trauma.

In both studies respondents were asked if they had experienced any of the CIDI criterion A1 events listed in the CIDI 3.0. Respondents were asked how old they were when it first happened to them to determine age of onset of each experience. We defined childhood trauma as any trauma that was first experienced prior to the age of 18. Based on Forbes et al. (Forbes *et al.*, 2014) trauma types were categorised as non-interpersonal trauma or interpersonal. See Table 2 for the types of trauma in each category.

Analysis

All analyses were performed in STATA version 14.2, accounting for complex survey designs in both populations. Childhood trauma was analyzed by type, category (non-interpersonal, interpersonal or other), age first experienced (0-11 years, or 12-17 years) and number of types (single or multiple). Childhood mental disorder was analyzed by disorder type (anxiety, depression, alcohol use disorder), age of onset (0-11 years, or 12-17 years) and number of types (single or multiple). Age-specific rates for childhood trauma and childhood mental health variables were calculated for the ADF according to the following age strata (18-24, 25-34, 35-44, 45-54). Rates for employed civilian males (ABS) were then directly-standardized to the ADF population based on these age-strata. P values were not calculated due to the complexities associated with accurately testing results across 2 complex surveys. We use the term 'significant' to describe differences between the population rates when the 95% confidence intervals do not overlap.

We performed logistic regression analyses for the association between childhood trauma and childhood mental disorder controlling for current age as a continuous variable, as preliminary analyses showed no evidence for non-linear associations with age. The few sociodemographic variables to which we had access in both populations were relevant to adulthood rather than childhood. For example, current relationship status was unlikely to impact on childhood trauma or childhood disorder and was more likely to be impacted on by childhood factors. Therefore, current relationship status was not controlled for in this analysis. Highest educational attainment was available in both populations. Preliminary analyses demonstrated that highest educational attainment did not differ between the

populations according to age-strata. Therefore, age-adjusted Odds Ratios were calculated and presented as Forest Plots.

Results

Over half of the males in the ADF, and a higher proportion than civilians, reported childhood trauma. A higher proportion of the ADF reported childhood multiple trauma types and age of trauma onset aged 0-11 years. A higher proportion of the ADF experienced non-interpersonal childhood trauma and interpersonal childhood trauma (See Table 1). There were no significant differences in proportions of childhood mental disorders between the populations.

In the ADF there were higher proportions of those who had experienced the following types of trauma; exposed to a toxic chemical, man-made disaster, life-threatening illness and life-threatening automobile accident (See Table 2). Due to higher rates of multiple trauma types in the ADF, for comparability and in an attempt to differentiate trauma type from trauma load, we re-categorized childhood trauma into mutually exclusive categories; non-interpersonal trauma experienced in childhood (but without interpersonal trauma experienced in childhood), interpersonal trauma experienced in childhood (but without non-interpersonal trauma experienced in childhood) and both non-interpersonal and interpersonal trauma experienced in childhood. Those who had experienced only trauma types in childhood that were neither interpersonal nor non-interpersonal were categorised as 'Other'.

Those in the ADF reported higher rates of non-interpersonal trauma (without interpersonal trauma), and both interpersonal and non-interpersonal trauma in childhood. The difference in proportions of childhood non-interpersonal trauma between the populations was significant in the oldest age group (aged 45-54 years). The difference in proportions of both interpersonal

and non-interpersonal trauma between the populations was significant in the youngest age groups (see Table 3)

Multiple trauma types and younger age of trauma onset were strongly associated with childhood mental disorder in both populations. Single trauma types and non-interpersonal childhood trauma (without interpersonal trauma) did not have a significant association with childhood depression in either population (See Figure 1).

Data regarding childhood emotional and behavioral problems were available for the ADF only (see supplementary Table 4). There was no significant association between any emotional or behavioral problem with either other childhood trauma or childhood non-interpersonal (without interpersonal) trauma.

Paper 1: Tables and figures

Table 1: Childhood trauma and disorder standardised rate comparison

	ADF			ABS age-standardized		
	%	95% CI		%	95% CI	
CHILDHOOD TRAUMA						
Number of types						
Single	25.0	21.3	29.0	24.1	21.2	27.0
Multiple	31.5	27.2	36.1	19.5	16.9	22.0
AGE of first onset						
0-11	33.6	29.2	38.2	23.1	20.7	25.6
12-17	22.9	19.3	27.0	20.5	17.8	23.1
Any childhood non-interpersonal trauma	27.5	23.4	32.1	13.3	11.0	15.7
Any childhood interpersonal trauma	22.9	19.1	27.1	16.2	13.9	18.5
Total reporting any childhood trauma (including other types)	56.5	51.8	61.0	43.6	40.4	46.7
CHILDHOOD DISORDER						
Number of types: Single	14.5	12.1	17.3	13.2	11.0	15.3
Number of types: Multiple	11.1	8.1	15.1	8.2	6.5	9.8
Age of onset: 0-11	11.2	8.3	14.9	7.0	5.5	8.6
Age of onset: 12-17	14.5	11.8	17.6	14.3	12.2	16.4
Any childhood anxiety	17.5	13.9	21.6	15.3	13.2	17.4
Any childhood depression	3.9	2.1	7.3	2.5	1.6	3.3
Any childhood alcohol	7.6	5.3	11.0	7.2	5.5	8.9
Total reporting any childhood disorder	25.6	21.7	30.0	21.4	18.8	23.9

Table 2: Prevalence of childhood trauma types

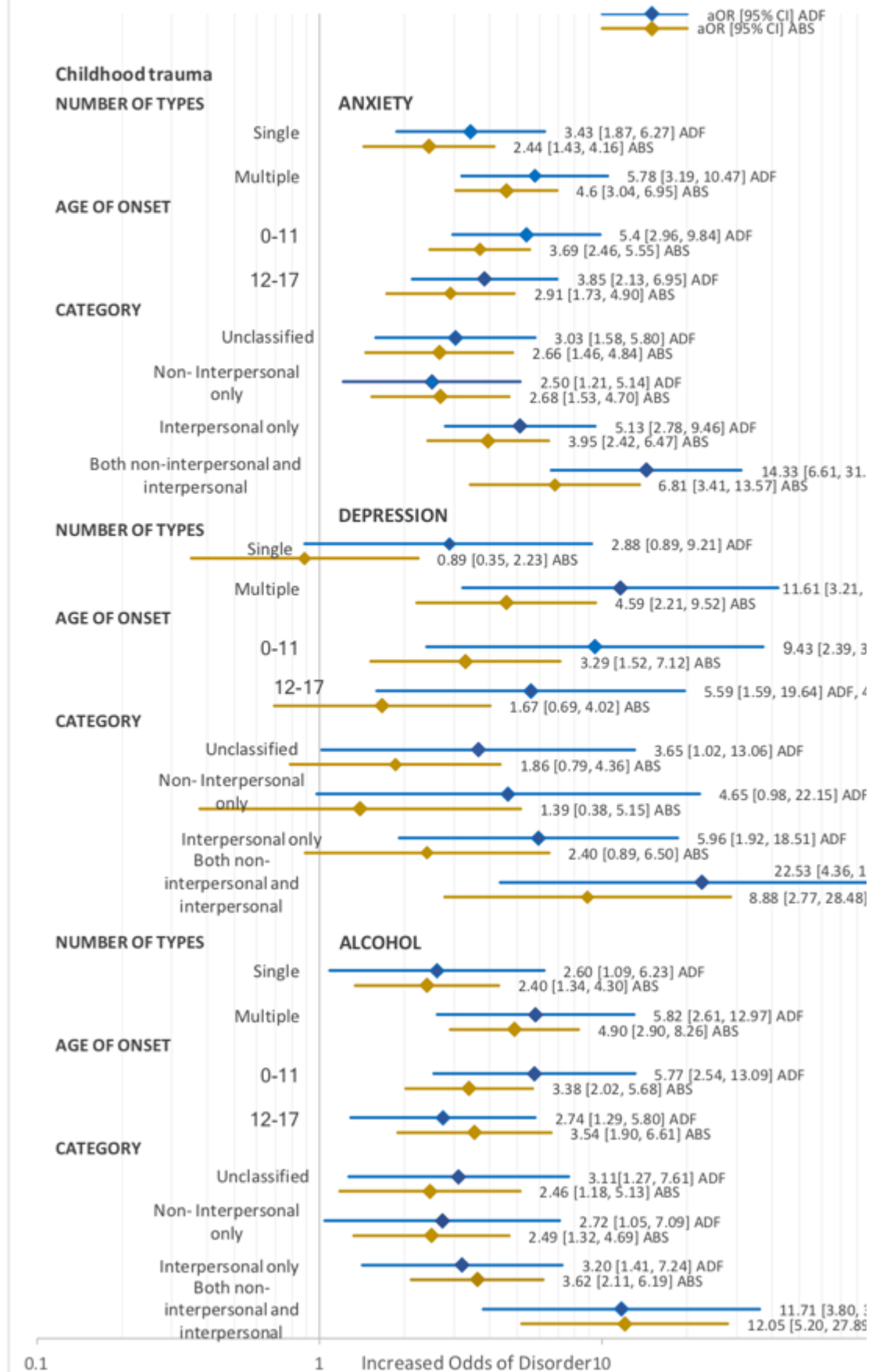
	ADF			ABS age-standardized rate		
	%	95% CI		%	95% CI	
NON-INTERPERSONAL						
Exposed to a toxic chemical that could cause serious harm	3.0	1.3	6.5	0.0	0.0	0.0
Other life-threatening accident	3.2	2.0	5.2	2.6	1.7	3.5
Man-made disaster	4.7	2.7	7.9	1.4	0.8	1.9
Life-threatening illness	5.8	3.4	9.9	2.0	1.4	2.7
Major natural disaster	7.4	5.6	9.7	4.6	3.2	5.9
Life-threatening automobile accident	10.9	7.9	14.9	4.7	3.3	6.0
INTERPERSONAL						
Kidnapped or help captive	1.3	0.3	6.6	0.0	0.0	0.0
Badly beaten by anyone else	8.0	5.7	11.1	6.2	4.7	7.7
Mugged, held up or threatened with a weapon	9.9	7.8	12.4	7.3	5.8	8.9
Beaten by spouse/romantic partner	0.0	0.0	0.2	0.2	0.0	0.5
Stalked	1.6	0.4	6.1	0.6	0.2	1.0
Raped	3.1	1.4	6.5	1.5	0.9	2.2
Beaten by parents/guardian as a child	3.9	2.8	5.3	3.6	2.5	4.8
Sexual assault	5.8	3.7	9.0	3.4	2.2	4.7
UNCLASSIFIED						
Child had life threatening illness/injury	0.0	0.0	0.0	0.0	0.0	0.0
Combat	0.1	0.0	0.2	0.0	0.0	0.0
Refugee	0.1	0.0	0.7	0.8	0.2	1.3
Peacekeeper	0.2	0.1	1.0	0.0	0.0	0.0
Purposefully injured/tortured/killed someone	0.4	0.1	1.0	0.7	0.3	1.1
Other traumatic event	1.2	0.7	1.9	2.2	1.3	3.1
Unarmed civilian in a place of conflict	1.3	0.7	2.5	1.3	0.4	2.1
Accidentally injured/killed someone	1.7	0.5	6.1	0.9	0.3	1.4
Lived as a civilian in a place of ongoing terror	1.8	1.1	2.9	1.0	0.4	1.6
Experience don't want to talk about	1.8	1.0	3.4	0.8	0.4	1.3
Saw atrocities or carnage	2.9	1.3	6.4	1.3	0.4	2.2
Someone close had traumatic experience	3.8	2.4	6.0	3.1	2.2	4.1
Witness serious physical fights at home as a child	10.4	8.3	13.0	7.7	6.1	9.2
Someone close died	15.4	12.5	18.9	11.1	9.2	12.9

Saw someone badly injured	19.7	16.3	23.6	14.4	12.1	16.8
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Table 3: Exclusive childhood trauma categories by age strata

Childhood trauma	ADF			ABS age-standardized rate		
	%	95% CI		%	95% CI	
Non-interpersonal (without interpersonal)						
Current age 18-24	22.2	12.9	35.3	13.0	8.5	17.4
Current age 25-34	13.6	7.4	23.8	10.2	6.6	13.9
Current age 35-44	13.2	9.3	18.5	9.7	5.8	13.7
Current age 45-54	23.2	15.2	33.9	5.4	3.1	7.7
Total	16.9	13.3	21.3	9.3	7.5	11.1
Interpersonal (without non-interpersonal)						
Current age 18-24	10.9	6.2	18.4	13.4	10.1	16.6
Current age 25-34	9.0	6.4	12.7	15.2	10.0	20.4
Current age 35-44	16.6	12.4	21.9	11.4	8.6	14.3
Current age 45-54	11.4	7.7	16.7	8.5	4.2	12.8
Total	12.2	10.2	14.7	12.1	10.0	14.2
Both non-interpersonal and interpersonal						
Current age 18-24	13.0	6.3	24.8	3.6	1.5	5.6
Current age 25-34	15.7	8.2	27.7	4.5	2.0	7.1
Current age 35-44	5.2	3.6	7.4	3.8	2.2	5.5
Current age 45-54	10.0	6.3	15.6	4.1	1.1	7.1
Total	10.6	7.6	14.6	4.1	2.9	5.3
Unclassified trauma only						
Current age 18-24	7.5	4.1	13.2	18.6	13.8	23.4
Current age 25-34	15.6	10.7	22.1	16.6	12.0	21.3
Current age 35-44	17.5	12.9	23.2	16.3	12.8	19.8
Current age 45-54	22.2	16.2	29.7	22.3	15.9	28.7
Total	16.7	14.0	19.8	18.2	16.1	20.3
Any childhood trauma						
Current age 18-24	53.5	40.7	65.8	48.5	41.8	55.2
Current age 25-34	53.9	43.4	64.0	46.6	40.1	53.0
Current age 35-44	52.4	45.7	59.0	41.3	36.1	46.5
Current age 45-54	66.8	59.2	73.7	40.2	31.8	48.7
Total	56.5	51.8	61.0	43.6	40.4	46.7

Figure 1: Forest Plot of the relationship between childhood trauma and disorder in military compared with civilian males



Discussion

It is increasingly recognised that childhood factors are important determinants of health. We critically analyzed childhood trauma and childhood disorder in ADF and civilian employed men. A greater proportion of ADF reported childhood trauma, multiple trauma types, trauma onset below 12 years of age and interpersonal trauma, than civilian employed men. A greater proportion of ADF reported childhood non-interpersonal trauma (without interpersonal trauma), such as accidents, than civilian employed men, with a marked difference in the oldest age group (45-54 years). In both populations, childhood disorder was associated with childhood trauma, however, childhood depression was not associated with childhood non-interpersonal trauma in either population.

Other epidemiological studies have also demonstrated high rates of childhood trauma in military samples. Whilst those studies used different methodologies and measures they are broadly in keeping with our findings (Rosen and Martin, 1996). For example, one study (Youssef *et al.*, 2013), assessed childhood trauma in US military personnel and veterans (of which 80% was male) and found that only 44% did not report childhood trauma (the same as in this current study). Rates of childhood physical assault were 34%, sexual assault 13% and other trauma types (including manmade and natural disasters) were 39% (compared to our rate of non-interpersonal trauma of 28%). In a UK study, 19% of male military personnel reported pre-enlistment antisocial behavior. (Macmanus *et al.*, 2012) This is comparable to our study in which 20% of our sample reported childhood behavioral problems. Consistent with other studies, our study also demonstrated that there are high rates of multiple childhood trauma types in the military (Iversen *et al.*, 2007b).

Our finding that a higher proportion of military males first experience trauma prior to the age of 12 years than civilian employed males, is both novel and important. Our results demonstrate, trauma onset below the age of 12 had a strong association with childhood mental disorder in both populations. This is consistent with neuroimaging studies which demonstrate a sensitive period in amygdala development prior to the age of 12 years (Pechtel *et al.*, 2014).

Counter-intuitively a large proportion of the oldest age group (aged 45-54), and significantly more than civilians, reported childhood trauma (66.8%, 95%CI: 59.2-73.7). This was surprising as we had hypothesized that childhood trauma rates would reduce with age in comparison to civilians due to those with mental health vulnerabilities, transitioning out of the military earlier. Interestingly, 23.2% (95%CI: 15.2-33.9) of the oldest ADF age group reported non-interpersonal childhood trauma (without interpersonal trauma) compared with 5.4% (95%CI 3.1-7.7) of the civilian employed population. It is therefore possible that men who experienced accidents or disasters as children in the absence of interpersonal trauma were more likely to enlist and/or *less* likely to transition out of military service early. In contrast, a higher proportion of ADF in the youngest current age categories (18-24 and 25-34) experienced both interpersonal and non-interpersonal trauma in childhood than civilian employed men, this difference is not apparent in the older age categories. This is broadly consistent with previous research which demonstrates that leaving the military early is associated with childhood adversity (Buckman *et al.*, 2013a).

Interestingly there was no association between non-interpersonal childhood trauma and externalizing behaviors. It might be surmised that those who reported non-interpersonal childhood trauma did not necessarily have preexisting risk-taking tendencies.

Strengths

This study is original in investigating childhood trauma and mental disorder simultaneously in a military population, and moreover we were able to compare proportions and associations with employed civilians in whom the same measures were used. Both of these datasets provided unusually detailed interview data on lifetime mental disorder and trauma. The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from load which has been a particular challenge for research on childhood experiences (Finkelhor *et al.*, 2007).

Weaknesses

The main predictor variables utilized in this analysis were childhood experiences retrospectively reported from adulthood, thus rendering the responses vulnerable to autobiographical bias. However, it appears that such retrospective reporting of childhood experiences is more prone to false negatives than positives and that it does produce good reliability if well defined (Hardt and Rutter, 2004), as in this study.

Whilst there may appear to be a low response rate in the ADF, unlike most surveys, the demographic and health status of the ADF members who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error.

We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the range, rather than frequency or severity of trauma experienced. However, similar trauma count variables have previously shown consistent significant associations with mental disorder. (Sareen *et al.*, 2013a) It is possible that in some cases mental disorder pre-dated the trauma, and that mental disorder may not have been related to that trauma. In addition, other measures of adversity such as more general family dysfunction or neglect were not measured in this study.

Conclusions

Military service may provide a positive social experience for individuals from disadvantaged backgrounds. This needs to be balanced against the potential risk of cumulative trauma. The challenge is to develop a more nuanced interpretation of these issues. For example, the majority of men who reported childhood trauma in the ADF experienced trauma that was not interpersonal in nature, i.e. non-interpersonal trauma, such as accidents, or other trauma. As these had weak associations with childhood disorder, and particularly depression, this may explain why rates of childhood disorder were similar in ADF and civilian men.

It could be theorized that resilience in the face of childhood trauma drives some individuals to deal with challenging environments in adult life. Thus, certain trauma profiles may not impact negatively on longer-term outcomes including military longevity. In contrast, childhood interpersonal trauma is more likely to occur in conjunction with a dysfunctional family background and have more of an impact on poor outcomes (Fryers and Brugha, 2013).

Thus, screening all of those with a history of childhood trauma out of military forces may be counter-productive and a deeper understanding of the longer-term implications of different childhood trauma profiles both within the military and civilian context are needed.

This is the first in a series of studies to investigate the impact of early factors in military personnel and civilian populations. Based on the results of this study we believe that the following hypotheses warrant further investigation. Firstly, that different childhood trauma profiles confer unique risk and resilience into adulthood and, secondly, that childhood disorder and specifically depression is an important mediator of adult outcome.


**Chapter 6: Paper 2. Associations of
childhood trauma and childhood
mental disorder with past-year
mental disorder in military and
civilian employed men**

Statement of authorship

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Overall percentage (%)	90%

Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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Abstract

Childhood factors are pivotal to understanding mental health over the lifespan. However, there is a dearth of research exploring childhood trauma and childhood disorder simultaneously in determining adult mental disorder. We aimed to analyze childhood trauma and childhood disorder in determining past-year disorder in military and civilian employed men aged 18-60 years. Data derived from the 2010 Australian Defence Force (ADF) Mental Health Prevalence and Wellbeing Study, and the 2007 Australian Bureau of Statistics National Survey of Mental Health and Wellbeing were analysed using logistic regression and Generalised Structural Equation Modelling (GSEM). All major findings were consistent across both populations. The association between childhood disorder and past-year disorder remained after controlling for demographics, childhood and adult trauma (and service factors in the ADF). Childhood non-interpersonal trauma was not associated with past-year disorder in either population. The pathway between childhood trauma and past-year disorder was fully mediated by the spectrum of common childhood disorders, but not by childhood anxiety, depression or alcohol use disorders alone. Identification, intervention and prevention of childhood disorders is imperative. Investment in interventions targeting the influence of childhood traumatic events on the whole spectrum of childhood disorder, not only PTSD or anxiety, is a priority.

KEYWORDS: epidemiology; childhood trauma; childhood mental health; military; male

Introduction

Childhood factors are pivotal to understanding mental health over the lifespan. Studies have consistently demonstrated that childhood mental health is key to determining adult mental health (Fryers and Brugha, 2013). In addition, there is a body of literature evidencing the impact of trauma as well as other adverse childhood experiences on adult mental health (Carr *et al.*, 2013, Curran *et al.*, 2016, Dovran *et al.*, 2016), physical health (Gilbert *et al.*, 2015); (Wade *et al.*, 2016); (Felitti *et al.*, 1998), and other social and occupational outcomes (Norman *et al.*, 2012).

Historically, military studies have focused on the relationship between military factors, including deployment, on mental health and particularly PTSD (Creamer *et al.*, 2011). More recently, adverse childhood experiences have also been found to be an important determinant of military health and related health outcomes (Iversen *et al.*, 2007b), and potentially as influential as combat experiences on mental health post-deployment (Jones *et al.*, 2013). Some evidence suggests that a higher proportion of those in the military have a history of childhood adversity than those in the general population (Blosnich *et al.*, 2014).

In general populations, the most evidenced childhood predictor of adult mental health is childhood mental disorder, but with limited disorder specificity (Fryers and Brugha, 2013). Furthermore, evidence is emerging that mental disorders are on a continuum and that individuals move between categories of mental disorder over their lifespan (Goodkind *et al.*, 2015, McGorry and Nelson, 2016). Therefore, studies attempting to observe the impact of childhood disorder would need to include the spectrum of diagnostic categories. However,

there is a dearth of research on the impact of childhood disorder on adult mental health in military populations.

Childhood mental disorders are associated with broad outcomes such as substance abuse, poor psychological and social functioning (Birmaher *et al.*, 1996), low academic achievement, nicotine dependence, unemployment and early parenthood (Fergusson and Woodward, 2002). Given these consistent associations it is somewhat remarkable that so few studies (in either civilian or military populations) have explored both childhood trauma and childhood disorder simultaneously in determining adult health and social outcomes (Fryers and Brugha, 2013).

It has proved very challenging to decipher the impact of trauma by type from that of load. The few studies that have attempted to observe the associations of childhood trauma by type have encountered the problem of clustering, whereby trauma does not occur randomly, rather those who are exposed to childhood trauma are often exposed to multiple types (Finkelhor *et al.*, 2007).

Whilst the majority of military epidemiological studies focus on stress related disorders such as PTSD (Creamer *et al.*, 2011), a study in the UK compared common mental disorders (depression and anxiety) in the military with employed civilians (Goodwin *et al.*, 2015). It was found that even controlling for demographic factors, the proportion of common mental disorders was higher in the military than the general population. However, with no measure for childhood adversity it was unclear if this was related to childhood or military factors.

We are not aware of any comparisons between representative military and civilian samples that have investigated the impact or interplay of childhood trauma and mental disorder on adult mental disorder. It is possible that differences exist in the relationship between childhood factors and adult mental disorder in military and employed civilian populations due to differences in the childhood trauma profiles (ref blinded for peer review), healthy warrior effect (Haley, 1998), differences in military and civilian healthcare services and help-seeking behaviours (Zamorski, 2011) and differences in occupational trauma load. We hypothesised that elucidation of these associations and differences between populations would provide vital clues to early signs relating to risk and resilience and provide vital information to better inform early intervention and prevention strategies.

In this current study we set out to investigate childhood trauma and mental disorder as determinants of past-year mental disorder in Australian Defence Force (ADF) and employed civilians. More specifically, in both populations, we aimed to examine the association of childhood trauma and mental disorder with past-year mental disorder, to examine whether the impact of childhood trauma is independent of childhood disorder, and vice versa, to examine and compare mediator pathways from childhood trauma to past-year disorder and finally to investigate whether the associations between childhood factors and past-year disorder were independent of military factors in the ADF.

There is evidence of important gender differences within military populations (Rona *et al.*, 2007). There is also evidence of differences in the association between childhood trauma and

disorder according to gender in military and civilian populations (Evans *et al.*, 2018). Unfortunately, there were insufficient female responders in the ADF for us to be able to conduct a meaningful separate analysis. Therefore, as in other studies (Dorresteijn *et al.*, 2019), we limited this analysis to men. Furthermore, as the ADF is an employed population we compared ADF males between the ages of 18 and 60 with male employed civilians, of the same age range.

Methods

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis.

Australian Defence Force (ADF) sample

All ADF personnel were invited to participate in the 2010 ADF Mental Health Prevalence and Wellbeing Study (MHPWS). All recruitment and assessments were conducted between April 2010 and January 2011. The MHPWS employed a two-phase design to estimate the prevalence of ICD-10 mental disorders across all serving regular ADF personnel (Van Hooff *et al.*, 2014). This two-phase design is well accepted for investigating mental disorder prevalence. (Dunn *et al.*, 1999)

- At Phase 1 all serving ADF personnel (N= 50049), excluding trainees and reservists, were invited to complete a self-report questionnaire to investigate levels of psychological and physical symptoms, which is economical of time and resources.

- At Phase 2 a stratified sub-sample of Phase 1 respondents were selected to complete the World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) which is a more accurate but costly and time-consuming structured diagnostic interview, to examine mental disorder prevalence.

In all, 24481 participants provided usable data at Phase 1, including basic demographics, the K10 (Kessler Distress Scale), (Andrews and Slade, 2001) the Posttraumatic Stress Disorder Checklist (PCL) (Ventureyra *et al.*, 2002) and the Alcohol Use Disorders Identification Test (AUDIT) (Conigrave *et al.*, 1995). Fifteen percent of the eligible participants from Phase 1 were stratified and selected for participation in Phase 2. Participants were selected for Phase 2 with the joint aims of ensuring sufficient power within key demographic groups and of ensuring that participants had a reasonable chance of a positive diagnosis. Therefore, eligibility for Phase 2, was based on Service, sex, and scores on the PCL and AUDIT.

Detailed descriptions of stratification procedures and weighting are available elsewhere (Hodson, 2011, Van Hooff *et al.*). In summary, mental disorder prevalence estimates were derived using a robust two stage weighting process which attenuated the impact of low response rates, as well as any selection and responder bias. In the first step a weight was assigned which was equal to the inverse of the probability of being selected for an interview. This accounted for the differential probability of being selected for Phase 2, based on scores on the PCL and Audit (band) sex and service. In the second step, weights were applied to correct for differential non-response to the survey. A representative value or ‘weight’ was applied to each survey responder, using known characteristics about each individual in the population, in this case, age, sex, rank and medical fitness, to indicate how many ‘like’

individuals in the entire population (based on those characteristics) each responder represented. These two weights were combined to give each responder a single weight within the data, enabling data from responders to be adjusted so that it was representative of the entire ADF.

For the purposes of this study, output for men was achieved by post-stratification to adjust the weights so that known population totals were reproduced by the estimates. A total of 43207 (86.3%) of the ADF were men aged 18-60. Of these, 1356 had a CIDI interview. Weights were applied to this data to estimate prevalence rates across all regular ADF men aged 18-60.

Australian Bureau of Statistics (ABS) civilian sample

The 2007 Australian Bureau of Statistics (ABS) National Survey of Mental Health and Wellbeing (NSMHWB) was based on a stratified, multistage area probability sample of residents, 16–85 years of age, across all states and territories in Australia.(Slade *et al.*, 2009a) Person weights were calibrated to independent estimates of population benchmarks in order to minimise sampling error of estimates and non-response bias. Population benchmarks were obtained from the 2006 Australian Census, as well as from the 2007 Australian Survey of Education and Work. This allowed weighting of the sample according to the probability of being selected, so that the final sample of 8841 represented the estimated population of Australian adults.

For the purposes of this study, all employed males aged 18-60 were selected. As this was the civilian sample, those who said they had served in the ADF, received a Department of Veterans' Affairs (DVA) pension or experienced combat exposure were then excluded. A total of 4.67 million (CI 4.54 – 4.79 million) of the ABS sample were civilian employed men aged 18-60. Of these 2120 had a CIDI interview. Person and replicate weights were applied to this data to ensure that subpopulation weighting was correct to estimate prevalence rates across all civilian employed men aged 18-60.

Measures

Both the ADF and ABS studies utilized the CIDI (Kessler and Ustun, 2004) which consists of a structured diagnostic assessment of lifetime, 12-month and 30-day ICD-10 disorder. Past-year disorder was assessed based on standard CIDI algorithms with ICD hierarchical rules applied. Past-year disorder included dysthymia, hypomania, mild, moderate or severe depressive episode, social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD, alcohol abuse and dependence. Childhood disorder was defined as any disorder with age of onset below age 18 and was coded by number of disorder types (single or multiple). Disorder types were then categorised as any depression (mild, moderate or severe depressive episode), any anxiety (social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD) and any alcohol use disorder (abuse or dependence).

As a part of the CIDI interview, respondents were asked if they had experienced any of the CIDI criterion A1 events listed in the CIDI 3.0. To determine age at onset of each experience, respondents were asked how old they were when it first happened to them. For the purposes of

this study we defined childhood trauma as those with age of onset below 18. As per Forbes et al (Forbes *et al.*, 2011), types of childhood trauma were classified as non-interpersonal trauma (exposed to a toxic chemical, life-threatening automobile accident, other life-threatening accident, man-made disaster, life-threatening illness, major natural disaster) and interpersonal trauma (sexual assault, raped, stalked, beaten by spouse/romantic partner, beaten by parents /guardian as a child, badly beaten by anyone else, kidnapped or held captive, mugged/held up or threatened with a weapon). (Forbes *et al.*, 2011) These are abbreviations of the questions from the CIDI. (Kessler and Ustun, 2004)

Due to the fact that many who experience childhood trauma experience a number of types, (Finkelhor *et al.*, 2009) childhood trauma was analysed by mutually exclusive category, as per a previous study. (Syed Sheriff *et al.*, 2018) These categories were ‘non-interpersonal’ trauma (without interpersonal trauma), ‘interpersonal’ trauma (without non-interpersonal trauma) and ‘both non-interpersonal and interpersonal’ trauma. As our aim was to compare different childhood trauma profiles with no childhood trauma, those who reported trauma in childhood but not either childhood interpersonal nor non-interpersonal trauma were categorized as ‘unclassified’ (child had life threatening illness/injury, combat, refugee, peacekeeper, purposefully injured/tortured/killed someone, other traumatic event, unarmed civilian in a place of conflict, accidentally injured/killed someone, lived as a civilian in a place of ongoing terror, experience don’t want to talk about, saw atrocities or carnage, someone close had traumatic experience, witness serious physical fights at home as a child, someone close died, saw someone badly injured). The mutually exclusive categories were therefore exhaustive of the lifetime trauma types asked about in the CIDI. Adult trauma refers to the number of trauma types first experienced aged 18 or over.

In the ABS, prior to the formal mental health diagnostic interview, socio-demographic information was collected, including age, education and relationship status. In the ADF, information regarding age, education and relationship status was available from the self-report questionnaire.

In the ADF, information regarding Service characteristics was available from ADF administrative data. Military ranks were grouped into three categories: other ranks (Private to Corporal equivalents), Non-Commissioned Officers (Sergeant to Warrant Officer equivalents) and Commissioned Officers (Lieutenant to General equivalents). Information regarding previous deployment was available from the self-report questionnaire.

Analysis

As the data to be compared came from surveys in two different populations, data-merging techniques were not deemed statistically appropriate primarily due to complexities in the poststratification process. All analyses were performed in STATA version 14.2, accounting for complex survey designs by survey weighting, utilising the STATA 'svy' command. Due to the complexities associated with accurately testing results across 2 complex surveys P values were not calculated. The term 'significant' is used to describe differences when the 95% confidence intervals do not overlap. Associations with demographic, service and childhood factors were calculated controlling for demographic factors (age, highest education and current relationship).

Next, logistic regression analyses were utilized to calculate adjusted odds ratios (aORs) for each childhood trauma and disorder variable on past-year disorder controlling for demographics (age, educational attainment and current relationship), and for the number of childhood trauma types (for disorder variables) or the number of childhood disorder types (for trauma variables). This was then repeated also controlling for the number of types of trauma first experienced in adulthood. These analyses were conducted with the same variables in both populations for direct comparison. The analyses were then repeated in the ADF including service variables and a final step was added to control for previous deployment.

In order to assess potential mediation, we utilized Generalized Structural Equation Modelling (GSEM) pathway analysis, as per Acock, 2006 (Acock, 2006). The GSEM pathway utilized the link 'logit' and the family 'Bernoulli'. We compared pathways in both populations, in the following three pairs of models. First, the pathway between childhood trauma (number of types) and past-year disorder compared to the same model with childhood anxiety, depression and alcohol use disorders added as mediators. Second, the pathway between childhood trauma (number of types) and past-year disorder controlling for demographics (age, current relationship and educational attainment) compared to the same model with childhood anxiety, depression and alcohol use disorders added as mediators including covariance between the childhood disorders. Third, the pathway between childhood trauma (number of types) and past-year disorder controlling for demographics (age, current relationship and educational attainment) compared to the same model with childhood anxiety, depression and alcohol use disorders and also multiple adult trauma included as mediators. The indirect effect for each

mediator was calculated utilizing the ‘nlcom’ command which calculates nonlinear combinations of estimators and is suitable for use with complex survey designs (StataCorp, 2013). Goodness of Fit estimations were not suitable for this analysis, in most cases due to the joint-normality assumption (StataCorp, 2013).

Results

Overall, 21.7% (95% CI: 18.2-25.6) of ADF males and 18.1% (95% CI: 15.2-21.1) of employed civilian males, aged 18-60, had an ICD-10 past-year mental disorder. In ADF men, past-year disorder was associated with being young and with lower educational attainment. In contrast, in civilian men, past-year disorder was only associated with being single but not with current age or educational attainment. Controlling for demographics, in the ADF, past-year disorder was associated with being in the Airforce (rather than the Navy) but was not associated with rank.

In both populations, past-year disorder was associated with both single and multiple types of childhood trauma. However, it was not associated with childhood non-interpersonal trauma (without interpersonal trauma) in either population. In both populations, past-year disorder was associated with all diagnostic categories of childhood disorder (anxiety, depression and alcohol use disorders). Multiple types of childhood disorder had a stronger association with past-year disorder than single types of childhood disorder in both populations (see Table 1).

After controlling for demographics (current age, educational attainment and relationship status) and the number of childhood disorder types, childhood trauma (however specified) no longer had an association with past-year disorder, in either population. In contrast, even after controlling for demographics, the number of childhood trauma types and adult trauma types, childhood disorders (however specified) were all strongly associated with past-year disorder, in both populations. Multiple childhood disorders had a stronger association with past-year disorder than single childhood disorder, in both populations (see Table 2).

In the ADF, controlling for demographics and service factors, all categories of childhood trauma were associated with past-year disorder, with the exception of childhood non-interpersonal trauma. However, controlling for childhood disorder (anxiety, depression and alcohol use disorders), the associations between all categories of childhood trauma and past-year disorder became non-significant. In contrast, when controlling for childhood trauma, all associations between childhood disorder and past-year disorder remained significant. The associations between childhood disorder and past-year disorder remained significant also controlling for adult trauma (number of types) and previous deployment (see Table 3).

Generalized Structural Equation Modelling

As the results in Table 4 indicate, the first GSEM mediator analyses demonstrated that childhood trauma had a direct association with past-year disorder in both populations. When childhood disorders (anxiety, depression and alcohol use disorders) were introduced as mediators, the relationship between childhood trauma and past-year disorder became non-significant, whereas all mediator pathways were significant. This was the case in both populations. This suggests full mediation. As an additional analysis, we repeated this, adding in each diagnostic category of childhood disorder individually as mediators, and found in

each case that a significant relationship remained between childhood trauma and past-year disorder. This suggests that no individual diagnostic category alone fully mediated the relationship between childhood trauma and past-year disorder.

The results of the second GSEM mediator analysis, controlling for demographics (age, current relationship and highest education) and for co-variance between childhood disorders, are demonstrated in Figures 1 and 2. This also suggested full mediation by childhood disorder, in both populations. We then repeated the same analyses introducing adult trauma as a mediator. The pathway from childhood trauma to past-year disorder via adult trauma was significant in both populations. However, in the ADF (but not civilians) there was a significant mediator pathway between childhood depression and past-year disorder via adult trauma (see Figures 3 and 4). However, a more detailed discussion of this particular point is beyond the scope of this current paper

Paper 2: Tables and figures

Table 1: Population proportions and associations with ICD-10 past-year mental disorder, controlling for demographic factors

	ADF men						Civilian employed men						
	%	95% CI		aOR	95% CI		%	95% CI		aOR	95% CI		
Demographics													
Current age													
<25	18.9	18.8	19.0	1.0			15.8	14.3	17.3	1.0			
25-34	36.4	36.2	36.5	0.9	0.5	1.8	24.1	22.2	26.0	1.1	0.7	1.8	
35-44	28.1	28.0	28.3	0.6	0.3	1.2	26.7	24.9	28.4	0.9	0.6	1.5	
45+	16.6	16.5	16.7	0.4	0.2	0.7	33.5	31.8	35.2	0.8	0.5	1.4	
Highest education													
Year 10	11.3	11.2	11.4	1.0			13.6	11.6	15.7	1.0			
Certificate or diploma	38.6	38.4	38.7	0.3	0.1	0.7	41.3	38.9	43.7	0.9	0.6	1.5	
Year 11/12	30.3	30.2	30.5	0.3	0.1	0.6	21.9	19.4	24.3	0.8	0.4	1.3	
University degree	19.8	19.7	19.9	0.4	0.2	0.8	23.2	21.2	25.3	0.6	0.3	1.0	
Current relationship													
Not in relationship	24.4	24.2	24.5	1.0			34.5	32.0	37.0	1.0			
Current relationship	75.6	75.5	75.8	0.6	0.7	3.4	65.5	63.0	68.0	0.6	0.4	0.9	
Childhood TRAUMA													
Number of types													
Single	24.9	21.3	28.8	1.9	1.2	2.9	23.2	20.6	25.9	2.1	1.1	3.8	
Multiple	31.3	27.2	35.8	2.8	1.7	4.5	18.9	16.4	21.4	2.5	1.7	3.5	
Category													
Unclassified	16.5	13.9	19.5	1.8	1.1	2.9	17.5	15.2	19.9	2.0	1.2	3.4	
Non-interpersonal	17.0	13.5	21.3	1.5	0.9	2.5	9.1	7.4	10.8	1.1	0.6	2.0	
Interpersonal	12.3	10.2	14.7	2.5	1.5	4.0	11.7	9.7	13.7	3.3	1.7	6.3	
Both	10.4	7.5	14.2	5.8	2.9	11.8	3.9	2.8	5.1	3.7	1.9	7.3	
Childhood DISORDER													
Number of types													
Single	14.5	12.1	17.2	3.9	2.6	5.9	12.8	10.8	14.8	4.3	2.5	7.3	
Multiple	10.9	7.9	14.8	14.5	7.5	28.2	7.9	6.4	9.5	16.8	9.8	29.0	
Diagnostic category													
Any anxiety	17.2	13.7	21.2	5.5	3.2	9.3	14.8	12.8	16.8	7.8	4.9	12.2	
Any depression	3.9	2.0	7.1	11.9	4.7	30.3	2.3	1.5	3.1	2.6	1.4	5.0	
Any alcohol	7.4	5.1	10.6	2.3	1.2	4.4	6.9	5.4	8.5	2.9	1.9	4.6	
Service													
Navy	22.1	22.1	22.2	1.0									
Army	52.4	52.3	52.4	1.0	0.6	1.6							
Airforce	25.5	25.5	25.5	0.6	0.4	0.9							
Rank													
Officers	23.7	23.6	23.8	1.0									
NCO	44.8	44.6	44.9	1.2	0.8	2.0							
Other ranks	31.5	31.4	31.7	1.6	0.8	3.2							

Table 2: Regression childhood factors on ICD-10 past-year mental disorder

	MODEL 1						MODEL 2					
	ADF men			Civilian employed men			ADF men			Civilian employed men		
Childhood factors	aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI	
Childhood trauma	Childhood disorder (number of types)						Childhood disorder (number of types) and adult trauma (number of types)					
Number of types							All non-significant			All non-significant		
Single	1.35	0.85	2.16	1.67	0.85	3.29						
Multiple	1.34	0.85	2.10	1.32	0.87	2.02						
Category												
Unclassified	1.32	0.79	2.19	1.52	0.94	2.42						
Non-Interpersonal	1.05	0.62	1.79	0.84	0.44	1.63						
Interpersonal	1.49	0.88	2.52	2.30	0.96	5.47						
Both	1.89	0.89	3.99	1.15	0.35	3.70						
Childhood disorder	Childhood trauma (number of types)						Childhood trauma (number of types) and adult trauma (number of types)					
Number of types												
Single	3.75	2.46	5.70	4.14	2.35	7.29	3.67	2.31	5.82	3.88	2.18	6.90
Multiple	13.16	6.58	26.33	15.34	8.44	27.89	11.91	5.89	24.09	15.53	8.23	29.32
Type												
Any anxiety	5.35	3.17	9.04	7.22	4.40	11.83	5.35	3.07	9.33	7.36	4.34	12.45
Any depression	11.38	4.40	29.48	2.42	1.23	4.75	8.85	3.24	24.20	2.66	1.32	5.38
Any alcohol	2.24	1.16	4.35	2.72	1.69	4.37	2.42	1.24	4.71	2.34	1.42	3.84

aOR: adjusted Odds Ratio

Model 1: Demographics (current age, current relationship and highest education) controlled for in all models

For childhood trauma variables, we controlled for number of types of childhood disorder

For childhood disorder variables, we controlled for number of types of childhood trauma

MODEL 2: MODEL 1 +adult trauma (number of types of trauma with first onset aged 18 or over)

Table 3: ADF regression

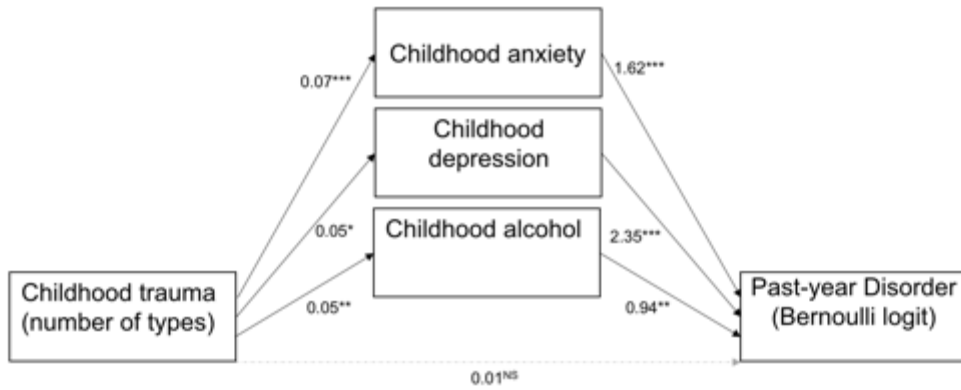
	MODEL 1			MODEL 2			MODEL 3			MODEL 4		
	aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI	
Childhood trauma												
Unclassified	1.82	1.11	2.98	1.33	0.78	2.28	1.10	0.63	1.92	1.35	0.78	2.31
Non-Interpersonal	1.44	0.83	2.50	1.01	0.58	1.76	0.97	0.54	1.75	1.06	0.61	1.83
Interpersonal	2.48	1.54	4.01	1.54	0.93	2.54	1.13	0.66	1.94	1.56	0.94	2.59
Both	5.89	2.97	11.67	2.29	0.99	5.29	1.78	0.74	4.29	2.28	0.98	5.30
Childhood disorder												
Any anxiety				4.47	2.75	7.26	4.52	2.63	7.78	4.47	2.74	7.30
Any depression				10.40	4.08	26.48	8.01	2.95	21.77	10.40	4.07	26.53
Any alcohol				2.08	1.04	4.15	2.13	1.05	4.29	2.13	1.08	4.20
Adult trauma types												
Previous deployment							1.40	1.27	1.55			
										1.37	0.85	2.20

MODEL 1: Demographics (current age, current relationship and highest education) AND Service factors (Rank, Service)
 MODEL 2: MODEL 1 + childhood disorder
 MODEL 3: MODEL 2 + adult trauma (number of types)
 MODEL 4: MODEL 2 + previous deployment

Table 4: GSEM childhood trauma on ICD-10 past-year mental disorder

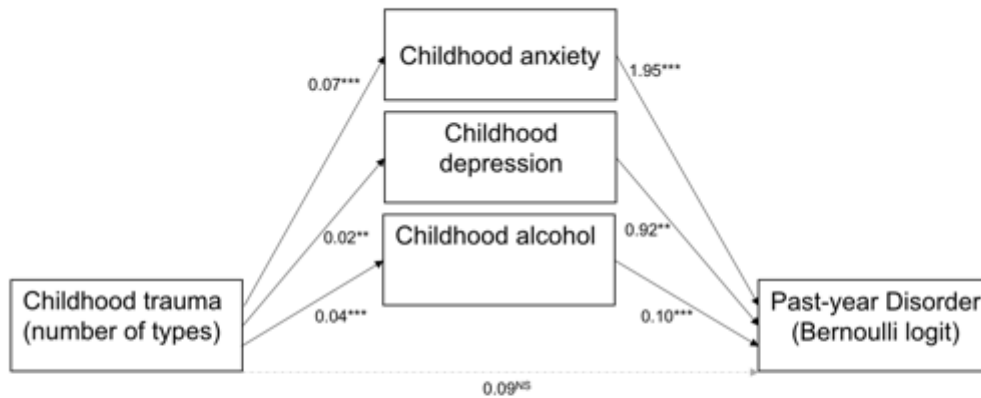
Childhood trauma (count of types) to past-year disorder	ADF men		Civilian employed men	
	B	p	B	p
Unmediated model				
Direct pathway (without mediator in model)	0.26	0.000	0.29	0.000
Mediated models				
1. Childhood disorder (Anxiety, Depression and Alcohol)				
Direct pathway (with mediators in model)	1.02	0.761	0.10	0.173
Total pathway via mediator				
Anxiety	0.12	0.000	0.14	0.000
Depression	0.11	0.029	0.02	0.030
Alcohol	0.05	0.026	0.04	0.001
2. Childhood ANXIETY alone				
Direct pathway (with mediator in model)	0.14	0.033	0.15	0.039
Total pathway via mediator	0.13	0.000	0.14	0.000
3. Childhood DEPRESSION alone				
Direct pathway (with mediator in model)	0.16	0.002	0.26	0.000
Total pathway via mediator	0.12	0.040	0.03	0.008
4. Childhood ALCOHOL alone				
Direct pathway (with mediator in model)	0.20	0.000	0.25	0.000
Total pathway via mediator	0.06	0.028	0.04	0.001

Figure 1: Military men mediator pathways through childhood disorder, controlling for current age, current relationship, highest education and covariance between childhood disorders



	β	β co-efficients are shown * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Total (no mediators)	0.24***	
Mediator Analysis		
<i>Total indirect pathway</i>		
Childhood anxiety	0.12***	
Childhood depression	0.11*	
Childhood alcohol	0.05*	

Figure 2: Civilian employed men mediator pathways through childhood disorder, controlling for current age, current relationship, highest education and covariance between childhood disorders



	β	β co-efficients are shown * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Total (no mediators)	0.27***	
Mediator Analysis		
<i>Total indirect pathway</i>		
Childhood anxiety	0.14***	
Childhood depression	0.02*	
Childhood alcohol	0.04**	

Figure 3: Military male mediator pathways through childhood disorder, controlling for age, education and current relationship, and co-variance between childhood disorders

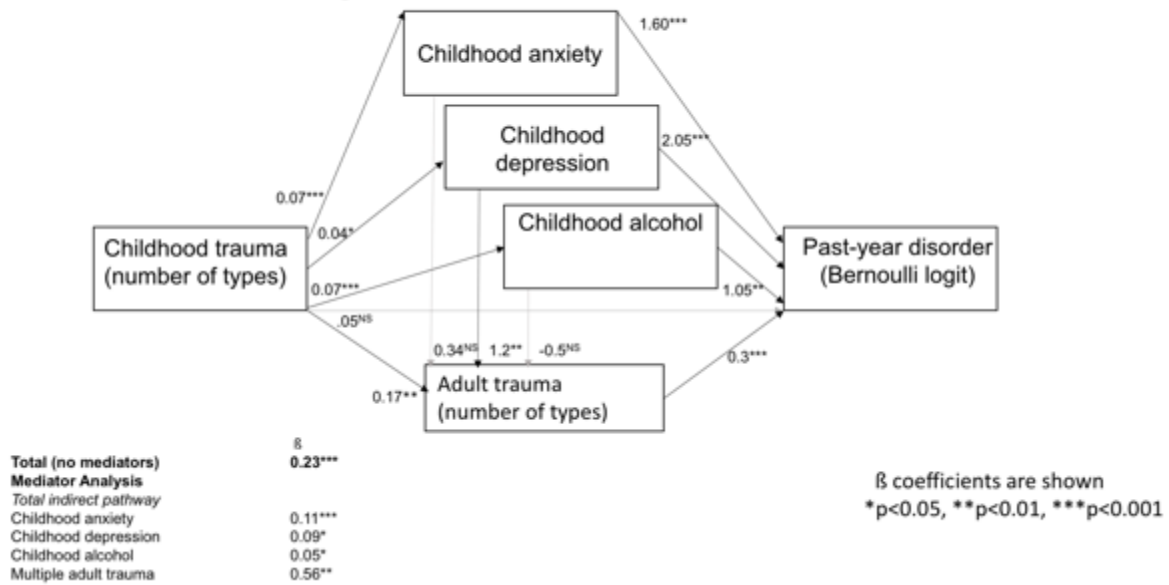
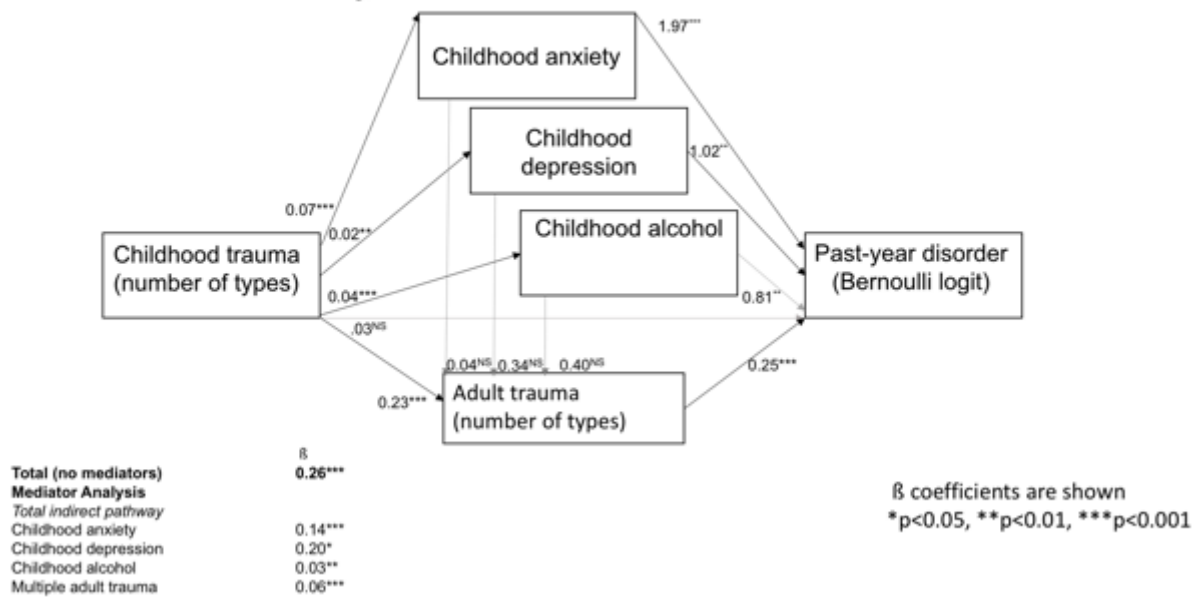


Figure 4: Civilian male mediator pathways through childhood disorder, controlling for age, education and current relationship, and co-variance between childhood disorders



Discussion

It is increasingly recognised that childhood factors are important determinants of adult health, however, the interplay between childhood trauma and childhood disorder and their impact on adult disorder has undergone little systematic investigation in epidemiological population samples. This study is novel in several ways, firstly in exploring the association of childhood mental disorder with past-year disorder in a military population, secondly, in comparing the association of childhood trauma and past-year disorder in the military with a civilian population, and finally in examining and comparing mediator pathways. All major findings were consistent across populations. There was a strong relationship between childhood disorder and past-year disorder, which remained after controlling for demographics as well as childhood and adult trauma in both populations. In the ADF, the significant relationship between childhood disorder and past-year disorder also remained after controlling for service factors, and deployment. Those who experienced childhood non-interpersonal trauma (in the absence of interpersonal trauma) did not have increased odds of past-year disorder in either population. The relationship between childhood trauma and past-year disorder was fully mediated by the full spectrum of childhood disorders (but not by childhood anxiety, depression or alcohol use disorders alone), in both populations.

Our findings are consistent with the wealth of studies that demonstrate that childhood disorder is an important predictor of adult disorder (Fryers and Brugha, 2013, Reef *et al.*, 2009, Reef *et al.*, 2010b). They are also consistent with studies that demonstrate the link between adverse childhood experiences and adult disorder in both civilian (Felitti *et al.*, 1998) and military populations (Iversen *et al.*, 2007b) (Afifi *et al.*, 2014).

Previous studies have investigated the influence of childhood non-interpersonal trauma types such as such as natural disasters on adult mental health with contrasting results. A study of children effected by a dam collapse demonstrated initial psychological distress but without longer term psychological consequences into adulthood (Green *et al.*, 1994). In addition, whilst rates of adult PTSD were raised in a study of children subject to a major man-made disaster at a school, there was no impact on other common disorders into adulthood (Morgan *et al.*, 2003, Yule *et al.*, 2000). Of note, however, these studies did not include data regarding other lifetime traumatic experiences, and control groups were selected at follow up, rather than at the time of the disaster (McFarlane and Van Hooff, 2009a). In contrast, a more recent analysis of those exposed to the Australian bush fires compared with matched controls selected at the time, demonstrated little difference in overall adult lifetime disorder, and no difference in adult PTSD due to the prevalence of other traumas that affected the controls and disaster survivors (McFarlane and Van Hooff, 2009a). This is broadly consistent with our results. However, this does not exclude the possibility that these events might affect the response to future traumatic events.

The full mediation of the association of childhood trauma with adult disorder through childhood disorder has not been demonstrated previously. Some studies have found partially mediating effects of clusters of post-traumatic stress symptoms on specific adult disorders (Schierholz *et al.*, 2016, Watt *et al.*, 2012). Whilst these findings are broadly consistent with ours, we have been able to extend this considerably by discovering that this pathway is not mediated by a single type of childhood disorder alone, but by the whole range of common mental disorders. Therefore, any increased support for those with childhood disorder should

include all common mental disorders, and not PTSD alone. When adult trauma was added to the analysis, the mediation pathway between childhood depression and adult trauma was significant only in the military population. This finding is both novel and concerning and implies that those already vulnerable to mental disorder due to childhood depression, are also at a higher risk due to adult trauma, in the military population only. This suggests that civilian men, with a history of childhood depression in the context of childhood trauma, may be in a better position to avoid damaging trauma as adults than men in the military. This finding warrants further investigation.

Limitations

The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. However, it appears that such retrospective reporting of childhood experiences is more prone to false negatives than positives and that it does have good reliability if well defined (Hardt and Rutter, 2004), as in this study.

There may appear to be a low response rate in the ADF sample. However, in contrast to most surveys, the demographic and health status of the ADF members who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error. Thus, the two-stage weighting process, combined with a 48.9% response rate and oversampling based on scores of the PCL and AUDIT, enabled this analysis to minimise the chance of random error and provide confidence that the estimates were as representative as possible of all current-serving regular ADF men between 18 and 60 years of age.

As our aim was to compare the male military and civilian employed populations, only male employed civilian subjects were included. Therefore, the poorer functioning unemployed male civilian population, who may have had higher rates of traumatic childhood experiences, were not included in this analysis. In addition, we did not have a measure of other types of childhood adversity such as neglect.

Conclusion

The major findings of this study were consistent across two large epidemiological datasets. Both of these datasets provided detailed interview data on lifetime disorder and trauma. In addition, we were able to examine the influence of a whole range of childhood traumatic experiences whilst also including the other major determinant of adult disorder, namely childhood disorder. We were also able to include a wide spectrum of childhood disorders. The classification of people into mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load, which has been a particular challenge for research on childhood trauma (Finkelhor et al., 2007).

The major findings of this research have important clinical and epidemiological implications. First, childhood disorders have a direct and significant association with adult disorder. This provides a prime opportunity for early intervention and prevention, thus reinforcing the long-term benefits of interventions to monitor and support those with a history of childhood disorder and particularly multiple types of disorder. Second, that the impact of childhood

trauma depends on the childhood trauma profile. For example, those who have experienced only childhood trauma that is not interpersonal in nature, have similar odds of adult disorder as those who have not experienced any childhood trauma. Therefore, it is essential to fully assess childhood trauma profile in order to determine the risk of adult disorder. Third, research concentrating on post-traumatic symptoms or PTSD alone when examining the longer-term impact of childhood trauma obfuscates appreciation of the full picture. Our research demonstrates that the pathway from childhood trauma to adult disorder is fully mediated by the spectrum of childhood disorders, opening up a useful additional avenue for intervention.


Given the novel insights provided by our analysis, more nuanced analyses of the influence of childhood factors on specific adult disorders and other health related outcomes, would be of interest. In particular the influence of childhood factors on the impact of adult trauma on

**Chapter 7: Paper 3. Associations of
childhood trauma and childhood
disorder with past-year PTSD in
military and civilian men**

Statement of Authorship

Title of Paper	Associations of childhood trauma and childhood disorder with past-year PTSD in military and civilian men
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff		
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper for publication. I amended the paper according to supervisor/co-author comments.		
Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Contribution to the Paper	Provided advice, technical expertise regarding the dataset and comments on the final manuscript		
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Contribution to the Paper	Provided advice regarding the survey weighting, advice regarding the statistical analysis in general and comments on the final manuscript		
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Name of Co-Author	Gin Malhi		
Contribution to the Paper	Provided advice and comments on the final manuscript		
Signature		Date	04/10/19

Abstract

To identify early life factors associated with PTSD, we investigated the association of childhood trauma and mental disorder with ICD past-year PTSD in military and civilian employed men aged 18-60 years. Data, derived from the 2010 Australian Defence Force (ADF) Mental Health Prevalence and Wellbeing Study (N= 1356) and the 2007 Australian Bureau of Statistics (ABS) National Survey of Mental Health and Wellbeing Study (N=2120), were analyzed using logistic regression and Generalized Structural Equation Modelling (GSEM). Controlling for demographics, PTSD was associated with childhood anxiety, $aOR= 3.94$, 95% CI [2.36, 6.58] and depression $aOR= 7.01$, 95% CI [2.98, 16.49] but not alcohol use disorders in the ADF. In civilians, PTSD was associated with childhood anxiety only, $aOR= 7.06$, 95% CI [3.50, 14.22]. These associations remained significant after controlling for childhood and adult trauma in both populations, as well as service factors, and deployment, combat or adult trauma in the ADF. In both populations, PTSD was associated with more than three types of childhood trauma, ADF $aOR= 2.97$, 95% CI [1.53, 5.75], ABS $aOR= 5.92$, 95% CI [3.00, 11.70] and childhood interpersonal trauma, ADF $aOR= 3.08$, 95% CI [1.61, 5.90], ABS $aOR= 6.63$, 95% CI [2.74, 16.06], but not childhood non-interpersonal trauma (such as accidents). The association between childhood trauma and PTSD was fully mediated by childhood disorder in the ADF, but not civilians. In taking a lifetime perspective we have been able to identify that the risk of PTSD from childhood trauma and disorder is potentially predictable and therefore modifiable.

Keywords: Military; Men; Trauma exposure; Epidemiology; Childhood; Mental Disorder

Introduction

Posttraumatic stress disorder (PTSD) has historically been attributed to adult traumatic experiences in military populations (Creamer *et al.*, 2011), with military studies tending to focus on the role that military factors, specifically deployment, play in the development of PTSD (Jones *et al.*, 2013). However, whilst some studies have found a ‘deployment effect’, a number of other studies have not. This variation between studies has been the subject of several reviews (Kok *et al.*, 2012, Ramchand *et al.*, 2010, Richardson *et al.*, 2010, Sundin *et al.*, 2010).

Over time, the literature has increasingly focused on PTSD as a product of traumatic experiences over the lifespan, rather than a single traumatic incident as defined in the diagnostic criteria (Priebe *et al.*, 2018). In keeping with this, civilian and military studies have demonstrated an association between childhood adversity and adult PTSD (Bremner *et al.*, 1993, Brewin *et al.*, 2000, Cabrera *et al.*, 2007, Iversen *et al.*, 2007a, Ozer *et al.*, 2003b). In addition, men with a history of military service are more likely to report childhood adversity (and/or traumatic experiences) (Blosnich *et al.*, 2014). Childhood adversity is a well-known predictor of poor adult mental health in military populations (Iversen *et al.*, 2007a, Rosen and Martin, 1996, Youssef *et al.*, 2013, Zheng *et al.*, 2016).

However, all lifetime trauma is not equal and childhood trauma is likely to have a different impact to adult trauma due to its occurrence during brain development (Pechtel *et al.*, 2014). In addition, in civilian populations, researchers have demonstrated that it is not the antecedent trauma per se that predicts subsequent reactions to trauma but mental health reactions to the antecedent trauma (Breslau *et al.*, 2008). Similarly in the Australian Defence Force (ADF), antecedent symptoms were found to fully mediate the cumulative effects of prior trauma in

determining depression and PTSD post-deployment (Searle *et al.*, 2017). This would suggest that the burden of antecedent symptoms carries the risk of prior trauma exposure.

The lifetime trajectory of childhood mental disorder as a major determinant of adult mental disorder has been documented in numerous studies (Copeland *et al.*, 2009, Fergusson and Horwood, 2001, Hofstra *et al.*, 2002, Reef *et al.*, 2010b). Furthermore, prospective research demonstrates that specific childhood psychopathologies are predictive of a range of disorders into adulthood, rather than remaining stable in their form across time (Copeland *et al.*, 2009, Reef *et al.*, 2009). Despite this, there is currently no published research investigating childhood trauma and childhood mental disorder simultaneously in determining adult PTSD in military personnel.

In addition, we are not aware of any comparisons between representative military and civilian employed samples which have investigated the impact or interplay of childhood trauma and mental disorder on past-year PTSD. There are several possible reasons why differences might exist. First, there is evidence that a higher proportion of those with a history of military service experience childhood trauma (Blosnich *et al.*, 2014). Second, exclusions at recruitment and periodic health screening, may have the effect of maintaining the fitness of the military population, and hence impact on how these risk factors manifest during active service (Haley, 1998). Third, differences in military and civilian healthcare services (Zamorski, 2011) may result in earlier effective intervention and weaken the association between childhood factors and adult PTSD. Fourth, differences in occupational trauma load may modify the impact of these risk factors. We hypothesised that elucidation of these

associations and differences between civilian and military populations may provide vital information required to more clearly understand early predictors of risk and resilience.

The current study had three primary aims. First, to analyze and compare the associations between past-year PTSD and both childhood trauma and childhood disorder in representative ADF and civilian employed populations. Second, to examine whether these associations were independent of each other in both populations, and, third, to examine and compare mediator pathways between childhood trauma and past-year PTSD in both populations. A secondary aim was to examine whether the associations were independent of service factors in the ADF. We did not have sufficient female responders in the ADF for a meaningful separate analysis. Therefore, due to evidence of important gender differences within military populations (Rona *et al.*, 2007), we have limited this analysis to men. As the ADF is an employed population we compared ADF men between the ages of 18 and 60 with employed civilian men in the same age range.

Method

Participants

ADF sample. The 2010 ADF Mental Health Prevalence and Wellbeing Study (MHPWS) employed a two-phase design to estimate the prevalence of ICD-10 mental disorders across all current serving regular ADF personnel (Van Hooff et al., 2014). This two-phase design is well accepted for investigating mental disorder prevalence (Dunn et al., 1999).

At Phase 1, all current serving ADF personnel (N= 50049), excluding trainees and Reservists, were invited to complete a self-report questionnaire, including basic demographics, the Kessler Distress Scale (K10) (Andrews and Slade, 2001), the Posttraumatic Stress Disorder Checklist- Civilian Version (PCL-C) (Ventureyra et al., 2002) and the Alcohol Use Disorders Identification Test (AUDIT) (Conigrave et al., 1995). In all, 24481 participants provided usable data at Phase 1.

Fifteen percent of the eligible participants from Phase 1 were stratified and selected for participation in Phase 2. At Phase 2, The World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) was utilized.

Civilian study (ABS sample)

The 2007 National Survey of Mental Health and Wellbeing (Slade *et al.*, 2009a) was based on a stratified, multistage area probability sample of residents aged 16–85 years across all states and territories in Australia. For the purposes of this study, all employed men aged 18–60 were selected. Those who said they had served in the ADF, received a Department of Veterans' Affairs pension or experienced combat exposure were excluded.

Procedure

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis.

ADF sample.

The responses to the survey and interview were de-identified and participants were informed that no personal details, including whether or not they participated in the study would be provided to Defence. Participants were selected for Phase 2 with the joint aims of ensuring sufficient power within key demographic groups and to ensure a cross-section of scores on the self-reported measures of mental health. Therefore, eligibility for Phase 2, was based on Service, sex, and scores on the PCL and AUDIT. The 60th and 80th percentiles of the PCL and AUDIT distributions were used as cut-offs to form three stratification bands. The 80th percentile was suitable as a cut-off for 'high scorers' as it was deemed a conservative lower bound on what the diagnostic cut-off could be. The 60th percentile was chosen as a further cut-off to provide reasonable numbers of participants just below the first cut-off. Using these bands, the higher-scoring ADF members (those in Bands 2 and 3) were oversampled to enable adequate power in analyses of low prevalence disorders.

To calculate Phase 2 sample size, projections of incidence rates were based on the most relevant, contemporaneous Australian ADF rates available from CIDI interviews. (Ikin *et al.*, 2017) Based on the prevalence rates of depression, anxiety and PTSD, it was calculated that a total sample of 887, 1126 and 252 respectively would be required to maintain precision of CIs at 0.015.

Of the 3688 participants selected for Phase 2, 1798 (49%) completed a CIDI interview. Taylor series linearization was used to estimate variance. (Deville, 1999) A total of 43207 (86.3%) of the ADF were men aged 18-60. Of these, 1356 had a CIDI interview which was weighted to represent all regular ADF men aged 18-60.

Civilian study (ABS sample).

A total of 2120 employed civilian men in the general population (ABS) had a CIDI interview which was weighted to represent all 4.67 million (CI 4.54 – 4.79 million) employed civilian men. Person and replicate weights were applied to this data to ensure that subpopulation weighting was correct.

Measures

Mental Disorder.

Both studies utilized the CIDI (Kessler and Ustun, 2004) which consists of a structured diagnostic assessment of lifetime, 12-month and 30-day ICD-10 disorder. Mental disorder (including past-year PTSD) was assessed based on standard WMH-CIDI algorithms with ICD hierarchical rules applied. Childhood disorder was defined as disorder with age of onset below age 18 years. Disorder types were then grouped as follows: any depression (mild, moderate or severe depressive episode), any anxiety (social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD) and any alcohol use disorder (abuse or dependence).

Traumatic experiences

As a part of the CIDI interview, respondents were asked if they had experienced any of the CIDI criterion A1 events listed in the CIDI 3.0. To determine age at onset of each experience, respondents were asked how old they were when it first happened to them. In this study, childhood trauma was defined as trauma that first occurred in childhood, and therefore had an onset age of 0-17. In contrast, adult trauma included traumatic events which first occurred at the age of 18 or later. Consequently, if a trauma type was first experienced in childhood and subsequently in adulthood it was classified as childhood trauma, and not as adult trauma, despite the fact it may have occurred in both childhood and adulthood. This is an important defining factor in this study as the aim was to examine the impact of trauma according to the age of first occurrence. Due to the fact that many who experience childhood trauma experience a number of types (Finkelhor *et al.*, 2009), childhood trauma was analysed by mutually

exclusive category and by number of types (less than three types, three or more types). Types of trauma first experienced in adulthood were classified by type, and by number of types (single or multiple).

Childhood and adult trauma were classified as follows (Forbes *et al.*, 2014); non-interpersonal trauma (exposed to a toxic chemical, life-threatening automobile accident, other life-threatening accident, man-made disaster, life-threatening illness, major natural disaster) and interpersonal trauma, divided into intimate interpersonal (sexual assault, raped, stalked, beaten by spouse/romantic partner, beaten by parents /guardian as a child) and non-intimate interpersonal trauma (badly beaten by anyone else, kidnapped or held captive, mugged, held up or threatened with a weapon). These are abbreviations of the questions from the CIDI (Kessler and Ustun, 2004).

Due to the co-occurrence of childhood trauma types (Green *et al.*, 2010), we then categorized individuals into mutually exclusive childhood trauma categories (Syed Sheriff *et al.*, 2018), non-interpersonal trauma (without interpersonal trauma), interpersonal trauma (without non-interpersonal trauma) and both non-interpersonal and interpersonal trauma. We categorized those who experienced childhood trauma that did not fit into the previous categories as unclassified trauma. Childhood unclassified trauma included those who experienced the following types of trauma, without either non-interpersonal or interpersonal trauma, in childhood: child had life threatening illness/injury; combat; refugee; peacekeeper; purposefully injured/tortured/killed someone; other traumatic event; unarmed civilian in a place of conflict;

accidentally injured/killed someone; lived as a civilian in a place of ongoing terror; experience don't want to talk about; saw atrocities or carnage; someone close had traumatic experience; witness serious physical fights at home as a child; someone close died; saw someone badly injured. The mutually exclusive childhood trauma categories were therefore exhaustive of the lifetime trauma types asked about in the CIDI.

Demographic and Service variables

In the ABS, prior to the formal mental health diagnostic interview, socio-demographic information was collected, including age, current relationship and highest educational attainment. In the ADF, information regarding age, current relationship and highest educational attainment was available from the self-report questionnaire completed at Phase 1. Information regarding service variables were available from ADF administrative data. Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), Non-Commissioned Officers (Sergeant to Warrant Officer equivalents) and Commissioned Officers (Lieutenant to General equivalents). Data regarding previous deployment was available from the self-report questionnaire completed at Phase 1.

Data Analysis

ADF sample

For the ADF detailed descriptions of stratification procedures and weighting are available elsewhere (Hodson, 2011, Van Hooff *et al.*, 2014). However, in brief, mental disorder prevalence estimates were derived using a robust two stage weighting process which

attenuated the impact of low response rates, as well as any selection and responder bias. In the first step a weight was assigned which was equal to the inverse of the probability of being selected for an interview. This accounted for the differential probability of being selected for a CIDI based on scores on the PCL and Audit (band) sex and service. In the second step, weights were applied to correct for differential non-response to the survey. A representative value or 'weight' was applied to each survey responder, using known characteristics about each individual in the population, in this case, age, sex, rank and medical fitness, to indicate how many 'like' individuals in the entire population (based on those characteristics) each responder represented. These two weights were combined to give each responder a single weight within the data, enabling data from responders to be adjusted so that it was representative of the entire ADF.

With regard to missing data, separate weights were calculated for each section of the survey, with the application of weights determined based on the outcome variable. As such, individuals who did not answer all questions in a section were deemed as missing and excluded from the analysis. A finite population correction was applied to adjust the variance estimates. For the purposes of this study, output for men was achieved by post-stratification to adjust the weights so that known population totals were reproduced by the estimates.

Civilian study (ABS sample)

Person weights (used in this study) were calibrated to independent estimates of population benchmarks in order to minimize sampling error of estimates and the level of non-response bias. Population benchmarks were obtained from the 2006 Australian Census, as well as from the 2007 Australian Survey of Education and Work. This allowed weighting of the sample

according to the probability of being selected, so that the final sample of 8841 represented the entire estimated population of Australian adults (Slade *et al.*, 2009a).

Comparison.

Data-merging techniques were not deemed statistically appropriate primarily due to complexities in the poststratification process in comparing data from complex surveys in different populations. All analyses were performed in STATA version 14.2, accounting for complex survey designs, utilizing the STATA 'svy' command with survey weighting. Due to the difficulties associated with accurately testing results across two complex surveys, P values were not calculated for differences between the populations. For population comparisons, the term 'significant' was used to describe differences when the 95% confidence intervals did not overlap.

Firstly, descriptive statistics were undertaken to describe the prevalence of past-year PTSD across both populations. Associations with demographic, service, childhood and adult variables were calculated as adjusted Odds Ratios (*aORs*), controlling for demographics. We reported the nested regression analysis of each variable block compared with demographics only (age, educational attainment and current relationship). Nested regression likelihood ratio tests are incompatible with complex survey designs within STATA. Therefore, modified F-tests were used to test for model goodness of fit. F-statistics and associated degrees of freedom were used (Archer *et al.*, 2007). F-statistics are likely to be more reliable than either Chi-squared tests in clustered survey designs (Archer *et al.*, 2007), or Wald tests in surveys with a relatively small number of sampling clusters (Thomas R, 1987).

Logistic regression analyses were conducted with the same variables in both populations for direct comparison. Model 1 describes the association of past-year PTSD with childhood trauma and childhood disorder controlling for each other. Demographics (age, educational attainment and current relationship) and adult trauma were then also controlled for in Model 2. We have reported F values for nested regression analyses comparing Model 2 with Model 1 in each population. We then conducted regression analyses in the ADF only. In the most basic model, we controlled for childhood factors (trauma and disorder), demographics and service factors (rank and service). We then added previous deployment, adult combat exposure, and adult trauma in separate models and conducted nested regression analyses comparing each model to the basic model.

In order to assess for potential mediation, we utilized Generalized Structural Equation Modelling (GSEM) pathway analysis, as per Acock, 2006 (Acock, 2006), accounting for complex survey designs. Goodness of Fit (GoF) estimations were not suitable for this analysis (StataCorp, 2013), in most cases this was due to the joint-normality assumption. The GSEM pathway modelled outcomes using logistic regressions (logit link). We compared pathways in both populations, in the following three pairs of models. First, the pathway between high counts of childhood trauma (more than three types) and past-year PTSD compared to the same model with childhood anxiety, depression and alcohol use disorders added as mediators. Second, the pathway between high counts of childhood trauma and past-year PTSD controlling for demographics (age, current relationship and educational attainment) compared to the same model with childhood anxiety, depression and alcohol use disorders added as mediators including covariance between the childhood disorders. Third, the pathway between high counts of childhood trauma and past-year PTSD controlling for

demographics (age, current relationship and educational attainment) compared to the same model with childhood anxiety, depression and alcohol use disorders and also multiple adult trauma included as mediators. The total indirect pathway via each mediator was calculated utilizing the 'nlcom' command which calculates nonlinear combinations of estimators and is suitable for use with complex survey designs (StataCorp, 2013). Essentially, for each mediator, the total indirect pathway was calculated utilising product terms (on the logit scale) from the 'a' path (from childhood trauma to the mediator) and 'b' path (from the mediator to past-year PTSD). For ease of interpretation we converted the beta coefficients (β) produced in STATA to Odds Ratios by exponentiating them.

Results

The prevalence of past-year PTSD was 8.0%, 95% CI [5.8, 11.0] in ADF men compared with 4.5%, 95% CI [3.3, 5.7] in civilian employed men. Past-year PTSD was not associated with current age or current relationship status in either population. Past-year PTSD was not associated with rank or Service in the ADF.

As the results displayed in Table 1 indicate, past-year PTSD was associated with childhood anxiety and depression in the ADF and childhood anxiety, but not depression, in civilians. Past-year PTSD was not associated with childhood alcohol use disorders in either population. A significantly greater percentage of those in the ADF experienced high counts of childhood trauma (three or more types) than civilians. High counts of childhood trauma were associated with past-year PTSD in both populations. In both populations, past-year PTSD was associated with childhood interpersonal trauma but not childhood non-interpersonal trauma (such as accidents or disasters). A significantly greater percentage of the ADF experienced

multiple new types of trauma as adults than civilians. Multiple (but not single) adult trauma types were associated with past-year PTSD in both populations.

As indicated by the results displayed in Table 2, once childhood disorder was controlled for, childhood trauma (including all trauma categories) was not associated with past-year PTSD, in the ADF. Whereas, in civilians, childhood trauma categories that included childhood interpersonal trauma were associated with past-year PTSD, even when controlling for childhood disorder. In the ADF, childhood depression and anxiety continued to be associated with past-year PTSD even when we controlled for childhood trauma. This remained the case when additionally controlling for adult trauma. In civilians, childhood anxiety continued to be associated with past-year PTSD even when we controlled for childhood trauma. This remained the case when we additionally controlled for adult trauma.

As the results displayed in Table 3 (results for ADF only) indicate, previous deployment was not associated with past-year PTSD when controlling for childhood factors (childhood trauma and disorder) as well as demographic and service factors. In contrast, when controlling for the same factors, previous combat was associated with past-year PTSD. Both childhood anxiety and childhood depression had a direct and significant association with past-year PTSD, even when controlling for childhood trauma, demographics and service factors, as well as previous combat, adult trauma or deployment.

The first pair of GSEM pathway analyses demonstrated a significant direct pathway between high counts of childhood trauma (three or more types) and past-year PTSD in both the ADF, $aOR=3.16$, $p=.006$, and civilians, $aOR =5.64$, $p<.001$. In the ADF, when childhood disorders were added as mediators, the pathway between high counts of childhood trauma and past-

year PTSD became non-significant ($aOR = 1.45$, $p < .142$), whilst the total indirect pathways were, for childhood anxiety, $aOR = 1.31$, $p < .001$, depression, $aOR = 1.29$, $p = .096$ and alcohol use disorders, $aOR = 1.04$, $p < .576$. This suggests full mediation. In civilians, even though the total indirect pathway for childhood anxiety, $aOR = 1.57$, $p < .001$, was significant, the pathway between high counts of childhood trauma and past-year PTSD remained significant, $aOR = 3.40$, $p < .001$ when childhood anxiety, depression and alcohol use disorders were added as mediators. This therefore does not suggest full mediation. The results of the second pair of GSEM pathway analyses, illustrated in Figures 1 and 2, were consistent with our first analyses, again suggesting full mediation in the ADF but not in civilians. In the third pair of GSEM pathway analyses (Figures 3 and 4, supplementary material), multiple adult trauma was added as a mediator. These analyses demonstrated full mediation of the pathway between high counts of childhood trauma and past-year PTSD in the ADF but not in civilians. Interestingly there were significant pathways between each childhood disorder and multiple adult trauma types in the ADF but not in civilians, suggesting that those with childhood vulnerabilities were less likely to be able to avoid damaging adult trauma in the ADF. However, a more detailed analysis and discussion of this particular point is beyond the scope of this current paper.

Paper 3: Tables and figures

Table 1: Population Percentages and Associations with Past-year PTSD

		ADF men				Civilian employed men							
		%	[95% CI]		aOR	[95% CI]		%	[95% CI]		aOR	[95% CI]	
Education:	Year 10	11.3	[11.2,	11.4]	1.00			13.6	[11.6,	13.6]	1.00		
	Cert or diploma	38.6	[38.4,	38.7]	*0.28	[0.01,	0.77]	41.3	[38.9,	41.3]	1.97	[0.69,	5.60]
	Year 11/12	30.3	[30.2,	30.5]	*0.32	[0.11,	0.93]	21.9	[19.4,	21.9]	*2.63	[1.09,	6.35]
	Degree	19.8	[19.7,	19.9]	*0.33	[0.11,	0.95]	23.2	[21.2,	23.2]	1.41	[0.44,	4.45]
Child trauma	Nil				1.00						1.00		
	Unclassified	16.5	[3.9,	19.5]	*2.23	[1.07,	4.61]	17.5	[15.2,	19.9]	*2.32	[1.08,	4.96]
	N-Interpersonal	17.0	[13.5,	21.3]	1.82	[0.84,	3.92]	9.1	[7.4,	10.8]	2.93	[0.93,	9.20]
	Interpersonal	12.3	[10.2,	14.7]	***3.08	[1.61,	5.90]	11.7	[9.7,	13.7]	***6.63	[2.74,	16.06]
	Both	10.4	[7.5,	14.2]	**4.26	[1.53,	11.90]	3.9	[2.8,	5.1]	***11.62	[4.34,	31.10]
	3+ types	17.9	[14.8,	21.7]	***2.97	[1.54,	5.75]	8.7	[6.9,	10.5]	***5.92	[3.00,	11.66]
Childhood disorder	Anxiety	17.2	[13.7,	21.2]	***3.94	[2.36,	6.58]	14.8	[12.8,	16.8]	***7.06	[3.50,	14.22]
	Depression	3.9	[2.0,	7.1]	***7.01	[2.98,	16.49]	2.3	[1.5,	3.1]	1.40	[0.46,	4.25]
	Alcohol use	7.4	[5.1,	10.6]	1.16	[0.50,	2.78]	6.9	[5.4,	8.5]	1.43	[0.64,	4.41]
Adult trauma	Nil				1.00						1.00		
	Single	19.3	[15.8,	23.5]	1.05	0.16	6.90	27.5	[25.0,	30.5]	1.91	0.70	5.50
	Multiple	64.7	[60.3,	69.0]	***17.52	4.05	75.86	32.0	[29.1,	35.0]	***8.62	3.89	13.14

Note. All regressions controlled for demographics (age, education and relationship status).

Change F: nested regression of variable block compared with basic model which included demographics only (age, relationship and education).
aOR= adjusted Odds Ratio. *p<.05, **p<.01, ***p<.001

	ADF men		Civilian employed men	
	<i>aOR</i>	[95% CI]	<i>aOR</i>	[95% CI]
Model 1: Childhood trauma and childhood disorder, controlling for each other				
Unclassified CT	1.55	[0.69, 3.44]	1.75	[0.78, 3.90]
Non-interpersonal CT	1.08	[0.51, 2.25]	2.05	[0.63, 6.66]
Interpersonal CT	1.93	[0.99, 3.76]	**4.36	[1.46, 13.02]
Both CT	1.33	[0.59, 2.98]	***6.39	[2.11, 19.28]
Child Anxiety	***3.41	[2.03, 5.71]	***4.81	[2.02, 11.48]
Child Depression	***7.48	[3.11, 18.00]	1.22	[0.44, 3.38]
Child Alcohol	1.43	[0.68, 3.02]	0.87	[0.33, 2.28]
Model 2: Model 1 plus current age, education, relationship status and adult trauma count				
Unclassified CT	1.43	[0.64, 3.24]	1.55	[0.67, 3.53]
Non-interpersonal CT	1.27	[0.61, 2.67]	1.88	[0.52, 6.82]
Interpersonal CT	1.52	[0.76, 3.02]	*3.64	[1.29, 10.30]
Both CT	0.99	[0.39, 2.54]	**4.84	[1.50, 15.62]

Child Anxiety	***3.17	[1.84,	5.46]	***5.20	[2.44,	11.05]
Child Depression	***5.72	[2.44,	13.41]	1.11	[0.42,	2.93]
Child Alcohol	1.22	[0.51,	2.93]	0.90	[0.31,	2.64]

Table 2: Population Percentages and Associations with Past-year PTSD

Note. CT= Childhood Trauma, *aOR*= adjusted Odds Ratio.

p*<.05, *p*<.01, ****p*<.001

Table 3: Logistic Regression Analyses for Past-year PTSD in ADF men

	Deployment		Combat		Adult trauma	
	<i>aOR</i>	[95% CI]	<i>aOR</i>	[95% CI]	<i>aOR</i>	[95% CI]
Childhood trauma						
Unclassified	1.64	[0.70, 3.84]	1.59	[0.69, 3.66]	1.20	[0.54, 2.70]
Non-Interpersonal	1.42	[0.66, 3.04]	1.44	[0.66, 3.13]	1.01	[0.47, 2.18]
Interpersonal	1.96	[0.98, 3.90]	1.98	[0.98, 4.00]	1.62	[0.83, 3.15]
Both	1.30	[0.58, 2.89]	1.43	[0.65, 3.15]	0.76	[0.29, 2.00]
Childhood Disorder						
Any anxiety	3.57	[2.13, 5.99]	3.58	[2.12, 6.03]	3.55	[2.04, 6.19]
Any depression	7.10	[3.05, 16.53]	6.68	[2.84, 15.74]	4.89	[2.02, 11.83]
Any alcohol	1.18	[0.52, 2.70]	1.13	[0.49, 2.61]	1.18	[0.49, 2.83]
Deployment	1.35	[0.81, 2.25]				
Combat			1.70	[1.01, 2.88]		
Adult trauma						
Unclassified					0.72	[0.26, 2.04]
Non-Interpersonal					2.23	[1.17, 4.72]
Non-Int Interpersonal					2.67	[1.53, 4.66]
Int Interpersonal					3.28	[1.61, 6.71]

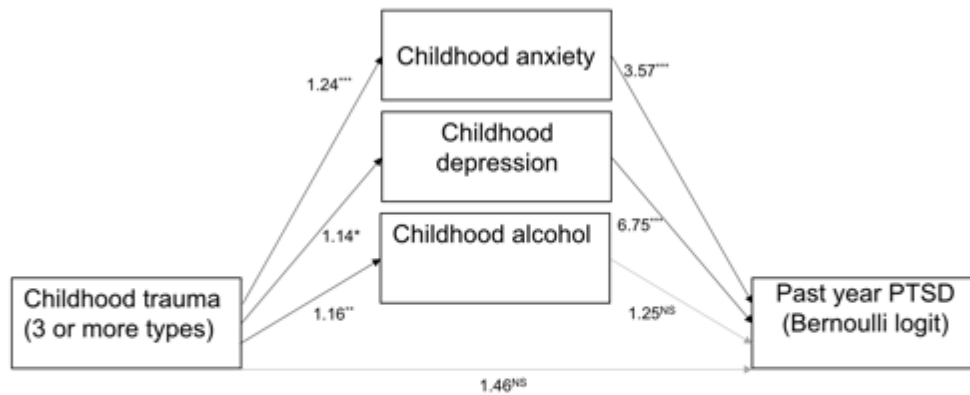
Note. Basic model includes childhood trauma, childhood disorder, demographics (age, education and

relationship status) and service factors (Service and rank).

Int= Intimate, *aOR*= adjusted Odds Ratio.

p*<.05, *p*<.01, ****p*<.001 (only included for F values

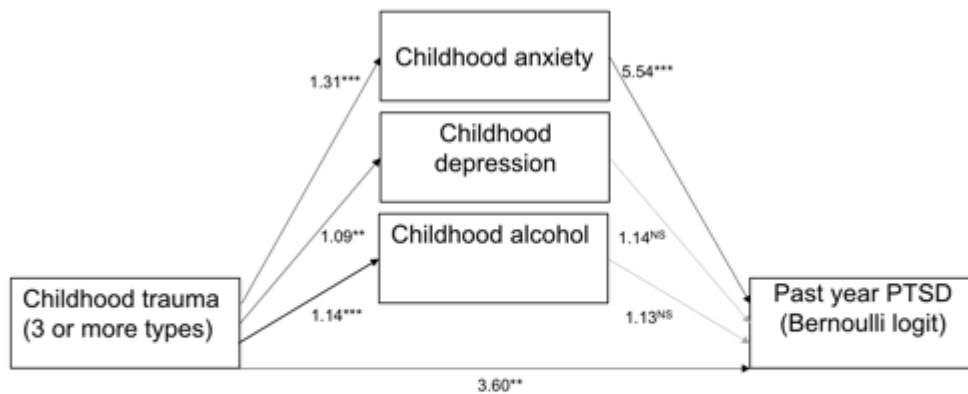
Figure 1: Military male mediator pathways through childhood disorder, controlling for age, education and current relationship and covariance between disorders



	aOR	p
Total (without mediators)	2.86	.004
Mediator Analysis		
<i>Indirect</i>		
Childhood anxiety	1.31	.007
Childhood depression	1.29	.094
Childhood alcohol	1.03	.635

Adjusted Odds Ratios (aORs) are shown
*p<0.05, **p<0.01, ***p<0.001

Figure 2: Civilian employed male mediator pathways through childhood disorder, controlling for age, education and current relationship and covariance between childhood disorders



	aOR	p
Total (without mediators)	5.87	.000
Mediator Analysis		
<i>Indirect</i>		
Childhood anxiety	1.59	.000
Childhood depression	1.01	.806
Childhood alcohol	1.02	.812

Adjusted Odds Ratios (aOR) are shown
*p<0.05, **p<0.01, ***p<0.001

Discussion

This study compared the relationship between childhood trauma, childhood disorder and past-year PTSD in separate military and employed civilian cohorts of men aged 18-60 years. The purpose was to investigate whether childhood trauma and childhood disorder were differentially associated with past-year PTSD among male military personnel who operate in an occupational environment that carries a high risk of adult trauma exposure compared to men employed in a range of civil occupations.

There was a higher prevalence of past-year PTSD in ADF compared with civilian employed men. There was a higher percentage of those who experienced high counts (more than three types) of childhood trauma and multiple trauma types as adults, in the ADF. Past-year PTSD was associated with childhood anxiety and depression (but not alcohol use disorders) in the ADF, but only childhood anxiety in civilian employed men. In both populations, past-year PTSD was associated with high counts of childhood trauma, and childhood interpersonal trauma (but not non-interpersonal trauma) and multiple adult trauma types (but not single). GSEM analyses suggested that the association between childhood trauma and past-year PTSD was fully mediated by childhood disorder in the ADF, but only partially in civilians.

Consistent with this current study, both prospective and retrospective studies in civilian populations have demonstrated an association between childhood disorder and adult PTSD (Breslau *et al.*, 2014, Koenen *et al.*, 2008). However, to our knowledge there are no studies specifically in the military that have investigated the relationship between childhood mental disorder and adult PTSD. In the current study, childhood anxiety had a significant direct association with past-year PTSD in civilians, whereas in the ADF both anxiety and depression had a significant direct association with past-year PTSD. Whilst this study cannot

answer the question of why that is, it is possible that in the context of greater lifetime trauma in the military population, childhood depression becomes a more important determinant of past-year PTSD. This may relate to childhood depression as a major determinant of adult depression (Lewinsohn *et al.*, 2000), which in turn increases the risk of PTSD in adulthood for those who experience trauma (Searle *et al.*, 2017).

In both populations there was a direct and significant association between childhood disorder and past-year PTSD, which remained after controlling for childhood trauma. Broadly consistent with our findings, a prospective study by Breslau and colleagues (Breslau *et al.*, 2014) demonstrated that the association between childhood disorder and adult PTSD was independent of childhood maltreatment in a civilian population.

Those who experienced childhood non-interpersonal trauma (without interpersonal trauma) were not at increased odds of past-year PTSD in either population. These findings are consistent with a longitudinal study of children exposed to the Australian bush fires compared with matched controls, which demonstrated no difference in adult PTSD between these groups (McFarlane and Van Hooff, 2009b). However, this finding does not exclude the possibility that these experiences might affect the response to future traumatic events.

Childhood interpersonal trauma, high childhood trauma counts (over three types) and multiple (but not single) types of new adult trauma were all associated with past-year PTSD, in both populations. This is broadly consistent with previous research evidence that interpersonal trauma types are more likely to be associated with the development of PTSD than non-interpersonal trauma types (Kessler *et al.*, 2017). Previous studies have shown that

cumulative trauma, mostly defined as the number of different trauma types, is associated with greater risk of PTSD (Green et al., [2000](#); Karam et al., [2014](#); Wilker et al., [2015](#)).

This current study cannot answer the question as to why we see full mediation by childhood disorder in the ADF, but not in civilians. However, it is broadly consistent with the finding that antecedent symptoms were found to fully mediate the cumulative effects of prior trauma in determining depression and PTSD post-deployment (Searle *et al.*, 2017). It therefore appears that in the military, the symptomatic distress that childhood trauma generates is the marker of longer-term risk. In the study of Searle et al 2017, the symptoms prior to deployment, even if relatively mild, were the residual marker of the risk of prior trauma exposure.

Consistent with some previous studies (Cabrera *et al.*, 2007, Fear *et al.*, 2010, Rona *et al.*, 2009), deployment in and of itself was not significantly associated with past-year PTSD. Rather, PTSD was associated with combat exposure. This highlights the role of combat in the adverse psychological impact of deployment as well as the stress of military life outside of military deployments. (Vasterling *et al.*, 2010) In addition, screening prior to deployment may exclude some of those with pre-existing mental health problems and vulnerabilities and hence reduce the probability of these relationships in deploying populations.

This is the first study, of which we are aware, to investigate childhood experiences and childhood disorder simultaneously in determining past-year PTSD in a military population. Exploration of this relationship was possible due to the use of the CIDI to define past-year disorder and also the lifetime history of disorder. In contrast, most studies of military populations have examined only the lifetime history of PTSD using structured interviews or

focused on a range of current disorders rather than the lifetime history. In addition, we were able to compare this with a civilian employed population with similarly detailed interview data on lifetime disorder and trauma. The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load which has been a particular challenge for research on childhood experiences (Finkelhor *et al.*, 2007). We analyzed the association of PTSD by the number of types of childhood trauma experienced, along with mediator pathways through childhood disorder and adult trauma, to discover consistencies and differences.

A weakness of this current study was that the main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias (Moffitt *et al.*, 2010). However, such retrospective reporting of childhood experiences is more prone to false negatives than positives and if well defined, as in this study, has good reliability (Hardt and Rutter, 2004). There may appear to be a low response rate in the ADF sample. However, unlike most surveys, the demographic and health status of the ADF members who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error. As our aim was to compare the male military and civilian populations, only male employed civilian subjects were included. Therefore, the poorer functioning unemployed male civilian population, were not included in this analysis. Measures of other forms of childhood adversity, such as neglect, were not included. We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the range, rather than frequency or severity of trauma experienced. However, similar trauma count variables have previously shown consistent

significant associations with mental disorder outcomes. (Sareen *et al.*, 2013a) It is possible that in some cases mental disorder pre-dated the trauma, and that mental disorder may not have been related to that trauma. In addition, it should be noted with regard to SEM, that some methodologists have taken issue with the use of the standard normal distribution for deriving a p value for the total indirect effect of a mediator, since the sampling distribution is normal only in large samples (Preacher and Hayes, 2008). However, the implication of full or partial mediation in this analysis was also demonstrated by the change in the total direct effect calculated with and without mediators.

These findings have clinical implications especially with regard to early intervention and prevention, for example, additional monitoring and support may be useful for those with a history of childhood disorder who take up high stress roles within the military. However, the risk of PTSD in those with childhood vulnerabilities relate to all childhood common mental disorders such as anxiety and depression, rather than childhood anxiety or PTSD alone. In addition, the relatively high rates of high childhood trauma counts and multiple adult trauma in the ADF has implications for PTSD symptom severity and treatability in military populations (Priebe *et al.*, 2018). However, this understanding should not negate the role of combat traumas and other trauma exposures in military service as risk factors of disorder but be used to better inform and manage the level of risk. PTSD can be conceived in the context of a cumulative sequence of trauma exposures and the resultant levels of symptomatic distress which they have generated, particularly in populations at higher risk of trauma as adults. The diagnostic criteria which focus on the instigating proximal trauma event does not incorporate this aetiological body of evidence.

Conclusion

In conclusion, we do not suggest that the results of this study are used to screen those from vulnerable backgrounds out of defence forces. These results cannot answer questions as to how these people would have fared outside of military service. Rather these results reassure that a large proportion of those who enlist do not have increased odds of past-year PTSD due to childhood trauma, for example those who experienced non-interpersonal trauma (without interpersonal trauma). In taking a lifetime perspective we have identified that the risk of PTSD from childhood trauma and disorder is potentially predictable and therefore modifiable. In light of these findings, the influence of these childhood factors on the impact of adult trauma also warrants further prospective investigation.

Chapter 8: Paper 4. Childhood

determinants of suicidality:

comparing males in military and

civilian employed populations

Statement of Authorship

Title of Paper	Childhood determinants of suicidality: comparing males in military and civilian employed populations
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	<p>Published in Psychological Medicine (Nov 2018)</p> <p>Syed Sheriff, R., Van Hooff, M., Malhi, G., Grace, B. & McFarlane, A. (2018). Childhood determinants of suicidality: comparing males in military and civilian employed populations. <i>Psychological Medicine</i> 13, 1-11.</p>

Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper for publication. I amended the paper according to supervisor/co-author comments.
Overall percentage (%)	90%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.

Signature		Date	04/10/19
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Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Abstract

Background: To better understand the associations of childhood trauma and childhood disorder with past-year suicidality (thoughts, plans or attempts), we compared male military and civilian populations aged 18-60 years old. **Methods:** Data derived from the 2010 Australian Defence Force (ADF) Mental Health Prevalence and Wellbeing Study and the 2007 Australian Bureau of Statistics Australian National Survey of Mental Health and Wellbeing were compared using logistic regression and generalized structural equation modelling (GSEM). **Results:** A greater proportion of the ADF experienced suicidality than civilians. Those who experienced childhood trauma that was not interpersonal in nature were not at increased odds of suicidality, in either population. A higher proportion of the ADF experienced three or more types of trauma in childhood and first experienced three or more types of trauma in adulthood. Both were associated with suicidality in the ADF and civilians. Childhood anxiety had a strong and independent association with suicidality in the ADF (controlling for demographics and childhood trauma, adult trauma and adult onset disorder). Childhood anxiety fully mediated the relationship between childhood trauma and suicidality in the ADF, but not in civilians. **Conclusions:** These data highlight the need to take a whole life approach to understanding suicidality, and the importance of categorising the nature of childhood trauma exposure. Importantly, childhood anxiety was not only associated with suicidality, it fully mediated the relationship between childhood trauma and suicidality in the more trauma exposed (military) population only. These findings have the potential to inform the development of strategies for suicide prevention.

Introduction

Suicide is a public health priority. (Nelson *et al.*, 2017) Concerns regarding the impact of military service on military personnel are longstanding globally.(Gradus *et al.*, 2013) However, the importance of understanding suicidal behaviours has become increasingly urgent with studies showing that the rates of suicide in military personnel are rising.(Schoenbaum *et al.*, 2014) There are lower rates of completed suicide in the Australian Defence Force (ADF) than the general population but rates of suicidal ideation are higher. In addition, rates of suicide are particularly high in ex-military personnel and the issue of suicide in the ADF has been the subject of two recent enquiries. (2017)

Whilst suicide itself is a rare outcome, it is strongly predicted by the broader measure of suicidality (suicidal thoughts, plans and attempts).(Joiner *et al.*, 2005) Research on suicidality in military populations (Kuehn, 2009) has traditionally concentrated on occupational risk factors. However, several studies have not found a significant impact of deployment. (LeardMann *et al.*, 2013) (Kang *et al.*, 2015) (Schoenbaum *et al.*, 2014) It is likely, therefore, that other factors also impact on the rates of suicidality in military personnel. (Afifi *et al.*, 2016)

General population studies have demonstrated the severe and long-term impact of childhood adversity on physical (Gilbert *et al.*, 2015) and mental health, (Green *et al.*, 2010) as well as on suicidality. (Dube *et al.*, 2001, Norman *et al.*, 2012) Higher rates of adversity have been demonstrated in military compared with civilian populations in the UK, (Iversen *et al.*, 2007b) US, (Blosnich *et al.*, 2014) Canada, (Afifi *et al.*, 2016) and higher rates of childhood trauma exposure, in the ADF. In addition, a recent Canadian study (Afifi *et al.*, 2016) demonstrated that childhood adversity was strongly related to suicidality in military and

civilian populations, but that whilst child abuse was more common in the military population, the association appeared stronger in civilians. In the US, mental disorder, including pre-enlistment disorder, was found to be an important determinant of suicidality in the Army (Nock *et al.*, 2014) but this study did not examine the specific role of childhood mental disorder.

Childhood factors are not only important determinants of adult suicidality but are also likely to be the earliest identifiable factors related to suicidality. Therefore they hold great potential for the development of prevention and early intervention strategies. (Nelson *et al.*, 2017) Before this can be achieved however, there are several important gaps in our understanding of the childhood determinants of adult suicidality.

It is unclear if all types of childhood trauma (including accidents) are related to adult suicidality, or if suicidality is related only to interpersonal types of childhood trauma such as abuse. This has proved challenging to decipher because of clustering, i.e. many of those who have been exposed to childhood adverse experiences have experienced many different types of trauma.(Finkelhor *et al.*, 2007) Whilst pre-enlistment disorder has been studied in military populations, childhood disorder has not been specifically studied (Nock *et al.*, 2009) but is potentially different from adult pre-enlistment disorder in terms of its etiological significance.

Previous studies have demonstrated that it is not only trauma, but the mental health impact of the trauma, that carries risk in terms of future outcomes. (Breslau *et al.*, 2008) The relationship between childhood disorder and trauma is therefore potentially important in determining future suicidality. Given that differences exist between military and civilian populations in terms of the patterns and rates of childhood trauma, comparing the populations

is likely to be a useful avenue in determining the impact of childhood trauma and disorder and how they relate to each other in contributing to future suicidality.

In an attempt to decipher the early factors relating to risk and resilience, we investigated the association of childhood trauma and childhood disorder with past-year suicidality, in military compared with employed civilian populations. Due to marked sex differences in non-lethal suicidal behavior rates, (Nock *et al.*, 2014) (Ursano *et al.*, 2015) and the relatively low number of females in the ADF which limited statistical power, we confined this analysis to males.

More specifically, in both populations we aimed to analyze and compare the associations between childhood trauma and past-year suicidality, to analyze and compare the associations between childhood disorder and past-year suicidality and to examine whether the association of childhood trauma and past-year suicidality was independent of childhood disorder, and vice versa, in both populations. In addition, we aimed to examine and compare mediator pathways from childhood trauma to past-year suicidality via childhood disorder. Finally, we aimed to investigate whether the associations between childhood trauma, disorder and past-year suicidality were independent of service factors and combat exposure in the ADF. We hypothesized that elucidation of these associations, mediator pathways and differences between populations, would provide clues as to the early signs relating to risk and resilience.

Methods

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis.

Military study (ADF sample)

All Australian Defence Force (ADF) personnel were invited to participate in the 2010 ADF Mental Health Prevalence and Wellbeing Study (MHPWS) which employed a two-phase design to estimate the prevalence of ICD-10 mental disorders across all serving regular ADF personnel. (Van Hooff *et al.*, 2014) This two-phase design is well accepted for investigating mental disorder prevalence. (Dunn *et al.*, 1999)

- Phase 1 investigated levels of psychological and physical symptoms through a self-report questionnaire, which is economical of time and resources.
- Phase 2 examined mental disorder prevalence within the ADF. To do this, a stratified sub-sample of Phase 1 respondents was selected to complete a more accurate but costly and time-consuming structured diagnostic interview, the CIDI.

All recruitment and assessment were conducted between April 2010 and January 2011. At Phase 1, all serving ADF personnel (N= 50049), excluding trainees and reservists, were invited to complete a self-report questionnaire, including basic demographics, the K10 (Kessler Distress Scale), (Andrews and Slade, 2001) the Posttraumatic Stress Disorder Checklist (PCL) (Ventureyra *et al.*, 2002) and the Alcohol Use Disorders Identification Test (AUDIT). (Conigrave *et al.*, 1995) There were also 3 items relating to past year suicidality. In all, 24481 participants provided usable data at Phase 1.

Fifteen percent of the eligible participants from Phase 1 were stratified and selected for participation in Phase 2, where the World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) was utilized. Participants were selected for Phase 2 with the joint aims of ensuring sufficient power within key demographic groups and of ensuring that participants had a reasonable chance of a positive diagnosis. Therefore, eligibility for Phase 2, was based on Service, sex, and scores on the PCL and AUDIT.

The 60th and 80th percentiles of the PCL and AUDIT distributions were used as cut-offs to form three stratification bands. The 80th percentile for 'high scorers' as it was deemed a conservative lower bound on what the diagnostic cut-off could be. The 60th percentile was chosen as a further cut-off to provide reasonable numbers of participants just below the first cut-off. Using these bands, the higher-scoring ADF members (those in Bands 2 and 3) were oversampled to provide adequate power to make more accurate prevalence estimates. Of the 3688 participants selected for Phase 2, 1798 (49%) completed a CIDI interview. Taylor series linearization was used to estimate variance. (Deville, 1999, Ravva *et al.*, 2014)

Weighting

Detailed descriptions of stratification procedures and weighting are available elsewhere. (Hodson, 2011, Van Hooff *et al.*) In summary, mental disorder prevalence estimates were derived using a robust two stage weighting process which attenuated the impact of low response rates, as well as any selection and responder bias. In the first step a weight was assigned which was equal to the inverse of the probability of being selected for an interview. This accounted for the differential probability of being selected for a CIDI based on scores on the PCL and Audit (band) sex and service. In the second step, weights were

applied to correct for differential non-response to the survey. A representative value or 'weight' was applied to each survey responder, using known characteristics about each individual in the population, in this case, age, sex, rank and medical fitness, to indicate how many 'like' individuals in the entire population (based on those characteristics) each responder represented. These two weights were combined to give each responder a single weight within the data, enabling data from responders to be adjusted so that it was representative of the entire ADF.

For the purposes of this study, output for men was achieved by post-stratification to adjust the weights so that known population totals were reproduced by the estimates. A total of 43207 (86.3%) of the ADF were men aged 18-60. Of these, 1356 had a CIDI interview which was weighted to represent all regular ADF men aged 18-60.

Civilian study (ABS sample)

The 2007 ABS (Australian Bureau of Statistics) National Survey of Mental Health and Wellbeing (NSMHWB) was based on a stratified, multistage area probability sample of residents aged 16–85 years across all states and territories in Australia. Person weights (used in this study) were calibrated to independent estimates of population benchmarks in order to minimise sampling error of estimates and the level of non-response bias. Population benchmarks were obtained from the 2006 Australian Census, as well as from the 2007 Australian Survey of Education and Work. This allowed weighting of the sample according to the probability of being selected, so that the final sample of 8841 represented an estimated population of 16015000 Australian adults.(Slade *et al.*, 2009a)

For the purposes of this study, all employed males aged 18-60 were selected. Those who said that they had served in the ADF, received a DVA pension or experienced combat exposure

were then excluded. A total of 2120 employed civilian males in the general population (ABS) had a CIDI interview which was weighted to represent all 4.67 million (CI 4.54 – 4.79 million) employed civilian males. This interview included items relating to suicidality. Person and replicate weights were applied to this data to ensure that subpopulation weighting was correct.

Measures

Both studies utilized the CIDI (Kessler and Ustun, 2004) which consists of a structured diagnostic assessment of Lifetime, 12-month and 30-day ICD-10 disorder. Additional socio-demographic data was also available from the ABS census and the ADF self-report questionnaire, and service data from ADF administrative data. In the ADF, items relating to suicidality were included in the self-report questionnaire at phase 1. In the ABS, the CIDI interview included items relating to suicidality.

Suicidality

In the ADF, at Phase 1, the self-report questionnaire included the following specific items regarding suicidality:

- In the last 12 months, have you ever felt so low that you thought about committing suicide?
- In the last 12 months, have you made a suicide plan?
- In the last 12 months, have you attempted suicide?

In the ABS, as a part of the CIDI interview, each respondent was asked to read the respondent booklet, and consider each of the following experiences which were described there:

- Experience A was ‘seriously thought about committing suicide’,
- Experience B was ‘made a plan for committing suicide’,
- Experience C was ‘attempted suicide’.

If they had experienced it, they were asked how old they were the first time it had happened and whether it had happened to them within the previous 12 months. If they responded that they had not experienced A, the interviewer did not ask about experiences B or C. The previous 12-month responses were used for the purposes of this study.

The items were analyzed to determine overall rates of thoughts, plans and attempts in each population. The items were also combined to form a measure of ‘any suicidality’ in the previous 12 months.

Disorder

Childhood disorder was defined as disorder with age of onset below 18 years and was grouped as follows: any depression (mild, moderate or severe depressive episode), any anxiety (social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD) and any alcohol use disorder (abuse or dependence). Those who had a lifetime anxiety disorder but no childhood anxiety disorder were coded as having an adult onset anxiety disorder. Coding was performed in a similar way for adult onset depression and adult onset alcohol use disorders.

Traumatic experiences

Respondents were asked if they had experienced any of the CIDI criterion A1 events listed in the CIDI 3.0. To determine age at onset of each experience, respondents were asked how old they were when it first happened to them.

For the purposes of this study, we defined childhood trauma as those experienced with age of onset below 18 years and coded the number of trauma types (trauma count) and age of onset (0-11 years old or 12-17 years old). Adult trauma refers to trauma types first experienced aged 18 years or over.

Types of childhood trauma were classified as follows, based on Forbes et al. (Forbes *et al.*, 2014), non-interpersonal trauma (exposed to a toxic chemical, life-threatening automobile accident, other life-threatening accident, man-made disaster, life-threatening illness, major natural disaster) and interpersonal trauma (sexual assault, raped, stalked, beaten by spouse/romantic partner, beaten by parents /guardian as a child, badly beaten by anyone else, kidnapped or held captive, mugged, held up or threatened with a weapon).

Due to the co-occurrence of childhood trauma types, (Green *et al.*, 2010) we then categorized individuals (as per our previous study) into mutually exclusive childhood trauma categories, non-interpersonal trauma without interpersonal trauma, interpersonal trauma without non-

interpersonal trauma and both non-interpersonal and interpersonal trauma. We categorized those who experienced childhood trauma that did not fit into the previous categories as unclassified trauma (child had life threatening illness/injury, combat, refugee, peacekeeper, purposefully injured/tortured/killed someone, other traumatic event, unarmed civilian in a place of conflict, accidentally injured/killed someone, and lived as a civilian in a place of ongoing terror, experience don't want to talk about; saw atrocities or carnage; someone close had traumatic experience; witness serious physical fights at home as a child; someone close died; saw someone badly injured). The mutually exclusive childhood trauma categories were therefore exhaustive of the lifetime trauma items in the CIDI.

Demographics and service characteristics

In the ABS, prior to the formal mental health diagnostic interview, socio-demographic information was collected, including age, education and relationship status. In the ADF, information regarding age, education and relationship status was available from the self-report questionnaire.

In the ADF, information regarding service characteristics was available from ADF administrative data. Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), non-commissioned officers (Sergeant to Warrant Officer equivalents) and commissioned officers (Lieutenant to General equivalents). Medical fitness to deploy was based on MEC categories. Information regarding previous deployment was available from the self-report questionnaire

Analysis

As the data to be compared came from surveys in different populations, data-merging techniques were not deemed statistically appropriate primarily due to complexities in the poststratification process. All analyses were performed in STATA version 14.2, accounting for complex survey designs by survey weighting, utilising the STATA 'svy' command. Therefore, all analyses were conducted applying weights to provide population prevalence estimates. P values were not calculated due to the complexities associated with accurately testing results across 2 complex surveys. Therefore, for each population the weighted analyses give the population prevalence, and the term 'significant' is used to describe differences when the 95% confidence intervals do not overlap.

Firstly, descriptive statistics were undertaken to describe the overall prevalence of suicidal thoughts, plans and attempts over the previous 12 months, in both populations. Next, associations between childhood and adult factors and past-year suicidality, were calculated, controlling for demographic factors.

Logistic regression analyses were utilized to analyze the relationship between childhood trauma and childhood disorder with suicidality, controlling for each other and demographics. We then also controlled for adult onset trauma types and adult onset mental disorder. All of these analyses were conducted with the same variables in both populations for comparison. The analyses were then repeated in the ADF with the addition of service characteristics in each step, with a final step for adult combat exposure. Any differences were highlighted and reported.

We examined mediator pathways between childhood trauma and suicidality, via childhood disorder, using logistic regression models. We utilized Generalized Structural Equation Modelling (GSEM), rather than SEM, as the outcome variable was dichotomous. In STATA the GSEM pathway utilized the link 'logit' and the family 'Bernoulli'. We conducted mediator analysis where there was a direct association between childhood trauma and suicidality. Where possible, we accounted for complex survey designs within STATA by utilizing the 'svy' command. Possible mediators examined were childhood disorder (childhood anxiety, depression and alcohol use disorders). We examined all pathways both with and without controlling for demographic variables (age, highest education and current relationship status). In order to investigate the extent of possible mediation we compared β Coefficients for Total effects with Indirect and Direct effects, along with levels of significance. We compared military and civilian populations using the same variables, and then repeated the analysis in the military population, also controlling for service factors (Service and Rank).

Results

Insert Table 1: Comparison of suicidality rates

There were significantly higher rates of suicidality in the ADF. (See Table 1)

Insert Table 2: Associations controlling for demographic factors

In the ADF, controlling for other demographic factors, suicidality was associated with the lowest education category (year 10 or below) and with being older. There was no association

of suicidality with age or highest education in civilians. In both populations, suicidality was associated with being single.

Childhood factors

In the ADF, there was a much higher proportion of those with a high count of childhood trauma (three or more types). Suicidality was associated with high counts of childhood trauma types in both populations. Suicidality was not associated with childhood non-interpersonal or unclassified trauma (in the absence of interpersonal trauma) in either population, however it was associated with childhood interpersonal trauma (alone or together with non-interpersonal trauma) in both populations.

In the ADF, suicidality was associated with childhood anxiety, but not with childhood depression or alcohol use disorders. In contrast, in civilians, it was associated with childhood depression and with alcohol use disorder, but not with childhood anxiety.

Adult trauma

A higher proportion of those in the ADF experienced high counts of adult trauma (number of types of trauma first experiences over age 18). Suicidality was associated with high counts of adult trauma in both populations.

Service Factors

Suicidality was associated with being in the Navy or Army and with not being an Officer.

Suicidality was not associated with combat exposure or deployment.

Insert TABLE 3: Childhood factors regression comparison

In the ADF, in the first model, which controlled for childhood factors (disorder and trauma) and demographics, high counts of childhood trauma were not associated with suicidality in either population once childhood disorder was controlled for.

However, controlling for childhood trauma, childhood anxiety was associated with suicidality in the ADF, whereas childhood depression was associated with suicidality in civilians.

Controlling for adult onset trauma types and adult onset disorder (as in the second model) did not affect the significance of the association of childhood disorder and suicidality. Depression (but not anxiety or alcohol use disorder) which had its first onset in adulthood was associated with suicidality in the ADF. In civilians no adult onset disorders were associated with suicidality.

Insert TABLE 4: Regression ADF

In the ADF, (Table 4) childhood anxiety was associated with suicidality even when also controlling for service factors, and combat exposure. Combat exposure, however was not associated with suicidality in any model.

GSEM

Insert Figures

There was a significant association between high count childhood trauma (more than three types of trauma types experienced in childhood) and past-year suicidality in both populations (see Table 2 and Figures). GSEM mediator analysis demonstrated that the direct pathway became insignificant when childhood disorders were added as mediators. The indirect pathway between childhood trauma and suicidality was significant for childhood anxiety but not for childhood depression or childhood alcohol in the ADF. This was also the case when controlling for demographic factors. (See Figure 1) Therefore, we investigated the mediator pathway for childhood anxiety alone. The indirect pathway was significant (β Coefficient =0.28, $p=.004$) whereas the direct pathway became insignificant (β Coefficient =1.640, $p=.136$). This suggests full mediation of the association between childhood trauma and suicidality by childhood anxiety in the ADF.

In civilians, GSEM mediator analysis also demonstrated that the direct pathway between childhood trauma and suicidality became insignificant when childhood disorders were included as mediators. The indirect pathway between childhood trauma and suicidality was significant for childhood depression but not for childhood anxiety or childhood alcohol. This was also the case when controlling for demographic factors. (see Figure 2) Therefore, we investigated the mediating pathway for childhood depression alone, controlling for demographic factors, however the direct pathway remained significant. These results suggest full mediation of the relationship between childhood trauma and disorder via the spectrum of childhood disorders, most notably depression, but not by childhood depression alone.

Paper 4: Tables and figures

Table 1: Comparison of suicidality rates
Males 18-60 **Proportion**

	ADF			ABS (employed)		
	%	95% CI		%	95% CI	
Any suicidality	3.78	3.70 3.87		1.42	0.86 1.99	
Thoughts	3.70	3.61 3.78		1.34	0.85 1.83	
Plans	1.06	1.01 1.11		0.29	0.09 0.50	
Attempts	0.40	0.37 0.44		0.21	0.00 0.42	

Table 2: Population proportions and associations with suicidality controlling for demographics (age, relationship status and highest education)

	ADF percentage of male population			aOR			ABS proportion of male employed civilian population			aOR		
	%	95% CI		95% CI			%	95% CI		OR	95% CI	
Age												
<25	21.55	21.17	21.94	1.00			15.76	14.26	17.26	1.00		
25-34	38.92	38.47	39.38	1.19	1.09	1.30	24.07	22.18	25.97	2.13	0.29	15.45
35-44	25.96	25.55	26.37	1.87	1.71	2.05	26.67	24.92	28.41	1.58	0.36	6.99
45+	13.57	13.25	13.89	1.90	1.73	2.09	33.50	31.84	35.17	1.09	0.27	4.36
Highest Education												
Year 10	11.31	11.21	11.42	1.00			13.64	11.63	15.65	1.00		
Certificate or diploma	38.59	38.44	38.74	0.84	0.77	0.91	41.29	38.85	43.72	0.51	0.15	1.81
Year 11/12	30.33	30.18	30.48	0.75	0.69	0.82	21.85	19.42	24.27	0.45	0.18	1.09
University degree	19.76	19.66	19.87	0.76	0.70	0.83	21.85	21.15	25.31	0.65	0.17	2.40
Relationship status												
No current significant relationship	24.36	24.22	24.51	1.00			34.51	37.22	31.80	1.00		
Current significant relationship	75.64	75.49	75.78	0.45	0.42	0.47	65.49	62.78	68.20	0.23	0.08	0.63
Childhood trauma												
Number of types												
None	43.78	39.34	48.32	1.00			57.86	54.95	60.78			
Low (1 or 2)	38.24	33.89	42.80	1.89	0.97	3.67	33.45	30.80	36.10	2.39	0.97	5.89
High (3+)	17.98	14.75	21.72	3.15	1.53	6.49	8.69	6.90	10.48	8.84	3.05	25.64
Category												
None	43.78	39.34	48.32	1.00			57.78	54.87	60.70			
Unclassified	16.54	13.91	19.54	1.58	0.72	3.48	17.53	15.21	19.85	2.62	0.89	7.73
Non interpersonal (without interpersonal)	17.04	13.49	21.29	1.53	0.62	3.74	9.09	7.41	10.77	0.95	0.06	14.56
Interpersonal (without non-interpersonal)	12.27	10.23	14.65	3.42	1.65	7.09	11.67	9.66	13.68	6.07	2.53	14.55
Both interpersonal and non-interpersonal	10.37	7.47	14.22	3.38	1.45	7.88	3.92	2.79	5.05	8.45	1.05	68.20
Childhood disorder (controlled for each other)												
Anxiety	17.17	13.75	21.23	3.72	2.01	6.91	14.84	12.83	16.84	2.67	0.92	7.72
Depression	3.85	2.05	7.14	1.90	0.51	7.08	2.30	1.49	3.12	6.49	2.43	17.33
Alcohol	7.41	5.11	10.63	1.79	0.76	4.18	6.95	5.35	8.54	4.28	1.34	13.73

Trauma types first experienced as adult												
None	15.84	12.53	19.83	1.00			40.39	37.46	43.32			
Low (1 or 2)	39.22	34.71	43.92	1.48	0.58	3.75	41.97	38.76	45.19	2.94	1.05	8.19
High (3+)	44.94	40.56	49.39	3.54	1.43	8.77	17.64	15.15	20.13	8.35	2.04	34.19
Adult trauma class (controlled for each other)												
Unclassified	73.88	69.52	77.82	0.98	0.51	1.90	44.31	41.73	46.89	2.68	1.00	7.22
Non-interpersonal	53.74	49.15	58.27	1.78	1.01	3.14	28.36	25.34	31.39	1.66	0.42	6.50
Non intimate interpersonal	23.67	19.80	28.04	1.54	0.84	2.81	15.16	12.94	17.39	1.44	0.51	4.07
Intimate interpersonal	4.47	3.41	5.86	0.78	0.31	1.95	4.53	3.42	5.65	3.59	1.20	10.76
Adult onset disorder (controlled for each other)												
Anxiety	12.40	10.45	14.65	1.19	0.59	2.40	7.96	6.38	9.55	1.57	0.48	5.16
Depression	12.81	10.74	15.21	4.16	2.23	7.78	7.07	5.12	9.01	1.83	0.64	5.26
Alcohol	30.38	26.27	34.83	1.32	0.77	2.26	28.59	25.40	31.78	0.88	0.39	1.99
Service factors controlled for military factors and demographics												
Service (controlled for rank)												
Navy	23.19	21.60	22.38	1.00								
Army	52.82	52.35	53.29	0.94	0.89	1.01						
RAF	25.19	24.78	25.60	0.84	0.79	0.90						
Rank (controlled for service)												
Officers	21.99	22.80	23.59	1.00								
Non-comissioned Officers	45.17	44.70	45.64	1.17	1.07	1.28						
Other ranks	31.64	31.20	32.08	1.35	1.22	1.50						
Military experiences (controlled for service and rank)												
Combat exposure	31.74	27.88	35.88	1.07	0.61	1.87						
Deployment	63.33	63.18	63.49	0.97	0.92	1.02						

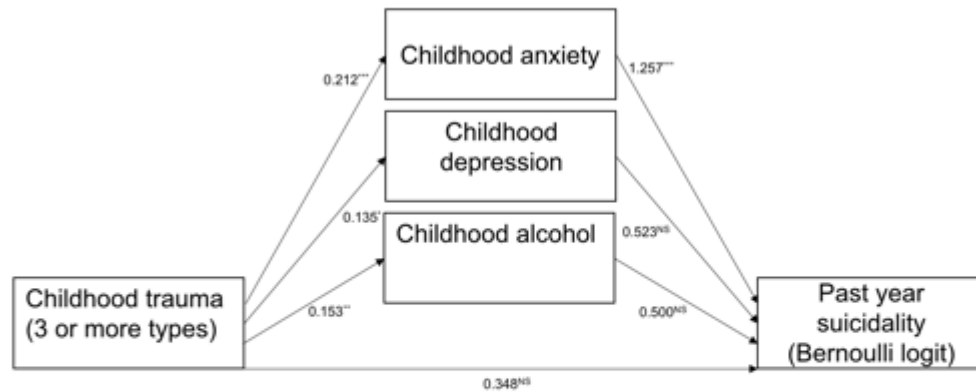
Table 3: Childhood regression comparison controlling for demographics

All males 18-60	Model 1			Model 2		
	ADF	ABS		ADF	ABS	
	aOR	95% CI	aOR 95% CI%	aOR	95% CI	aOR 95% CI%
Childhood disorder						
Anxiety	3.52	1.91 6.48	2.34 0.66 8.37	3.37	1.68 6.77	2.24 0.56 8.93
Depression	1.69	0.41 6.99	5.01 1.58 15.85	2.05	0.51 8.28	5.86 1.53 22.44
Alcohol use	1.65	0.69 3.95	3.55 0.97 13.03	1.69	0.69 4.16	2.61 0.57 12.03
Count childhood onset trauma types						
Three or more	1.42	0.67 2.99	2.73 0.66 11.28	1.25	0.59 2.67	2.32 0.51 10.57
Adult onset disorder						
Anxiety				1.70	0.79 3.67	1.69 0.37 7.82
Depression				3.79	1.89 7.61	1.54 0.36 6.52
Alcohol				1.28	0.70 2.31	0.84 0.31 2.27
Count adult onset trauma types						
Low				1.07	0.43 2.67	2.51 0.82 7.67
High				1.74	0.66 4.59	4.82 1.17 19.88

Table 4: ADF regression controlling for service and demographic factors
All males 18-60 **Past year suicidality**

	MODEL 1: childhood trauma aOR 95% CI			MODEL 2: Model 1+ combat aOR 95% CI		
Childhood disorder						
Anxiety	3.40	1.72	6.75	3.39	1.71	6.75
Depression	1.93	0.46	8.18	1.90	0.44	8.22
Alcohol	1.68	0.67	4.19	1.68	0.67	4.21
Count childhood onset trauma types						
3 or more	1.26	0.59	2.68	1.25	0.58	2.68
Adult onset disorder						
Anxiety	1.77	0.84	3.75	1.78	0.85	3.73
Depression	3.83	1.93	7.60	3.82	1.93	7.56
Alcohol	1.22	0.66	2.24	1.23	0.67	2.25
Count adult onset trauma types						
Low	1.04	0.42	2.56	1.06	0.42	2.67
High	1.64	0.65	4.16	1.72	0.62	4.73
Adult combat				0.89	0.48	1.66

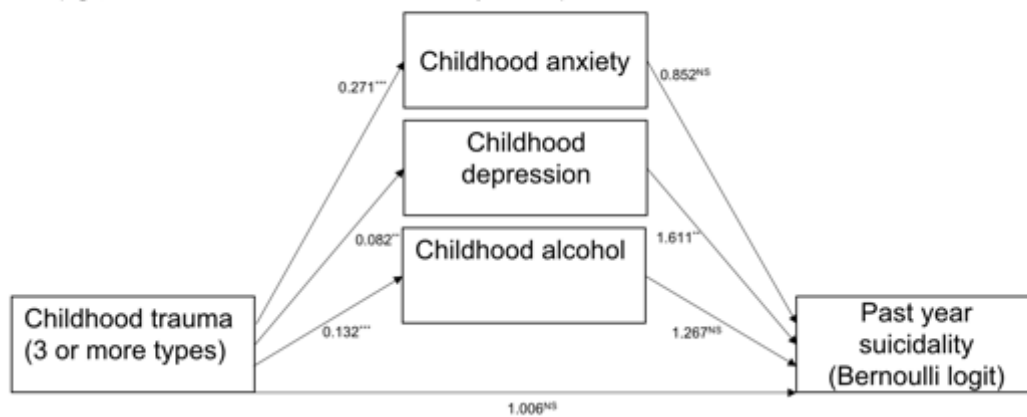
Figure 1: Military male mediator pathways through childhood disorder, controlling for demographics (age, education and current relationship status)



	Co-ef.	P
Total (controlled for age, education and current relationship)	0.677	0.003
Mediator Analysis (controlled for age, education and current relationship)		
<i>Indirect</i>		
Childhood anxiety	0.266	0.007
Childhood depression	0.132	0.014
Childhood alcohol	0.070	0.430
<i>Direct</i>	0.348	0.061

Coefficients are shown
*p<0.05, **p<0.01, ***p<0.001

Figure 2: Civilian male mediator pathways through childhood disorder, controlling for demographics (age, education and current relationship status)



	Co-ef.	P
Total (controlled for age, education and current relationship)	1.59	0.000
Mediator Analysis (controlled for age, education and current relationship)		
<i>Indirect</i>		
Childhood anxiety	0.231	0.164
Childhood depression	0.132	0.014
Childhood alcohol	0.167	0.074
<i>Direct</i>	1.006	0.155

Coefficients are shown
*p<0.05, **p<0.01, ***p<0.001

Discussion

Main findings

The prevalence of suicidality was substantially higher in ADF than civilian males. Suicidality was associated with being single in both populations. In both populations, suicidality was associated with high counts of childhood trauma (3 or more types), as well as high counts of trauma types first experienced in adulthood. In the ADF, combat exposure was not associated with suicidality (in any model).

There were substantially higher proportions of those with high counts of childhood trauma types and high counts of adult trauma types in the ADF than civilians. Childhood non-interpersonal trauma, such accidents, and unclassified trauma (in the absence of interpersonal trauma) were not associated with suicidality in either population. Childhood anxiety (but not depression or alcohol use disorders) had a strong and independent association with suicidality in the ADF (controlling for demographics and childhood trauma) which remained when controlling for adult trauma and adult onset disorder. In contrast, in civilians, this was the case for childhood depression (but not anxiety or alcohol use disorders). Adult onset depression was associated with suicidality in the ADF, but not in civilians. GSEM suggested that childhood anxiety fully mediated the relationship between childhood trauma and suicidality in the ADF. Whereas, in civilians, the association of childhood trauma with suicidality appeared to be fully mediated via childhood disorder, most notably childhood depression, but not by any of the individual disorder types alone.

Comparison with other studies

In agreement with studies in the USA and Canada, (Kuehn, 2009) (Afifi *et al.*, 2016) the rate of suicidality was higher in the military than the civilian population. Given that youth (15-24 years old) suicide has been found to be higher than the average rates in Australia and New Zealand (Pritchard, 1992) and is the leading cause of death in those aged 25-44 years in Australia, (Kinchin and Doran, 2018) this is an issue of importance. The rate of past year suicidal thoughts in the ADF was similar to that in the Canadian military, (Afifi *et al.*, 2016) but less than that in the US military. (Nock *et al.*, 2014)

Consistent with studies in civilian populations, (Dube *et al.*, 2001) (Harford *et al.*, 2014) and another in the military, (Afifi *et al.*, 2016) childhood adversity was associated with suicidality. However, our study investigated childhood traumatic experiences, but not certain items included in studies of childhood adversity, such as neglect.

In terms of demographics, once childhood factors were included in our analysis, the only demographic factor associated with suicidality, in both populations, was being single. A recent meta-analysis demonstrated that being single significantly increased risk for ideation and death, but not attempts. (Huang *et al.*, 2017)

The Canadian study (Afifi *et al.*, 2016) looked particularly at childhood abuse and deployment-related trauma, in contrast to our broader definitions of both childhood and adult trauma. However, consistent with our findings, child abuse was associated with suicidality,

and was a stronger indicator of suicidality than deployment-related trauma. However, childhood disorder, and its role in these relationships was not explored in that study.

Military studies have not tended to explore childhood disorder. However, there are studies that shed light on these phenomena in civilian populations. One such study prospectively demonstrated that the total number of childhood adversities had a strong graded relationship with new onset suicidality. In the case of both physical abuse and neglect (but not other adversities), an association remained once other types of adversity and disorder were controlled for. However, that study did not include PTSD, a major factor in the pathway between childhood trauma exposure and suicidality. (Enns *et al.*, 2006a)

A US Army research project looked specifically at disorder (pre and post-enlistment) and suicidality in order to delineate the relationships. (Nock *et al.*, 2009) Whilst their measurements and predictors were dissimilar to those used in this study, interestingly and consistent with our findings, the pre-enlistment disorders relating to suicidality were both anxiety disorders, namely panic disorder and PTSD. The authors stated that approximately one-third of post-enlistment suicide attempts were associated with pre-enlistment mental disorders suggesting that pre-enlistment mental disorders are potential targets for early intervention.

Recently, studies in general populations have highlighted anxiety as an important independent determinant of suicidality, (Sareen *et al.*, 2005) and also as a mediator of the relationship between childhood trauma and suicidality. (Bahk *et al.*) These studies found evidence for state and trait anxiety as risk factors for adolescent suicidal behaviors, (Ohring *et al.*, 1996) and also features of anxiety within affective disorders as risk factors for adult

suicidality.(Fawcett *et al.*, 1990) Importantly, there is evidence of anxiety disorders (particularly panic and PTSD) as independent predictors of adult suicidality, including attempts, (Cogle *et al.*, 2009) in males.

Strengths

This is the first study, of which we are aware, to investigate childhood trauma and childhood disorder simultaneously in determining suicidality in a military population compared with a civilian employed population. Both of these datasets provide detailed interview data on lifetime disorder and trauma. The classification of people into mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load which has been a particular challenge for research on childhood experiences. (39)

Weaknesses

This analysis utilized two cross-sectional surveys. The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. However, such retrospective reporting of childhood experiences is more prone to false negatives than positives and if well defined, as in this study, has good reliability. (40)

There may appear to be a low response rate in the ADF sample. However, unlike most surveys, the demographic and health status of the ADF members who did not respond at each

stage was known. This was accounted for in the back-weighting of the sample to minimise any error. However, it is possible that there may be an underestimate of the impact of childhood adversity in this sample, due to false negatives.

As our principle aim was to compare the male ADF and civilian populations, only male employed civilian subjects were included. Therefore, the poorer functioning unemployed male civilian population, are not included in this analysis. In addition, we did not include a measure of other forms of childhood adversity, such as neglect.

Conclusions

These data demonstrate the need to take a whole life approach to understanding suicidality and the importance of categorizing the nature of childhood trauma exposure. Particularly, there was a lack of association between childhood trauma that was not interpersonal in nature (such as accidents) and adult suicidality, in both populations.

The comparison with employed civilians provides insights into the relative magnitude of child and adult aspects of traumatic experiences and their impact on suicidality, as well as how these relate to childhood and adult onset disorder. The higher proportion of those who had three or more types of childhood trauma in the military compared with civilians, highlights how military service may provide a refuge for a subgroup of recruits who then carry this vulnerability into their service. This risk matrix is an important consideration in understanding suicidality in military and veteran populations.

Importantly, we have extended our understanding of the importance of childhood disorders as mediators of childhood traumatic experiences and suicidality. In the ADF, childhood anxiety was not only independently associated with suicidality, but also and in contrast to civilians, fully mediated the association between childhood trauma and suicidality. In addition, adult onset depression was also associated with suicidality in the military but not the civilian population. This has etiological implications for the importance of these factors in a population more highly exposed to trauma. These findings have the potential to inform the development of strategies for suicide prevention.

Chapter 9: Paper 5. Childhood

determinants of current

psychological distress and days out

of role in military and civilian

employed men

Chapter 10:

Statement of Authorship

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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff
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Overall percentage (%)	90%
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or

	contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Signature		Date	04/10/19

ABSTRACT

Objective: To investigate the relationship between childhood factors (trauma and disorder) and current self-reported psychological distress ($K10 \geq 25$) and severely impaired occupational functioning (eight or more days out of role in the previous 30 days) in the ADF compared with Australian employed civilian men aged 18-60. **Methods:** Data derived from the 2010 ADF MHPWS, and the 2007 ABS NSMHW were analysed using logistic regression. **Results:** A higher proportion of ADF reported distress (7.3%, 95%CI: 7.2-7.5) than ABS men (3.0%, 95% CI: 2.2-3.7). In both populations childhood interpersonal trauma was associated with distress whereas the association with childhood non-interpersonal trauma was only significant in ADF men (3.19, 95%CI: 1.50-6.79). In ABS men, all childhood disorder categories had a direct and significant association with distress whereas in ADF men the association was only significant for childhood anxiety. Impaired functioning was reported by a significantly higher proportion of ABS (3.7, 95%CI: 2.7-4.8) than ADF men (1.3%, 95%CI: 1.2-1.3). All childhood variables other than childhood anxiety were associated with impaired functioning in ABS men. In contrast, childhood non-interpersonal trauma had an inverse association and childhood anxiety (but not depression or alcohol use disorders) was associated with impaired functioning in ADF men. **Conclusions:** Whether differences between populations are due to risk factors being different in more trauma exposed populations or due to selection is beyond the scope of this study. However, this illustrates the need for population specific studies and elucidates factors for further longitudinal exploration essential to better inform early intervention and prevention strategies.

INTRODUCTION

Military service is generally accepted as having an impact on mental health (Bryan *et al.*, 2013, Hoge *et al.*, 2004, Prigerson *et al.*, 2002). However, the respective roles of military life, (Riddle *et al.*, Sareen *et al.*, 2013b) the specific impact of deployment (Boulos and Zamorski, 2016, Hotopf *et al.*, 2006) and the higher rates of childhood adversity/trauma observed in military populations, (Blosnich *et al.*, 2014, Iversen *et al.*, 2007b) remains unclear (Jones *et al.*, 2013). In addition, there is a dearth of evidence regarding the role of childhood mental disorder in determining military mental health. It has previously been demonstrated that there is an association between childhood trauma/adversity and adult physical and mental disorder in both civilian and military populations (Felitti *et al.*, 1998, Iversen *et al.*, 2007b, Youssef *et al.*, 2013).

Self-reported measures of psychological distress are often used in epidemiological studies to estimate the prevalence of mental disorder (Furukawa *et al.*, Kessler *et al.*, 2002, Searle *et al.*, 2015). However, psychological distress and mental disorder, whilst related (Kessler *et al.*, 2002), are not on a single continuum and can be regarded as important separate concepts (Payton, 2009). Distress is an important determinant of the mental health impact of trauma (Searle *et al.*, 2017), mental disorders with a more severe/chronic course (Call *et al.*, 2015), and other outcomes such as suicidality (Smith *et al.*, 2016, Zimmermann *et al.*, 2012), somatic symptoms (Clarke *et al.*, 2008), functioning (Blanc *et al.*) and help-seeking behaviour (Waitzkin *et al.*, 2018).

A concept that is related to psychological distress and mental disorder is role function. Whilst previous studies have demonstrated that childhood adversity is associated with

unemployment in civilian populations (Liu *et al.*, 2013), and early separation from service in military populations (Buckman *et al.*, 2013a, Patrick *et al.*, 2011), very few have investigated the occupational role function of those still employed.

We set out to investigate the association between childhood factors (trauma and mental disorder) with psychological distress and days out of role in the ADF and, where possible to compare this with the employed civilian population. We did not have sufficient female responders in the ADF for a meaningful separate analysis. Therefore, due to evidence of important gender differences within military populations (Rona *et al.*, 2007), we have limited this analysis to men. As the Australian Defence Force (ADF) is an employed population we compared ADF men between the ages of 18 and 60 with employed civilian men of the same age range.

Methods

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis.

Military study (ADF sample)

The 2010 ADF Mental Health Prevalence and Wellbeing Study (MHPWS) employed a two-phase design to estimate the prevalence of ICD-10 mental disorders (Van Hooff *et al.*, 2014). This two-phase design is well accepted for investigating mental disorder prevalence (Dunn *et al.*, 1999). The responses to the survey and interview were de-identified and participants were informed that no personal details, including whether or not they participated in the study would be provided to Defence.

At Phase 1, all regular Australian Defence Force (ADF) personnel (i.e. excluding trainees and reservists) serving in 2010 (N= 50049), were invited to complete a self-report questionnaire, including basic demographics, the Kessler Distress Scale (K10) (Andrews and Slade, 2001), the Posttraumatic Stress Disorder Checklist (PCL) (Ventureyra *et al.*, 2002) and the Alcohol Use Disorders Identification Test (AUDIT) (Conigrave *et al.*, 1995). In all, 24481 participants provided usable data at Phase 1. Fifteen percent of the eligible participants from Phase 1 were stratified and selected for participation in Phase 2. Participants were selected for Phase 2 with the joint aims of ensuring sufficient power within key demographic groups and to ensure a cross-section of scores on the self-reported measures of mental health. Therefore, eligibility for Phase 2, was based on Service, sex, and scores on the PCL and AUDIT. The 60th and 80th percentiles of the PCL and AUDIT distributions were used as cut-offs to form three stratification bands. The 80th percentile was suitable as a cut-off for 'high scorers' as it was deemed a conservative lower bound on what the diagnostic cut-off could be. The 60th percentile was chosen as a further cut-off to provide reasonable numbers of participants just below the first cut-off. Using these bands, the higher-scoring ADF members (those in Bands 2 and 3) were oversampled to enable adequate power in analyses of low prevalence disorders.

At Phase 2, The World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) was utilized. Of the 3688 participants selected for Phase 2, 1798 (49%) completed a CIDI interview. Taylor series linearization was used to estimate variance.

To develop weights, demographic information (e.g. sex, service and rank) was obtained from ADF administrative data. Weights were applied at both phases to provide population prevalence estimates. At Phase 1, to correct for differential non-response, survey results were weighted based on strata derived from sex, service, rank, and Medical Employment Classification (MEC) status which is a 4-point scale indicating medical fitness for duty. Separate weights were calculated for each section of the survey. A finite population correction was applied to adjust the variance estimates.

At Phase 2, within each stratum, the weight was calculated as the population size divided by the number of respondents from each phase 2 stratum. As band was not available for non-responders, the population size within each stratum was estimated by multiplying the sex by service population total by the observed proportion belonging to the band of interest from within the corresponding stratum. A finite population correction was also applied to adjust the interview variance estimates.

When outputs by sex, service, and rank were required, post-stratification by these variables was used to adjust the weights so that known population totals were reproduced by the estimates. This also accounted for the known differential non-response by rank to the survey. For the purposes of this study, output for males was achieved by post-stratification to adjust the weights so that known population totals were reproduced by the estimates. A total of 43207 (86.3%) of the ADF were males aged 18-60. Of these, 1356 had a CIDI interview which was weighted to represent all 43207 males aged 18-60.

Civilian study (ABS sample)

The 2007 ABS (Australian Bureau of Statistics) National Survey of Mental Health and Wellbeing (NSMHWB) was based on a stratified, multistage area probability sample of residents aged 16–85 years across all states and territories in Australia. (Slade *et al.*, 2009a) Person weights (used in this study) were calibrated to independent estimates of population benchmarks in order to minimise sampling error of estimates and the level of non-response bias. Population benchmarks were obtained from the 2006 Australian Census, as well as from the 2007 Australian Survey of Education and Work. This allowed weighting of the sample according to the probability of being selected, so that the final sample of 8841 represented the entire estimated population of Australian adults.

For the purposes of this study, all employed males aged 18-60 were selected. Those who said they had served in the ADF, received a DVA pension or experienced combat exposure were then excluded. A total of 2120 employed civilian males in the general population (ABS) had a CIDI interview which was weighted to represent all 4.67 million (CI 4.54 – 4.79 million) employed civilian males. Person and replicate weights were applied to this data to ensure that subpopulation weighting was correct.

Measures

Mental Disorder

The Composite International Diagnostic Interview (CIDI), (Kessler and Ustun, 2004) consisting of a structured diagnostic assessment of lifetime, 12-month and 30-day International

Classification of Diseases 10th revision (ICD-10) disorder, was utilized in both studies. Affective, anxiety and alcohol use disorders were assessed based on standard CIDI algorithms with ICD hierarchical rules applied. Categories were depression (mild, moderate or severe depressive episode), anxiety (social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, PTSD) and alcohol use disorder (abuse or dependence).

Traumatic experiences

Respondents were asked whether they had experienced any of 27 specific experiences listed in the CIDI. They were then asked whether they had ever experienced any ‘other extremely traumatic or life-threatening event’ or a ‘private event’ they did not wish to talk about. To determine age at onset of each experience, respondents were asked how old they were when it first happened to them.

We defined childhood trauma as those with age of onset below 18. Adult trauma refers to trauma types first experienced aged 18 or over. Childhood trauma types were classified as follows (Forbes *et al.*, 2014); non-interpersonal trauma (exposed to a toxic chemical, life-threatening automobile accident, other life-threatening accident, man-made disaster, life-threatening illness, major natural disaster) and interpersonal trauma (sexual assault, raped, stalked, beaten by spouse/romantic partner, beaten by parents /guardian as a child, badly beaten by anyone else, kidnapped or held captive, mugged, held up or threatened with a weapon). These are abbreviations of the questions from the CIDI (Kessler and Ustun, 2004).

Due to the co-occurrence of childhood trauma types (Green *et al.*, 2010), we then categorized individuals based on our previous studies (ref blinded for peer review) into mutually exclusive childhood trauma categories, as follows, ‘non-interpersonal’ trauma (without interpersonal trauma) and any ‘interpersonal trauma’. We categorized those who experienced childhood trauma that did not fit into the previous categories as ‘other’ trauma. Other childhood trauma included those who experienced the following types of trauma in childhood, without either non-interpersonal or interpersonal trauma: child had life threatening illness/injury; combat; refugee; peacekeeper; purposefully injured/tortured/killed someone; other traumatic event; unarmed civilian in a place of conflict; accidentally injured/killed someone; lived as a civilian in a place of ongoing terror; experience don’t want to talk about; saw atrocities or carnage; someone close had traumatic experience; witness serious physical fights at home as a child; someone close died; saw someone badly injured. These mutually exclusive childhood trauma categories were therefore exhaustive of the lifetime trauma types asked about in the CIDI.

Current Psychological Distress and Days out of Role

Measures of psychological distress and days out of role were included in the self-report questionnaire at Phase 1 of the ADF study. However, in the ABS study, measures of distress and days out of role were included in the face to face interview.

Current psychological distress was measured using the K10 (Andrews and Slade, 2001) in both the ADF and ABS. The K10 comprises 10 items with five available responses, ranging from 1 (“none of the time”) to 5 (“all of the time”), it is therefore scored out of 50. The K10 has undergone validity studies in both the Australian community (Slade *et al.*, 2009a) and in the ADF. (Searle *et al.*, 2015) However, to the best of our knowledge there have been no validity studies specifically in the Australian employed population and there is a lack of evidence to suggest that the community cut-offs are applicable to either to the ADF or to the employed civilian male sample. The ADF validated cut-offs for affective/anxiety disorders, for epidemiological purposes, is 25. (Searle *et al.*, 2015) This is similar to that used for the Australian community in the Victoria Population Health Survey, (Services, 2001) which used a cut-off of 25 for high/very high distress (Services, 2001). Therefore, a cut-off of 25 was used to signify ‘current high-levels of psychological distress’ in this current study across both populations, to allow direct comparison (Searle *et al.*, 2015).

In the ADF, items relating to days out of role were included in the self-report questionnaire immediately following the K10. Respondents were asked ‘In the past four (4) weeks, how many days were you TOTALLY UNABLE to work, study or manage your day to day activities because of these feelings?’, with ‘these feelings’ referring to the feelings of psychological distress asked about in the K10. In contrast, in civilians, items relating to days out of role were asked immediately following the K10 in the face to face interview.

Respondents were asked how many days they were totally unable to perform their normal activities as a result of health problems. A cut-off of eight or more full days out of role in the previous 30 days was chosen to reflect a severe reduction in role function to compare across both populations. This equates with the number of days those who made suicide plans reported over the previous 30 days in the Australian community (Slade *et al.*, 2009b).

Adult Demographics and service characteristics

In the ABS, prior to the CIDI interview, socio-demographic information was collected, including age, education and relationship status. In the ADF, information regarding age, education and relationship status was available from the self-report questionnaire and further information regarding service characteristics was available from ADF administrative data.

Analysis

All analyses were performed in STATA version 14.2, accounting for complex survey designs. P values were not calculated due to the complexities associated with accurately testing results across 2 complex surveys. The term 'significant' is used to describe differences when the 95% confidence intervals do not overlap.

Firstly, associations of childhood characteristics with current psychological distress and days out of role were analyzed in both populations. Next, in both populations, logistic regression analyses were utilized to calculate adjusted odds ratios (aORs) for current psychological distress and days out of role by demographic and adult factors (as well as service factors in the ADF only).

This was then repeated for childhood factors (trauma and disorder) controlling for each other (Model 1) and then controlling for demographic factors and adult trauma (Model 2).

childhood mental disorder variables. This was then repeated in the ADF only to control for service factors (rank and service branch) and previous deployment.

RESULTS

As of 2010, 7.4% (95%CI: 7.2-7.5) of ADF men compared with 3.0% (2.2-3.7) of employed civilians men aged 18-60 had current psychological distress as defined previously (K10 cut-off of 25). In ADF men, distress was associated with childhood anxiety, but not childhood depression or alcohol use disorders. In employed civilian men, distress was associated with childhood anxiety, depression and alcohol use disorders. In ADF men, distress was associated with interpersonal and non-interpersonal childhood trauma, but **not** other types of childhood trauma whereas in civilian employed men, it was associated with childhood interpersonal trauma only.

A higher proportion of civilian employed men had 8 or more days out of role (3.7, 95%CI: 2.7-4.8) than ADF men (1.3%, 95%CI: 1.2-1.3). In the ADF days out of role was associated with childhood interpersonal trauma and inversely associated with childhood non-interpersonal trauma, whereas in civilian employed men it was associated with all categories of childhood-onset trauma. In the ADF days out of role was associated with childhood anxiety whereas in civilian employed men it was associated with childhood depression and alcohol (See Table 1).

In ADF men, current psychological distress was associated with lower educational attainment and being single (but not age). In civilian employed men, current psychological distress was

associated with being older and with being single. In ADF men, current psychological distress was associated with being in the Navy, with not being an Officer, and no previous deployment.

In ADF men, eight or more full days out of role was associated with being older (than 35), lower educational attainment, and being single and adult trauma. It was also associated with not being an Officer. In civilian men, more than 8 full days out of role was associated with being single and adult-onset trauma. (see Table 2)

In ADF men, the association between current psychological distress and childhood factors (trauma and disorder) remained the same when controlling for each other, demographic factors and adult-onset trauma. However, in contrast, in civilian employed men the association between childhood trauma and current psychological distress became non-significant when controlling for childhood disorder. A direct and significant association remained between current psychological distress and childhood depression and anxiety.

In ADF men the significant association between days out of role and childhood non-interpersonal trauma remained when controlling for childhood disorder. However, in the fully adjusted model only childhood interpersonal trauma was associated with days out of role in ADF men. In civilian employed men, in the fully adjusted model eight or more full days out of role was associated with childhood non-interpersonal trauma, interpersonal trauma, depression and alcohol use disorders. (see Table 3). These associations remained the same when controlling for service factors and previous deployment in ADF men. (see Table 4)

Paper 5: Tables

Table 1: Associations of current psychological distress and days of role with childhood factors

		ADF men (18-60), N= 1356									Civilian employed men (18-60), N= 2120								
		Proportion			Current psychological distress (K10>=25)			Eight or more days out of role (of the previous 30 days)			Proportion			Current psychological distress (K10>=25)			Eight or more days out of role (of the previous 30 days)		
		%	95% CI		aOR	95% CI		aOR	95% CI		%	95% CI		aOR	95% CI		aOR	95% CI	
High distress		7.3	7.2	7.5							3.0	2.2	3.7						
8 or more days out of role		1.3	1.2	1.3							3.7	2.7	4.8						
CHILDHOOD trauma																			
Category	None	43.8	39.3	48.3	1.00			1.00			57.8	54.9	60.7	1.00			1.00		
	Other	16.5	13.9	19.5	1.36	0.75	2.46	0.35	0.09	1.28	17.5	15.2	19.9	1.84	0.62	5.40	2.59	1.07	6.28
	Non-interpersonal	17.0	13.5	21.3	3.19	1.50	6.79	0.19	0.03	0.98	9.1	7.4	10.8	2.09	0.71	6.16	3.05	1.17	7.96
	Interpersonal	22.6	19.0	26.7	3.67	2.23	6.04	2.83	1.09	7.33	15.6	13.3	17.9	3.25	1.46	7.25	3.63	1.62	8.15
CHILDHOOD disorder																			
Type	Anxiety	17.2	13.7	21.2	3.92	2.26	6.80	2.35	1.01	5.46	14.8	12.8	16.8	3.16	1.72	5.81	0.85	0.40	1.82
	Depression	3.9	2.0	7.1	1.32	0.31	5.64	1.78	0.35	9.00	2.3	1.5	3.1	5.74	2.80	11.74	5.18	5.18	17.36
	Alcohol	7.4	5.1	10.6	1.86	0.71	4.90	0.53	0.09	3.01	6.9	5.4	8.5	2.79	1.38	5.62	3.11	1.30	7.47
aOR= adjusted Odds Ratio, controlling for childhood trauma and childhood disorder separately																			

Table 2: Population characteristics and associations with current psychological distress and days out of role

		ADF men (18-60)									Civilian employed men (18-60)								
		Proportion			Current psychological distress (K10 \geq 25)			Eight or more days out of role (of the previous 30 days)			Proportion			Current psychological distress (K10 \geq 25)			Eight or more days out of role (of the previous 30 days)		
		%	95% CI		aOR	95% CI		aOR	95% CI		%	95% CI		aOR	95% CI		aOR	95% CI	
DEMOGRAPHICS																			
Age	<25	18.9	18.8	19.0	1.00			1.00			15.76	14.26	17.26	1.00			1.00		
	25-34	36.3	36.2	36.5	0.94	0.87	1.01	2.19	1.69	2.84	24.07	22.18	25.97	2.70	1.00	7.23	1.65	0.60	4.53
	35-44	28.1	28.0	28.3	0.93	0.86	1.01	2.58	1.98	3.37	26.67	24.92	28.41	2.06	0.85	4.97	1.25	0.43	3.62
	45+	16.6	16.5	16.7	0.96	0.88	1.04	2.49	1.90	3.28	33.50	31.84	35.17	2.67	1.10	6.51	1.44	0.66	3.11
Highest Education	Year 10	11.3	11.2	11.4	1.00			1.00			13.64	11.63	15.65	1.00			1.00		
	Certificate or diploma	38.6	38.4	38.7	0.75	0.70	0.81	0.63	0.52	0.76	41.29	38.85	43.72	1.28	0.47	3.43	0.58	0.14	2.39
	Year 11/12	30.3	30.2	30.5	0.72	0.66	0.78	0.96	0.79	1.16	21.85	19.42	24.27	0.96	0.36	2.56	0.57	0.12	2.73
	University degree	19.8	19.7	19.9	0.54	0.49	0.58	0.37	0.30	0.47	23.23	21.15	25.31	0.51	0.16	1.57	0.32	0.07	1.58
Relationship status	No current significant relationship	24.4	24.2	24.5	1.00			1.00			34.51	37.22	31.80	1.00			1.00		
	Current significant relationship	75.6	75.5	75.8	0.64	0.60	0.68	0.63	0.52	0.75	65.49	62.78	68.20	0.38	0.22	0.68	0.56	0.32	0.98
ADULT trauma	MEAN	2.8	2.6	3.0	1.18	1.09	1.29	1.16	1.02	1.31	1.28	1.18	1.38	1.32	1.13	1.54	1.18	1.02	1.36
SERVICE factors																			
Service	Navy	22.0	21.6	22.4	1.00			1.00											
	Army	52.8	52.3	53.3	0.84	0.79	0.89	1.08	0.93	1.26									
	RAF	25.2	24.8	25.6	0.72	0.68	0.76	0.86	0.73	1.02									
Rank	Officers	23.2	22.8	23.6	1.00			1.00											
	Non-commissioned Officers	45.2	44.7	45.6	1.17	1.08	1.26	1.23	1.01	1.49									
	Other ranks	31.6	31.2	32.1	1.60	1.46	1.75	2.40	1.90	3.02									
Experiences	Combat exposure	31.7	27.9	35.9	0.81	0.58	1.13	0.57	0.25	1.30									
	Deployment	61.6	61.5	61.8	0.76	0.72	0.80	0.96	0.83	1.11									

aOR's: adjusted Odds Ratios, all control for demographics
Service factors (ADF only): aOR's all control for demographic factors, service and rank
Standard Error for Adult trauma mean in ADF= 0.099
Standard Error for Adult trauma mean in Civilian Employed men=0.056

	Current psychological distress (K10>=25)												Eight or more days out of role (of the previous 30 days)											
	ADF men (18-60)						Civilian employed men (18-60)						ADF men (18-60)						Civilian employed men (18-60)					
	Model 1			Model 2			Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
Childhood factors	aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI		aOR	95% CI	
Childhood trauma																								
None	1.00						1.00			1.00			1.00			1.00			1.00			1.00		
Other	1.17	0.62	2.22	1.10	0.58	2.10	1.52	0.51	4.58	1.42	0.48	4.23	0.33	0.09	1.20	0.30	0.08	1.10	2.37	0.99	5.67	2.45	0.98	6.09
Non-interpersonal	2.76	1.48	5.14	2.72	1.47	5.03	1.80	0.57	5.66	1.60	0.50	5.10	0.18	0.03	0.95	0.19	0.03	1.06	2.93	1.08	7.95	2.86	1.07	7.62
Interpersonal	2.37	1.32	4.27	2.13	1.19	3.83	1.85	0.83	4.11	1.50	0.67	3.34	2.50	1.00	6.28	2.68	1.12	6.44	3.15	1.42	7.00	2.71	1.10	6.67
Childhood disorder																								
Anxiety	3.08	1.80	5.28	2.93	1.71	5.01	2.81	1.58	5.01	2.77	1.54	4.98	1.62	0.71	3.69	1.54	0.70	3.38	0.66	0.33	1.32	6.67	0.33	1.45
Depression	1.22	0.34	4.32	1.07	0.29	3.90	5.54	2.78	11.04	5.90	2.96	11.75	1.61	0.28	9.26	1.31	0.30	5.72	5.14	1.54	17.14	4.95	1.51	16.25
Alcohol	1.47	0.62	3.51	1.47	0.61	3.56	2.44	1.23	4.86	2.08	0.95	4.52	0.42	0.06	2.79	0.49	0.09	2.84	2.55	1.04	6.25	2.31	0.97	5.50
Adult factors																								
Adult-onset trauma type count				1.12	1.03	1.22				1.24	1.06	1.46				1.09	0.96	1.24				1.08	0.91	1.29
Current relationship				0.49	0.29	0.83				0.41	0.21	0.81				0.16	0.06	0.39				0.59	0.34	1.01

Model 1 controls for childhood factors (trauma and disorder) only. Model 2 controls for childhood factors (trauma and disorder), demographic factors (relationship status, age and educational attainment) and adult onset trauma count

Table 4: Regression analysis ADF only						
	Current psychological distress (K10>=25)			Eight or more days out of role (of the previous 30 days)		
	aOR	95% CI		aOR	95% CI	
Childhood factors						
Childhood trauma						
None	1.00			1.00		
Other	1.18	0.62	2.25	0.28	0.08	1.02
Non-interpersonal	2.72	1.45	5.11	0.18	0.03	1.04
Interpersonal	2.22	1.24	3.96	2.60	1.10	6.12
Childhood disorder						
Anxiety	2.95	1.73	5.03	1.55	0.67	3.55
Depression	0.89	0.25	3.21	1.42	0.31	6.49
Alcohol	1.37	0.58	3.26	0.48	0.08	2.87
Adult trauma count	1.15	1.05	1.25	1.09	0.95	1.25
Significant intimate relationship	0.52	0.31	0.88	0.15	0.06	0.37

Controlling for childhood factors, adult trauma count, demographics (age, relationship and educational attainment) and service factors (rank, service branch and previous deployment)

DISCUSSION

This study demonstrated that there is a higher prevalence of current psychological distress, but a lower prevalence of 8 or more days out of role, in ADF than in civilian employed men. This concerningly implies that whilst functioning and not demonstrating higher prevalence of mental disorder (Sheriff *et al.*, 2019b), a higher proportion of ADF men are distressed and potentially at risk of poor outcomes. This study was consistent with previous studies in establishing an association between interpersonal childhood trauma and current psychological distress in military (Agorastos *et al.*, 2014, Iversen *et al.*, 2007b) and civilian populations (Behnke *et al.*, 2019, Felitti *et al.*, 1998).

Non-interpersonal childhood trauma such as natural disasters or accidents (in the absence of interpersonal trauma) was associated with current psychological distress in ADF men but not civilian employed men. Non-interpersonal childhood trauma was also inversely associated with 8 or more days out of role in ADF men but positively associated with 8 or more days out of role in civilian employed men. Whilst there are many studies regarding childhood maltreatment and abuse and adult outcomes, there are fewer regarding the effects of non-interpersonal trauma and again these observe adult disorder as opposed to distress per se (McFarlane and Van Hooff, 2009a).

Childhood disorders had very different associations in ADF and civilian employed men. Whereas childhood anxiety was associated with both current psychological distress and 8 or more days out of role in ADF, it was not associated with either outcome in civilian employed men. Whereas childhood depression and alcohol use disorders were not associated

with distress or days out of role in ADF men, exactly the opposite was found in civilian employed men.

We could not locate any other studies in military populations with which to compare our findings. The comparability of our findings was limited and many longitudinal studies observe rates of disorders rather than distress per se (Fryers and Brugha, 2013). Interestingly in a sample of emergency medical staff childhood maltreatment was associated with poorer resilience in the face of additional occupational trauma (Behnke *et al.*, 2019).

The differences between the civilian population and the ADF regarding associations of childhood anxiety are stark. It is possible that the occupational trauma exposure associated with being in the military increases distress in those with a history of childhood anxiety. Given that a higher proportion of the ADF have exposure to both childhood and adult trauma than civilians, this would seem to support the theory regarding the cumulative effects of prior trauma (Agorastos *et al.*, 2014, Suliman *et al.*, 2009). It is unclear why there was not an association between childhood anxiety and current distress in employed civilian men. It is possible that the people for whom there was an association were more likely to be unemployed and therefore not included in this analysis.

Whilst rates of past-year mental disorder appear to be broadly similar between ADF and civilian employed men (reference blinded for peer review), this current study demonstrates that a significantly larger proportion of ADF men had high levels of current distress. A K10 score of 25 is the epidemiological cut-off for depression/anxiety in the ADF. Whilst rates of past-year disorder are related to current distress, distress reflects a snapshot of current mental state, whereas past year-disorder reflects mental disorder over time. Past-year mental disorder

and current high levels of distress had different associations with childhood factors (ref blinded for peer review). Of note, in ADF men, past-year disorder was associated with all types childhood disorder (anxiety, depression and alcohol use disorders) whereas this study demonstrated that current distress was associated with childhood anxiety only.

In addition, childhood non-interpersonal trauma was not associated with past-year disorder (reference blinded for peer review), whereas this current study demonstrated that it was associated with current distress. Interestingly, the associations between childhood factors and current high levels of distress in civilian men were similar to their associations with past-year disorder.

Strengths

We were able to compare these two populations using the same measure of current psychological distress. Moreover, both of these datasets utilised in this analysis provide detailed interview data on lifetime disorder and trauma

Limitations

The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias (Baldwin *et al.*, 2019). Such retrospective reporting of childhood experiences is more prone to false negatives than positives and if well defined, as in this study, has good reliability (Hardt and Rutter, 2004). There may appear to be a low response rate in the ADF sample. However, unlike most surveys, the demographic and health status of the ADF members who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error. As our aim was to compare the male military and civilian populations, only male employed civilian subjects were included. Therefore, the poorer functioning unemployed male civilian population, were not included in this analysis. Measures of other forms of childhood adversity, such as neglect, were not included. We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the range, rather than frequency or severity of trauma experienced. However, similar trauma count variables have previously shown consistent significant associations with mental disorder outcomes. (Sareen *et al.*, 2013a) It is possible that in some cases mental disorder pre-dated the trauma, and that mental disorder may not have been related to that trauma. In addition, it should be noted with regard to SEM, that some methodologists have taken issue with the use of the standard normal distribution for deriving a p value for the total indirect effect of a mediator, since the sampling distribution is normal only in large samples (Preacher and Hayes, 2008). However, the implications of full or partial mediation in this analysis was also demonstrated by the change in the total direct effect calculated with and without mediators.

Different wording was used in the two studies. In the ADF study participants were asked for the number of days out of role they had in the previous 30 days due 'these feelings', in the self-report questionnaire following the K10. Whereas in the ABS study participants were asked about the number of full days out of role in the previous 30 days at the face to face interview. Differences may be present between the populations due to differences in wording or differences in the mode of administration. However, some studies and a meta-analysis demonstrate that mode may not be an important source of bias (Rutherford *et al.*, 2016).

Implications

Whilst childhood depression had a large, significant and direct impact on current distress in civilian employed men, this was not the case for ADF men. In contrast, childhood anxiety had a direct and significant association with current distress in ADF but not civilian employed men. This is a concern as 17.2% (95%CI: 13.7-21.2) of the male ADF population experienced childhood anxiety. In these people the odds of high distress levels were significantly raised by an odds ratio of 3.92 (95%CI: 2.26-6.80).

Concerningly, non-interpersonal childhood trauma appears to be associated with high-levels of distress but inversely associated with very poor functioning in ADF men. In addition, associations between childhood factors and current distress appeared different from the associations with past-year disorder (reference blinded for peer review), in ADF men.

These findings imply, first, that studies regarding childhood determinants of current distress should be population specific. Second, that in a more trauma exposed population the childhood determinants of high levels distress are different from mental disorder and the two outcomes should be analysed separately. Third, non-interpersonal trauma does not appear to have an association with past-year disorder, (reference blinded for peer review), or past-year PTSD (reference blinded for peer review), but a positive association with high levels of distress (current paper) and suicidality (Syed Sheriff *et al.*, 2018) and new post-deployment disorder (Syed Sheriff *et al.*, 2019) but has an inverse association with more than 8-days out of role over the previous 30 days. There is also a markedly high proportion of those in the oldest age groups in the ADF who reported non-interpersonal childhood trauma (Sheriff *et al.*, 2019b). These findings regarding the rates and impact of childhood non-interpersonal trauma in military population are worthy of further prospective investigation.

CONCLUSIONS

Whether observed differences in associations of childhood factors with current high distress between populations are due to the risk factors for psychological distress being different in more trauma exposed populations or due to screening/self-selection is beyond the scope of this current study. In addition, the observed association of childhood non-interpersonal trauma with current high distress contrasts with its relationship with past-year mental disorder in which no significant association was observed in the same ADF population (reference blinded for peer review). Somewhat unexpectedly childhood non-interpersonal trauma was inversely associated with highly impaired occupational functioning in ADF men. These findings are concerning and imply that there may be people who appear to be functioning but who are distressed and at risk of poor outcomes when exposed to additional trauma or when


transitioning from military service .Therefore, it appears to be essential to conduct population specific studies into the childhood determinants of current distress, which not only stands alone as an important outcome but is also an important determinant of the mental health impact of deployment and suicidality. In addition, the long-term impact of childhood non-interpersonal trauma warrants further prospective investigation.

**Chapter 11: Paper 6. The impact of
childhood trauma on the
development of mental disorder in
deploying military males**

Statement of Authorship

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Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
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By signing the Statement of Authorship, each author certifies that:

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- ii. permission is granted for the candidate to include the publication in the thesis; and
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Abstract

Background: Childhood adversity is associated with mental disorder following military deployment. However, it is unclear how different childhood trauma profiles relate to developing a post-deployment disorder. We aimed to investigate childhood trauma prospectively in determining new post-deployment disorder. **Methods:** 1009 Regular male ADF personnel from the Australian Defence Force (ADF) Middle East Area of Operations (MEAO) Prospective Study provided pre and post-deployment self-report data. Logistic regression and generalised structural equation modelling (GSEM) were utilised to examine associations between childhood trauma and new post-deployment probable disorder and possible mediator pathways through pre-deployment symptoms. **Results:** There were low rates of pre-deployment probable disorder. New post-deployment probable disorder was associated with childhood trauma, index deployment factors (combat role and deployment trauma), and pre-deployment symptoms but not with demographic, service or adult factors prior to the index deployment (including trauma, combat or previous deployment). Even after controlling for demographic, service and adult factors prior to the index deployment as well as index deployment trauma, childhood trauma was still a significant determinant of new post-deployment probable disorder. GSEM demonstrated that the association between interpersonal childhood trauma and new post-deployment probable disorder was fully mediated by pre-deployment symptoms. This was not the case for those who experienced childhood trauma that was not interpersonal in nature. **Conclusions:** To determine the risk of developing a post-deployment disorder an understanding of the types of childhood trauma encountered is essential, and pre-deployment symptom screening alone is insufficient.

KEYWORDS: epidemiology; military; childhood trauma; mental disorder; deployment

Introduction

The high prevalence of mental disorder following combat-related deployment is well documented (Fear *et al.*, 2010). Research regarding antecedent trauma and the mental health impact of deployment has been somewhat contradictory. Some research suggests that antecedent trauma reduces the mental health impact of deployment (known as inoculation) (Owens *et al.*, 2009), some research suggests that antecedent trauma increases the mental health impact of deployment (known as sensitization) (Solomon and Flum, 1988), and yet other research suggests that there is no interactive effect (Van Voorhees *et al.*, 2014). However, these studies have generally been cross-sectional and have defined prior trauma in a variety of ways, some including childhood trauma alongside adult trauma, whilst others have considered them separately.

Childhood trauma is likely to have different implications to adult antecedent trauma due to its impact at potentially critical periods of brain development (Teicher *et al.*, 2014). Some studies have treated childhood adversity as a continuous concept (Iversen *et al.*, 2007b) whilst others have focussed on particular types of childhood trauma, such as child abuse (Fritch *et al.*, 2010). In general, the literature regarding childhood adversity/trauma and deployment demonstrates that childhood adversity/trauma has an independent association with post-deployment disorder (Cabrera *et al.*, 2007). However, there have been challenges in exploring the associations of particular types of childhood traumatic experience as they tend to cluster, with most of those who experience childhood trauma/adversity experiencing more than one type (Finkelhor *et al.*, 2007).

Previously we investigated childhood trauma and disorder in determining mental disorder and associated outcomes across the Australian Defence Force (ADF) compared with employed

civilian males, aged 18-60 years. We attempted to overcome the issue of clustering by forming mutually exclusive categories based on the types of childhood trauma experienced. We then compared these different childhood trauma categories with each other and with no childhood trauma. We found important differences in the associations of different types of childhood trauma with mental disorder as well as with suicidality (Syed Sheriff *et al.*, 2018).

In order to better inform early intervention and prevention strategies we investigated the association of childhood trauma with the development of probable disorder (anxiety/affective, depression, PTSD or alcohol use disorder) between pre and post-deployment assessments. We also sought to investigate the extent that this relationship was mediated by pre-deployment symptoms. Due to evidence of important gender differences within military populations (Rona *et al.*, 2007), and the fact that we did not have sufficient female responders for a meaningful separate analysis, we have limited this analysis to males. In addition, due to demonstrated differences in the impact of deployment for Reservists (Hotopf *et al.*, 2006), we have included only Regular male ADF personnel deployed to Afghanistan.

Methods

The Joint Health Command Low-Risk Ethical Review Panel provided ethical approval for this analysis. This sample was taken from the Middle East Area of Operations (MEAO) Prospective Study (Davy C, 2012), which assessed ADF members deploying to Afghanistan after June 2010, and returning by June 2012 (Operation SLIPPER). In total 3074 ADF members deployed during this period and were thus eligible. However, due to many of these being subject to extensive training commitments and short lead-up time, many could not be approached for participation. Thus, personnel from 13 units and a Navy ship, as well as those deploying into Coalition units, were approached to participate. In all, 1871 ADF members participated in the 'pre-deployment' assessment. 1324 (70.8% retention rate) also participated within 4 months following their deployment (the 'post-deployment' assessment). Participants spanned all ranks and Services, and included Special Forces (who were unidentifiable, and classified under Army Service), and full-time Reservists. However, we excluded females and Reservists from this analysis. In total, 1009 male Regular ADF personnel completed pre and post assessments and were included in this analysis.

Procedure

Prior to deployment, eligible participants attended briefings where researchers described the study and provided information and materials. Participants were informed that although initial consent was for both assessments together, they could withdraw at any time. They were also informed that participation was anonymous, and that their results would not be identifiable, or provided to the military. Military personnel were not involved in recruitment or data collection.

Participants completed and returned consent forms and questionnaires either at the briefing or

later (by post). Following deployment, the researchers sent participants hard-copy and electronic questionnaires with unique de-identified study IDs (not military IDs) attached.

At both assessments, non-responders received email and reminders by post one week after receiving study materials, and telephone messages one week later. This study was approved by the Australian Defence Human Research Ethics Committee (no. 488-07) and the University of Adelaide Human Research Ethics Committee (no. H-064-2008).

Variables (pre-deployment assessment)

Demographics

Data regarding Service (Navy, Army or Royal Air Force) and rank were obtained from military records. Participants reported their age, educational qualifications, and prior deployment history. Ranks were grouped into other ranks (Private to Corporal equivalents), Non-Commissioned Officers (Sergeant to Warrant Officer equivalents) and Commissioned Officers (Lieutenant to General equivalents).

Trauma history

Participants were asked to indicate if they had ever experienced 18 specific traumatic events listed in the questionnaire. Of these items, 11 were adapted from the Composite International Diagnostic Interview, (Kessler and Ustun, 2004) and 7 were based on systematic recoding of

the ‘other’ trauma category from a previous community study (Goldney et al., 2000).

Participants were also asked the age at which they had first experienced each event.

These events were coded according to those which had first occurred prior to the age of 18 years (childhood) and those that first occurred aged 18 years or over (adult). Although the questionnaire was not exactly the same as that used in our previous study (Syed Sheriff *et al.*, 2018), we used the same system of coding trauma by type. Trauma types were coded as ‘non-interpersonal’ (life-threatening accident or natural disaster) or ‘interpersonal’ (rape, sexual molestation, serious physical attack/assault, threatened with a weapon/held captive/kidnapped, tortured or victim of terrorists, threatened/harassed without a weapon, experienced domestic violence, child abuse-emotional, child abuse-physical). As our aim was to compare different types of traumatic experiences with no trauma, we coded all types of trauma that had not already been coded as either interpersonal or non-interpersonal as ‘unclassified’ (direct combat, witnessed someone badly injured/killed, witnessed domestic violence, found a dead body, witnessed suicide/attempt, other stressful event and shocked because of event to someone close).

As per our previous study (Syed Sheriff *et al.*, 2018), mutually exclusive childhood trauma categories were formed so that each could be compared with each other and with ‘no childhood trauma’ as a reference category. These were non-interpersonal (without interpersonal), interpersonal (without non-interpersonal), both non-interpersonal and interpersonal and unclassified (without either interpersonal or non-interpersonal).

Pre and post-deployment assessment: Probable mental disorder

Anxiety/affective disorder.

The Kessler Distress Scale (K10) (Kessler et al., 2002) detects symptoms found in several common disorders, including affective disorders and anxiety. Participants rate the 10 questions in reference to the previous four weeks. Total scores range from 10 to 50, with higher scores indicating greater distress. The K10 is widely used in epidemiological research and clinical screening and demonstrates high factorial validity and internal consistency. It performs at least as well as, or better than similar questionnaires (Andrews and Slade, 2001). A previous study in the ADF demonstrated an optimal epidemiological cut off of point of ≥ 25 to indicate probable 30-day anxiety or affective disorder (Searle et al., 2015).

Depression.

Depressive symptoms were assessed using the 9-item depression module of the Patient Health Questionnaire (PHQ-9), which correspond to the 9 criteria for DSM-IV depressive disorder (Kroenke et al., 2002). Respondents rated the severity of symptoms over the previous 2 weeks on a 4-point (i.e., 0–3) Likert scale with the total score ranging from 0–27, with higher scores indicating greater depressive symptoms. The PHQ-9 has strong psychometric properties including high diagnostic validity in depression detecting, internal consistency, and test-retest reliability. An epidemiological cut-off point of ≥ 10 was used to indicate probable 30-day depression (Kroenke et al.).

PTSD

DSM IV PTSD was assessed using the Post-traumatic Stress Disorder Checklist civilian version (PCL-C) (Weathers *et al.*, 1993), which allows ratings to be based on any lifetime trauma (not just military-related). Respondents rate symptoms in the past month, which are summed to give a total score, ranging from 17 to 85. Higher scores indicate a greater severity of PTSD symptoms. The PCL shows high validity and reliability. We chose a cut off score of ≥ 53 , previously validated against the CIDI in this population to indicate probable 30-day disorder (Searle *et al.*, 2015).

Alcohol Use Disorders.

The AUDIT comprises 10 questions on alcohol consumption, dependence and problems, over the last 12 months. Total scores range from zero to 40. Higher scores indicate more problematic alcohol consumption. The AUDIT demonstrates high internal consistency, factorial convergent and criterion validity (Reinert and Allen). Previous research within the ADF population demonstrated an optimal epidemiological cut off of ≥ 20 for probable 30-day alcohol disorder (Searle *et al.*, 2015).

Any disorder.

Any individual that scored equal or above the pre-specified epidemiological cut-off on any of the K10, PCL, PHQ or AUDIT was coded as having a probable 30-day disorder. Those who had a greater number of probable 30-day disorders at the post-deployment assessment than at pre-deployment assessment was coded as having a new post-deployment probable disorder.

Post-deployment assessment

Index deployment trauma

A 26-item questionnaire adapted from the Deployment Risk and Resilience Inventory (Vogt *et al.*, 2008), the King's College Gulf War Survey (Unwin *et al.*, 1999) and the Traumatic Stressors Exposure Scale (TSES-R), was utilised to retrospectively report trauma experienced on their most recent deployment to the MEAO. Each trauma item was coded dichotomously. The 26 items were grouped into nine broader exposure categories based on US factor-analytic research on combat exposures (Wilk *et al.*) and previous research within this Australian sample (Davy C, 2012, Dobson A, 2012). Traumas experienced within each of these nine categories were summed to create a count of the number of deployment-related trauma types experienced, ranging from zero to nine (Dobson A, 2012). Thus, rather than frequency or severity, it reflected the range of trauma experienced. Previously, similar trauma count variables have shown consistent significant associations with mental disorder outcomes (Sareen *et al.*, 2013a).

Analysis

All analyses were performed in STATA version 14.2. Descriptive analyses were utilized to describe the sample and compare them to the rest of the MEAO male regular ADF population. We then analysed the difference in proportions of probable disorder between pre and post-deployment assessments. Analyses were then performed for the prevalence and

associations of new post-deployment probable disorder with demographic (age, education and relationship status) and service factors (rank and Service), childhood trauma (by number of types and by category compared with no childhood trauma as the reference category), adult factors prior to the index deployment (combat, deployment and trauma), pre-deployment symptoms and index deployment factors (trauma, deployment length and combat).

Next, logistic regression analyses were performed to calculate associations between childhood trauma categories (compared with no childhood trauma as the reference category) and new post-deployment probable disorder. In the first model (Model 1), we controlled for demographics (age, education and relationship status), service factors (rank and service) and adult trauma (prior to the index deployment). In the second model (Model 2), we controlled for the same factors as in Model 1 and also for index deployment trauma. In the third model (Model 3), we controlled for the same factors as in Model 2 and also for pre-deployment baseline symptoms.

We examined mediator pathways between childhood trauma and new post-deployment probable disorder using logistic regression models. As the outcome of interest was dichotomous, we utilized generalized structural equation modelling (GSEM) within STATA. The GSEM pathway utilized the link 'logit' and the family 'Bernoulli'.

We calculated associations between childhood trauma categories (compared with no childhood trauma as the reference category) and new post-deployment probable disorder. We then reran the GSEM analysis adding baseline symptoms (PHQ score) as a mediator (Acock, 2006). The total indirect pathways were calculated utilizing nonlinear combinations of

estimators (StataCorp, 2013). In order to exclude the possibility that our results were due to confounding by deployment trauma, we then repeated the analysis controlling for demographics, service factors and adult factors prior to the index deployment (adult trauma and deployment), and also added index deployment trauma count, as well as baseline symptoms as mediators.

RESULTS

Compared to the rest of the male MEAO deployed personnel, the sample of 1009 used in this analysis were older, a higher proportion were Officers and a higher proportion were in the Royal Air Force (see Table 1).

Significantly more of the sample had a probable mental disorder at post-deployment than at the pre-deployment assessment. This was the case for all of the individual disorders, other than anxiety (see Table 2).

In total, 41.9% (95%CI: 39.0-45.0) of the sample experienced childhood trauma. About one fifth of the sample (21.3%, 95%CI: 18.9-23.9) experienced childhood interpersonal trauma (interpersonal trauma and both interpersonal and non-interpersonal trauma), and about one fifth (20.7%, 95%CI: 18.3-23.2) experienced childhood trauma that was not interpersonal in nature (non-interpersonal and unclassified trauma).

The development of post-deployment probable disorder was associated with all categories of childhood trauma (compared with no childhood trauma), index deployment factors (number of types of trauma or having a combat role), and with baseline symptoms (on any of the scales- but most notably with the PHQ). Post-deployment probable disorder was not associated with demographic or service factors, adult factors prior to the index deployment (adult trauma, combat or previous deployment) or index deployment length (see Table 3).

Regression analyses demonstrated that (compared with no childhood trauma), all childhood trauma categories had a significant association with new post-deployment probable disorder, controlling for demographics, service factors, previous deployment, previous adult trauma

and index deployment trauma. However, when also controlling for pre-deployment symptoms (PHQ score), the association became non-significant for categories that included childhood interpersonal trauma (i.e. interpersonal trauma alone and both interpersonal and non-interpersonal trauma, see Table 4).

GSEM

Compared with no childhood trauma, all categories of childhood trauma, were associated with new post-deployment probable disorder, see Figure 1. However, once the pre-deployment PHQ score was included as a mediator, this association became non-significant for childhood interpersonal trauma categories (interpersonal trauma and both interpersonal and non-interpersonal trauma). The mediator pathways for those categories were highly significant, demonstrated by the mediated total indirect effect, indicated in Figure 1. This suggests full mediation of the association between childhood interpersonal trauma and new post-deployment probable disorder by the pre-deployment PHQ score. However, the results for non-interpersonal childhood trauma did not suggest mediation by pre-deployment PHQ score. The results for unclassified childhood trauma suggested only partial mediation.

We then conducted a GSEM analysis which controlled for demographics, service factors, and adult factors priors to the index deployment (deployment and adult trauma), see Figure 2.

When we added pre-deployment PHQ score and index deployment trauma count as mediators, childhood trauma that was not interpersonal in nature (unclassified trauma and non-interpersonal trauma) continued to have a direct and significant association with new post-deployment probable disorder. In contrast, childhood trauma categories that included

interpersonal trauma did *not* have a direct association with new post-deployment probable disorder.

Paper 6: Tables and figures

Table 1: Sample characteristics

		Analysis sample	The rest of MEAO male regulars	P
Number	N	1,009.0	1,676.0	
Age	Mean	30.7	27.9	0.000
Service	Navy (%)	5.3	7.5	0.000
	Army (%)	72.7	81.1	
	Royal Air Force (%)	22.0	11.4	
Rank	Officers (%)	19.3	12.1	0.000
	NCOs (%)	40.0	39.2	
	Other Ranks (%)	40.7	48.7	

Table 2: Pre and post deployment disorder

Probable disorder	Proportion before (%)	Proportion after (%)	Pearson Chi2(1)	P
Anxiety (K10, cut off 25)	2.4	4.5	8.6	0.300
Depression (PHQ-9, cut off 10)	0.9	4.6	33.2	0.000
PTSD (PCL-C, cut off 53)	0.2	2.2	21.5	0.000
Alcohol use disorder (AUDIT, cut off 20)	0.9	2.6	63.4	0.000
Any disorder	3.7	7.9	25.0	0.000

Table 3: Associations control for demographics (age, highest education and relationship status) and service factors (rank and Service)

			Sample population (N=1009)			New post-deployment disorder		
			%/mean	95% CI		aOR	95% CI	
Demographics	Age	18-24 (%)	31.0	28.2	33.9	1.0		
		25-34 (%)	39.2	36.3	42.3	1.3	0.7	2.6
		35-44 (%)	20.5	18.1	23.1	1.4	0.6	3.5
		45-54 (%)	9.2	7.6	11.2	0.9	0.3	3.3
	Educational level	Year 10 (%)	11.7	9.9	13.8	1.0		
		Certificate or diploma (%)	43.0	39.9	46.0	0.7	0.4	1.5
		Year 11/12 (%)	29.6	26.8	32.5	0.6	0.3	1.3
		University degree (%)	15.8	13.6	18.2	0.7	0.2	2.4
	Relationship	Married/Partnered (%)	70.8	67.9	73.5	1.1	0.6	2.0
	Service characteristics	Service	Navy (%)	5.3	4.0	6.8	1.0	
Army(%)			72.7	69.9	75.4	2.1	0.5	9.1
RAF (%)			22.0	19.5	24.7	1.0	0.2	4.9
Rank		Officers (%)	19.3	16.9	21.9	1.0		
		NCOs (%)	40.0	36.9	43.1	1.3	0.4	4.1
		Other Ranks (%)	40.7	37.6	43.9	1.8	0.6	5.7
Childhood trauma	Category-mutually exclusive (%)	None	58.0	54.9	61.0	1.0		
		Unclassified	7.7	6.2	9.6	3.2	1.4	7.3
		Non interpersonal (without interpersonal)	13.0	11.0	15.2	2.4	1.2	5.0
		Interpersonal (without non-interpersonal)	13.3	11.3	15.5	3.0	1.4	6.1
		Both interpersonal and non-interpersonal	8.0	6.5	9.9	3.0	1.3	7.0
	Number of types	Single	20.2	17.8	22.8	3.5	1.9	6.4
		Multiple	21.8	19.4	24.5	2.3	1.2	4.3
Previous adult trauma (before index deployment)	Category	Any unclassified (%)	43.5	40.5	46.6	1.5	0.9	2.7
		Any non-interpersonal (%)	32.4	29.6	35.4	1.4	0.8	2.4
		Any interpersonal (%)	24.6	22.0	27.3	0.8	0.4	1.5
	Number of types	Single (%)	23.7	21.2	26.4	1.3	0.7	2.6

		Multiple (%)	37.0	34.0	40.0	37.0	0.8	2.8
	Adult combat	Any (%)	15.8	13.6	18.1	1.6	0.8	3.1
Previous deployment		Any (%)	69.2	66.3	72.0	1.4	0.7	2.5
Pre-deployment assessment	Baseline symptom score	K10 (mean)	13.0	12.8	13.3	1.1	1.0	1.1
		PHQ (mean)	1.2	1.1	1.3	1.2	1.1	1.3
		PCL (mean)	19.5	19.2	19.8	1.1	1.0	1.1
		AUDIT (mean)	6.7	6.5	7.0	1.1	1.0	1.1
Index deployment	Deployment trauma	Number of types (mean)	3.9	3.7	4.0	1.2	1.1	1.4
	Combat role	(%)	56.7	53.6	59.7	2.6	1.2	5.5

Table 4: Regression new probable disorder

	New probable disorder								
	Model 1: Childhood trauma and previous adult trauma			Model 2: Model 1 + recent deployment trauma			Model 3: Model 2+ baseline symptoms (PHQ)		
	aOR	95% CI		aOR	95% CI		aOR	95% CI	
Childhood trauma category									
None	1.00			1.00			1.00		
Unclassified	3.51	1.60	7.74	3.44	1.55	7.64	3.07	1.37	6.88
Non interpersonal (without interpersonal)	2.44	1.18	5.05	2.20	1.05	4.59	2.13	1.01	4.49
Interpersonal (without non-interpersonal)	2.45	1.20	5.01	2.40	1.17	4.95	2.04	0.98	4.27
Both interpersonal and non-interpersonal	2.96	1.29	6.76	2.89	1.26	6.66	2.06	0.85	5.01
Count trauma types first experienced as adult	1.06	0.92	1.22	1.01	0.87	1.17	0.96	0.82	1.11
Recent deployment trauma count				1.23	1.06	1.42	1.21	1.05	1.41
Baseline symptoms (PHQ)							1.17	1.08	1.27

Figure 1: Generalised Structural Equation Modelling Pathway Analysis

Childhood trauma category (compared with no childhood trauma)

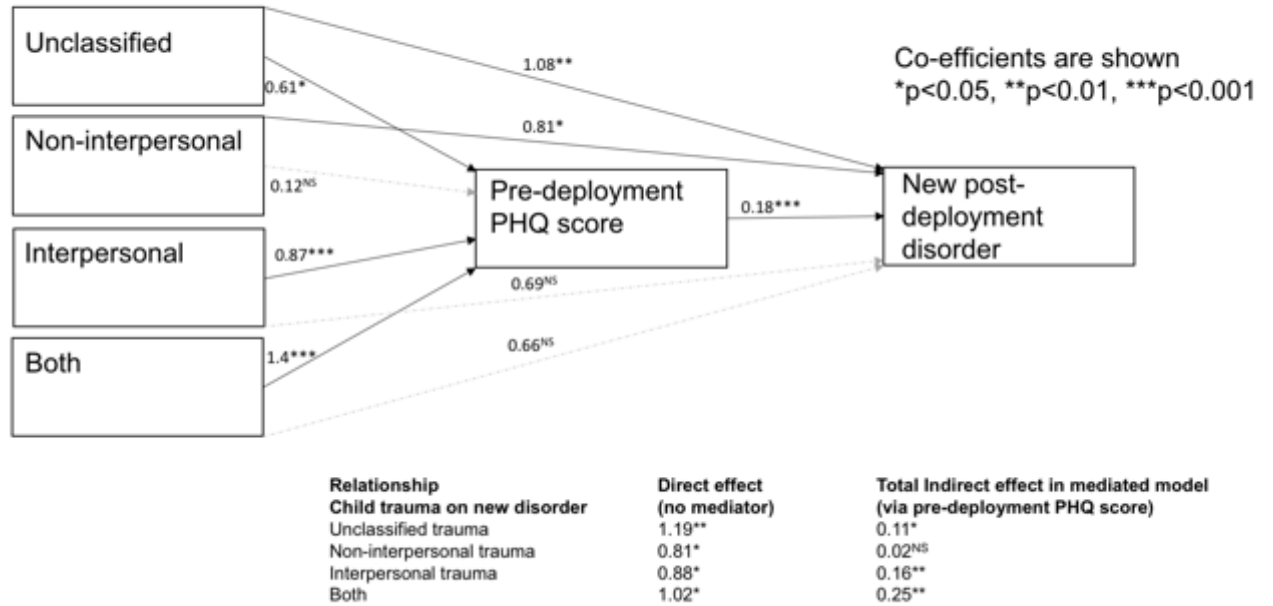
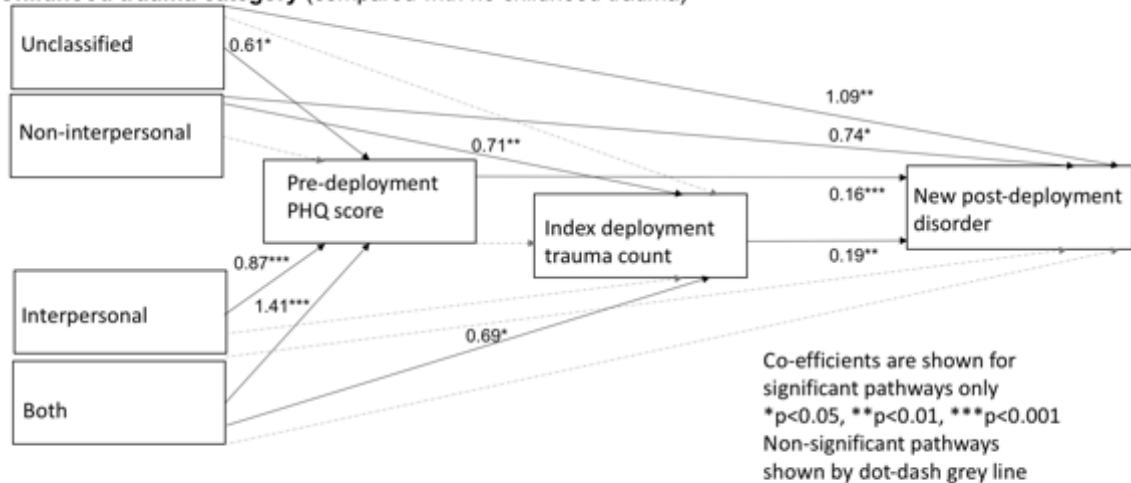


Figure 2: Generalised Structural Equation Modelling Pathway Analysis, including index deployment trauma as a mediator

Childhood trauma category (compared with no childhood trauma)



Controlling for demographics (age, current relationship and educational attainment), service factors (rank and Service) and previous adult factors (adult trauma and deployment), none of which had a significant association with post-deployment new disorder

DISCUSSION

Very few prospective studies have investigated the influence of childhood factors on the development of post-deployment disorder (Berntsen *et al.*, 2012). In this current study pre-deployment probable disorder rates were very low (3.7%), consistent with the aim to deploy healthy personnel. This is likely to be the result of pre-deployment screening and/or the increased likelihood of those with mental health vulnerabilities transitioning out of military service early (Van Hooff, 2018). This is an example of the ‘healthy worker survivor effect’ (Arrighi and Hertz-Picciotto, 1994), where health assessments have the effect of maintaining the fitness of the population, whereas those who are at risk may leave. It is likely that stringent pre-deployment assessments make this a particularly extreme example.

The very low rates of probable disorder may also be related to relatively low rates of childhood trauma. In this current study, a total of 42.0% (95% CI: 39.0-45.1) of the sample experienced childhood trauma compared to 56.2% (95% CI: 51.7-60.7) of the general ADF population (Syed Sheriff *et al.*, 2018). Although these studies used different measures for childhood trauma, with the latter including more items, they both included items for trauma types not specifically asked about. The rate of childhood trauma in this male deployment sample appears to be similar to the rate in Australian employed civilian males, of 42.2% (95% CI: 39.3-48.3) (Syed Sheriff *et al.*, 2018).

There were higher rates of probable disorder at post-deployment than at pre-deployment. The development of post-deployment probable disorder was associated with index deployment factors (deployment trauma and having a combat role). This is broadly consistent with the

current literature, which suggests that some deployment experiences, and particularly combat, are associated with PTSD post-deployment (Fear *et al.*, 2010, Rona *et al.*, 2009).

This current study demonstrates that there was not an association between adult factors prior to the index deployment (including previous combat) and post-deployment probable disorder. Again, this is likely to be due to pre-deployment screening and self-selection, with those who had significant prior trauma related symptoms being less likely to deploy.

Given that the post-deployment assessment was conducted less than four-months following deployment, there is also the substantial probability that it was too early to detect delayed onset post-deployment disorders, particularly PTSD (Berntsen *et al.*, 2012). Therefore, these post-deployment disorder rates may underestimate the true rates of post-deployment disorder. Baseline symptoms fully mediated the relationship between childhood interpersonal trauma and developing a post-deployment probable disorder. Whilst there are no studies with which to directly compare our findings, a previous study in the ADF demonstrated that baseline symptoms fully mediated the association between antecedent trauma and PTSD symptoms post-deployment (Searle *et al.*, 2017). Our study adds significantly to this by demonstrating that the impact of childhood interpersonal trauma was fully mediated by pre-deployment symptoms, whilst other types of childhood trauma had a significant and direct association with developing a post-deployment probable disorder.

There was a lack of association of developing a post-deployment probable disorder with trauma first occurring in adulthood (prior to the index deployment). However, trauma types which first occurred in childhood *did* have an association with developing a post-deployment probable disorder. This is consistent with a recent study in the Danish military where

childhood adversity was *central* to the development of PTSD post-deployment (Berntsen *et al.*, 2012). This suggests a greater capacity for adaptation to adult trauma than events first occurring in childhood.

Symptoms at the pre-deployment assessment were associated with developing a post-deployment probable disorder. It seems intuitive that those with a higher level of baseline symptomatology were closer to the threshold for disorder, so would be more likely to reach threshold post-deployment than others. This was the case for all baseline symptom measures included in our analysis. It appears that this is the pathway by which interpersonal childhood trauma exerts its influence on the development of post-deployment disorder. However, GSEM demonstrated that the association between non-interpersonal childhood trauma and post-deployment disorder was not mediated by baseline symptoms. These findings are consistent with a previous study which demonstrated that across the whole ADF and civilian male populations, non-interpersonal childhood trauma was not associated with adult mental disorder. In the same way, non-interpersonal childhood trauma did not appear to be associated with elevated baseline symptomatology in this current study. However, experiencing childhood trauma that was non-interpersonal in nature *did* increase the odds of post-deployment new disorder. GSEM analyses suggest that this association was not fully mediated by index deployment trauma either.

Strengths

This analysis utilised a prospective study design with a large sample size. Personnel from recent Afghanistan operations and who often worked alongside Allied forces were assessed.

Selection bias was minimised by recruiting from a wide cross-section of units preparing to deploy (rather than from a treatment-seeking population). A wide range of previous trauma were assessed prior to deployment.

Limitations

The retrospective reporting of childhood trauma is prone to bias. However, this would be likely to affect all types of childhood trauma, whereas these analyses demonstrate significant and interesting differences. Whilst retrospective trauma reporting is a generally accepted methodology, there is the risk that trauma recollection may be distorted by a post-deployment disorder, especially when deployment trauma is assessed at the same time as symptoms following deployment.

There were some differences between the sample and general deploying population, and therefore these results may not be entirely representative. This is an intrinsic hazard of investigating deploying personnel, where the short-notice and training associated with deployment precludes approaching all potential participants. In addition, there was not a measure of other forms of childhood adversity, such as neglect, in this study.

Implications

For those who experienced interpersonal trauma as children, the association with new post-deployment disorder was fully mediated by pre-deployment symptoms, whereas for those who had experienced other types of trauma, a direct and significant association remained. This is potentially a very meaningful result. The consequences of childhood traumatic

experiences are not only far-reaching but are potentially recognizable early. This finding suggests that there are different pathways of effect of different types of childhood trauma on the development of post-deployment disorder. Non-interpersonal trauma, such as disasters and accidents, are those in which there is a substantial threat to life (Forbes *et al.*, 2014). The associated fear memories for these traumatic events may have a different long-term impact on interpreting current threat than those associated with interpersonal experiences, which may instead exert their influence through pre-existing dysphoria (Sartory *et al.*, 2013). However, it is beyond the scope of this study to decipher whether the post-deployment disorder associated with childhood non-interpersonal trauma is mild/self-limiting or has more important long-term consequences. In addition, these findings may explain the possible reasons for contradictory research findings regarding antecedent trauma, and the pitfalls of analysing antecedent trauma by count (regardless of category) and/or of lumping childhood and adult trauma together.

Conclusion

Taken together, these findings indicate that childhood trauma is an important determinant of developing a post-deployment probable disorder. In addition, that an understanding of childhood factors is essential in determining the necessary support for those being deployed, as pre-deployment symptom screening alone is likely to be insufficient in identifying all those at risk.

Chapter 12: Paper 7. Childhood

determinants of past-year anxiety


and depression in recently

transitioned military personnel

Statement of Authorship

Title of Paper	Childhood determinants of past-year anxiety and depression in a recently transitioned military population
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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff		
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper. I amended the paper according to supervisor/co-author comments.		
Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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ABSTRACT

Background: Anxiety and depression may hamper a smooth transition from military to civilian life and may be important predictors of longer-term health and functioning. However, it is as yet unclear to what extent they are determined by childhood factors in a recently transitioned population. **Methods:** We utilised logistic regression and Generalised Structural Equation Modelling to analyse associations of past-year anxiety and depression with childhood trauma and disorder in those who had transitioned from regular full-time military service during the preceding five years using detailed (CIDI) interview data from the ADF (Australian Defence Force) Transition and Wellbeing Research Programme. **Results:** Past-year anxiety disorders were prevalent (36.4%, 95% CI, 31.9-41.1) and associated with childhood anxiety (but not other types of childhood disorder), childhood interpersonal trauma (but not other childhood trauma) and adult-onset trauma. Childhood anxiety had a direct and significant association with past-year anxiety. The pathway between childhood interpersonal trauma and past-year anxiety was fully mediated by childhood anxiety. Past-year depression was at a rate of 11.3% (95% CI, 8.7-14.5) and had no association with childhood disorder or trauma variables **Limitations:** The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. **Conclusions:** Past-year anxiety was highly prevalent in the period of transition and had strong associations with childhood and military factors, suggesting predictability and therefore preventability.

Keywords: Anxiety; Depression; Military; Epidemiology

Introduction

Many people transition from regular full-time military service. For example, every year approximately 5000 people transition out of the Regular Australian Defence Force (ADF) (Van Hooff M, 2018). The average length of military service is approximately 10 years, and therefore less than 10% of those leaving regular full-time military service transition into retirement (Van Hooff M, 2018) and most service-leavers transition with the aim of entering civilian occupations. There are many concerns for those transitioning from military services, particularly regarding mental health (Shields, 2016), suicidality (Nelson *et al.*, 2017) and homelessness (Rosenheck *et al.*, 1994).

However, despite acknowledgement that the period of transition is likely to be a time of significant stress (Pease *et al.*, 2016), there is very little systematic research into the mental health and wellbeing of military personnel during the transition period (Shields, 2016). Most studies are specific to particular deployments (Fear *et al.*, 2010, Thomas *et al.*, 2010) or are in treatment (or compensation) seeking populations (Pickett *et al.*, 2015, Ramchand *et al.*, 2015, Ramchand *et al.*, 2010). This may be because these populations may be easier to access once they have left the military (Burdett *et al.*, 2014). However, these studies may lead to inflated prevalence rates due to individuals being entitled to treatment for a service-related health condition. Therefore, these studies have limited generalisability (Thompson *et al.*, 2011b). In addition, it has been suggested that research into the mental health of those transitioning from regular military service has been too narrowly focused on PTSD (Mobbs and Bonanno,

2018). To date the only study of in a representative sample of transitioned military personnel was the Canadian 2010 Survey on Transition to Civilian Life (STCL). Overall, 20% of respondents to the STCL reported either depression or anxiety (Thompson, 2011).

Anxiety and depression are not only likely to be common; they may also hamper a smooth transition from military to civilian life. As already stated, there is a paucity of research into mental disorder in a representative sample during the period of transition from regular military service. However, anxiety and depression have been linked to poor occupational functioning (Nicholson, 2018), physical health symptoms (Creed *et al.*, 2012), wellbeing and suicidality (Cogle *et al.*, 2009) in general population studies. Anxiety and depression during the transition period are therefore likely be important predictors of longer-term health and psycho-social functioning in veterans.

Childhood factors may have particular aetiological significance in determining adult mental health outcomes (Andersen and Teicher, 2008, Teicher *et al.*, 2014). Previous research has demonstrated that a greater proportion of regular ADF reported childhood trauma than civilian employed men. Childhood interpersonal trauma was associated with past-year mental disorder whilst childhood non-interpersonal trauma was not. Childhood disorder had a significant and direct association with past-year disorder and fully mediated the association between childhood trauma and past-year disorder (Sheriff *et al.*, 2019a). Given these previous findings, it would seem likely that childhood factors might be an important determinant of disorder during the transition period, however this has not previously been investigated.

Therefore, it is as yet unclear how childhood and military factors interact to determine anxiety and depression in transitioning military populations. However, an improved understanding of these potentially important aetiological factors is likely to prove a fruitful avenue to better inform early intervention and prevention strategies in these populations. Especially the possibility of identifying people with underlying vulnerabilities before leaving the regular military service in order to optimise social and health service provision.

Aim

We set out to investigate the prevalence and associations of ICD-10 past-year anxiety and depression with childhood trauma and disorder in those recently (within the previous five years) transitioned from regular full-time ADF service . Secondary aims were to examine whether these associations were independent of deployment and other adult trauma in those previously deployed. In addition, whether the pathways between childhood factors and past-year anxiety and depression were mediated by childhood disorder. We hypothesised that childhood factors might be associated with mental disorders during the period of transition independently of service factors particularly deployment and other adult trauma. We also hypothesised, that childhood disorder might mediate the pathway between childhood trauma and disorders during the transition period. Overall, we hypothesised that an in-depth analysis of childhood and service factors associated with past-year anxiety and depression were likely to provide essential insights into additional avenues for identification, early intervention and prevention of poor outcomes in those transitioning from military services.

Method

This analysis utilises data from the Transition and Wellbeing Research Programme (the Programme), a comprehensive research programme undertaken in 2015 to establish the prevalence of mental disorders in a representative cohort of ADF members who transitioned out of regular ADF service during the five-year period prior to the assessment. The methodologies utilised in this study are described in more detail elsewhere (Van Hooff M, 2018). However, in brief, ethical approval for the Transition and Wellbeing Research Programme (the Programme), was provided by the DVA Human Research Ethics Committee (E014/018). Ethical approval for this particular analysis was provided by the Departments of Defence and Veterans Affairs Human Research Ethics Committee (057-18).

The sample was drawn from the Military and Veteran Research Study Roll generated for the Programme and held at the Australian Institute of Health and Welfare (AIHW). The Study Roll was generated using identifying information from Defence and DVA and contact details from ComSuper and cross-referenced against the National Death Index. All potential participants were given the opportunity to opt out of the study roll, prior to study commencement. Contact information for those who did not opt out was passed on to the University of Adelaide and used to invite study participants to enrol in the research. Participants were informed that neither DVA nor Defence would have access to their study data nor be informed of their decision regarding participation. This provided participants with an additional degree of certainty that their responses would not affect their employment or compensation entitlements.

This Programme used a two-phase design. In Phase 1, Transitioned ADF members were screened for mental health problems using a 60-minute self-report questionnaire. In Phase 2, members were selected to participate in a one-hour diagnostic telephone interview using the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview – version 3.0 (CIDI) (Kessler and Ustun, 2004). Selection for this interview was based on strata derived from rank, sex, Service and scores on the Posttraumatic Stress Disorder Checklist (PCL-C) (Ventureyra *et al.*, 2002) and the Alcohol Use Disorders Identification Test (AUDIT) (Conigrave *et al.*, 1995).


Weighting and stratification

Basic demographic characteristics to be used in weighting were held for both respondents and non-respondents by the AIHW until the end of the data collection. These data were then provided to researchers in either identified or de-identified form, depending on participation and consent status in order to allow the data from respondents to be weighted up to the entire population.

All Phase 1 survey data for the Transitioned ADF was weighted using distinct strata for sex, Service, rank and medical fitness. Phase 2 weights were based on strata including band (cut-offs were based on PCL and AUDIT), sex and Service. Post-stratification by the variables of sex, Service and rank were used to adjust the weights so that the known population totals were reproduced by the estimates, and to correct for differential non-response by rank.

Sample

A total of 24932 people transitioned out of the regular ADF between 2010 and 2014 including those who transitioned into the Active and Inactive Reserves as well as those who had discharged completely from the ADF. All individuals were given the opportunity to opt out of being invited to participate in the research. Those not invited to participate were those who opted out of the study or did not have any usable contact information. In total 23974 were invited to participate in Phase 1 and 4326 (18%) completed the survey. As previously stated, selection for Phase 2 was based on strata derived from rank, sex, Service and scores on the PCL and AUDIT. In all, 1807 transitioned ADF members were selected for Phase 2 and 1043 produced usable CIDI interview data, which was weighted to represent all of the regular ADF who transitioned between 2010 and 2014. We also selected only those who had previously deployed for an analysis to examine whether these associations were independent of deployment and other adult trauma. In total, 882 previously deployed transitioned personnel produced usable CIDI data for this analysis.



Measures

Disorder

The CIDI was utilised to examine mental disorder prevalence. The CIDI consists of a structured diagnostic assessment of lifetime, 12-month and 30-day ICD-10 disorder. Past-

year disorder was assessed based on standard CIDI algorithms with ICD hierarchical rules applied. Past-year anxiety included social phobia, specific phobia, OCD, GAD, agoraphobia, panic attack, panic disorder and PTSD. Past-year depression included mild, moderate and severe depressive episode. Childhood disorder was defined as any disorder with age of onset below age 18. Disorder types were then categorized as any depression, any anxiety and any alcohol use disorder (abuse or dependence).

Demographics and service characteristics

In the ADF, information regarding service characteristics was available from ADF administrative data. Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), non-commissioned officers (Sergeant to Warrant Officer equivalents), and commissioned officers (Lieutenant to General equivalents). Information regarding previous deployment was obtained from the self-report questionnaire.

Trauma

Lifetime exposure to trauma was also examined as part of the PTSD module of the CIDI. All 'criteria A' events listed in the CIDI were examined. We used definitions previously described by Forbes (Forbes *et al.*, 2014) to classify trauma types into interpersonal and non-interpersonal. Interpersonal included physical assault (with or without a weapon), and non-

interpersonal included falls, motor vehicle and other accidents. We then utilised the mutually exclusive categorisation of childhood trauma as in previous studies (Syed Sheriff *et al.*, 2018, 2019). We merged the two categories which did not include interpersonal trauma into one category named 'Other' childhood trauma', likewise we merged the two categories which included interpersonal trauma into one category named 'Any interpersonal' childhood trauma. The first category, known as 'Other' included those who reported experiencing any of the following types of trauma in childhood (but not interpersonal trauma types), combat, refugee, peacekeeper, someone close died unexpectedly, someone close had traumatic experience, saw atrocities or carnage, experience don't want to talk about, unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, accidentally injured/killed someone, saw someone badly injured/killed, child illness, purposefully injured or killed someone else, life-threatening automobile accident, other life-threatening accident, natural disaster, man-made disaster, life-threatening illness, but not any interpersonal trauma types during childhood. The second category, known as 'Any interpersonal', included those who reported experiencing any interpersonal trauma types in childhood (sexual assault, raped, stalked, kidnapped, mugged, beaten by spouse/romantic partner, badly beaten by anyone else) regardless of whether they had also experienced other trauma types during childhood.

Adult trauma included trauma types which first occurred at the age of 18 or older. These were then categorised as per a previous study as those unlikely to be deployment related (Frank *et al.*, 2018). These non-deployment related traumas were further categorized as interpersonal (sexual assault, raped, stalked, beaten by spouse/romantic partner, badly beaten by anyone else) or other (unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing

terror, refugee, life-threatening automobile accident, child illness, life-threatening illness, someone close had traumatic experience).

Deployment trauma exposure

Deployment trauma exposure was calculated as the sum of 12 deployment trauma exposure items from the 'Deployment Exposure' section of the self-report questionnaire. This included the following exposures (these are abbreviated), come under fire, caused injury, discharged your weapon, unable to respond due to rules of engagement, fear encounter an IED (Improvised Explosive Device), go on combat patrols, unauthorised discharge of weapon, clear buildings, in danger of being killed, handle or see dead bodies, casualties of people close to you, witness human degradation. Whilst this reflects the range of trauma experienced rather than frequency or severity, similar trauma count variables have previously been shown to have consistent significant associations with mental disorder outcomes (Sareen *et al.*, 2013a).

Analysis

All analyses were performed in STATA version 14.2, accounting for complex survey designs, utilizing the STATA 'svy' command with survey weighting to provide estimated proportions for the entire transition population. Descriptive analyses were utilized to describe

associations of past-year depression and anxiety with demographic and service characteristics as well as childhood trauma and disorder and adult onset trauma variables.

Logistic regression analyses were utilized to calculate the association of past-year depression and anxiety with childhood variables, controlling for demographic (age, education and relationship status) and service (rank and service) factors (Model 1), and then also with adult-onset trauma types and previous deployment (Model 2).

We then restricted our analyses to the previously deployed transitioned population only. We conducted descriptive analyses to describe associations of past-year depression and anxiety with demographic, service factors, trauma and disorder variables. We utilized logistic regression analyses to assess whether the association between childhood factors (trauma and disorder) and past-year depression and anxiety were independent of each other (Model 1), and then also with deployment and adult-onset non-deployment trauma (Model 2).

We examined mediator pathways between childhood trauma and past-year anxiety using logistic regression models, again accounting for complex survey designs. As the outcome of interest was dichotomous, we utilized generalized structural equation modelling (GSEM) to assess mediation. The GSEM pathway utilized the link 'logit' and the family 'Bernoulli' within STATA. First, we calculated associations between childhood trauma and past-year anxiety. We then reran the GSEM analysis adding childhood-onset anxiety as a mediator. The total indirect pathways were calculated utilizing the 'nlcom' command which calculates nonlinear combinations of estimators (Acock, 2006).

Results

Based on the CIDI (N=1043), using a weighted analysis to produce estimates for the entire transitioned population, 40.4% (95% CI, 35.9-45.2) had either past-year anxiety or depression and 7.2% (95% CI, 5.1-10.0) had both past-year anxiety and depression. About a third had a past-year anxiety disorder (36.4%, 95% CI, 31.9-41.1) and around a tenth had past-year depression (11.3%, 95% CI, 8.7-14.5) (See Table 1). Therefore most, (64.0%, 95%CI, 50.5-75.6) of those who had past-year depression also had a past-year anxiety disorder. In total, 16.8%, 95% CI: 13.6-20.5) had past-year PTSD.

Past-year depression was associated with being single and inversely associated with having a certificate or diploma but not with any other demographic or service factors. Past-year depression was not associated with childhood or adult trauma or with childhood disorders. Past-year depression was strongly associated with self-reported impaired functioning. (See Table 1)

Past-year anxiety was associated with lower educational attainment (year 10 or less) and with previous deployment. Past-year anxiety was associated with childhood interpersonal trauma, childhood anxiety (but not depression or alcohol use disorders) and adult-onset trauma types. Past-year anxiety was also strongly associated with self-reported impaired functioning. (See Table 1)

When controlling for childhood-onset disorders, childhood interpersonal trauma no longer had a significant association with past-year anxiety. In the fully adjusted model, childhood

anxiety and adult-onset trauma types were associated with past-year anxiety, whereas previous deployment and childhood interpersonal trauma were not. (See Table 2)

When we restricted the analysis to only those who had been previously deployed (n=882), past-year depression was not associated with any demographic (including being single) or service factors. Past-year depression was not associated with any childhood trauma or disorder variables or adult trauma variables. Past-year anxiety was inversely associated with having a certificate/diploma. It was associated with childhood interpersonal trauma (but not the number of types of childhood trauma), childhood anxiety, five or more types of deployment trauma and with non-interpersonal (non-deployment related) adult-onset trauma. (See Table 3)

When controlling for childhood disorders, childhood interpersonal trauma no longer had a significant association with past-year anxiety. When controlling for adult non-deployment trauma as well as deployment trauma, childhood anxiety remained a significant determinant of past-year anxiety. Five or more types of deployment trauma as well as adult-onset non-interpersonal (non-deployment related) trauma were also significantly associated with past-year anxiety, however interpersonal adult-onset trauma was not. (See Table 4)

GSEM demonstrated that there was a significant association between childhood interpersonal trauma and past-year anxiety. When childhood-onset anxiety was added as a mediator there was no longer a significant pathway between childhood interpersonal trauma and past-year anxiety. This suggests full mediation of the association between childhood interpersonal trauma and past-year anxiety via childhood anxiety. (See Figure 1)

Paper 7: Tables and figures

Table 1: ADF transitioned population, characteristics and associations with past-year anxiety and depression

N= 1043					Past-year depression			Past-year anxiety		
		%	95% CI		aOR	95% CI		aOR	95% CI	
	%				11.3%	8.7%	14.5%	36.4%	31.9%	41.1%
Age	<25	11.2	9.9	12.6	1.00			1.00		
	26-35	41.1	39.3	42.8	0.72	0.24	2.17	0.92	0.39	2.21
	36-45	22.1	20.8	23.5	0.79	0.26	2.36	0.88	0.34	2.27
	46-55	15.3	14.4	16.3	0.35	0.12	1.04	0.70	0.29	1.74
	56+	10.3	9.7	11.0	0.21	0.07	0.64	0.79	0.32	1.98
Sex	Male	86.9	86.9	86.9	0.79	0.35	1.77	1.01	0.58	1.75
Relationship	Current	76.5	74.8	78.0	0.38	0.19	0.76	0.77	0.45	1.31
Highest educational attainment	Year 10 (%)	7.2	6.4	8.2	1.00			1.00		
	Certificate or diploma (%)	21.5	20.0	23.1	0.22	0.07	0.75	0.17	0.07	0.42
	Year 11/12 (%)	50.6	48.8	52.4	0.42	0.16	1.11	0.43	0.20	0.90
	University degree (%)	20.7	19.6	21.8	0.35	0.09	1.36	0.30	0.13	0.73
Service	Army	60.3	60.3	60.3	1.00			1.00		
	Navy	22.7	22.7	22.7	1.55	0.73	3.29	0.80	0.48	1.32
	Airforce	16.9	16.9	16.9	1.89	0.90	3.96	0.84	0.52	1.34
Rank	CO	16.3	16.3	16.3	1.00			1.00		
	NCO	31.5	31.5	31.5	1.34	0.57	3.14	1.26	0.80	1.99
	Other	52.2	52.2	52.2	0.73	0.26	2.01	0.93	0.50	1.72
Previously deployed		77.1	75.5	78.6	1.13	0.48	2.63	2.14	1.18	3.88
Childhood-onset trauma types	Nil	42.8	38.2	47.6	1.00			1.00		
	Other	32.2	27.9	36.8	1.33	0.68	2.63	0.76	0.49	1.19
	Interpersonal	25.0	21.0	29.4	0.82	0.41	1.66	1.92	1.16	3.17
	Number of types	1.1	1.0	1.2	1.02	0.84	1.25	1.16	1.00	1.36
Childhood-onset disorder	Anxiety	22.1	18.3	26.3	1.36	0.70	2.64	5.43	3.29	8.98
	Depression	3.7	2.1	6.4	3.11	0.75	13.02	1.83	0.38	8.81
	Alcohol	5.3	3.4	8.1	0.52	0.18	1.49	1.29	0.47	3.52
	Any disorder	29.2	24.9	33.9	1.51	0.82	2.76	4.89	3.07	7.81
Adult-onset trauma types	Number of types	3.5	3.3	3.8	1.10	0.97	1.25	1.33	1.21	1.45
Self-reported functioning	Impaired	37.9	36.1	39.7	4.18	2.13	8.22	9.20	5.86	14.44
All aORs control for demographic (age, education, relationship status) and service (rank and service) factors										

Table 2: Regression analysis for past-year anxiety and depression in ADF transitioned population

		Past-year depression						Past-year anxiety					
		Model 1			Model 2			Model 1			Model 2		
		aOR	95%CI		aOR	95%CI		aOR	95%CI		aOR	95%CI	
Childhood-onset trauma	Nil	1.00			1.00			1.00			1.00		
	Other	1.26	0.65	2.44	1.26	0.64	2.46	0.68	0.42	1.08	0.64	0.38	1.06
	Interpersonal	0.70	0.32	1.54	0.68	0.30	1.55	1.41	0.82	2.43	1.42	0.82	2.47
Childhood onset disorder	Anxiety	1.44	0.73	2.82	1.42	0.71	2.82	5.25	3.21	8.58	4.92	2.87	8.44
	Depression	3.38	0.88	12.95	3.39	0.92	12.48	1.71	0.31	9.43	2.22	0.30	16.59
	Alcohol	0.55	0.19	1.60	0.56	0.20	1.54	1.20	0.45	3.21	1.21	0.42	3.43
Adult-onset trauma types					1.10	0.96	1.26				1.32	1.19	1.46
Ever deployed					1.08	0.43	2.67				1.52	0.79	2.92

All control for demographic (age, education, relationship status) and service (rank and service) factors

Model 1: Also controls for childhood-onset factors (trauma and disorder)

Model 2: Controls for all variables in Model 1, adult-onset trauma types and previous deployment

Table 3: Previously deployed ADF transitioned associations with past-year anxiety and depression

n=882		Proportions			Past-year depression			Past-year anxiety		
					aOR			aOR		
		%	95% CI						95% CI	
	Prevalence				11.3%	8.6%	14.7%	39.1%	34.3%	44.2%
Age	<25	6.4	5.3	7.7	1.00			1.00		
	26-35	41.3	39.4	43.3	0.62	0.15	2.66	0.58	0.19	1.76
	36-45	24.8	23.3	26.5	0.95	0.23	3.94	0.60	0.18	1.97
	46-55	16.9	15.8	18.1	0.37	0.09	1.48	0.54	0.17	1.70
	56+	10.5	9.8	11.3	0.28	0.07	1.14	0.69	0.21	2.21
Sex	Male	88.9	88.3	89.6	0.79	0.35	1.78	1.02	0.59	1.75
Relationship	Current	79.8	78.0	81.4	0.47	0.22	1.00	0.86	0.48	1.54
Education	Year 10 (%)	7.6	6.6	8.8	1.00			1.00		
	Certificate or diploma (%)	19.3	17.7	21.1	0.43	0.12	1.50	0.23	0.09	0.62
	Year 11/12 (%)	52.8	50.8	54.8	0.59	0.20	1.73	0.53	0.25	1.13
	University degree (%)	20.2	19.0	21.5	0.61	0.14	2.65	0.44	0.17	1.09
Service	Army	60.0	59.0	60.9	1.00			1.00		
	Navy	24.9	24.1	25.8	1.41	0.62	3.22	0.75	0.44	1.28
	Airforce	15.1	14.4	15.8	1.74	0.77	3.93	0.73	0.44	1.20
Rank	CO	16.7	16.3	17.2	1.00			1.00		
	NCO	36.8	36.0	37.6	1.87	0.73	4.80	1.53	0.92	2.54
	Other	46.5	45.4	47.6	1.13	0.35	3.62	1.42	0.71	2.85
Childhood-onset trauma	Nil	42.9	38.0	48.0	1.00			1.00		
	Other	30.7	26.3	35.6	1.42	0.66	3.06	0.68	0.43	1.09
	Interpersonal	26.3	22.0	31.2	0.67	0.34	1.30	1.96	1.15	3.34
	Mean number of types	1.1	1.0	1.2	1.04	0.84	1.28	1.14	0.96	1.35
Childhood-onset disorder	Anxiety	22.7	18.6	27.3	1.32	0.64	2.73	4.92	2.83	8.55
	Depression	2.8	1.4	5.6	2.26	0.35	14.46	0.56	0.08	3.74
	Alcohol	5.7	3.5	9.0	0.55	0.20	1.48	1.13	0.40	3.20
	Any disorder	29.9	25.3	35.0	1.34	0.69	2.60	3.87	2.36	6.34
Deployment trauma	Nil	14.2	11.1	18.0	1.00			1.00		
	Four or less types	32.1	27.7	36.9	1.22	0.44	3.38	1.06	0.50	2.26
	Five or more types	53.7	49.0	58.3	0.75	0.29	1.96	2.51	1.23	5.12
Combat	Combat	39.3	34.8	44.1	1.17	0.54	2.53	2.56	1.61	4.09
Non-deployment adult trauma	Non-interpersonal	56.1	50.9	61.2	1.48	0.77	2.86	1.98	1.24	3.17
	Interpersonal	17.2	13.9	21.0	0.88	0.38	2.05	1.63	0.97	2.72
Adult functioning										

All aORs control for demographic (age, education, relationship status) and service (rank and service) factors

Table 4: Regression analysis for past-year anxiety and depression in previously deployed transitioned population

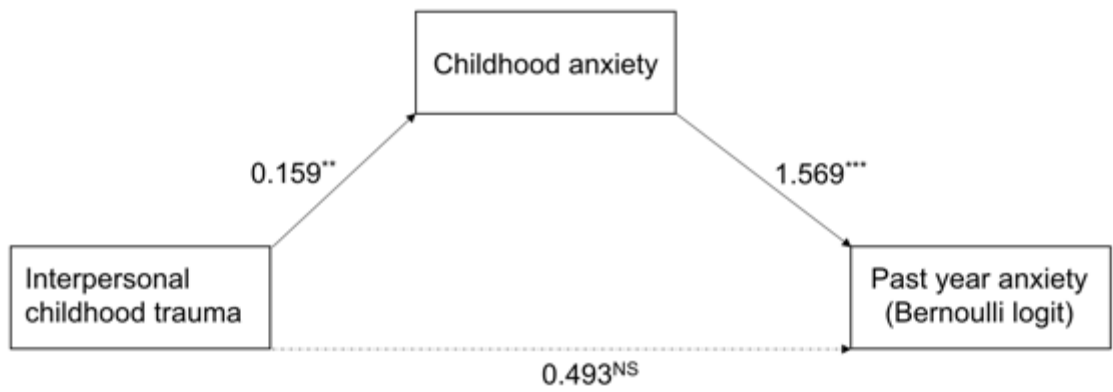
		Past-year depression						Past-year anxiety					
		Model 1			Model 2			Model 1			Model 2		
		aOR	95%CI		aOR	95%CI		aOR	95%CI		aOR	95%CI	
Childhood-onset trauma	Nil	1.00			1.00			1.00			1.00		
	Other	1.38	0.66	2.91	1.51	0.73	3.11	0.65	0.38	1.10	0.61	0.33	1.12
	Interpersonal	0.58	0.29	1.19	0.59	0.29	1.19	1.66	0.94	2.91	1.61	0.88	2.93
Childhood-onset disorders	Anxiety	1.54	0.79	3.00	1.59	0.83	3.02	4.76	2.84	7.98	5.54	3.15	9.76
	Depression	2.53	0.55	11.62	2.38	0.63	9.02	0.44	0.05	3.51	0.42	0.05	3.35
	Alcohol	0.62	0.23	1.70	0.59	0.21	1.66	0.97	0.35	2.73	0.64	0.24	1.73
Deployment trauma	Nil				1.00						1.00		
	Four or less types				1.38	0.48	3.96				1.57	0.76	3.23
	Five or more types				0.75	0.28	2.01				3.63	1.88	7.00
Adult-onset non-deployment trauma	Non-Interpersonal				1.35	0.71	2.54				1.87	1.11	3.12
	Interpersonal				1.01	0.46	2.21				1.69	0.87	3.27

All models control for demographic (age, education, relationship status) and service (rank and service) factors

Model 1: Also controls for childhood-onset factors (trauma and disorder)

Model 2: Controls for all variables in Model 1, deployment trauma and adult-onset non-deployment trauma

Figure 1: Mediator analysis through childhood anxiety, controlling for demographics (age, education and current relationship status) and service factors (rank, service, previous deployment)



	Co-ef.	P	Coefficients are shown *p<0.05, **p<0.01, ***p<0.001
Total unmediated	0.684	0.004	
Mediator analysis			
Total Indirect pathway	0.249	0.006	

Discussion

The proportion of those with past-year anxiety or depression was 40.4% (95% CI, 35.9-45.2), with anxiety effecting around one in three people (36.4%, 95% CI, 31.9-41.1). This is a significantly higher proportion of anxiety than in the regular ADF (14.8%, 95% CI: 12.1-18.0) (data from previous study to include females, previously unpublished finding) (Sheriff *et al.*, 2019b), and higher than in working age adults in the Australian community (16.5%, 95% CI: 15.2-17.8) (data from previous study, to include females, previously unpublished finding) (Sheriff *et al.*, 2019a)

However, despite different measures and sampling strategies, the proportion of those reporting past-year anxiety in this transitioned population is broadly consistent with those in other veteran and transitioning populations, at around 40% (Dedert *et al.*, 2009, Fulton *et al.*, 2015, Sayer *et al.*, 2010, Seal *et al.*, 2007). Therefore, it appears that anxiety is highly prevalent in this population. However, only 16.8%, 95% CI: 13.6-20.5) reported past-year PTSD. Therefore in agreement with previous analyses (Mobbs and Bonanno, 2018), research may previously have too been narrowly focussed on PTSD. The proportion of depression and anxiety we found was higher than that estimated in the Canadian STCL, which reported a prevalence rate of 20%. However, the STCL was a self-report telephone survey, and specified a length of illness of at least 6 months, so differences in sampling and measures may be in part responsible for differential prevalence rates.

The higher prevalence of past-year anxiety in the transitioned population may be in part due to those with poorer mental health leaving the military early, a concept known as healthy warrior effect (Haley, 1998). In addition, the transition period brings significant life changes

in a number of domains, including occupation, identity, routines, responsibilities, family roles, community, residence, status, finances, culture and social networks (Harvey *et al.*, 2011, Hatch *et al.*, 2013, Sayer *et al.*, 2010). Therefore, it is possible that the high rates of anxiety could also be attributable to the stress of the transition period in itself triggering an episode of anxiety. Difficulties in navigating civilian health services may also be an exacerbating factor.

In contrast, however, the proportion of those with past-year depression was 11.3% (95% CI, 8.7-14.5) in the transitioned population. This compares to a proportion in the regular ADF of 10.3% (8.1-13.1) and for working age adults in the Australian community of 8.2%, 95% CI: 7.3-9.3 (data from previous study (Sheriff *et al.*, 2019a) to include females, previously unpublished finding). Therefore, unlike past-year anxiety, past-year depression did not appear to be elevated in the transitioned population, either in comparison to the regular ADF nor the Australian community. Also, in contrast to past-year anxiety, past-year depression was not associated with childhood trauma or disorder. This contrasts with findings in civilian population's where childhood trauma is a major risk factor for adult depression (Huh *et al.*, 2017, Mandelli *et al.*, 2015) as is childhood disorder (Fergusson and Woodward, 2002, Fryers and Brugha, 2013). The findings of this current study are novel and somewhat surprising and may in part be due to self-selection, military health screening or some other protective aspect of military service and/or transition that lessens the connection between childhood vulnerability and past-year depression. These findings also highlight the importance of analyzing anxiety and depression separately in this population, as they appear to have unique associations. These findings are novel and require further exploration and replication.

In this current study we found that childhood interpersonal trauma was associated with past-year anxiety. Whilst there is a scarcity of military studies that have observed anxiety disorders specifically, this is broadly consistent with findings that childhood adversity was associated with poor health (Iversen *et al.*, 2007a) and with studies of anxiety in civilian populations (Gibb *et al.*, 2007). The finding that childhood anxiety fully mediated the association between childhood trauma and past-year anxiety is novel and requires further exploration. Consistent with previous military studies, deployment trauma was associated with past-year anxiety. (Booth-Kewley *et al.*, 2012)

This particular analysis focused on the impact on childhood factors on past-year anxiety and depression in a transitioning military population. There are also other factors of which we are aware that may also impact on mental health during the period of transition, however, exploring these factors was beyond the scope of this analysis. For example, there are studies that demonstrate that leaving the service early (before serving the minimal term on their contract) is associated with poor mental health (Buckman *et al.*, 2013a). We also know, both from this transitioning population, (Van Hooff M, 2018) as well as others that time since leaving, as well as the reason for discharge, also have associations with mental disorder during this time (MacLean *et al.*, 2014). Another major factor is whether service-leavers are seeking help or compensation and are engaged with veteran organisations (Thompson, 2011).

Strengths

This is the first study, of which we are aware, to investigate childhood experiences and childhood disorder simultaneously in determining past-year anxiety and depression in a

transitioned military population. The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load which has been a particular challenge for research on childhood experiences. (Finkelhor *et al.*, 2007) We also analysed the association of past-year anxiety and depression by the number of types of childhood trauma experienced, along with mediator pathways through childhood anxiety.

Limitations

The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. A recent systematic review highlights differences between prospective and retrospective reporting of childhood maltreatment (Baldwin *et al.*, 2019). This review demonstrated that there was poor agreement between prospective and retrospective measures of childhood maltreatment. However, agreement was higher when the retrospective measures of childhood maltreatment were based on interviews rather than questionnaires, as in this current study.

Whilst there may still be differences in prospective and retrospective reporting of childhood experiences, it is likely in this population that attempts to identify these people would occur in adulthood, for example, at entry or exit from military service. Therefore, we have identified that certain retrospectively reported childhood-onset traumatic experiences and disorders, and adult-onset traumatic experiences, are associated with past-year anxiety and

depression in a recently transitioned population. However, any conclusions regarding the etiological significance of these childhood factors should be treated with caution.

There may appear to be a low response rate. However, in contrast to most surveys, the demographic and health status was known for those who did not respond at each stage. This was accounted for in the back-weighting of the sample to minimise error.

Measures of other forms of childhood adversity, such as neglect, were not included. We accounted for the number of types of childhood trauma but not for the number of times each trauma was experienced during childhood. Thus, rather than frequency or severity of trauma this reflected the range of trauma experienced. However, previously, similar trauma count variables have shown consistent significant associations with mental disorder outcomes. (Sareen *et al.*, 2013a)

Implications

This current study demonstrated that the proportion of those with past-year depression in those transitioning from the ADF is similar to that in the Australian community and in the regular ADF and had no association with childhood disorder or trauma. This is unexpected and may suggest that childhood vulnerabilities are somehow uncoupled from adult depression in military/transition populations. This requires further exploration, ideally utilising prospective methodologies.

A high proportion of the transitioning ADF had past-year anxiety, and significantly more than in the regular ADF and the Australian community. Some of these anxiety disorders may be mild and self-limiting, however they may also predict longer term mental and physical health as well as suicidality (Syed Sheriff *et al.*, 2018). This requires further elucidation as to more specific predictors of poor outcomes.

Childhood factors (anxiety and interpersonal trauma) are associated with past year-anxiety, are present before transitioning and even before entering military service and are therefore possible targets for early intervention and prevention. In addition, adult factors such as deployment trauma and adult non-interpersonal trauma types are associated with past-year anxiety, and may also be identifiable before leaving the military and be a possible target for early intervention strategies. Childhood anxiety is not only a significant and direct determinant of past-year anxiety in a recently transitioned population, it fully mediated the association between childhood trauma and past-year anxiety. Childhood anxiety therefore appears to be of particular aetiological significance of anxiety during the transition period. Childhood factors are the earliest identifiable features that might aid early intervention and prevention strategies.

Conclusion

Past-year anxiety (unlike depression) was highly prevalent and had strong associations with childhood and military factors, suggesting predictability and therefore preventability. Given the prevalence of anxiety disorders in those who had recently transitioned, the association with poor functioning, suicidality, physical health as well as social and economic implications, it appears that the current debate may focus too narrowly on PTSD.

It is as yet unclear if anxiety precedes the decision to Transition from military service or is precipitated by the relative social and occupational instability which reawakens a pre-existing vulnerability present from childhood. However, the cost of anxiety to both the individual and to society is likely to be immense (Greenberg *et al.*, 1999). It is important to be aware of the prevalence and potential cost of anxiety disorders in the transition period. Further studies have the potential to put together the various identified risk factors from this and previous studies, including childhood factors, in order to establish if people at risk of disorder in the transition period are identifiable early. This study has laid the groundwork for further studies utilising comparison populations or prospective methodologies with which to further elucidate these novel findings.


Chapter 13: Paper 8: Childhood

**determinants of multiple somatic
symptoms in recently transitioned
regular military personnel**

Statement of Authorship

Title of Paper	Childhood determinants of multiple health symptoms in a recently transitioned military population
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
Publication Details	Has been submitted for publication to the journal Psychiatry Research

Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sherif		
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper. I amended the paper according to supervisor/co-author comments.		
Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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ABSTRACT

Many people transition out of full-time military service each year. A smooth transition to civilian life may be hampered by experiencing multiple somatic symptoms. We set out to investigate associations of multiple somatic symptoms with childhood trauma and disorder in those recently who had transitioned from regular military service with the previous five years. We utilised logistic regression analyses and generalised structural equation modelling in the ADF (Australian Defence Force) Transition and Wellbeing Research Programme. Multiple somatic symptoms were prevalent and significantly associated with self-reported impaired functioning and suicidality. Childhood anxiety was a significant and direct determinant of multiple somatic symptoms and fully mediated the relationship between childhood trauma and multiple somatic symptoms. Adult trauma (deployment related and other) was also associated with multiple somatic symptoms as were adult-onset anxiety and alcohol use disorders. Counter intuitively, in the deployed cohort only, childhood depression had an inverse association with multiple somatic symptoms. This study lays the groundwork for further research utilising prospective methodologies to further elucidate the aetiological significance of these childhood factors and also the longer-term prognostic significance of experiencing multiple somatic symptoms in the transition period.

Keywords: Somatic Symptoms; Military; Epidemiology

INTRODUCTION

Many people transition from regular full-time military service each year. For example, in Australia approximately 5000 people transition out of the Regular Australian Defence Force (ADF) each year (Van Hooff M, 2018). The average length of military service is approximately 10 years, therefore only a minority (less than 10%) transition into retirement (Van Hooff M, 2018). Instead most service-leavers transition with the aim of entering civilian occupations. However, despite acknowledgement that the period of transition is likely to be a time of significant stress (Pease *et al.*, 2016), there is very little systematic research into the mental health and wellbeing of transitioning military personnel (Shields, 2016).

Multiple somatic symptoms are common in veterans and whilst they appear to be particularly prevalent in Gulf War veterans (in whom a specific chronic multi-symptom illness has been described and has been the subject of numerous studies (Gwini *et al.*, 2016)), rates appear to be high in other previously deployed military personnel (Kelsall *et al.*, 2009, Smith *et al.*, 2014). In addition, the number of somatic symptoms is predictive of mental disorder and impaired functioning across veteran (Barrett *et al.*, 2002, Engel *et al.*, 2000), and civilian (Kroenke *et al.*, 1994) populations and is associated with increased mortality (Engel *et al.*, 2002).

An association between traumatic events and physical symptom reporting has been found in military (Kelsall *et al.*, 2009) as well as non-military populations, including refugees (Keller *et al.*, 2006), emergency services workers (Witteveen *et al.*, 2007) and accident victims (Kupchik *et al.*, 2007). Numerous studies have investigated the relationship between somatic symptoms and PTSD (Engel *et al.*, 2000, Hoge *et al.*, 2007). Multiple somatic symptoms most likely sit at the centre of the Venn diagram of mental and physical health, signifying not

only the most disabling and persistent disorders (Armenta *et al.*, 2018) but also predicting poor outcomes (Engel *et al.*, 2000).

Given the association between multiple somatic symptoms and previous trauma as well as mental disorder, the dearth of research on the relationship between childhood factors (trauma and mental disorder) and multiple somatic symptom reporting is somewhat surprising. These childhood factors may not only have important aetiological significance but may also be the earliest identifiable factors to better inform early intervention and prevention strategies in transitioning military populations.

Aim

We set out to investigate the prevalence of self-reported multiple somatic symptoms, in recently transitioned military personnel and associations with childhood trauma and disorder. We also aimed to assess the associations in the previously deployed population to examine whether these associations were independent of deployment and other adult trauma.

We hypothesised that factors prior to the period of transition might impact on multiple somatic symptoms during transition. Identification of early life factors relating to multiple self-reported somatic symptoms are likely to provide essential insights into additional avenues for identification, early intervention and prevention strategies. In particular, the possibility that those at risk of poor outcomes can be identified before leaving the regular military service to ensure adequate social and health service provision.

Method

Procedure

The methodologies utilised in this study are described in more detail elsewhere (Van Hooff M, 2018). However, in brief, this study used a two-phase design. In Phase 1, Transitioned ADF members were screened for mental health problems using a 60-minute self-report questionnaire. In Phase 2, members were selected to participate in a one-hour diagnostic telephone interview using the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview – version 3.0 (CIDI) (Kessler and Ustun, 2004). Selection for this interview was based on strata derived from rank, sex, Service and scores on the Posttraumatic Stress Disorder Checklist (PCL) and the Alcohol Use Disorders Identification Test (AUDIT).

The sample was drawn from the Military and Veteran Research Study Roll generated for the Programme and held at the Australian Institute of Health and Welfare (AIHW). The Study Roll was generated using identifying information from Defence and DVA and contact details from ComSuper and cross-referenced against the National Death Index. All potential participants were given the opportunity to opt out of the study roll, prior to study commencement. Contact information for those who did not opt out was passed on to the University of Adelaide and used to invite study participants to enrol in the research. Participants were informed that neither DVA nor Defence would have access to their study data nor be informed of their decision regarding participation. This provided participants with an additional degree of certainty that their responses would not affect their employment or compensation entitlements. Defence and DVA were able to access de-identified data.

Weighting and stratification

Basic demographic characteristics to be used in weighting were held for both respondents and non-respondents by the AIHW until the end of the data collection. These data were then provided to researchers in either identified or de-identified form, depending on participation and consent status in order to allow the data from respondents to be weighted up to the entire population.

All survey data for the Transitioned ADF was weighted using distinct strata for sex, Service, rank and medical fitness. CIDI weights were derived for the Transitioned ADF, based on strata including band (cut-offs were based on PCL and AUDIT), sex and Service. Post-stratification by the variables of sex, Service and rank were used to adjust the weights so that the known population totals were reproduced by the estimates, and to correct for differential non-response by rank.

Sample

Out of a total of 24932 who transitioned between 2010 and 2014, 23974 were invited, and 4326 (18%) completed the survey. Those not invited represented individuals who may have opted out of the study or did not have any usable contact information and included those who transitioned into the Active and Inactive Reserves as well as those who had discharged completely from the current ADF (Ex-Serving). All individuals were given the opportunity to opt out of being invited to participate in the research. Of the 1807 invited to complete a CIDI, 1049 participated and 1043 had usable data for this analysis which was weighted to

represent all of the regular ADF who transitioned between 2010 and 2014. We also selected only those who had previously deployed for an analysis to examine whether these associations were independent of deployment and other adult trauma. In total, 882 previously deployed transitioned personnel produced usable CIDI data for this analysis.

Measures

Somatic symptoms

The 67-item symptom questionnaire included items to assess the following systems, respiratory, cardiovascular, musculoskeletal, dermatological, gastrointestinal, genitourinary, neurological, and neuropsychological and cognitive. It was based the 63-item questionnaire used in the Gulf War Veterans Follow up study (Sim, 2015) with additional items from the MilHOP study (Van Hooff *et al.*, 2014). This was based on the symptom questionnaire developed and used by the King's College Gulf War Illness Research Unit,(Unwin *et al.*, 1999) which was based on the Hopkins Symptom Checklist (Derogatis *et al.*, 1974).

All symptoms were originally coded as 0=No, 1=Mild, 2=Moderate, and 3=Severe. For the purposes of these analyses the variables were dichotomised as 0=No and (1, 2, 3) =Yes. The top decile of the whole population (2015 current-serving and Transitioned ADF) reported ≥ 29 somatic symptoms (Van Hooff M, 2018). As described in previous studies (Hotopf *et al.*, 2006), this was used as the definition of multiple symptoms for this study.

Functional Impairment

Functional impairment was assessed via the Sheehan Disability Scale (Sheehan and Sheehan, 2008), which is a 5-item self-report measure of disability due to mental health symptoms across three domains; work/school, social and family life. The items assessing impairment across the 3 domains were scored from 0 to 10 and could therefore yield a total score of between 0 and 30. Impaired self-reported global functioning was defined, according to the Australian Bureau of Statistics (Slade *et al.*, 2009b), as a total score of ≥ 12 , indicating moderate/severe impairment.

Mental Disorder

The World Mental Health Initiative Version of the Composite International Diagnostic Interview version 3.0 (CIDI) (Kessler and Ustun, 2004) was utilised to examine lifetime mental disorder. The CIDI consists of a structured diagnostic assessment of ICD-10 disorder. ICD lifetime disorders were assessed based on standard CIDI algorithms with ICD hierarchical rules applied. Disorders were categorized as depression, anxiety and alcohol use disorders. ‘Anxiety’ included social phobia, specific phobia, OCD, GAD, agoraphobia, panic attack, panic disorder and PTSD, ‘Depression’ included mild, moderate and severe depressive episode and ‘Alcohol’ included alcohol abuse and dependence. When any disorder in a category had an age of onset below 18 years that category was coded as childhood-onset. For those who had a lifetime disorder within a category but none of the disorders within that category had an age of onset below 18 years, the disorder category was coded as adult-onset.

Demographics and service characteristics

In the ADF, information regarding service characteristics was available from ADF administrative data. Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), non-commissioned officers (Sergeant to Warrant Officer equivalents), and commissioned officers (Lieutenant to General equivalents). Information regarding previous deployment was obtained from the self-report questionnaire.

Trauma exposure

Lifetime exposure to trauma was examined as part of the PTSD module of the CIDI. All 'criteria A' events listed in the CIDI were examined. We coded childhood trauma by the number of types first experienced prior to age 18. We also used a mutually exclusive categorisation of childhood trauma as utilised in previous studies (Syed Sheriff *et al.*, 2018, 2019). The first category, known as 'Other' included those who reported experiencing any of the following types of trauma prior to age 18 (but not interpersonal trauma types), combat, refugee, peacekeeper, someone close died unexpectedly, someone close had traumatic experience, saw atrocities or carnage, experience don't want to talk about, unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, accidentally injured/killed someone, saw someone badly injured/killed, child illness, purposefully injured or killed someone else, life-threatening automobile accident, other life-threatening accident, natural disaster, man-made disaster, life-threatening illness. The second group were those

who reported experiencing any interpersonal trauma types (irrespective of whether they had also experienced other types of childhood trauma) prior to the age of 18 (sexual assault, raped, stalked, kidnapped, mugged, beaten by spouse/romantic partner, badly beaten by anyone else). Adult trauma included trauma types which first occurred at the age of 18 or older. These were coded by number of types.

Adult trauma exposure in the previously deployed cohort

The deployment trauma exposure section (Van Hooff M, 2018) was based on the MEAO Census (Dobson A, 2012) and calculated as the sum of 12 deployment trauma exposure items from the 'Deployment Exposure' section of the self-report questionnaire. This included the following exposures (these are abbreviated), come under fire, caused injury, discharged your weapon, unable to respond due to rules of engagement, fear encounter an IED (Improvised Explosive Device), go on combat patrols, unauthorised discharge of weapon, clear buildings, in danger of being killed, handle or see dead bodies, casualties of people close to you, witness human degradation. Whilst this reflects the range of trauma experienced rather than frequency or severity, similar trauma count variables have previously been shown to have consistent significant associations with mental disorder outcomes (Sareen *et al.*, 2013a).

'Non-deployment related' trauma types were extracted from the lifetime trauma section of the CIDI and included only trauma types with onset aged 18 or older. They were defined and coded as per a previous study (Frank *et al.*, 2018) as the following types, sexual assault, raped, stalked, beaten by spouse/romantic partner, badly beaten by anyone else, unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, refugee, life-

threatening automobile accident, child illness, life-threatening illness, someone close had traumatic experience.

Analysis

All analyses were performed in STATA version 14.2, accounting for complex survey designs. Descriptive analyses were utilized to describe associations of multiple somatic symptoms with impaired functioning and suicidality. In addition, the frequency of each symptom reported by those with multiple somatic symptoms were calculated. Finally, the demographic and service characteristics as well as childhood and adult onset trauma and disorder variables and associations with multiple somatic symptoms were described.

Logistic regression analyses were utilized to calculate the association of multiple somatic symptoms with childhood variables, controlling for demographic (age as a categorical variable, education and relationship status) and service (service and rank) factors as well as previous deployment (Model 1). We then also controlled for adult-onset trauma (Model 2) and adult-onset disorder (Model 3).

We examined mediator pathways between childhood trauma and multiple somatic symptoms using logistic regression models, again accounting for complex survey designs. As the outcome of interest was dichotomous, we utilized generalized structural equation modelling (GSEM) to assess mediation by childhood-onset disorder. The GSEM pathway utilized the link 'logit' and the family 'Bernoulli' within STATA. First, we calculated associations between childhood trauma and multiple somatic symptoms. We then reran the GSEM

analysis adding childhood-onset anxiety as a mediator. The total indirect pathways were calculated utilizing the 'nlcom' command which calculates nonlinear combinations of estimators (Acock, 2006).

We then restricted our analyses to the previously deployed Transitioned population only. We conducted descriptive analyses to describe associations of multiple somatic symptoms with demographic, service factors, trauma and disorder variables. We utilized logistic regression analyses to assess whether the association between childhood factors and multiple somatic symptoms were independent of deployment and other types of adult trauma controlling for adult-onset mental disorder.

Results

In total, 18.4% (95% CI:16.8-20.0) of the Transitioned population reported multiple (≥ 2) somatic symptoms compared with 7.7%, (95% CI: 6.3-7.4) of the 2015 current serving ADF. There was a strong association with self-reported impaired functioning and suicidality (see Table 1).

Of those who reported multiple somatic symptoms, the most commonly reported symptoms were fatigue, feeling unrefreshed and sleeping difficulties (see Table 2).

In the Transitioned population multiple somatic symptoms were associated with being older (36 years old or over), being previously deployed, childhood-onset anxiety (but not other childhood-onset disorder categories), childhood interpersonal trauma, adult-onset disorder (anxiety, depression and alcohol use disorders) and adult-onset trauma. Multiple somatic

symptoms were inversely associated with being in the Airforce and having a university degree (see Table 3).

In Model 1, which controlled for childhood anxiety, childhood interpersonal trauma no longer had an association with multiple somatic symptoms. In Model 2, which controlled for childhood-onset anxiety and trauma as well as adult-onset trauma, childhood anxiety and adult-onset trauma were associated with multiple somatic symptoms. Childhood anxiety and adult-onset trauma continued to be associated with multiple somatic symptoms when adult-onset disorder was also controlled for (Model 3). Adult-onset anxiety and alcohol use disorders but not adult onset depression were also associated with multiple somatic symptoms in Model 3 (see Table 4).

GSEM analyses demonstrated that in the unmediated model, childhood interpersonal trauma was associated with multiple somatic symptoms. When childhood anxiety was added as a mediator this association became non-significant, whereas the indirect pathway between childhood interpersonal trauma and multiple somatic symptoms via childhood anxiety was significant (see Figure 1). This suggests full mediation of the relationship between childhood interpersonal trauma and multiple somatic symptoms via childhood anxiety.

Restricting the analysis to only those previously deployed, 20.6% (95%CI: 18.8-22.5) reported multiple somatic symptoms. Multiple somatic symptoms were associated with being older (36-55 years of age, but not those 56 and older), childhood trauma (number of types was just significant whereas interpersonal trauma was just below level of significance), and inversely associated with being an Officer. Multiple somatic symptoms were associated with childhood anxiety and inversely associated with childhood depression. There was no

significant association with childhood alcohol use disorders. Multiple somatic symptoms were associated with adult onset anxiety and alcohol use disorder but not depression. Multiple somatic symptoms were associated with non-deployment adult trauma and deployment trauma, but not specifically combat. (see Table 5)

Logistic regression analyses demonstrated that once childhood anxiety and depression were adjusted for, childhood trauma no longer had a significant association with multiple somatic symptoms. In the fully adjusted model, multiple somatic symptoms were associated with childhood anxiety, inversely associated with childhood depression, and associated with adult-onset trauma (both deployment and non-deployment related) and adult-onset anxiety and alcohol use disorder (see Table 6).

Paper 8: Tables and figures

Table 1: Associations of mental health and related outcomes with multiple somatic symptoms (29 or more).

N=1043		Proportion in entire Transitioned population			Proportion of those with multiple somatic symptoms			OR Multiple somatic symptoms			aORs Multiple somatic symptoms		
		%	95% CI	95% CI	%	95% CI	95% CI	OR	95% CI	95% CI	aOR	95% CI	95% CI
Self-reported impaired functioning	Social	42.9	40.9	44.9	89.4	86.1	92.1	17.70	12.70	24.65	17.33	12.40	24.22
	Family	40.2	38.2	42.3	87.6	84.4	90.3	16.94	12.67	22.63	15.98	11.89	21.46
	Work	31.7	29.8	33.5	75.3	70.8	79.2	10.86	8.44	13.99	10.66	8.21	13.84
	Global	37.6	35.7	39.6	86.5	82.9	89.4	17.62	13.11	23.69	17.09	12.68	23.04
Suicidality	Any	21.7	20.2	23.3	54.7	49.9	59.3	7.30	5.74	9.28	7.65	5.97	9.80
Past-year PTSD		16.8	13.6	20.5	37.6	27.9	48.4	4.77	2.76	8.26	5.06	2.92	8.78

aORs control for demographic (age, education, relationship status) and service factors (rank and service branch

Table 2: Most frequently reported health symptoms in those reporting multiple somatic symptoms (29 or more)

	%	95% CI	95% CI
Fatigue	98.8	97.0	99.5
Feeling unrefreshed	98.5	97.4	99.2
Sleeping difficulties	97.1	95.3	98.3
Irritability outbursts	93.8	91.3	95.6
Avoiding things	92.4	89.5	94.5
Difficulty finding word	92.3	89.9	94.2
Loss of concentration	90.4	87.0	93.0
Headaches	90.0	86.5	92.7
Joint stiffness	88.7	84.8	91.6
Feeling distant	88.3	84.9	91.0
Feeling jumpy	85.6	81.9	88.7
Forgetfulness	85.4	81.4	88.6
Ringing ears	82.3	78.1	85.8
Loss interest sex	78.9	74.5	82.7
Pain joints	78.5	73.9	82.4
Flatulence	76.4	72.0	80.3
Tingling fingers	71.4	66.7	75.7
Bowel not finished	69.4	64.8	73.6
Sensitivity noise	66.9	61.9	71.5
Itchy eyes	66.8	62.1	71.2
Diarrhoea	65.0	60.2	69.5
Rapid heartbeat	64.1	59.1	68.7
Tingling legs	60.6	55.7	65.3
Stomach cramps	59.7	54.9	64.4
Numbness fingers	59.1	54.1	63.9
Indigestion	58.9	54.0	63.6
Faster breathing	58.3	53.4	63.0
Unable to breathe	55.3	50.4	60.2
Pain face	54.3	49.4	59.1
Sexual functioning	53.9	49.0	58.8
Sensitivity light	53.0	48.0	57.8

Table 3: ADF Transitioned population characteristics and associations with multiple somatic symptoms

		%	95% CI		aOR	95% CI	
	Population proportion	18.4	16.8	20.0			
Age	<25	11.2	9.9	12.6			
	26-35	41.1	39.3	42.8	1.53	0.90	2.59
	36-45	22.1	20.8	23.5	2.63	1.49	4.64
	46-55	15.3	14.4	16.3	2.42	1.37	4.29
	56+	10.3	9.7	11.0	1.90	1.04	3.48
Sex	Male	86.9	86.9	86.9	1.03	0.77	1.39
Relationship	Current	76.5	74.8	78.0	0.89	0.68	1.18
Highest educational attainment	Year 10	7.2	6.4	8.2	1.00		
	Year 11/12	21.5	20.0	23.1	0.71	0.46	1.11
	Certificate or diploma	50.6	48.8	52.4	0.71	0.49	1.04
	University degree	20.7	19.6	21.8	0.55	0.34	0.89
Service	Army	60.3	60.3	60.3	1.00		
	Navy	22.7	22.7	22.7	1.12	0.84	1.49
	Airforce	16.9	16.9	16.9	0.75	0.58	0.97
Rank	CO	16.3	16.3	16.3	1.00		
	NCO	31.5	31.5	31.5	1.78	1.32	2.40
	Other	52.2	52.2	52.2	2.09	1.44	3.02
Previously deployed		77.1	75.5	78.6	2.02	1.41	2.88
Childhood-onset trauma types	Nil	42.8	38.2	47.6	1.00		
	Other	32.2	27.9	36.8	0.88	0.49	1.58
	Interpersonal	25.0	21.0	29.4	1.99	1.08	3.67
	Number of types (mean)	1.1	1.0	1.2	1.15	0.98	1.36
Adult-onset trauma types	Number of types (mean)	3.5	3.3	3.8	1.32	1.19	1.47
Childhood-onset disorder	Anxiety	18.4	15.0	22.4	3.09	1.77	5.41
	Depression	2.5	1.3	4.8	0.27	0.06	1.15
	Alcohol	5.3	3.4	8.1	0.97	0.30	3.13
Adult-onset disorder	Anxiety	27.7	23.7	32.1	2.05	1.24	3.39
	Depression	20.1	16.6	24.0	1.91	1.15	3.17
	Alcohol	42.2	0.4	47.0	3.20	1.83	5.60

aORs control for demographic (age, education and relationship) and service (rank and service) factors

Table 4: Regression analysis in Transitioned ADF, controlling for demographic (age, education, relationship status) and service (rank and service, previous deployment) factors

		Model 1			Model 2			Model 3		
		aOR	95% CI		aOR	95% CI		aOR	95% CI	
Childhood Trauma	Nil	1.00			1.00			1.00		
	Other	0.87	0.48	1.55	0.82	0.44	1.55	1.01	0.54	1.89
	Interpersonal	1.61	0.85	3.02	1.67	0.89	3.16	1.75	0.91	3.37
Childhood-onset	Anxiety	2.74	1.54	4.86	2.25	1.24	4.11	4.40	2.13	9.10
Adult trauma	Number of types				1.32	1.18	1.48	1.24	1.09	1.40
Adult-onset disorder	Anxiety							4.00	1.98	8.05
	Depression							0.78	0.43	1.41
	Alcohol							2.84	1.59	5.08

All control for demographic (age, education, relationship status) and service (rank and service, previous deployment) factors

Table 5: Associations with multiple somatic symptoms (29 or more) in previously deployed

N=882		Prevalence			Association		
		%	95% CI		aOR	95% CI	
	Overall	20.6%	18.8%	22.5%			
Age	<25	6.4	5.3	7.7	1.00		
	26-35	41.3	39.4	43.3	1.23	0.63	2.39
	36-45	24.8	23.3	26.5	2.05	1.02	4.13
	46-55	16.9	15.8	18.1	2.10	1.03	4.27
	56+	10.5	9.8	11.3	1.67	0.79	3.52
Sex	Male	88.9	88.3	89.6	0.96	0.69	1.34
Relationship	Current	79.8	78.0	81.4	0.82	0.60	1.11
Education	Year 10	7.6	6.6	8.8	1.00		
	Year 11/12	19.3	17.7	21.1	0.77	0.48	1.25
	Certificate or diploma	52.8	50.8	54.8	0.78	0.52	1.18
	University degree	20.2	19.0	21.5	0.68	0.40	1.16
Service	Army	60.0	59.0	60.9	1.00		
	Navy	24.9	24.1	25.8	1.05	0.77	1.43
	Airforce	15.1	14.4	15.8	0.87	0.65	1.16
Rank	CO	16.7	16.3	17.2	1.00		
	NCO	36.8	36.0	37.6	1.83	1.31	2.55
	Other	46.5	45.4	47.6	2.43	1.58	3.72
Childhood-onset trauma	Nil	42.9	38.0	48.0	1.00		
	Other	30.7	26.3	35.6	0.86	0.46	1.62
	Interpersonal	26.3	22.0	31.2	1.88	0.995	3.57
	Number of types (mean)	1.1	1.0	1.2	1.19	1.001	1.42
Childhood-onset disorder	Anxiety	18.3	14.7	22.6	3.33	1.84	6.01
	Depression	2.5	1.2	5.4	0.14	0.02	0.83
	Alcohol	5.7	3.5	9.0	0.35	0.11	1.08
Adult-onset disorder	Anxiety	29.9	0.3	0.3	2.88	1.67	4.97
	Depression	17.7	14.5	21.4	1.05	0.60	1.82
	Alcohol	44.2	39.2	49.2	3.81	2.17	6.70
Deployment trauma	Number of types (mean)	4.9	4.7	5.0	1.22	1.11	1.35
	Combat	33.8	31.9	35.8	1.73	0.94	3.16
Non-deployment trauma	Number of types (mean)	1.1	1.0	1.2	1.78	1.42	2.23

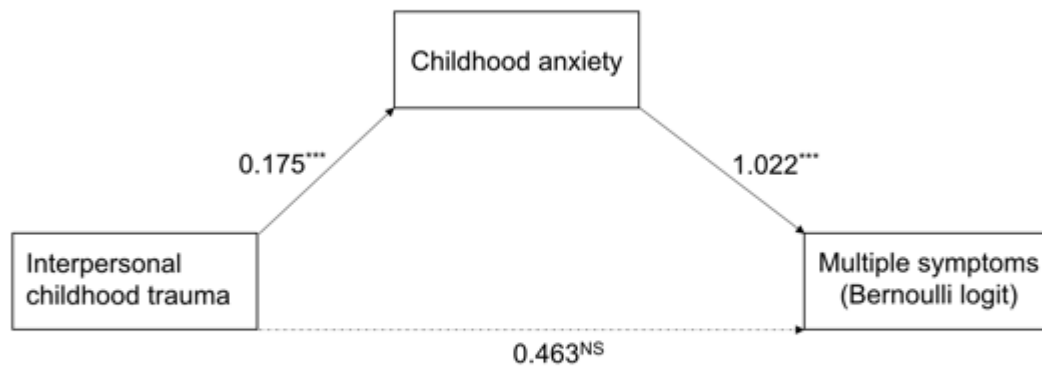
aORs control for demographic (age, education, relationship status) and service (rank and service) factors

Table 6: Regression analysis in previously deployed Transitioned population, controlling for demographic (age, education, relationship status) and service (rank and service) factors

		Multiple (29 or more) somatic symptoms								
		Model 1			Model 2			Model 3		
		aOR	95%CI		aOR	95%CI		aOR	95%CI	
Childhood factors	Childhood-onset trauma types	1.17	0.98	1.39	1.13	0.96	1.34	1.16	0.99	1.37
	Childhood-onset anxiety	3.07	1.70	5.58	3.27	1.74	6.17	7.29	3.35	15.84
	Childhood-onset depression	0.11	0.02	0.64	0.12	0.02	0.66	0.09	0.01	0.79
Adult-onset trauma	Deployment trauma types				1.22	1.11	1.35	1.15	1.04	1.28
	Other trauma types				1.70	1.31	2.20	1.55	1.22	1.96
Adult-onset disorder	Anxiety							5.00	2.30	10.84
	Depression							0.94	0.51	1.72
	Alcohol							2.85	1.54	5.28

All control for demographic (age, education, relationship status) and service (rank and service) factors

Figure 1: Mediator analysis through childhood anxiety, controlling for demographics (age, education and current relationship status) and service factors (rank, service, previous deployment)



	Co-ef.	P	Coefficients are shown *p<0.05, **p<0.01, ***p<0.001
Total unmediated	0.657	0.015	
Mediator analysis			
Total indirect pathway	0.178	0.011	

Discussion

Around a fifth of Transitioned ADF reported multiple (29 or more) somatic symptoms. This was highly associated with self-reported impaired functioning (aOR: 17.62, 95%CI: 13.11-23.69) and suicidality (aOR: 7.30, 95%CI: 5.74-9.28). Childhood anxiety appeared to be a strong and direct determinant of multiple somatic symptoms (even controlling for child and adult-onset trauma and adult-onset disorder) and fully mediated the relationship between childhood trauma and multiple somatic symptoms. Adult trauma (deployment related and other) was also associated with multiple somatic symptoms as were adult-onset anxiety and alcohol use disorders.

Multiple somatic symptoms appear to be common in the Transitioned ADF population (18.4%, 95%CI: 16.8-20.0) and dramatically higher than in the 2015 current-serving ADF (7.7%, 95%CI: 6.3-9.4) in whom the same measure was administered and the same threshold applied. This may merely signify that those with multiple somatic symptoms are more likely to leave the military. It is beyond the scope of this study to decipher whether multiple somatic symptoms precede transition from the ADF or begin after leaving the regular ADF. However, multiple somatic symptoms do appear to be associated with poor outcomes.

Studies in current serving military populations have utilised different measures and thresholds for multiple somatic symptoms, for example 10 or more symptoms (de Silva *et al.*, 2013, McCutchan *et al.*, 2016) and 18 or more symptoms (Hotopf *et al.*, 2006). In these studies, prevalences of multiple symptoms appear to range between 10-12.5% (de Silva *et al.*, 2013, Hotopf *et al.*, 2006, McCutchan *et al.*, 2016). However, in agreement with this current study, current serving military populations appear to have a lower prevalence of multiple

somatic symptoms than this Transitioned population, despite using seemingly lower symptom thresholds. This is in keeping with the commonly held view that health in Transitioning populations is a cause for concern (Shields, 2016).

Many studies have investigated multiple symptoms in veterans, however the term ‘veteran’ is commonly used to refer to those who have returned from deployment, who may or may not still be serving, and therefore quite different from the Transitioned population in this study. However, as found in this current study, deployment (to the Gulf and other deployments) have previously been found to be associated with multiple physical symptoms (Gwini *et al.*, 2016, Hotopf *et al.*, 2006, Kelsall *et al.*, 2009, Smith *et al.*, 2014).

The relationship between multiple physical symptoms and disorder in military populations have commonly investigated post-traumatic symptoms/disorder (Ahmadian *et al.*, 2019, Asnaani *et al.*, 2014, McAndrew *et al.*, 2019). However, in this study less than half of those who reported multiple physical symptoms had past-year PTSD. This suggests that research focussing on PTSD is likely to be too narrow a prism to fully elucidate the relationship between trauma, disorder and multiple physical symptoms. Importantly, however, these studies demonstrate that physical symptom reporting appeared to be associated with severity, persistence and impairment (Ahmadian *et al.*, 2019, Asnaani *et al.*, 2014, McAndrew *et al.*, 2019). This is consistent with our current study in which there was a high correlation between multiple somatic symptoms and impaired functioning as well as suicidality.

Broadly consistent with our finding that childhood and adult-onset disorder is associated with multiple somatic symptoms, prospective studies in civilians have demonstrated a bidirectional relationship between multiple physical symptoms and mental disorder, each

predicting the other at the subsequent time point (Hotopf *et al.*, 1998). This also suggests that reporting multiple physical symptoms is a risk factor for future (new or persistent) mental disorder

Childhood maltreatment appears to be associated with both poor adult physical health (Felitti *et al.*, 1998) and somatic symptoms (Kealy *et al.*, 2018). This is in agreement with our finding regarding the association of childhood interpersonal trauma with multiple somatic symptoms. In addition, broadly in keeping with prior research (Keller *et al.*, 2006, Kelsall *et al.*, 2009) adult-onset trauma was associated with multiple physical symptoms.

Childhood anxiety had a strong and direct association with multiple somatic symptoms even controlling for trauma and adult-onset disorder. We could not identify any previous studies in which this relationship has been investigated in military or retired military populations.

Strengths

This is the first study, of which we are aware, to investigate childhood experiences and childhood disorder simultaneously in determining multiple somatic symptoms in a Transitioned military population. The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load which has been a particular challenge for research on childhood experiences (Finkelhor *et al.*, 2007). We also analysed the association of multiple somatic symptoms in a

previously deployed population to assess whether these associations were independent of deployment and adult-onset trauma.

Limitations

The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. A recent systematic review highlights differences between prospective and retrospective reporting of childhood maltreatment (Baldwin *et al.*, 2019). However, we aimed to analyze the associations between *retrospectively* reported childhood trauma and childhood disorder and multiple somatic symptoms in a sample of recently Transitioned ADF personnel. It is likely that attempts to identify these people would occur in adulthood, for example, at entry or exit from military service. Therefore, we have identified that certain retrospectively reported childhood experiences and disorders, and adult-onset disorders, are associated with multiple somatic symptoms. Conclusions regarding the etiological significance of these childhood factors should be treated with caution. In addition, we should remain mindful that these symptoms might predate transition from regular military service.

We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the range, rather than frequency or severity of trauma experienced. However, similar trauma count variables have previously shown consistent significant associations with outcomes (Sareen *et al.*, 2013a).

Implications

These findings emphasise the importance of assessing mental health, suicidality and impaired functioning in those presenting with multiple somatic symptoms. Furthermore, it is possible that those at heightened risk of poor outcomes can be identified before exiting regular military service and be offered appropriate psychological and social support.

Counter intuitively, in the deployed cohort only, childhood depression had an inverse association with multiple somatic symptoms, this may be a selection effect. Theoretically those who survive childhood depression well enough to deploy (self-select and deployment screening) may be resilient to multiple somatic symptoms.

Conclusions

Importantly we have identified that multiple somatic symptoms are not only common and disabling in the transition period but also potentially predictable and therefore preventable. For example, childhood anxiety is directly associated with multiple somatic symptoms in the transition period, even controlling for trauma and adult-onset disorder, and may be a target for early intervention and prevention strategies. This lays the groundwork for further research utilising prospective methodologies to further elucidate the aetiological significance of these childhood factors and also the longer-term prognostic significance of experiencing multiple somatic symptoms in the transition period.

Chapter 14: Paper 9. Childhood determinants of suicidality in recently transitioned military men

Statement of Authorship

Title of Paper	Childhood determinants of suicidality in recently transitioned military men
Publication Status	<input type="checkbox"/> Published <input type="checkbox"/> Accepted for Publication <input type="checkbox"/> Submitted for Publication <input type="checkbox"/> Unpublished and Unsubmitted work written in manuscript style
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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper. I amended the paper according to supervisor/co-author comments.
Overall percentage	90%

(%)			
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Contribution to the Paper	Provided advice, technical expertise regarding the dataset and comments on the final manuscript		
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Abstract

Rates of suicidal ideation are higher in military personnel than comparable civilian populations. The period of transition from regular military service may be a time of particular vulnerability. In order to best inform early intervention and prevention strategies we sought to investigate the childhood determinants of self-reported suicidality (thoughts, plans or attempts) in a population of ADF (Australian Defence Force) males who had recently transitioned (within the previous five years) from regular military service. We utilised logistic regression techniques on detailed (CIDI) interview data from the ADF (Australian Defence Force) Transition and Wellbeing Research Programme. The proportion of men reporting past-year suicidality was 21.6% (95%CI: 19.9-23.3). Controlling for demographic and service factors, suicidality was associated with childhood interpersonal trauma (but not high loads of childhood trauma), childhood-onset anxiety and adult-onset disorder (anxiety and depression). Generalised Structural Equation Modelling demonstrated that the pathway between childhood interpersonal trauma and past-year suicidality was not fully mediated by childhood anxiety. Restricting the analyses to those previously deployed demonstrated that deployment trauma and multiple types of non-deployment trauma were associated with suicidality. In the fully adjusted model, childhood onset anxiety and childhood interpersonal trauma had a direct and significant association with suicidality. This study sheds light onto the aetiological significance of early interpersonal trauma in a population undergoing significant transition that may revive pre-existing vulnerabilities. It also emphasises the importance of childhood anxiety as a risk factor for suicidality. These findings have potential to aid early intervention strategies and prevention strategies in identifying those at risk prior

to the period of transition and imply that interventions targeting depression and anxiety as well as social interventions may be useful in reducing suicidality during this period.

Background

Concerns regarding the impact of military service are matters of international focus and research (Gradus *et al.*, 2013). Between 2001 and 2015, there were 325 certified suicide deaths among serving or ex-serving Australian Defence Force (ADF) personnel, of these 93% (303 deaths) were men. Rates of death by suicide were substantially higher in ex-serving than in those currently serving in the ADF (AIHW, 2017). Studies in the US demonstrate that the rate of death by suicide in veterans has increased in recent years (Bruce and Laporte, 2015).

Whilst suicide itself is a rare outcome, it is strongly predicted by the broader measure of suicidality (suicidal thoughts, plans and attempts) (Joiner *et al.*, 2005). Research on suicidality in military populations (Kuehn, 2009) has traditionally concentrated on occupational risk factors. However, several studies have not found a significant impact of deployment (Kang *et al.*, 2015, LeardMann *et al.*, 2013, Schoenbaum *et al.*, 2014). It is possible, therefore, that other factors also impact on the rates of suicidality in military personnel (Afifi *et al.*, 2016).

The period of transition from military to civilian life is becoming recognised as one of the most stressful periods in the life of military personnel but remains an emerging field of international research (Shields, 2016). For example, it is as yet unclear how childhood and military factors interact to determine suicidality in transitioning military populations.

However, an improved understanding of these potentially important aetiological factors is likely to prove a fruitful avenue to better inform early intervention and prevention strategies in these populations. Especially the possibility that people with vulnerabilities can be identified before leaving the regular military service to ensure adequate social and health service provision.

Previous research demonstrated that the proportion of ADF men reporting suicidality (3.78%, 95%CI: 3.70-3.87) was higher than the proportion of employed civilian men reporting suicidality (1.42%, 95%CI: 0.87-1.99) (Syed Sheriff *et al.*, 2018). Past-year suicidality was associated with childhood interpersonal trauma, high loads of childhood trauma, high loads of adult trauma, and childhood-onset anxiety. In ADF men (but not civilian employed men) childhood anxiety fully mediated the relationship between childhood trauma and past-year suicidality. However, this previous study was unable to shed light on the rates and determinants of suicidality in transitioning military populations.

As in previous studies (Syed Sheriff *et al.*, 2018), due to marked sex differences in non-lethal suicidal behavior rates, (Nock *et al.*, 2014, Ursano *et al.*, 2015) and the relatively low number of females in the ADF, which limited statistical power, we confined analyses in this current paper to men. We aimed to analyze the associations between retrospectively reported childhood trauma and childhood disorder and past-year suicidality in a sample of recently transitioned ADF men. In addition, in those who had been previously deployed, we aimed to investigate whether the associations between childhood factors and past-year suicidality were independent of deployment trauma, controlling for other types of adult trauma. We also aimed to examine mediator pathways from childhood trauma to past-year suicidality via childhood-onset anxiety. We hypothesized that elucidation of these associations, would provide clues as to the signs relating to risk and resilience and provide vital information to better inform early intervention and prevention strategies.

Method

Procedure

This analysis utilises data from the Transition and Wellbeing Research Programme (the Programme), a comprehensive research programme undertaken to establish the prevalence of mental disorders in a representative cohort of ADF members who transitioned out of regular ADF service between 2010 and 2014. The methodologies utilised in this study are described in more detail elsewhere (Van Hooff M, 2018). However, in brief, ethical approval for the Transition and Wellbeing Research Programme (the Programme), was provided by the DVA Human Research Ethics Committee (E014/018). Ethical approval for this particular analysis was provided by the Departments of Defence and Veterans Affairs Human Research Ethics Committee (057-18).

In brief, the Programme utilised a two-phase design. In Phase 1, Transitioned ADF members were screened for mental health problems using a 60-minute self-report questionnaire. In Phase 2, members were selected to participate in a one-hour diagnostic telephone interview using the World Mental Health Survey Initiative Version of the World Health Organization Composite International Diagnostic Interview – version 3.0 (CIDI) (Kessler and Ustun, 2004). Selection for this interview was based on strata derived from rank, sex, Service and scores on the Posttraumatic Stress Disorder Checklist (PCL) and the Alcohol Use Disorders Identification Test (AUDIT).

The sample was drawn from the Military and Veteran Research Study Roll generated for the Programme and held at the Australian Institute of Health and Welfare (AIHW). The Study

Roll was generated using identifying information from Defence and DVA and contact details from ComSuper and cross-referenced against the National Death Index. All potential participants were given the opportunity to opt out of the study roll, prior to study commencement. Contact information for those who did not opt out was passed on to the University of Adelaide and used to invite study participants to enrol in the research. Participants were informed that neither DVA nor Defence would have access to their study data nor be informed of their decision regarding participation. This provided participants with an additional degree of certainty that their responses would not affect their employment or compensation entitlements. The DVA and Defence were, however, able to access de-identified data.

Weighting and stratification

Basic demographic characteristics to be used in weighting were held for both respondents and non-respondents by the AIHW until the end of the data collection. These data were then provided to researchers in either identified or de-identified form, depending on participation and consent status in order to allow the data from respondents to be weighted up to the entire population.

All survey data for the Transitioned ADF was weighted using distinct strata for sex, Service, rank and medical fitness. CIDI weights were derived for the Transitioned ADF, based on strata including band (cut-offs were based on PCL and AUDIT), sex and Service. Post-stratification by the variables of sex, Service and rank were used to adjust the weights so that the known population totals were reproduced by the estimates, and to correct for differential non-response by rank.

Sample

Out of a total of 21,671 men who transitioned between 2010 and 2014, 20,713 were invited, and 3646 (17.6%) completed the survey. Those not invited represented individuals who may have opted out of the study or did not have any usable contact information and included those who transitioned into the Active and Inactive Reserves as well as those who had discharged completely from the Current ADF (Ex-Serving). All individuals were given the opportunity to opt out of being invited to participate in the research. A total of 1511 men were selected for a CIDI interview and 901 (59.6%) completed it.

Measures

The measures utilised in this analysis are from telephone interview which utilised the CIDI (Kessler and Ustun, 2004) structured diagnostic assessment of lifetime, 12-month and 30-day ICD-10 disorder, and self-report data relating to suicidality and deployment trauma.

Suicidality

At phase 1, the self-report questionnaire included the following specific questions regarding suicidality:

- In the last 12 months, have you ever felt so low that you *thought* about committing suicide?
- In the last 12 months, have you made a suicide *plan*?

- In the last 12 months, have you *attempted* suicide?

The variable, past-year suicidality comprised those who responded yes to any of these three questions.

Disorder

Childhood disorder was defined as disorder with age of onset below 18 years and was grouped as follows: any depression (mild, moderate, or severe depressive episode), any anxiety [social phobia, OCD, GAD, agoraphobia, panic attack, panic disorder, post-traumatic stress disorder (PTSD)], and any alcohol use disorder (abuse or dependence). Those who had a lifetime anxiety disorder but no childhood anxiety disorder were coded as having an adult-onset anxiety disorder. Coding was performed in a similar way for adult-onset depression and adult-onset alcohol use disorders.

Demographics and service characteristics

In the ADF, information regarding service characteristics was available from ADF administrative data. Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), non-commissioned officers (Sergeant to Warrant Officer equivalents), and commissioned officers (Lieutenant to General equivalents). Information regarding previous deployment was obtained from the self-report questionnaire.

Trauma

We used mutually exclusive categorisation of childhood trauma utilised in numerous previous studies (Syed Sheriff *et al.*, 2018, 2019). The first category, known as ‘Other’

included those who reported experiencing any of the following types of trauma in childhood (but neither non-interpersonal nor interpersonal trauma types), combat, refugee, peacekeeper, someone close died unexpectedly, someone close had traumatic experience, saw atrocities or carnage, experience don't want to talk about, unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, accidentally injured/killed someone, saw someone badly injured/killed, child illness, purposefully injured or killed someone else. The second category were participants who reported experiencing non-interpersonal trauma (life-threatening automobile accident, other life-threatening accident, natural disaster, man-made disaster, life-threatening illness) but not any interpersonal trauma types during childhood. The third group were those who reported experiencing any interpersonal trauma types (sexual assault, raped, stalked, kidnapped, mugged, beaten by spouse/romantic partner, badly beaten by anyone else).

Adult trauma included trauma types which first occurred at the age of 18 or older. These were then categorised as per a previous study as those unlikely to be deployment related (Frank *et al.*, 2018). These non-deployment related traumas were further categorised as interpersonal (sexual assault, raped, stalked, beaten by spouse/romantic partner, badly beaten by anyone else) or other (unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, refugee, life-threatening automobile accident, child illness, life-threatening illness, someone close had traumatic experience). Deployment trauma exposure was the sum of 12 traumatic deployment exposure items from the self-report questionnaire. Previously, similar trauma count variables have shown consistent significant associations with mental disorder outcomes (Sareen *et al.*, 2013a).

Analysis

All analyses were performed in STATA version 14.2. Descriptive analyses were utilized to describe both populations by demographic and service characteristics as well as previous trauma and mental disorder and to analyze associations with any past-year suicidality.

Logistic regression analyses were utilized to calculate the association of past-year suicidality with childhood trauma categories, controlling for demographic (age, education and relationship status) and service (service and rank) factors as well as previous deployment (Model 1). We then also controlled for adult trauma (Model 2) and childhood and adult-onset disorder (Model 3).

We then restricted our analyses to the previously deployed male transitioned population only in order to assess whether the association between childhood factors and past-year suicidality were independent of deployment trauma and other types of adult trauma. We conducted logistic regression analyses controlling for deployment trauma as well as non-deployment adult trauma in both populations.

We examined mediator pathways via childhood anxiety between childhood trauma and past-year suicidality using logistic regression models. As the outcome of interest was dichotomous, we utilized generalized structural equation modelling (GSEM) to assess mediation by childhood-onset disorder. The GSEM pathway utilized the link 'logit' and the family 'Bernoulli' within STATA. First, we calculated associations between childhood trauma and suicidality. We then reran the GSEM analysis adding childhood-onset anxiety as a mediator (Acock, 2006). The total indirect pathways were calculated utilizing the 'nlcom' command which calculates nonlinear combinations of estimators. (StataCorp, 2013)

RESULTS

The proportion of those with past-year suicidality was very high (21.6%, 95%CI: 19.9-23.3) (see Table 1).

Most participants reported experiencing childhood trauma, about a quarter reported at least one type of interpersonal trauma in childhood. Almost a third (28.7%, 95%CI: 24.1-33.7) experienced a childhood disorder, by far the most common category of which were anxiety disorders (21.1%, 95%CI:17.1-25.6).

Most participants had been previously deployed (78.9%, 95%CI: 77.2-80.6). The vast majority (92.2%, 95%CI: 88.3-94.9) experienced at least one type of new trauma in adulthood. Most participants also reported the onset of a category of mental disorder in adulthood (72.5%, 95%CI: 67.3-76.9).

Controlling for other demographic and service factors, past-year suicidality was associated with being single, lower educational attainment, being an NCO or other rank, and being previously deployed. Past-year suicidality was also associated with childhood interpersonal trauma (but not other types of childhood trauma, or even the number of types of childhood trauma) and childhood-onset anxiety. Past-year suicidality was associated with adult-onset anxiety and depression (but not alcohol use disorders). Past-year suicidality was associated with adult-onset trauma types, including both non-deployment non-interpersonal and interpersonal trauma and adult combat. **See Table 1**

Logistic regression analyses demonstrated that even controlling for adult-onset trauma types, and previous deployment, childhood interpersonal trauma had a direct and significant association with past-year suicidality. In the final model (Model 3) when also controlling for childhood and adult-onset disorders, childhood anxiety as well as childhood interpersonal trauma had a direct and significant association with past-year suicidality. Adult-onset anxiety and depression were also associated with past-year suicidality whereas adult-onset trauma types were no longer associated with past-year suicidality. **See Table 2**

GSEM demonstrated that there was a direct and significant association between childhood interpersonal trauma and past-year suicidality. When childhood-onset anxiety was added as a mediator a significant pathway remained between childhood interpersonal trauma and past-year suicidality but was of a smaller magnitude. The pathway via childhood anxiety was significant, suggesting the possibility of partial but not full mediation. **See Figure 1.**

As most of the transitioned male population reported that they had been previously deployed when we restricted the analyses to previously deployed only, the population characteristics remained broadly similar. (See Table 3) However, in the previously deployed population, controlling for demographic and service factors, there was no association of past-year suicidality with either educational attainment or service. Past-year suicidality was associated with being single, and with being an NCO or Other rank (rather than a Commissioned Officer). Past-year suicidality was associated with childhood-onset anxiety and adult-onset disorders (anxiety, depression and alcohol). It was also associated with deployment trauma types as non-deployment trauma types, by count but not by type. **See Table 3**

Logistic regression analyses demonstrated that controlling for adult deployment and non-deployment trauma types (Model 1), childhood interpersonal trauma had a direct and significant association with past-year suicidality. In the fully adjusted model adult-onset trauma, (deployment trauma exposure and other types of adult trauma) appeared to have a weak but significant association with past-year suicidality. Childhood interpersonal trauma and childhood anxiety had a direct and significant association with past-year suicidality. See **Table 4**

Paper 9: Tables and figures

Table 1: ADF transitioned men, characteristics and associations with any suicidality

N=901		ALL			OR/aOR		
		%	95% CI			95% CI	
Suicidality	Thoughts	21.6	19.9	23.3			
	Plans	8.0	7.0	9.2			
	Behaviours	1.9	1.4	2.5			
Any suicidality		21.7	20.1	23.4			
Age	<25	10.8	9.4	12.4	1.00		
	26-35	40.3	38.4	42.2	1.01	0.65	1.56
	36-45	21.9	20.5	23.4	1.26	0.78	2.02
	46-55	15.8	14.8	16.9	1.20	0.73	1.95
	56+	11.2	10.5	12.0	0.97	0.58	1.62
Relationship	Current	77.6	75.7	79.3	0.51	0.40	0.66
Highest educational attainment	Year 10	8.0	7.0	9.1	1.00		
	Year 11/12	21.9	20.2	23.7	0.65	0.43	0.98
	Certificate or diploma	51.1	49.2	53.0	0.78	0.55	1.11
	University degree	19.0	17.9	20.3	0.61	0.39	0.96
Service	Army	62.9	62.9	62.9	1.00		
	Navy	21.0	21.0	21.0	0.96	0.73	1.26
	Air Force	16.1	16.1	16.1	0.78	0.60	1.01
Rank	CO	15.6	15.6	15.6	1.00		
	NCO	31.8	31.8	31.8	1.63	1.23	2.15
	Other	52.7	52.7	52.7	1.82	1.29	2.56
Previously deployed		78.9	77.2	80.6	1.42	1.04	1.95
Childhood-onset trauma	Nil	43.5	38.4	48.7	1.00		
	Other	17.2	13.5	21.5	0.79	0.36	1.71
	Non-Interpersonal	14.5	11.5	18.2	1.28	0.65	2.52
	Interpersonal	24.8	20.6	29.6	2.37	1.29	4.34
	Nil	43.5	38.4	48.7	1.00		
	1 or 2	44.9	39.8	50.1	1.40	0.82	2.39
	3+	11.6	8.8	15.2	2.10	0.96	4.60
	Mean	1.1	0.9	1.2	1.18	0.99	1.41
Adult-onset trauma	Mean	3.7	3.4	3.9	1.16	1.05	1.29
	Combat	35.3	30.6	40.3	1.45	0.83	2.55
	Anxiety	21.1	17.1	25.6	1.93	1.08	3.44

Childhood-onset disorder	Depression	3.2	1.6	6.1	1.82	0.39	8.50
	Alcohol	5.4	3.4	8.7	1.56	0.46	5.27
	Any disorder	28.7	24.1	33.7	2.13	1.26	3.59
Adult-onset disorder	Anxiety	36.1	31.3	41.2	2.01	1.17	3.46
	Depression	25.2	21.0	29.9	2.20	1.31	3.67
	Alcohol	45.1	40.1	50.3	1.65	0.97	2.81
	Nil	27.5	23.1	32.5	1.00		
	Single	39.6	34.7	44.7	2.77	1.23	6.24
	Multiple	32.9	28.2	37.8	5.46	2.48	12.03

All ORs control for demographic (age, education, relationship status) and service (rank and service) factors

Table 2: Regression analysis for any suicidality in Transitioned ADF men

		Model 1			Model 2			Model 3		
		OR	95%CI		aOR	95%CI		aOR	95%CI	
Childhood Trauma	Nil	1.00			1.00			1.00		
	Other	0.80	0.37	1.72	0.83	0.38	1.80	1.05	0.94	1.17
	Non-Interpersonal	1.21	0.59	2.46	1.12	0.54	2.35	1.04	0.50	2.17
	Interpersonal	2.56	1.38	4.74	2.58	1.38	4.82	2.18	1.13	4.23
Ever deployed		1.54	0.68	3.50	1.29	0.56	2.94	1.30	0.52	3.23
Count of adult-onset trauma types					1.15	1.03	1.29	1.05	0.94	1.17
Childhood-onset disorder	Anxiety							3.24	1.51	6.96
	Depression							1.80	0.34	9.44
	Alcohol							1.89	0.47	7.66
Adult-onset disorder	Anxiety							3.47	1.79	6.73
	Depression							2.18	1.27	3.74
	Alcohol							1.67	0.95	2.94

All models control for demographic (age, education, relationship status) and service (rank and service) factors

Table 3: Previously deployed ADF transitioned men associations with any suicidality,

		Previously deployed men			aOR		
		%	95% CI			95% CI	
Suicidality	Thoughts	22.4	20.6	24.3			
	Plans	7.9	6.8	9.1			
	Behaviours	1.8	1.3	2.5			
Any suicidality		22.5	20.7	24.4			
Age	Mean	39.2	38.8	39.5	1.00	0.99	1.02
	<25	4.3	2.1	8.4	1.00		
	26-35	39.9	34.8	45.1	0.72	0.41	1.26
	36-45	20.4	16.6	24.9	0.91	0.50	1.65
	46-55	18.0	15.5	20.8	0.86	0.47	1.59
	56+	17.5	15.0	20.3	0.74	0.40	1.38
Relationship	Current	80.9	79.0	82.7	0.49	0.38	0.65
Highest educational attainment	Year 10	8.2	7.1	9.5	1.00		
	Year 11/12	19.5	17.7	21.4	0.70	0.45	1.10
	Certificate/ diploma	53.5	51.3	55.6	0.79	0.54	1.16
	University degree	18.8	17.6	20.2	0.76	0.47	1.23
Service	Army	62.4	61.4	63.5	1.00		
	Navy	23.1	22.3	24.0	0.92	0.70	1.22
	Airforce	14.4	13.7	15.2	0.83	0.62	1.12
Rank	CO	16.1	15.7	16.6	1.00		
	NCO	36.6	35.8	37.5	1.79	1.32	2.43
	Other	47.2	46.0	48.4	2.05	1.38	3.04
Childhood-onset trauma	Nil	44.5	39.0	50.0	1.00		
	Other	15.3	11.8	19.6	0.96	0.42	2.16
	Non-interpersonal	14.8	11.5	18.8	1.10	0.54	2.23
	Interpersonal	25.4	20.9	30.6	2.23	1.17	4.25
	MEAN	1.1	0.9	1.2	1.17	0.98	1.41
	Nil	44.5	39.0	50.0	1.00		
	1 or 2	43.5	38.2	49.1	1.41	0.80	2.49
	3+	12.0	9.0	15.9	2.10	0.92	4.76
	Anxiety	22.0	17.7	26.9	2.02	1.11	3.68
	Depression	2.2	1.0	5.0	0.54	0.11	2.53

Childhood-onset disorder	Alcohol	5.9	3.5	9.6	1.16	0.25	5.29
	Any disorder	29.6	24.7	35.1	2.05	1.18	3.57
Adult-onset disorder	Anxiety	37.3	32.1	42.7	1.90	1.08	3.33
	Depression	24.2	19.9	28.9	2.61	1.51	4.50
	Alcohol	47.7	42.2	53.2	1.87	1.06	3.28
	Nil	26.4	21.8	31.6	1.00		
	Single	38.4	33.2	43.8	3.08	1.31	7.23
	Multiple	35.2	30.2	40.7	5.34	2.31	12.32
Combat	Combat	42.7	37.7	47.8	1.29	0.73	2.26
Deployment trauma exposure types	Mean	5.6	5.3	6.0	1.09	1.00	1.18
Non-deployment adult trauma	Non-interpersonal	43.5	38.1	49.1	1.53	0.87	2.71
	Interpersonal	14.6	11.3	18.6	1.19	0.61	2.31
	Nil	38.3	33.0	43.9	1.00		
	Single	30.9	26.3	36.0	0.86	0.45	1.63
	Multiple	30.8	26.1	36.0	1.93	1.01	3.70
	Mean	1.07	1.0	1.2	1.35	1.08	1.68

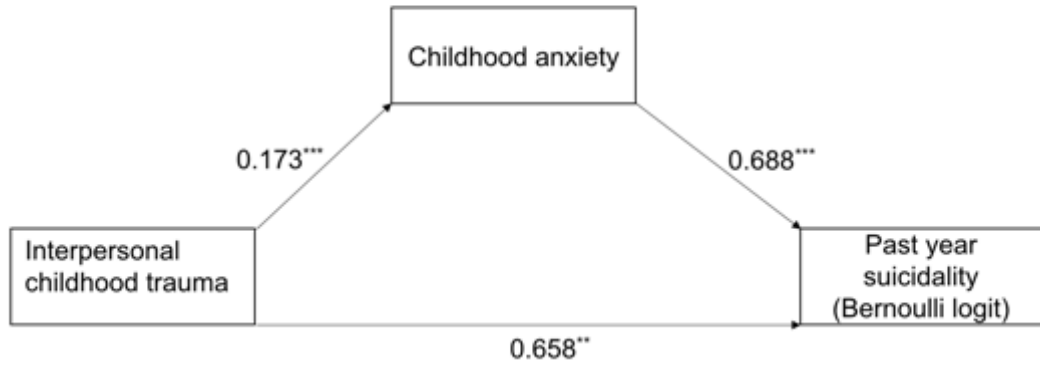
All aORs control for demographic (age, education, relationship status) and service (rank and service) factors

Table 4: Regression analysis for any suicidality in previously deployed Transitioned men, controlling for demographic (age, education, relationship status) and service (rank and service) factors

		Model 1			Model 2		
		aOR	95%CI		aOR	95%CI	
Childhood-onset Trauma	Nil	1.00			1.00		
	Other	0.79	0.34	1.81	0.82	0.35	1.94
	Non-Interpersonal	0.85	0.39	1.85	0.96	0.45	2.09
	Interpersonal	2.22	1.16	4.23	2.19	1.16	4.13
Deployment trauma types		1.32	1.05	1.66	1.09	1.01	1.19
Non-deployment adult-onset trauma types	Number of types	1.08	1.00	1.17	1.27	1.00	1.61
Childhood-onset disorders	Anxiety				2.23	1.20	4.16
	Depression				0.20	0.02	1.65
	Alcohol				0.64	0.13	3.27

All models control for demographic (age, education, relationship status) and service (rank and service) factors

Figure 1: Mediator analysis through childhood anxiety, controlling for demographics (age, education and current relationship status) and service factors (rank, service, previous deployment)



	Co-ef.	P	Coefficients are shown *p<0.05, **p<0.01, ***p<0.001
Total unmediated	0.766	0.000	
Mediator analysis			
Total Indirect pathway	0.119	0.003	

Discussion

There are concerning high rates of suicidality in recently transitioned ADF males. Several factors which are associated with suicidality are common in this population and are potentially identifiable early, such as childhood interpersonal trauma and childhood-onset anxiety. In contrast to previous research in the regular ADF (Syed Sheriff *et al.*, 2018) it does not appear that childhood anxiety fully mediated the relationship between childhood trauma and past-year suicidality in Transitioned ADF men.

The proportion of this transitioned male ADF population with past-year suicidality (21.7%, 95% CI: 19.9-23.3) was considerably higher than both the 2010 current ADF male population (2010) (3.8%, 95%CI: 3.7-3.9) and 2007 employed civilian men (1.4%, 95% CI: 0.9-2.0) (Syed Sheriff *et al.*, 2018). Whilst we know that suicidality changes with age, these proportions still appear too high to be explained by age alone. This implies that the transition may be a particularly vulnerable period for military males, or that a particularly vulnerable group was transitioning at that particular time. The Interpersonal-Psychological theory of suicidal behavior (Schonfelder *et al.*, 2019) states that feelings of thwarted belongingness and perceived burdensomeness (feelings of being a burden to friends, family, or society) lead to suicidal ideation. This might provide some explanation as to why the proportions of past-year suicidality were so high in the period of transition from the military.

In addition, interpersonal theories of suicidal behavior might explain why childhood interpersonal trauma was associated with suicidality in particular during the period of transition. Some studies suggest that childhood interpersonal trauma results in dysfunctional

emotional regulation, which is associated with suicidality in the context of challenging social circumstances (Lemaigre and Taylor, 2019).

Childhood trauma is associated with mental disorder and mental disorder is also known to impact on suicidality throughout the lifespan. Therefore, other studies have highlighted the importance of including mental disorder in assessing the association between childhood trauma and suicidality. Specifically, it is important to assess whether suicidality is fully explained by psychopathology resulting from childhood trauma or if there is a direct association of childhood trauma and suicidality. Several studies have demonstrated that mental disorder can act as a mediator (Enns *et al.*, 2006b, Fergusson *et al.*, 2000) of the association between childhood interpersonal trauma and adult suicidality. However, in agreement with this current study, may not fully mediate the relationship.

There have been contrasting results as to the impact of deployment and/or adult trauma on suicidality in military populations. Whilst some studies have found an association between deployment and suicide (Schoenbaum *et al.*, 2014), many studies have been unable to find an association between combat exposure and suicide-related outcomes. A U.S. study of nearly four million military personnel across multiple branches failed to find an association between deployment and suicide (Reger *et al.*, 2015). A longitudinal study of serving and ex-serving military personnel found that suicide risk was independently associated with mental disorders but not with military-specific variables (LeardMann *et al.*, 2013). This is important in the transitioning population as rates of current disorder are particularly high (Van Hooff, 2018). Methodological and subpopulation discrepancies are likely to account for these apparently contradictory findings (Bryan *et al.*, 2015).

Whilst we are not aware of previous studies in the military that have analyzed the impact of childhood disorders on past-year suicidality, there are civilian studies with which we can compare our findings. Recently, studies in general populations have highlighted childhood anxiety as an important determinant of suicidality (Sareen *et al.*, 2005) and also as a mediator of the relationship between childhood trauma and suicidality (Bahk *et al.*, 2017). These studies found evidence for state and trait anxiety as risk factors for adolescent suicidal behaviors (Ohring *et al.*, 1996) and also features of anxiety within affective disorders as risk factors for adult suicidality (Fawcett *et al.*, 1990). Importantly, there is evidence of anxiety disorders (particularly panic and PTSD) as predictors of adult suicidality, including attempts (Cogle *et al.*, 2009), in men.

Strengths

This is the first study, of which we are aware, to investigate childhood experiences and childhood disorder simultaneously in determining suicidality in a Transitioned military population. The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from trauma load which has been a particular challenge for research on childhood experiences. (Finkelhor *et al.*, 2007) We also analysed the association of past-year suicidality by the number of types of childhood trauma experienced, along with mediator pathways through childhood anxiety. This also allowed us to compare our findings with a previous analysis of a regular ADF and employed civilian men (Syed Sheriff *et al.*, 2018).

Limitations

The main predictor variables utilized in this analysis were childhood experiences recalled from adulthood, thus rendering the responses vulnerable to autobiographical bias. A recent systematic review highlights differences between prospective and retrospective reporting of childhood maltreatment (Baldwin *et al.*, 2019). However, we aimed to analyze the associations between *retrospectively* reported childhood trauma and childhood disorder and past-year suicidality in a sample of recently transitioned ADF men. It is likely that attempts to identify these men would occur in adulthood, for example, at entry or exit from military service. Therefore, we have identified that certain retrospectively reported childhood experiences and disorders, and adult-onset disorders, are associated with past-year suicidality in recently transitioned men. However, any conclusions regarding the etiological significance of these childhood factors should be treated with caution.

In order to aid comparability, as in a previous paper (Syed Sheriff *et al.*, 2018) we analysed the broad outcome of suicidality against childhood trauma and disorder, rather than suicidal ideation and suicide attempts separately, or the factors associated with transition between the two. Psychological factors such as impulsivity and irritability, military factors such as length of time in the military and type of discharge, as well as social factors such as employment after transition are also likely to impact on suicidal ideation, attempts and the transition between these. However, a full examination of these other factors this is beyond the scope of this current paper.

We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the

range, rather than frequency or severity of trauma experienced. However, as stated previously, similar trauma count variables have previously shown consistent significant associations with outcomes (Sareen *et al.*, 2013a).

Whilst there may appear to be a low response rate, unlike most surveys, the demographic and health status of those who did not respond at each stage was known. This was accounted for in the back-weighting of the sample to minimise any error.

Conclusions


Self-report suicidality was relatively high in men who have recently transitioned from regular ADF service. Risk factors, such as childhood interpersonal trauma and anxiety, are common and can potentially allow enhanced early identification of those at risk prior to the Transition period. In addition, and in contrast to current regular ADF men, the relationship between childhood interpersonal trauma and past-year suicidality was not fully mediated by childhood anxiety. In agreement with interpersonal theories suicidality may be precipitated by the period of relative social instability associated with transitioning. This also might explain the protective association of being in an intimate relationship. Thus, these findings have potential to aid early intervention strategies and prevention strategies in identifying those at risk prior to the period of transition and implies that early interventions targeting anxiety (such as CBT) as well as social interventions may be useful in reducing suicidality during this time.

**Chapter 15: Paper 10. Childhood
trauma and probable PTSD in
recently Transitioned and current
serving Regular military personnel**

Statement of Authorship

Title of Paper	Childhood trauma and probable PTSD in Current and recently Transitioned military populations
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Principal Author

Name of Principal Author (Candidate)	Rebecca Syed Sheriff		
Contribution to the Paper	I had the idea, conducted the analysis, wrote the paper and submitted the paper. I amended the paper according to supervisor/co-author comments.		
Overall percentage (%)	90%		
Certification:	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.		
Signature		Date	04/10/19

Co-Author Contributions

By signing the Statement of Authorship, each author certifies that:

- i. the candidate's stated contribution to the publication is accurate (as detailed above);
- ii. permission is granted for the candidate to include the publication in the thesis; and
- iii. the sum of all co-author contributions is equal to 100% less the candidate's stated contribution.

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Contribution to the Paper	Provided advice regarding the survey weighting, advice regarding the statistical analysis in general and comments on the final manuscript		

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Contribution to the Paper	Provided advice and comments on the final manuscript		
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Abstract

Against the significant prevalence rate of PTSD in military veterans, research has mainly focussed on the causal role of military factors. However military personnel have also been found to have higher prevalence's of childhood adversity/trauma than the civilian populations from which they are drawn. PTSD also can hamper a successful transition to civilian life. In order to better inform early intervention and prevention strategies we sought to examine the associations of childhood trauma with probable PTSD and mediation pathways via adult trauma in recently Transitioned and current serving Regular Australian Defence Force (ADF) members. The proportion of those with probable PTSD was higher in the Transitioned than the current serving Regular ADF. Probable PTSD was associated with childhood interpersonal trauma in both samples, but in the current serving Regular ADF probable PTSD was inversely associated with non-interpersonal childhood trauma. All associations with childhood trauma in both samples remained, using logistic regression, when controlling for socio-demographic, service factors and adult trauma. GSEM demonstrated that, whilst all categories of childhood trauma had indirect associations with probable PTSD via adult trauma, the direct associations remained significant. In a subsample that included only those previously deployed, probable PTSD was associated with interpersonal childhood trauma and both deployment-related and non-deployment related adult trauma in both samples. probable PTSD was inversely associated with childhood non-interpersonal trauma in the previously deployed current serving Regular ADF. These findings may reflect both selection criteria and resilience. Future research should investigate lifetime mental disorder and symptomatology in relation to childhood trauma and adult outcomes.

Introduction

Approximately 5000 (or 9%) of serving men and women transition out of the Regular ADF (Australian Defence Force) annually (Defence, 2016). The mental health of Australian Defence Force personnel at the time of transition is of concern (Hatch *et al.*, 2013, Jones *et al.*, 2013, Pinder *et al.*, 2012, Villatte *et al.*, 2015), with 46% of ADF members meeting criteria for a ICD-10 mental disorder in the first five years following transition from the Regular ADF (Van Hooff M, 2018). There is a significant diversity in those who transition from the military, some personnel transition after many years, whilst others transition before completing their basic training.

Of the over 24,000 ADF members who transitioned into the Reserves or discharged completely from the ADF between 2010 and 2014, the average length of military service was 10 years (Van Hooff M, 2018). Only a relatively proportion (5.5%) of those leaving the military transition into retirement (Van Hooff M, 2018). Instead, a significant proportion of Transitioned ADF members are in the critical early stages of transitioning to civilian life and employment, which is acknowledged as a significant stressor (Pease *et al.*, 2016). Despite this, until recently there has been very little systematic research into the mental health and wellbeing of those transitioning from Regular Military service (Shields, 2016).

US studies have reported PTSD prevalence rates of between 11 to 30% in deployed veterans, with rates differing with region of service (Müller *et al.*, 2015, Richardson *et al.*, 2010). PTSD affects an estimated 30% of Vietnam, 10% of Gulf War, 15% of Iraq and 11% of Afghanistan veterans (Knowles *et al.*, 2019, Müller *et al.*, 2015, Richardson *et al.*, 2010), whilst the estimated prevalence of PTSD from other Western nations appears to be lower (Richardson *et al.*, 2010). PTSD is characterized by intrusive thoughts, avoidance,

hyperarousal, negative cognitions and low mood which may be associated with irritability and aggression (Sippel *et al.*, 2018, Xue *et al.*, 2015). Veterans with PTSD are more susceptible to sleep problems, low mood, reckless behaviour, substance abuse and social isolation. PTSD and its associated problems are likely to hamper a successful transition from military to civilian life (Knowles *et al.*, 2019, Sippel *et al.*, 2018).

Recently transitioned veterans are at particular risk of developing PTSD due to the combined stress of military-related trauma and readjustment to civilian life. In addition, the literature has increasingly focused on PTSD as a product of traumatic experiences over the lifespan, rather than a single traumatic incident as defined in the diagnostic criteria (Priebe *et al.*, 2018). In keeping with this both civilian and military studies have demonstrated an association between childhood trauma/adversity and adult PTSD (Bremner *et al.*, 1993, Brewin *et al.*, 2000, Cabrera *et al.*, 2007, Iversen *et al.*, 2007a, Ozer *et al.*, 2003a). In addition, rates of childhood adversity (and/or traumatic experiences) appear to be higher in men with a history of military service (Blosnich *et al.*, 2014). Childhood adversity is a well-known predictor of poor adult mental health in military samples (Iversen *et al.*, 2007a, Rosen and Martin, 1996, Youssef *et al.*, 2013, Zheng *et al.*, 2016), and is possibly as important as combat exposure in determining poor mental health post-deployment (Jones *et al.*, 2013).

This study evaluated the relationship between probable PTSD and childhood trauma in recently Transitioned and current serving 2015 Regular Australian Defence Force (current-serving Regular ADF) members. We hypothesised that a more nuanced understanding of the role of childhood factors in determining PTSD in Current and Transitioning ADF samples would better inform prevention and early intervention strategies.

Method

This study compares survey data collected in 2015 from two separate cohorts, the Transitioned ADF, and the current-serving Regular ADF. The methodologies are described in more detail elsewhere (Van Hooff M, 2018). However, in brief, ethical approval for the Transition and Wellbeing Research Programme (the Programme), was provided by the DVA Human Research Ethics Committee (E014/018), was recognised by the Directorate, Defence Health Research, and the University of Adelaide Human Research Ethics Committee and was also approved by the Australian Institute of Health and Welfare Ethics Committee (EO 2015/1/163). Ethical approval for this particular analysis was provided by the Departments of Defence and Veterans Affairs Human Research Ethics Committee (057-18).

Populations

The Transitioned ADF comprised all ADF members who transitioned from the Regular ADF between 2010 and 2014 and included those who transitioned into the Active and Inactive Reserves as well as those who had discharged completely from the Regular ADF (Ex-Serving). All individuals were given the opportunity to opt out of being invited to participate in the research. Of the total Transitioned ADF population (N=24,932), 96.2% (23,974) were invited to participate. Those not invited represented individuals who may have opted out of the study or did not have any usable contact information. Of those invited, 18% (n = 4326) of the Transitioned ADF population completed the survey

The 2015 current-serving Regular ADF comprised three separate groups of current serving members who were invited to participate in the study: (1) those who participated in the 2010

Mental Health Prevalence and Wellbeing Study (MHPWS) and who remained in the Regular ADF in 2015; (2) those who participated in the Middle East Area of Operations (MEAO) Prospective Health Study between 2010 and 2012 and who remained in the current-serving Regular ADF in 2015; and (3) a stratified random population of 5040 who were current-serving Regular ADF members in 2015 and who were not part of the 2010 MHPWS or the MEAO Prospective Health Study. The combined results from these three groups were weighted to be representative of the 2015 current-serving Regular ADF. Of the 2015 current-serving Regular ADF (52,500), 38% (20,031) were invited to participate and 42.3% (n = 8480) completed the survey.

Weighting and stratification

Participant contact information and basic demographic and service characteristics were drawn from the Military and Veteran Research Study Roll (Study Roll) generated for the Programme and held at the Australian Institute of Health and Welfare (AIHW). The Study Roll was generated from members' data from Defence, contact data from DVA and contact details from ComSuper, and cross-referenced against the National Death Index. For all individuals in the Transitioned ADF and the 2015 current-serving Regular ADF, basic demographic characteristics to be used in weighting were held by the AIHW until the end of the data collection. These data were then provided to researchers in either identified or de-identified form, depending on participation and consent status.

All survey data for the Transitioned and Current ADF was weighted separately using distinct strata for sex, Service, rank and medical fitness. Survey responder weights were used to correct for differential non-response on the survey for both Transitioned and Current ADF.

The Transitioned ADF weights were derived from the distinct strata of sex, Service, rank and medical fitness, a dichotomous variable derived from Medical Employment Classification (MEC) status. Of the total Transitioned ADF population, 313 (1.3%) had missing information on the strata variables.

The 2015 current-serving Regular ADF weights were derived from the distinct strata of sex, Service, rank, medical fitness, and whether the individual participated in MilHOP (the 2010 Military Health Outcomes Program). This additional stratification variable was included to account for the targeted sampling of the MilHOP cohort, which was then over-represented within the current serving responders. To reduce this bias, a MilHOP flag variable (yes/no = 1/0) was created and used in the weighting process. There were 192 (0.4%) current-serving Regular ADF with missing information on the strata variables.

To maximise the data available for analysis, *survey* weights were calculated for each section of the survey. This addressed the issue of differential responses to various sections of the survey, whereby individuals potentially completed some but not all parts of the survey. A 'survey section responder' was defined as anyone who answered at least one question in a specific section of the survey. There were 29 section responder weight variables. For analysis, the weights used were always for the primary outcome variable of interest. Weights were calculated specifically for this study for the lifetime trauma section of the survey. Section responders were defined as those who reported no lifetime trauma or who gave an age of first trauma.

Samples for this analysis

For those who reported lifetime trauma, the participant was required to specify an age for their first trauma to be included in the analysis. Those who reported any lifetime trauma but did not give an age of first trauma were excluded from this study and the survey was weighted accordingly. In total, 3315 Transitioned ADF survey responders and 6702 survey responders from the 2015 current-serving Regular were included in the sample for analysis.

Variables of interest

Lifetime Trauma

Self-report lifetime trauma exposure questions were drawn from the PTSD module of the World Mental Health Initiative version of the Composite International Diagnostic Interview (CIDI) version 3.0 (Haro *et al.*, 2006). Participants were provided with a list of 26 traumatic events and were asked to identify which of these events they had experienced during their lifetime and the age when they first had that experience. In this study, childhood trauma was defined as trauma that first occurred in childhood, and therefore had an onset age of 0-17. In contrast, adult trauma included traumatic events which first occurred at the age of 18 or older.

We used the same mutually exclusive categorisation of childhood trauma used in numerous previous studies (Syed Sheriff *et al.*, 2018, 2019). The first category, known as ‘Other’ included those who reported experiencing any of the following types of trauma in childhood

(but not either non-interpersonal or interpersonal trauma types), combat, refugee, peacekeeper, someone close died unexpectedly, someone close had traumatic experience, saw atrocities or carnage, experience don't want to talk about, unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, accidentally injured/killed someone, saw someone badly injured/killed, child illness, purposefully injured or killed someone else. The second category were those who reported experiencing non-interpersonal trauma (life-threatening automobile accident, other life-threatening accident, natural disaster, man-made disaster, life-threatening illness) but not any interpersonal trauma types during childhood. The third group were those who reported experiencing interpersonal trauma types (sexual assault, raped, stalked, kidnapped, mugged, beaten by spouse/romantic partner, badly beaten by anyone else) but not any non-interpersonal trauma types in childhood. The fourth were those who reported experiencing both non-interpersonal and interpersonal trauma types in childhood.

Adult trauma included traumatic events which first occurred at the age of 18 or older. These were then categorised as per a previous study as those unlikely to be deployment related (Frank *et al.*, 2018). These non-deployment related traumas were further categorised as interpersonal (sexual assault, raped, stalked, beaten by spouse/romantic partner, badly beaten by anyone else) or other (unarmed civilian in a place of conflict, lived as a civilian in a place of ongoing terror, refugee, life-threatening automobile accident, child illness, life-threatening illness, someone close had traumatic experience).

Deployment trauma exposure

Deployment trauma exposure was calculated as the sum of 12 deployment trauma exposure items from the 'Deployment Exposure' section of the self-report survey. This included the following exposures (these are abbreviated), come under fire, caused injury, discharge your weapon, unable to respond due to rules of engagement, fear encounter an IED (Improvised Explosive Device), go on combat patrols, unauthorised discharge of weapon, clear buildings, in danger of being killed, handle or see dead bodies, casualties of people close to you, witness human degradation. Whilst this reflects the range of trauma experienced rather than frequency or severity, similar trauma count variables have previously been shown to have consistent significant associations with mental disorder outcomes (Sareen *et al.*, 2013a).

Probable PTSD

DSM IV PTSD was assessed using the Post-traumatic Stress Disorder Checklist civilian version (PCL-C), (Weathers *et al.*, 1993) which allows ratings to be based on any lifetime trauma (not just military-related). Respondents rate symptoms in the past month, which are summed to give a total score, ranging from 17 to 85. Higher scores indicate a greater severity of PTSD symptoms. The PCL shows high validity and reliability. We chose a cut off score of ≥ 53 , previously validated in this population to indicate probable 30-day disorder. (Searle *et al.*, 2015)

Demographics and service characteristics

Military ranks were grouped into three categories, other ranks (Private to Corporal equivalents), non-commissioned Officers (NCOs) (Sergeant to Warrant Officer equivalents), and commissioned Officers (Lieutenant to General equivalents). Information regarding previous deployment was obtained from the self-report questionnaire.

Analysis

Population characteristics

All analyses were performed in STATA version 14.2. Descriptive analyses were utilized to describe both populations by demographic and service characteristics as well as previous trauma and associations with probable PTSD.

Logistic regression analyses were utilized to calculate the association of probable PTSD with childhood trauma categories in both samples, controlling for demographic (age, education and relationship status) and service (service and rank) variables as well as adult trauma. We examined mediator pathways between childhood trauma and probable PTSD using logistic regression models in both samples. As the outcome of interest was dichotomous, we utilized generalized structural equation modelling (GSEM) to assess mediation by adult trauma. The GSEM pathway utilized the link 'logit' and the family 'Bernoulli' within STATA. First, we calculated associations between childhood trauma and probable PTSD. We then reran the GSEM analysis adding adult trauma as a mediator. (Acock, 2006) The total indirect pathways were calculated utilizing the 'nlcom' command which calculates nonlinear combinations of estimators. (StataCorp, 2013)

In order to exclude the possibility that the results of our logistic regression analyses were due to confounding by deployment trauma, we then calculated associations again, but only in those previously deployed. We controlled for deployment trauma as well as non-deployment related trauma in both populations.

Results

The proportion of probable PTSD in the Transitioned sample, at 15.4% (95% CI: 14.2-16.5) was significantly greater than in the current-serving Regular ADF, at 3.5% (3.1-3.9). A higher proportion of the current-serving Regular ADF reported childhood trauma. The mean number of adult trauma types was higher in the Transitioned than in the current-serving Regular ADF. A smaller proportion of the Transitioned sample had been previously deployed. A higher proportion of the current-serving Regular ADF were male, currently in a relationship, in the Navy or Airforce and were Officers or NCOs compared with the Transitioned samples. (see Table 1)

In both samples probable PTSD was associated with interpersonal childhood trauma (either alone or with non-interpersonal trauma), adult trauma, deployment, with being an NCO (compared with being a CO), lower educational attainment, and with being in the Army. In the current-serving Regular ADF only, it was INVERSELY associated with non-interpersonal childhood trauma. (see Table 1)

In logistic regression analyses, when controlling for demographic variables (age, sex, relationship status, educational attainment), service factors (rank and service) as well as previous deployment and adult trauma, probable PTSD was associated with interpersonal childhood trauma categories in both the Transitioned and current-serving Regular ADF. It was also associated with adult trauma in both samples. However, in the current-serving Regular ADF it was associated with previous deployment and INVERSELY associated with non-interpersonal childhood trauma (see Table 2).

GSEM analyses demonstrated that in the most basic model (without mediators) in current-serving Regular ADF non-interpersonal childhood trauma reduced the odds of probable PTSD whereas interpersonal childhood trauma increased the odds of probable PTSD. When adult trauma was added as a mediator the direct effect of non-interpersonal trauma did not change substantially in magnitude. The direct effect of interpersonal trauma reduced in magnitude but remained significant suggesting partial mediation by adult trauma. All types of childhood trauma had a significant indirect effect on probable PTSD via adult trauma (see Fig 1).

In the Transitioned sample, GSEM demonstrated that neither non-interpersonal nor other childhood trauma had a direct effect on probable PTSD in the basic unmediated model, whereas interpersonal childhood trauma did. This association remained highly significant when adult trauma was added as a mediator. All childhood trauma categories had a significant indirect association with probable PTSD via adult trauma (see Fig 2).

We then conducted an analysis in both samples only for those who reported ever having been deployed. A substantially smaller proportion of the current-serving Regular ADF had probable PTSD than the Transitioned sample. In comparison to the Transitioned sample a higher proportion of current-serving Regular ADF were male, in the Navy or Airforce, were COs and a higher proportion reported having experienced childhood trauma. The category 'Other' childhood trauma was significantly greater in the current-serving Regular ADF than the Transitioned sample. A higher proportion of the Transitioned sample reported experiencing deployment trauma, high loads (four or more types) of deployment trauma and 'other' types of non-deployment trauma than the current-serving Regular ADF. (see Table 3)

In both samples probable PTSD was associated with childhood interpersonal trauma (both with and without non-interpersonal trauma), deployment trauma and non-deployment trauma of both types (Interpersonal and Other). In the current-serving Regular ADF only, non-interpersonal childhood trauma was inversely associated with probable PTSD (see Table 4).

Paper 10: Tables and figures

Table 1: Transition and Current-serving population characteristics and proportions/means

		Current-serving Regular ADF (N= 6702)						Transitioned ADF (N= 3315)					
N=		%	95% CI		OR/aOR	95% CI		%	95% CI		OR/aOR	95% CI	
Probable PTSD		3.5	3.1	3.9				15.4	14.2	16.5			
Childhood Trauma	Nil	69.3	68.2	70.3	1.00			73.1	71.7	74.5	1.00		
	Other	12.7	12.0	13.5	1.02	0.70	1.48	10.2	9.3	11.3	0.93	0.67	1.28
	Non-Interpersonal	6.2	5.7	6.8	0.49	0.25	0.99	5.6	4.9	6.4	0.99	0.65	1.51
	Interpersonal	9.7	9.1	10.4	1.79	1.28	2.50	9.6	8.7	10.6	1.80	1.37	2.38
	Both	2.0	1.8	2.4	3.98	2.43	6.52	1.4	1.1	1.8	3.63	2.05	6.42
Adult trauma	Mean number of types	2.3	2.2	2.3	1.36	1.31	1.42	2.6	2.6	2.7	1.30	1.26	1.35
Deployment		81.1	78.9	83.2	3.26	1.86	5.72	75.4	73.6	77.2	2.25	1.66	3.05
Age	Mean	38.6	38.2	39.1	1.01	0.99	1.02	38.1	37.8	38.5	1.00	0.99	1.01
Sex	Male	91.4	91.2	91.7	1.05	0.73	1.53	87.4	86.8	87.9	0.95	0.71	1.28
Relationship	Current	81.6	79.3	83.8	0.71	0.51	0.99	76.4	74.5	78.2	0.70	0.55	0.89
Highest educational attainment	Year 10	8.3	6.9	10.1	1.00			6.9	5.9	8.0	1.00		
	Year 11/12	20.1	18.0	22.4	0.78	0.49	1.23	21.3	19.5	23.2	0.78	0.54	1.13
	Certificate or diploma	48.0	45.5	50.5	0.81	0.54	1.23	49.8	47.8	51.8	0.65	0.47	0.90
	University degree	23.6	22.5	24.7	0.77	0.42	1.40	22.0	20.7	23.4	0.36	0.23	0.54
Service	Army	49.8	48.9	50.8	1.00			60.9	60.1	61.8	1.00		
	Navy	24.8	24.1	25.5	0.58	0.42	0.80	21.5	20.7	22.4	0.76	0.58	0.98
	Airforce	25.3	24.8	25.9	0.42	0.30	0.57	17.5	17.0	18.1	0.54	0.42	0.70
Rank	CO	25.9	25.4	26.4	1.00			18.0	17.6	18.4	1.00		
	NCO	32.9	32.2	33.5	1.60	1.02	2.49	31.4	30.8	32.1	1.58	1.18	2.12
	Other	41.2	40.2	42.3	1.77	0.91	3.43	50.6	49.7	51.5	1.28	0.87	1.88

All unadjusted Odds Ratios (ORs) with the exception of demographic (Age, Sex, Relationship and Education) and service factors (Service and Rank) which all control for each other

Table 2: Regression analysis for probable PTSD in current-serving and Transitioned ADF populations

		Current			Transitioned		
		aOR	95%CI		aOR	95%CI	
Childhood Trauma	Nil	1.00					
	Other	1.04	0.71	1.53	0.84	0.59	1.19
	Non-Interpersonal	0.47	0.23	0.96	0.86	0.54	1.36
	Interpersonal	1.50	1.05	2.16	1.60	1.17	2.18
	Both	4.05	2.32	7.07	2.67	1.39	5.12
Previous deployment	No	1.00			1.00		
	Yes	2.11	1.11	3.99	1.33	0.95	1.88
Adult trauma	Number of types	1.33	1.27	1.41	1.31	1.25	1.36

All control for demographic (Age, Sex, Relationship and Education) and service factors (Service and Rank)

Table 3: Characteristics of previously deployed in Current-serving and Transition populations

		Current-serving Regular ADF			Transitioned ADF		
		%	95% CI		%	95% CI	
	Probable PTSD	3.9	3.5	4.4	17.1	15.8	18.4
Age	Mean	39.6	39.1	40.0	39.4	39.0	39.8
Sex	Male	92.7	92.3	93.0	89.8	88.9	90.6
Relationship	Current	82.9	80.5	85.1	79.6	77.5	81.5
Highest educational attainment	Year 10	9.5	7.8	11.6	7.2	6.1	8.4
	Year 11/12	19.6	17.4	22.0	19.1	17.2	21.2
	Certificate or diploma	47.5	44.9	50.2	52.5	50.3	54.8
	University degree	23.3	22.1	24.6	21.1	19.7	22.6
Service	Army	50.3	48.6	51.9	61.3	59.8	62.7
	Navy	27.6	26.3	28.9	23.6	22.2	24.9
	Airforce	22.2	21.2	23.1	15.2	14.3	16.1
Rank	CO	26.5	25.6	27.4	18.4	17.6	19.1
	NCO	36.5	35.3	37.7	37.0	35.7	38.2
	Other	37.0	35.0	39.0	44.7	43.0	46.4
Childhood Trauma	Nil	68.1	67.0	69.2	71.5	69.8	73.1
	Other	13.2	12.4	14.0	10.6	9.6	11.8
	Non-Interpersonal	6.6	6.1	7.2	6.1	5.3	7.0
	Interpersonal	10.0	9.4	10.8	10.3	9.3	11.4
	Both	2.1	1.8	2.5	1.5	1.1	1.9
Deployment trauma	Nil	21.2	20.2	22.1	14.5	13.3	15.8
	Low (3 or less)	26.4	25.4	27.4	22.6	21.1	24.1
	High (4 or more)	52.5	51.4	53.5	62.9	61.3	64.5
Non-deployment adult trauma	Other	25.9	24.9	27.0	28.4	26.9	30.1
	Interpersonal	9.9	9.2	10.6	10.7	9.7	11.9

Table 4: Regression analysis for PTSD in regular and transitioning FOR those who reported previous deployment

		Model 1						Model 2					
		Current			Transitioning			Current			Transitioning		
		OR	95%CI		aOR	95%CI		OR	95%CI		aOR	95%CI	
Childhood Trauma	Nil	1.00						1.00			1.00		
	Other	1.03	0.71	1.50	0.84	0.60	1.19	0.99	0.67	1.46	0.78	0.54	1.11
	Non-Interpersonal	0.48	0.24	0.97	0.95	0.62	1.47	0.45	0.22	0.93	0.81	0.51	1.28
	Interpersonal	1.72	1.22	2.44	1.65	1.24	2.21	1.56	1.08	2.26	1.42	1.03	1.97
	Both	3.59	2.19	5.89	2.77	1.51	5.10	3.33	1.98	5.60	2.23	1.11	4.47
Deployment trauma	Nil							1.00			1.00		
	Low (3 or less types)							2.72	1.41	5.24	2.30	1.29	4.12
	High (4 or more types)							6.18	3.35	11.39	6.03	3.51	10.36
Non-deployment adult trauma	Other							1.43	1.09	1.89	1.59	1.27	2.00
	Interpersonal							1.89	1.36	2.65	1.88	1.40	2.53

Model 1 only includes childhood trauma

Model 2 also controls for demographic and service

Figure 1: Generalised Structural Equation Modelling Pathway Analysis: Current-serving Regular ADF

Childhood trauma category (compared with no childhood trauma)

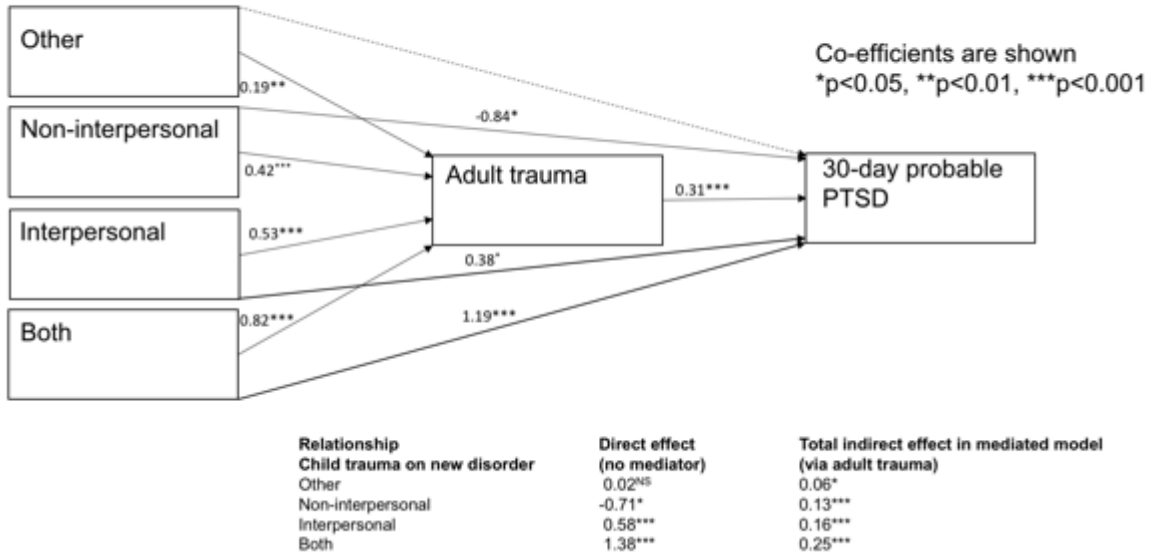
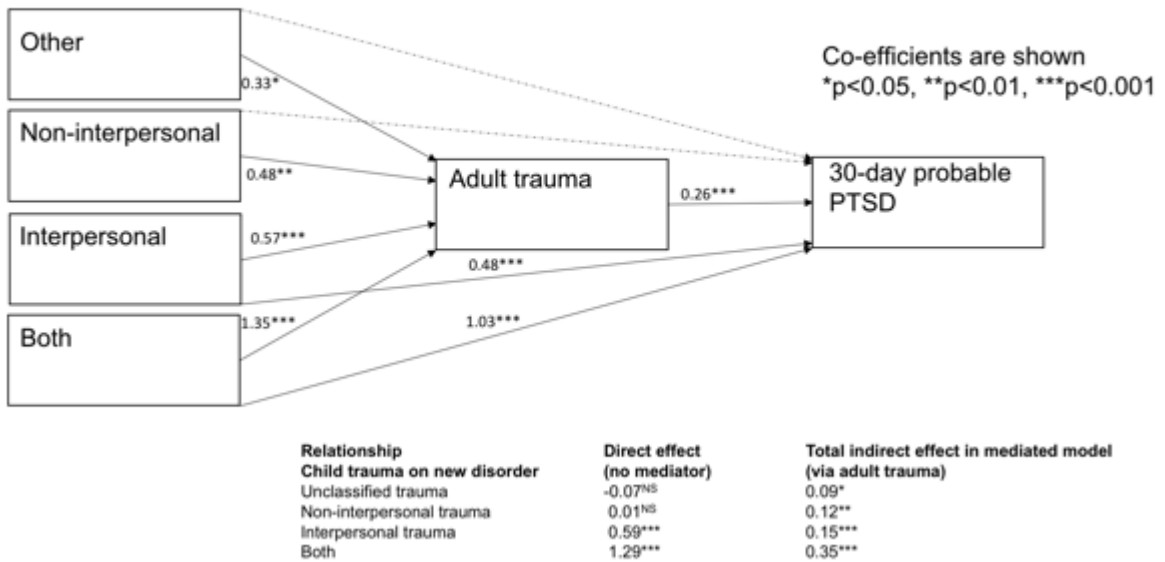


Figure 2: Generalised Structural Equation Modelling Pathway Analysis: Transitioned

Childhood trauma category (compared with no childhood trauma)



Discussion

There was a much higher proportion of probable PTSD in the Transitioned than the current-serving Regular ADF. In fact, a number of studies have reported rates of PTSD in transitioned members at around double that of current serving military personnel (Hatch *et al.*, 2013, Pinder *et al.*, 2012), whilst others have found similar rates. As this current study is cross-sectional, the probable PTSD in transitioned members may have predated transition from the regular military and may have been the reason for leaving.

Interpersonal childhood trauma had a significant association with probable PTSD in both samples. In the current-serving Regular ADF only, non-interpersonal childhood trauma had an inverse association with probable PTSD. The relationship between childhood trauma and probable PTSD remained even when controlling for sociodemographic and service factors as well as adult trauma. GSEM demonstrated that whilst there were significant indirect pathways between childhood trauma and probable PTSD via adult trauma the direct pathways also remained significant. When only considering the previously deployed samples, childhood trauma categories continued to have a direct and significant relationship with probable PTSD, as did deployment trauma and other types of adult trauma.

The association of childhood trauma/adversity with PTSD is broadly consistent with previous research in both military and civilian populations (Bremner *et al.*, 1993, Brewin *et al.*, 2000, Cabrera *et al.*, 2007, Iversen *et al.*, 2008, Kessler *et al.*, 2017, Ozer *et al.*, 2003b). However, most studies have observed childhood adversity/trauma on a continuum. The few studies that have attempted to observe the associations of childhood trauma by type have encountered the

problem of clustering, whereby trauma does not occur randomly, rather those who are exposed to childhood trauma are often exposed to multiple types (Finkelhor *et al.*, 2007). We attempted to overcome this by forming mutually exclusive categories of childhood trauma. The finding that interpersonal childhood trauma was associated with PTSD whereas non-interpersonal childhood trauma was not, is broadly consistent with previous research which demonstrates that interpersonal trauma is more likely to be associated with the development of PTSD than non-interpersonal trauma (Kessler *et al.*, 2017).

Consistent with some previous studies (Cabrera *et al.*, 2007, Fear *et al.*, 2010, Rona *et al.*, 2009), deployment in and of itself was not significantly associated with past-year PTSD in the Transitioned sample. PTSD was associated with deployment trauma exposure in both samples. In addition, both interpersonal and other types of adult-onset non-deployment trauma were associated with probable PTSD in both samples. This highlights the role of trauma in the adverse psychological impact of deployment as well as the stress of adult life outside of military deployments (Vasterling *et al.*, 2010).

Broadly consistent with other studies, childhood trauma had a significant indirect pathway to PTSD via adult trauma (Dar *et al.*, 2015) in both samples. Previous research demonstrates that prior trauma history predicts both future trauma exposure and future PTSD risk (Kessler *et al.*, 2017). However, whilst in both samples childhood trauma categories that included interpersonal trauma were directly associated with PTSD, in the current-serving Regular ADF, non-interpersonal childhood trauma was inversely associated with PTSD. There are no similar studies with which to compare our findings. However, Kessler *et al.* (Kessler *et al.*,

2017) found that whilst most types of antecedent trauma worsened the impact of later trauma, some types lessened subsequent reactions to similar types of trauma.

Thus, our results regarding non-interpersonal childhood trauma in the current-serving Regular ADF could be due either to selection and/or non-interpersonal childhood trauma exposures promoting resilience to future trauma (Wilson *et al.*, 2009). Both animal studies and human studies (Liu *et al.*, 2017, Rutter, 2012) support the possibility of resilience. A previous study in the 2010 current-serving Regular ADF, demonstrated that in the ADF childhood disorder fully mediated the relationship between childhood trauma and PTSD (Syed Sheriff, JTS, in press). This is also consistent with research showing that psychopathology after antecedent traumas mediates the association between trauma history and subsequent PTSD. Research on the ‘healthy warrior effect’ supports the possibility of selection (Larson *et al.*, 2008, Wilson *et al.*, 2009). It is possible, in this case, that both processes are at work (i.e. both inoculation and selection).

Strengths

The generation of mutually exclusive categories according to the types of trauma experienced as children allowed the disentangling of trauma type from load which has been a particular challenge for research on childhood experiences (Finkelhor *et al.*, 2007). In addition, this is the first study of which we are aware to compare the associations of childhood trauma and PTSD in current-serving and Transitioned military populations.

Weaknesses

The main predictor variables utilized in this analysis were childhood experiences retrospectively reported from adulthood, thus rendering the responses vulnerable to autobiographical bias. A recent systematic review highlights differences between prospective and retrospective reporting of childhood maltreatment (Baldwin *et al.*, 2019). It is likely that attempts to identify these people would occur in adulthood, for example, at entry or exit from military service. Therefore, we have identified that certain retrospectively reported childhood experiences are associated with probable PTSD in different samples, which is of value.

Whilst there may appear to be a low response rate, unlike most surveys, the demographic status of the ADF members who did not respond was known. This was accounted for in the back-weighting of the sample to minimise any error. In addition, bias may have been introduced by excluding those who reported trauma but did not report an age of first trauma. Unfortunately, missing data is an intrinsic hazard particularly of self-report data. This is likely to be minimized by using interview data. However, this study has laid the ground work for more rigorous methodologies, such as those using more reliable interview data and prospective studies to further investigate these findings.

We accounted for the number of types of childhood trauma that were experienced, however, not for the number of times each trauma occurred during childhood. Thus, reflecting the range, rather than frequency or severity of trauma experienced. However, similar trauma count variables have previously shown consistent significant associations with mental disorder. (Sareen *et al.*, 2013a) It is possible that in some cases mental disorder pre-dated the trauma, and that mental disorder may not have been related to that trauma. In addition, other measures of adversity such as more general family dysfunction or neglect were not measured in this study. The missing part of the puzzle is data regarding lifetime disorder/symptomatology in the current-serving Regular ADF.

Conclusion

Whilst mental health problems may predate transition from regular military service, and for some, may be a reason for transitioning, the period of adjustment to civilian life may be a particular period of vulnerability to mental health problems, including PTSD. It is possible that for some, this is a stressful period in which PTSD may manifest or worsen. This might explain some of the differences between the current-serving Regular ADF and Transitioned samples. In addition, the period between 2008 and 2012 was a period of particularly high operational intensity in the ADF (Van Hooff M, 2018). Those remaining in the ADF after this time may represent a particularly resilient group. This might also be responsible for some of the differences between the 2015 current-serving Regular ADF and Transitioned and the 2010 current-serving Regular ADF. It seems likely that a history of interpersonal childhood trauma is associated with PTSD across different populations, however, it is possible that selection and/or inoculation means that surviving non-interpersonal trauma such as disasters or accidents in childhood is associated with reduced odds of PTSD in the Current serving Regular sample. It might seem likely that those who remained in the ADF were those in whom non-interpersonal trauma had the least mental health impact. Future research should replicate these analyses with more reliable interview data and investigate lifetime disorder/symptomatology and associations with other outcomes longitudinally.

Chapter 16: **Discussion**

Context and contribution to knowledge

My overall aim was to investigate childhood trauma and childhood disorder in determining adult health and related outcomes. In this context, I utilized detailed lifetime interview data from the 2010 ADF MHPWS and the ADF Transition and Wellbeing Research Programme (the Programme). I also utilized self-report data from the ADF MEAO Prospective Study.

My objectives were to assess childhood trauma and formulate categories to allow meaningful comparison of trauma types across populations. In addition, I aimed to assess childhood mental disorder and the association between childhood trauma and childhood disorder. Moreover, I aimed to compare the association of childhood factors (trauma and disorder) with adult disorder and related outcomes (distress, functioning and suicidality). Where possible, I aimed to compare military with demographically matched civilian populations. I also aimed to investigate the association of childhood trauma with the development of new post-deployment disorder.

In a population who had left regular military service within the previous five years (Transition), I aimed to investigate the associations of childhood trauma and disorder on past-year anxiety and depression, PTSD, self-reported suicidality and multiple somatic symptoms. In addition, I aimed to analyse whether these associations were independent of military/deployment factors.

These studies utilized an innovative and unique way of classifying childhood trauma into mutually exclusive categories. Many of the findings of this research regarding proportions and associations of these childhood trauma categories with adult outcomes were therefore not in the literature previously. In addition, as no previous studies have specifically analyzed

childhood mental disorder in a military population, the findings with regard to childhood disorder and mediator pathways were also new.

This adds considerably to the literature. It was previously understood that childhood adversity was an important determinant of health in current serving military personnel (Iversen *et al.*, 2007a). This current research demonstrated that (at least in males), the associations between childhood trauma and adult mental health outcomes were fully mediated by childhood disorder. Important to note, childhood interpersonal trauma was not just a determinant of PTSD, but also the whole spectrum of past-year mental disorder. However, all of these associations appeared to be mediated by the spectrum of childhood mental disorders, with the exception of suicidality on which the association appeared to be fully mediated by childhood anxiety.

With the exception of suicidality in the regular ADF, the spectrum of childhood disorders (not only childhood anxiety) appeared to mediate these associations. This speaks to the importance of evaluating the spectrum of childhood mental disorders, rather than individual disorder types in determining the longer-term impact of childhood trauma.

This current research also adds considerably to knowledge regarding the Transition period. For example, childhood anxiety appeared not only to be an important determinant of adult outcomes (PTSD, anxiety, suicidality and multiple symptoms), it also appeared to fully mediate the relationship between childhood trauma and these outcomes (with the exception of suicidality). This speaks to the etiological importance of anxiety in determining mental health

during a period of social instability. Given that research into the Transition period is still an emerging field of international study, (Shields, 2016) this nuanced understanding of the childhood determinants of mental health and related outcomes lays the groundwork for future research and begins to better inform the provision of early intervention and prevention strategies during this vulnerable period.

Key Findings

Childhood factors

Non-interpersonal trauma

A large proportion of ADF men (and significantly more than civilians) experienced childhood non-interpersonal trauma (such as natural disasters and accidents) in the absence of interpersonal trauma (see Overview Table 1). The proportion of those reporting childhood non-interpersonal trauma increased (non-significantly) with age in the ADF but declined in civilians so that the difference between populations was marked in the oldest age group (Paper 1).

However, childhood non-interpersonal trauma was not associated with childhood depression in either ADF or civilian men whereas it was associated with both childhood anxiety and alcohol use disorders (Paper 1). Childhood non-interpersonal trauma was not associated with any of the adult outcomes in any of the populations that we investigated, with the exception of current distress in ADF (but not civilian employed) men (Paper 5) and new-post deployment disorder in the deployment sample (Paper 6). Somewhat surprisingly childhood non-interpersonal trauma was inversely associated with very poor occupational functioning (more than 8 full days out of role in the previous 30 days) in current regular ADF males

(2010) but not in civilian employed men, (Paper 5) however this inverse association became non-significant when controlling for other factors (see Overview Table 2). Similarly, it was inversely associated with probable PTSD in the current serving ADF (2015) (Paper 10), however this also became non-significant when controlling for other factors (Overview Table 2).

It therefore appears that childhood trauma that is not interpersonal in nature has less of an impact through the lifespan. This is consistent with previous research (Kessler *et al.*, 2017). However, the association of non-interpersonal childhood trauma with new-post-deployment disorder (Deployment sample, Paper 6) but not with past-year PTSD (ADF, 2010, Paper 3) and the inverse association very poor occupational functioning (ADF, 2010, Paper 5) and probable PTSD (ADF, 2015, Paper 7), at first glance appears contradictory.

However, it is in keeping with the finding that that childhood non-interpersonal trauma is associated with current distress in the ADF (Paper 5) and reinforces the concept of cumulative trauma. It is possible that those who experienced childhood non-interpersonal trauma and remained in the military, after a particularly intense period, in 2015, were at relatively lower risk of PTSD due to self-selection/ healthy warrior effect. It is also possible that the characteristics of the mental disorder experienced in those with particular childhood trauma profiles may be different.

Therefore, it would be premature to conceptualise non-interpersonal childhood trauma as being innocuous. In addition, it is concerning that, unlike childhood interpersonal trauma, the impact of childhood non-interpersonal trauma on new post-deployment disorder (Paper 6)

was not fully mediated by pre-deployment symptoms. This suggests that an understanding of childhood trauma profile is needed over and above pre-deployment symptom screening.

Interpersonal trauma

Childhood interpersonal trauma had a higher prevalence in the regular ADF (2010) than civilian employed men (Papers 1 and 2). Childhood interpersonal trauma had a significant association with all the outcomes we investigated in every population with the exception of past-year depression in the Transitioned population (Paper 7).

This analysis echoes previous research in further demonstrating the detrimental effects of childhood trauma/adversity on mental and physical health as well as related outcomes such as suicidality, distress and functioning (Felitti *et al.*, 1998). Whilst the association between childhood adversity and poor outcomes has been shown in other military populations (Afifi *et al.*, 2016, Iversen *et al.*, 2007b, Jones *et al.*, 2013), and a deploying ADF population (Zheng *et al.*, 2016), this has not been previously demonstrated across the entire regular ADF and Transitioned populations.

Anxiety

There were higher rates of childhood anxiety than other childhood disorders in the populations that we had CIDI data for (see Overview Table 1). Childhood anxiety had a positive association with all of the outcomes we investigated in the ADF and Transitioned populations with the exception of severely impaired occupational functioning (ADF 2010, Paper 5) and past-year depression (Transitioned population, Paper 7), see Overview Table 2.

Therefore, it appears that childhood anxiety is common, is a direct and significant determinant of poor adult outcomes and fully mediated the association between childhood trauma and suicidality (ADF 2010, Paper 4). However, in some cases, such as suicidality, there was an association with childhood anxiety in ADF men but no such significant association in civilian employed men. This suggests that childhood anxiety is more likely to come into play as an aetiological factor for these outcomes in populations with a higher trauma burden. As this data is cross-sectional, firm conclusions regarding the aetiological significance of these findings would be premature. However, these initial findings suggest that further longitudinal research is needed regarding childhood anxiety in order to better inform early identification and prevention of poor mental health outcomes.

With the exception of past-year depression, childhood anxiety was associated with all of the outcomes that we investigated in the Transitioned population. In contrast, childhood alcohol use disorders were not associated with any of the adult outcomes and childhood depression was only associated with past-year depression. This suggests that, in a period of social instability, childhood anxiety may be an important early indicator for poor outcomes.

Depression

Retrospectively reported childhood depression was relatively uncommon in the populations we investigated (See Overview Table 1). Childhood depression was associated with past-year disorder in both ADF men and civilian employed men. However, of note, there were many differences between ADF men and civilian employed men in terms of which outcomes were

significantly associated with childhood depression. In ADF men, childhood depression was associated with past-year PTSD but not with suicidality, distress or severely impaired functioning. In civilian employed men, childhood depression was not associated with past-year PTSD but was associated with distress and severely impaired functioning. In the Transitioned population childhood depression was associated with past-year depression, but somewhat surprisingly, inversely association with multiple somatic symptoms (See Overview Table 2).

This demonstrates the importance of population specific studies and also differences in early factors relating to risk and resilience in these populations. It is beyond the scope of this current study to elucidate whether these differences were due to screening or other differences between the populations such as different rates of trauma.

Alcohol use disorders

Other than the association with past-year disorder, childhood alcohol use disorders were not associated with any of the poor outcomes we investigated in either the current or the transitioned ADF populations. In contrast, in civilian employed men, childhood alcohol use disorder was associated with all of the poor outcomes we investigated with the exception of past-year PTSD (see Overview Table 1). This suggests that those in the ADF are relatively protected from poor outcomes associated with childhood alcohol use disorders.

Adult Factors

With exception of past-year depression in the Transitioned population, the number of adult-onset trauma types was associated with every poor outcome we investigated in every population we observed. However, combat was only associated with past-year anxiety and PTSD in the transitioned population. This demonstrates the importance of proximal factors in military, transitioned and community samples.

So, are those Transitioning from the ADF less healthy?

The proportion of those with past-year anxiety or depression was 40.4% (95% CI, 35.9-45.2), with anxiety effecting around one in three people (36.4%, 95% CI, 31.9-41.1). This is a significantly higher proportion of anxiety than in the regular ADF (14.8%, 95% CI: 12.1-18.0) (Sheriff *et al.*, 2019b), and higher than in working age adults in the Australian community (16.5%, 95% CI: 15.2-17.8 (Sheriff *et al.*, 2019a)

The proportion of those reporting past-year anxiety in this transitioned population was broadly consistent with those in other veteran and transitioning populations, at around 40% (Dedert *et al.*, 2009, Fulton *et al.*, 2015, Sayer *et al.*, 2010, Seal *et al.*, 2007). Therefore, it appears that anxiety is highly prevalent in this population. However, only 16.8%, 95% CI: 13.6-20.5) reported past-year PTSD. Therefore in agreement with previous analyses (Mobbs and Bonanno, 2018), research may previously have too been narrowly focussed on PTSD. The proportion of depression and anxiety we found was higher than that estimated in the Canadian STCL, which reported a prevalence rate of 20%. However, the STCL was a self-

report telephone survey, and specified a length of illness of at least 6 months, so differences in sampling and measures may be in part responsible for differential prevalence rates.

The higher prevalence of past-year anxiety in the transitioned population may be in part due to those with poorer mental health leaving the military early, a concept known as healthy warrior effect (Haley, 1998). In addition, the transition period brings significant life changes in a number of domains, including occupation, identity, routines, responsibilities, family roles, community, residence, status, finances, culture and social networks (Harvey *et al.*, 2011, Hatch *et al.*, 2013, Sayer *et al.*, 2010). Therefore, it is possible that the high rates of anxiety could also be attributable to the stress of the transition period in itself triggering an episode of anxiety. Difficulties in navigating civilian health services may also be an exacerbating factor.

In contrast the proportion of those with past-year depression was 11.3% (95% CI, 8.7-14.5) in the transitioned population. This compares to a proportion in the regular ADF of 10.3% (8.1-13.1) and for working age adults in the Australian community of 8.2%, 95% CI: 7.3-9.3 (data from previous study (Sheriff *et al.*, 2019a) to include females, previously unpublished finding). Therefore, unlike past-year anxiety, past-year depression did not appear to be elevated in the transitioned population, either in comparison to the regular ADF nor the Australian community. Also, in contrast to past-year anxiety, past-year depression was not associated with childhood trauma or disorder. This contrasts with findings in civilian population's where childhood trauma is a major risk factor for adult depression (Huh *et al.*, 2017, Mandelli *et al.*, 2015) as is childhood disorder (Fergusson and Woodward, 2002, Fryers and Brugha, 2013). The findings of this current study are novel and somewhat surprising and may in part be due to self-selection, military health screening or some other protective aspect

of military service and/or transition that lessens the connection between childhood vulnerability and past-year depression. These findings also highlight the importance of analyzing anxiety and depression separately in this population, as they appear to have unique associations. These findings are novel and require further exploration and replication.

We found that childhood interpersonal trauma was associated with past-year anxiety. Whilst there is a scarcity of military studies that have observed anxiety disorders specifically, this is broadly consistent with findings that childhood adversity was associated with poor health (Iversen *et al.*, 2007a) and with studies of anxiety in civilian populations (Gibb *et al.*, 2007). The finding that childhood anxiety fully mediated the association between childhood trauma and past-year anxiety is novel and requires further exploration. Consistent with previous military studies, deployment trauma was associated with past-year anxiety. (Booth-Kewley *et al.*, 2012)

Overview Table 1: Proportions of determinants in different populations

	ADF men (18-54)			Civilian employed men(18-54)			ADF men (18-60)			Civilian employed men			Pre-post deployment sample			TWRP CIDI sample			TWRP CIDI men			TWRP (with age first onset)			Current serving (age of first onset)				
	%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95% CI			
Childhood trauma																													
Nil	43.5	39.0	48.2	56.3	53.1	59.6	43.8	39.3	48.3	57.8	54.9	60.7	58.0	54.9	61.0	42.8	38.2	47.6	43.5	38.4	48.7	73.1	71.7	74.5	69.3	68.2	70.3		
Other	16.7	14.0	19.8	18.2	16.1	20.3	16.5	13.9	19.5	17.5	15.2	19.9	7.7	6.2	9.6	32.2	27.9	36.8	17.2	13.5	21.5	10.2	9.3	11.3	12.7	12.0	13.5		
Non-interperonsal	16.9	13.3	21.3	9.3	7.5	11.1	17.0	13.5	21.3	9.1	7.4	10.8	13.0	11.0	15.2							5.6	4.9	6.4	6.2	5.7	6.8		
Interpersonal	22.9	19.1	27.1	16.0	13.7	18.4	22.6	19.0	26.7	15.6	13.3	17.9	21.3	18.9	23.9	25.0	21.0	29.4	24.8	20.6	29.6	11.0	10.1	12.1	11.8	11.1	12.5		
Childhood Disorders																													
Anxiety	17.5	13.9	21.6	15.3	13.2	17.4	17.2	13.7	21.2	14.8	12.8	16.8				18.4	15.0	22.4	21.1	17.1	25.6								
Depression	3.9	2.1	7.3	2.5	1.6	3.3	3.9	2.0	7.1	2.3	1.5	3.1				2.5	1.3	4.8	3.2	1.6	6.1								
Alcohol	7.6	5.3	11.0	7.2	5.5	8.9	7.4	5.1	10.6	6.9	5.4	8.5				5.3	3.4	8.1	5.4	3.4	8.7								
Combat	31.8	27.8	36.0				31.7	27.9	35.9				15.8	13.6	18.1	31.9	27.8	36.3	35.3	30.6	40.3	32.1	30.7	33.5	24.2	23.3	25.1		
Mean number of adult-onset trauma types	2.8	2.6	3.0	1.2	1.1	1.4	2.8	2.6	3.0	1.3	1.2	0.0				3.5	3.3	3.8	3.7	3.4	3.9	2.6	2.6	2.7	2.3	2.2	2.3		
Paper	Paper 1						Papers 2-5						Paper 6			Papers 7-9						Paper 10							

Overview Table 2: Associations observed in different populations

Population	OUTCOMES	Prevalence			Other childhood trauma			Non-interpersonal childhood trauma			Interpersonal childhood trauma			Childhood anxiety		Childhood depression		Childhood alcohol		Adult-onset trauma (number of tyoes)			Combat		Paper				
		%	95% CI					OR	95% CI		OR	95% CI		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI						
ADF men (18-54)	Childhood anxiety	17.5	13.9	21.6	2.7	1.4	5.1	2.4	1.2	5.1	8.1	4.5	14.6													Paper 1			
	Childhood depression	3.9	2.1	7.3	3.4	0.9	12.0	4.6	1.0	21.6	13.2	3.3	52.1																
	Childhood alcohol use disorders	7.6	5.3	11.0	2.7	1.1	6.5	2.7	1.0	7.1	6.6	2.8	15.4																
Civilian employed men (18-54)	Childhood anxiety	15.3	13.2	17.4	2.6	1.5	4.8	2.8	1.6	4.9	4.7	3.0	7.4																
	Childhood depression	2.5	1.6	3.3	1.8	0.8	4.3	1.5	0.4	5.5	4.1	1.7	9.7																
	Childhood alcohol use disorders	7.2	5.5	8.9	2.4	1.2	5.1	2.8	1.5	5.2	5.6	3.3	9.4																
ADF men (18-60)	Past-year disorder	21.7	18.2	25.6	1.5	0.9	2.4	1.3	0.7	2.3	3.6	2.2	5.9	7.1	4.2	11.9	21.5	5.7	80.9	5.1	2.4	10.8	1.3	1.2	1.4	1.2	0.8	1.7	Paper 2
	Past-year PTSD	8.0	5.8	11.0	2.0	1.0	4.2	1.5	0.7	3.1	3.7	1.6	8.4	5.5	2.6	11.5	14.5	4.0	52.6	3.6	0.9	15.2	1.5	1.3	1.6	1.5	0.8	2.9	Paper 3
	Self-report suicidality	4.5	3.5	5.8	1.5	0.7	3.4	1.3	0.5	3.2	3.0	1.6	5.9	3.7	2.0	6.9	1.9	0.5	7.1	1.8	0.8	4.2	1.2	1.1	1.3	1.0	0.6	1.7	Paper 4
	Current distress	7.3	7.2	7.5	1.5	0.8	2.7	3.4	1.7	6.6	3.8	2.3	6.3	3.8	2.3	6.2	1.3	0.3	5.6	1.7	0.7	3.8	1.2	1.1	1.3	0.7	0.5	1.1	Paper 5
	More than 8 days out of role on past 30 days	1.3	1.2	1.3	0.3	0.1	1.2	0.2	0.0	1.2	3.3	1.3	8.2	2.2	1.0	5.0	1.4	0.3	6.5	0.7	0.1	3.7	1.2	1.0	1.3	1.1	0.4	2.8	
ABS men (18-60)	Past-year disorder	18.1	15.2	21.1	2.0	1.2	3.4	1.1	0.6	2.0	3.4	1.9	5.9	7.8	4.9	12.2	2.6	1.4	5.0	2.9	1.9	4.6	1.4	1.2	1.5				Paper 2
	Past-year PTSD	4.5	3.3	5.7	2.3	1.1	5.0	2.9	0.9	9.2	7.8	3.7	16.4	7.1	3.5	14.2	1.4	0.5	4.3	1.4	0.5	4.4	1.6	1.4	1.8				Paper 3
	Self-report suicidality	1.4	0.9	2.0	2.6	0.9	7.7	0.9	0.1	14.6	6.6	2.4	18.6	2.7	0.9	7.7	6.5	2.4	17.3	4.3	1.3	13.7	1.4	1.1	1.7				Paper 4
	Self-report distress	3.0	2.2	3.7	1.8	0.6	5.4	2.1	0.7	6.2	3.3	1.5	7.2	3.2	1.7	5.8	5.7	2.8	11.7	2.8	1.4	5.6	1.3	1.1	1.5				Paper 5
	Severely impaired functioning	3.7	2.7	4.8	2.6	1.1	6.3	3.0	1.2	8.0	3.6	1.6	8.1	0.9	0.4	1.8	5.2	1.5	17.4	3.1	1.3	7.5	1.2	1.0	1.4				
Deployment sample (ADF 18-60 pre-post deployment)	New post-deployment disorder	6.8	5.4	8.6	3.3	1.5	7.3	2.2	1.1	4.6	2.6	1.4	4.7													1.5	0.8	2.7	Paper 6
	Past-year anxiety	25.0	21.0	29.4	0.7	0.4	1.3	0.8	0.5	1.4	1.9	1.1	3.0	10.7	5.9	19.4	0.8	0.1	7.2	1.4	0.5	3.8	1.3	1.2	1.4	2.8	1.8	4.4	Paper 7

TWRP CIDI sample (includes females, therefore the regressions also control for gender)	Past-year depression	11.3	8.7	14.5	0.9	0.4	2.2	2.0	0.9	4.5	0.8	0.4	1.6	1.1	0.5	2.2	6.0	1.3	28.1	0.7	0.3	1.8	1.1	0.9	1.2	1.2	0.6	2.4	
	Multiple somatic symptoms	18.4	16.8	20.0	0.8	0.4	1.8	1.0	0.5	2.0	1.9	1.0	3.4	3.2	1.9	5.7	0.2	0.0	0.8	0.8	0.3	2.3	1.3	1.2	1.4	1.5	0.8	2.6	Paper 8
TWRP CIDI men	Suicidiality	21.6	19.9	23.3	0.8	0.3	1.6	1.3	0.6	2.5	2.2	1.2	4.0	2.6	1.4	4.8	0.3	0.1	1.8	1.6	0.5	4.9	1.1	1.0	1.2	1.3	0.7	2.2	Paper 9
TWRP survey sample	Probable PTSD	15.4	14.2	16.5	1.0	0.7	1.3	1.0	0.7	1.5	2.0	1.5	2.6										1.4	1.3	1.4	2.0	1.6	2.7	Paper 10
Current serving	Probable PTSD	3.5	3.1	3.9	1.1	0.7	1.6	0.5	0.3	1.1	2.3	1.7	3.2										1.4	1.3	1.4	2.1	1.6	2.7	

Severely impaired functioning: More than 8 days out of role in past 30 days

OR: Childhood Ors only control for age (ADF men and civilian employed men (18-54)

All other aORs control for age, educational attainment and relationship status. Where the sample also includes female also control for sex.

Please see individual consistent papers for further logistic regression analyses and generalised structural equation model

Problems encountered

A difficulty encountered to date has been the challenge of how to weigh underlying vulnerability and childhood factors against the factors that lead to the immediate onset of disorder. By focussing on age of onset, separating those that began prior to the age of 18 from adult-onset, we have attempted to overcome this. In taking this detailed lifetime perspective we were able to examine these factors within the same models. However, whilst we were able to examine age of onset, we were unable to examine the frequency or severity of these factors.

This research is based on the retrospective reporting of lifetime trauma and disorder recalled from adulthood, which may be prone to autobiographical bias, especially in the context of current disorder. For example current depression impairs memory but is also associated with mood congruent memory bias (Ellwart *et al.*, 2003). A recent meta-analysis sought to investigate the agreement between prospective and retrospective reporting of adverse childhood experiences (Baldwin *et al.*, 2019). It was found that the agreement between retrospective and prospective reporting was poor. However, it was relatively better when the retrospective reporting of childhood adversity was based on interview (as in this current study) rather than questionnaires.

In addition, this current research attempts to identify factors relating to risk and resilience. Identification of these factors, for the purposes of early identification, is likely to occur in

adulthood in military populations. We have discovered that the retrospective reporting of particular childhood factors is associated with particular outcomes. Previous research has demonstrated that this may vary from studies in which these factors are examined prospectively, and thus must be treated with caution in terms of aetiological significance. However, I would argue that the factors identified in this current research are still valuable in indicating the risk of these factors as retrospectively reported in adulthood.

What about women?

Many of the analyses (relating to papers 1, 2, 3, 4, 5, 6 and 9) in this thesis included males only. This was mainly due to evidence that childhood adversity in women may differ in terms of prevalence, type, response and association with adult outcomes, as is the case in the regular military (Rona *et al.*, 2007). Due to these potential differences according to sex, for most of these analyses I chose to include males alone as, unfortunately, there were insufficient numbers of females for a separate analysis. This is a common problem. There are very limited studies on women. These studies are very much needed as female veterans differ both from civilian females and from male veterans on demographics factors, including ethnicity, relationship status, and education (Curry *et al.*, 2019). Therefore, studies are needed to elucidate the relationships between childhood factors and adult outcomes in military females.

Delayed onset disorder

Longitudinal studies (Berntsen *et al.*, 2012, Vasterling *et al.*, 2016) have demonstrated that the emergence of symptoms following trauma in military veterans may be delayed. In fact, delayed onset PTSD may be the most common form of PTSD in veteran populations

(Vasterling *et al.*, 2016). A major limitation of the studies contained in this thesis is that the majority utilised cross-sectional data. For example, the transitioned population (described in papers 7,8,9 and 10) had left military service within the five years prior to assessment but we know from previous longitudinal studies (Eekhout *et al.*, 2016) that a delayed increase in PTSD symptoms may occur up to five years following a potentially traumatic event and therefore people with delayed onset-symptoms may have been missed. Whilst the deployment paper (described in paper 5) was a longitudinal design the assessments were made at four months, which would have missed those with delayed onset symptoms.

Complex PTSD

In addition, a weakness of this series of studies was the lack of particular attention to complex PTSD. Complex PTSD may be particularly relevant to the military as childhood trauma is known to be a risk factor for complex PTSD (Folke *et al.*, 2019) and is prevalent in military populations. In particular, because complex PTSD relates to chronic trauma it is therefore important to further elucidate in both the regular and transitioning populations. The prominent affective dysregulation and anxiety components may explain some of the associations with CMDs in childhood and adulthood and differences from civilian populations. This warrants further longitudinal study and has relevance to intervention approaches (McFarlane *et al.*, 2017).

Implications

Possibility of positive effects of military service

Essentially this research has allowed unique insights into the lifelong impact of childhood vulnerabilities. This has been achieved both by observing associations *within* populations and also observing similarities and differences *between* populations.

As previously stated, there was an association of interpersonal childhood trauma with adult mental disorder. However, despite higher rates of childhood interpersonal trauma in the ADF, this did not manifest in higher rates of adult mental disorder in the ADF compared with employed civilian men. These findings begin to suggest the possibility that military service can provide a positive or protective environment.

This is further supported by the finding that the poor outcomes associated with childhood depression in civilian employed men (suicidality, distress and more than eight days out of role) were not associated with childhood depression in ADF men. In addition, in the Transitioned population, childhood depression was associated with past-year depression, but not with past-year anxiety or suicidality and was inversely associated with multiple somatic symptoms.

In addition, the poor outcomes associated with alcohol use disorders in civilian employed men (suicidality, distress and poor functioning) were not seen in ADF men. Neither was

childhood alcohol disorder associated with any of the poor outcomes we analysed in the Transition population. Therefore, it appears that military service may also be protective for the longer-term poor outcomes of childhood alcohol use disorders.

As stated previously, there is no research with which to compare these findings regarding the association of childhood disorder in the military. However, this has implications for the military as potentially being protective against the negative adult outcomes of childhood depression and childhood alcohol use disorders, and these protective effects appear to last through into Transition.

However, it might alternatively be hypothesised that the lack of association between childhood depression (or alcohol) and poor outcomes in the ADF (but that is seen in civilian men) is a matter of selection. In other words, the military is either screening out people with a history of childhood depression, or those more likely to have poor outcomes associated with childhood depression transition out of military service early, known as the healthy warrior effect (Haley, 1998). However, the prevalence of childhood depression is higher, but not significantly higher, in ADF than in civilian employed men so that seems unlikely to be the sole explanation. It is possible that some aspects of the military, such as the structure, comradery or sense of purpose provides a therapeutic or protective environment from the poor outcomes associated with childhood depression. It could also be due to potential differences in military and civilian healthcare services and help-seeking behaviours (Zamorski, 2011).

Equally with alcohol use disorders, it is possible that the poor long-term outcomes associated with childhood alcohol use disorders may be due to continuation of these disorders into adulthood. However, only a very small proportion of ADF men had a past-year alcohol use disorder (2.6%, 95% CI: 1.8-3.5). Therefore, it appears that the military may provide a protective environment from the longer-term consequences of childhood alcohol use disorder by protecting against alcohol use disorders in adulthood. Of note, the low alcohol use disorder prevalence rates observed in the ADF contrasts with other military services, (Goodwin *et al.*, 2017, Stevelink *et al.*, 2018) however an in-depth discussion of the possible reasons for this is beyond the scope of this PhD.

There is a body of literature that suggests that the impact of military service should be viewed over the lifespan and take into account numerous outcomes of veterans health into old age. Some authors criticise current military research as being too narrowly focussed on the short-term impact of certain specific events such as deployment or combat. This literature suggests the many benefits of military service may manifest later in life, (Spiro *et al.*, 2016) and possibly even after the Transition period.

There does not seem to be a single 'experience of military service'. Life in the military, and war in particular, may provide an exaggerated version of the range of human emotion, not just the negative aspects such as guilt, fear and hate, but also the positive, such as mastery, excitement, love and friendship (Wessely, 2005). There are some for whom active service

is *'the best thing that ever happened to them'* (Wessely, 2005). However, the aged veterans that are currently being studied are generally still from the old era of conscription. The longer-term outcomes of the volunteer era of professional soldiers may see even more positive outcomes into old age.

However, interestingly, childhood anxiety is associated with all poor outcomes (other than severely impaired role function), including suicidality in ADF, and all poor outcomes except for past-year depression in the Transition population. Essentially this shows how military service affects those who have already demonstrated a vulnerability to anxiety. It is interesting that the main diagnosis associated with trauma is PTSD, which is categorised as an anxiety disorder. This might go some way to explaining the association of poor outcomes for those with childhood anxiety in the more trauma exposed military population, than in civilians.

Are some experiences universally negative?

What is clear is that interpersonal childhood trauma appears to be associated with poor outcomes across the board. It was associated with poor outcomes across all populations that we studied. This is consistent with previous research on child abuse. This may be due to the nature of the abuse, the chronicity of the trauma experienced or clustering, ie those who are exposed to child abuse may be exposed to a greater overall trauma load.

Neuroimaging studies highlight differential periods of vulnerability by demonstrating that particular regions of the brain are sensitive to insults at different ages. This is in turn associated with decreased connectivity of regions involved in the ability to accurately attribute thoughts and intentions to others and also with emotion regulation (Teicher *et al.*, 2014). In addition, there is increased centrality of the networks involved in self-referential thinking and awareness. It is possible that the disruption of neural development underpins the psychopathology that is associated with this interpersonal trauma in childhood and into adulthood.

Overall, 60.6% (95% CI: 56.0-65.0) of ADF males had any childhood vulnerability (trauma or disorder). Of those 28.3% (95% CI: 23.4-33.9) had any past-year disorder. Of those who did not have a childhood vulnerability, only 11.3% (8.2-15.6) had a past-year disorder. So, clearly people without any childhood vulnerability can develop a disorder in adulthood. Similar to what was found with screening previously (Jones *et al.*, 2003a), whilst each risk factor has a small association with disorder, our ability to predict disorder still may not sufficiently refined for the purposes of screening. In addition, caution must be advised in this area due to the potentially positive or protective effects of military life. However, it is possible that psychological interventions such as CBT might benefit those at increased risk, or subthreshold for disorder.

Future Directions

We categorically do not suggest that the results of this research are used to screen people from enlisting in military services. This research cannot answer questions as to how these individuals would have fared outside of the military. Military service can provide a stable environment for those from disadvantaged backgrounds. However, this must be balanced against the impact of the considerable stress of life in the military, especially in those with pre-existing vulnerabilities.

This current research points to the fact that there are early risk factors potentially of etiological significance and that the early identification of those most at risk may be possible at an early stage. Looking into the future, the challenges include adequately focusing on issues of vulnerability rather than solely on the immediate antecedents to the onset of disorder. This is a particular issue in the context of military psychiatry, which historically focused on vulnerability and dismissed the significance of recent trauma. More recently, with the advent of PTSD, the pendulum has possibly swung too far in the opposite direction. It is important to note, that even when controlling for all childhood factors, the number of adult trauma types (rather than deployment per se) were associated with poor outcomes. This current research would suggest further prospective research is needed to further elucidate early signs relating to risk and resilience and how they interact with proximal factors prospectively, and to formulate effective early intervention and prevention strategies in the context of military life and Transition. For example, this current research would suggest that those with childhood anxiety are at particular risk and therefore might be a suitable target for intervention, particularly prior to Transition. However, further

research is needed to further model the onset of disorder and ascertain the risks and benefits of such an approach.

A recent RCT indicated that even a post-deployment screening intervention did not improve outcomes for military personnel (Rona *et al.*, 2017). Therefore, I recommend caution in interpreting the findings of this series of studies. Given that Australia currently engages in post-deployment screening it will be important to investigate whether the identification of those at risk can be improved by modelling the onset of disorder using childhood and other risk factors. It will also be important to evaluate the effectiveness of such programmes.

This research reinforces the importance of pursuing epidemiological surveillance in this high-risk occupational population. This study was only possible in the context of high-quality and detailed epidemiological surveillance of a military cohort, the consistent monitoring of whom allowed for the elucidation of the prevalence of important outcomes and factors relating to risk and resilience essential in providing the best care to those who serve. This can also be seen in the international context where detailed epidemiological research has highlighted important risk factors and interventions in military personnel. However, this current research also demonstrates the importance of population specific research, with important differences between military, civilian and transitioning populations.

There would also be value in evaluating more recent cohorts as the data was collected in these studies some time ago. In addition, research is outlining how delayed onset PTSD might be its most common form in military personnel and further and prospective methodologies would enable us to elucidate how these childhood factors relate to complex PTSD specifically. Some have even suggested that data-driven longitudinal research would best allow us to map the impact of potentially traumatic events across time, removing the significant problems of losing important information when applying thresholds and timescales, as is the case in traditional epidemiological methodologies (O'Toole and Catts, 2017).

In addition, complex PTSD most likely relates to his population, given the high rates of childhood, and particular interpersonal trauma types. Of particular significance would be to further elucidate the affect dysregulation associated with this diagnosis perhaps with risk factor modelling in a military population.

In future research it will be important to incorporate more factors known to be associated with risk and resilience in military populations to form a more comprehensive model that can be tested longitudinally. Whilst I looked at a limited range of childhood disorders (due to the nature of the datasets), it will also be important to look at other childhood risk factors such as conduct disorders and traumatic brain injury. It would also be a potentially fruitful avenue to investigate the role of biological factors as potential mediators, moderators or

Concluding comments

These analyses have allowed us to overcome historical flaws in military research and trauma research more generally. Interestingly, critiques of why we are not good at predicting poor outcomes in the context of trauma state that we are lacking the best predictor as the trauma has not yet been experienced (Wessely, 2005). Yet, over half of those in military populations report at least one childhood traumatic event. Thus, these datasets, which also included childhood disorder, allowed us to catch a rare glimpse, albeit retrospective, of reactivity to previous traumatic events.

The line of research utilised in this PhD has taken advantage of unique datasets incorporating detailed interview data to allow the comparison of mutually exclusive categories of childhood trauma and a spectrum of childhood disorders in determining a wide range of important outcomes. It has highlighted the importance of evaluating the childhood trauma profile in determining longer term vulnerabilities and of the impact of traumatic experiences across the spectrum of mental disorders (not solely PTSD). A lifetime perspective has shed light on the relationships between childhood factors and more proximal adult factors in determining poor outcomes.

These analyses have enabled us to develop a rich and nuanced understanding of the childhood determinants of adult health and associated outcomes along with mediator pathways in different populations. This has proved exceedingly fruitful and lays the groundwork for further prospective research to better inform early prevention and

intervention strategies. These studies highlight both the utility and necessity for continued consistent epidemiological surveillance of these populations.

Chapter 17: **Appendix**

Appendix A: Suicidality questions

Please shade the circles that best describe your experience.
In the last 12 months, have you ever felt that life was not worth living? No <input type="radio"/> Yes <input type="radio"/>
In the last 12 months, have you ever felt so low that you thought about committing suicide? No <input type="radio"/> Yes <input type="radio"/>
In the last 12 months, have you made a suicide plan? No <input type="radio"/> Yes <input type="radio"/>
In the last 12 months, have you attempted suicide? No <input type="radio"/> Yes <input type="radio"/>

Appendix B: 26 deployment-related trauma items and their nine respective ‘trauma exposure’ categories

Trauma category	Items
Potential for exposure	Seriously fear you would encounter an IED Go on combat patrols or missions Participate in support convoys (e.g., re-supply, VIP escort) Concerned about yourself or others (including allies) having an unauthorised discharge of a weapon Clear/search buildings Clear/search caves
Coming under fire	Come under small arms or anti-aircraft fire Come under guided or directed mortar/artillery fire Experience indirect fire (e.g., rocket attack) Experience an IED/IOD that detonated Experience a suicide bombing Experience a landmine strike Encounter small arms fire from an unknown enemy combatant
In danger of being injured or killed	In danger of being killed In danger of being injured
Casualties among people close to you	Heard of a close friend or co-worker who had been injured or killed Were present when a close friend was injured or killed Heard of a loved one who was injured or killed Were present when a loved one was injured or killed
Handling/seeing dead bodies	Handled dead bodies Saw dead bodies
Threatening situation, unable to respond	Experience a threatening situation where you were unable to respond due to the rules of engagement
Witness to human degradation/misery	Witness to human degradation and misery on a large scale
Discharging own weapon	Discharge your own weapon in direct combat
Own action/inaction result in injury or death	Believe your own action or inaction resulted in someone being seriously injured Believe your own action or inaction resulted in someone being killed

Adapted from the Census Study report (Dobson et al., 2012).

Appendix C: Kessler Distress Scale

The following questions inquire about how you have been feeling over the last four (4) weeks. Please read each question carefully and then indicate, by shading the circle, the response that best describes how you have been feeling.

	ALL OF THE TIME	MOST OF THE TIME	SOME OF THE TIME	A LITTLE OF THE TIME	NONE OF THE TIME
In the past four (4) weeks, about how often did you feel tired for no good reason?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel nervous?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel so nervous that nothing could calm you down?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel hopeless?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel restless or fidgety?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel so restless that you could not sit still?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel depressed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel that everything was an effort?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel so sad that nothing could cheer you up?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the past four (4) weeks, about how often did you feel worthless?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix D: Demographics of Phase 1 survey respondents and non-respondents

Characteristic	population (N=50,049)		Respondents (N=24,481, 48.9%)		Non-respondents (N=25,568, 51.1%)	
	N	%	N	%	N	%
Sex						
Female	6,808	13.6	3,888	15.9	2,920	11.4
Male	43,241	86.4	20,593	84.1	22,648	88.6
Service						
Navy	11,612	23.2	5,392	22.0	6,220	24.3
Females	2,104	4.2	1,053	4.3	1,051	4.1
Males	9,508	19.0	4,339	17.7	5,169	20.2
Army	25,356	50.7	11,429	46.7	13,927	54.5
Females	2,513	5.0	1,437	5.9	1,076	4.2
Males	22,843	45.6	9,992	40.8	12,851	50.3
Air Force	13,081	26.1	7,660	31.3	5,421	21.2
Females	2,191	4.4	1,398	5.7	793	3.1
Males	10,890	21.8	6,262	25.6	4,628	18.1
Age	33.2 (M)	9.2 (SD)	35.5 (M)	9.3 (SD)	30.9 (M)	8.4 (SD)
18–27	18,422	36.8	6,514	26.6	11,908	46.6
28–37	16,688	33.3	8,285	33.8	8,403	32.9
38–47	10,984	21.9	6,899	28.2	4,085	16.0
48–57	3,748	7.5	2,640	10.8	11,008	4.3
58–over	207	0.4	143	0.6	64	0.3
Marital status						
Married	31,500	62.9	18,882	77.1	12,618	49.4
Not married	18,549	37.1	5,599	22.9	12,950	50.6
Education ^a		% (95% CI)				
Missing	–	–	396	1.6		
Primary school	89	0.2 (0.1, 0.2)	47	0.2		
Secondary school up to grade 10	5,389	10.8 (10.4, 11.1)	2,445	10.0		
Secondary school up to Grade 11–12	15,620	31.2 (30.7, 31.7)	6,831	27.9		
Certificate	11,927	23.8 (23.4, 24.3)	5,268	21.5		
Diploma	6,569	13.1 (12.8, 13.4)	3,487	14.2		
Bachelor degree	5,132	10.3 (10.0, 10.5)	2,888	11.8		

Detailed data tables

Characteristic	Population (N=50,049)		Respondents (N=24,481, 48.9%)		Non-respondents (N=25,568, 51.1%)	
	N	%	N	%	N	%
Postgraduate	5,322	10.6 (10.4, 10.8)	3,119	12.7		
Length of service (years) ^{a, b}	Mean (95% CI)					
Regular	11.6 (11.5, 11.7)	8.8 (SD)	12.9 (M)	8.9 (SD)		
Reserve	4.4 (4.3, 4.6)	5.0 (SD)	4.6 (M)	5.2 (SD)		
Rank						
Commissioned officer	12,034	24.0	7,268	29.7	4,766	18.6
Non-commissioned officer	22,319	44.6	12,381	50.6	9,938	38.9
Other ranks	15,696	31.4	4,832	19.7	10,864	42.5
MEC status						
MEC 1	32,816	65.6	14,954	61.1	17,862	69.9
MEC 2	11,712	23.4	6,726	27.5	4,986	19.5
MEC 3	4,485	8.9	2,301	9.4	2,184	8.5
MEC 4	1,036	2.1	500	2.0	536	2.1
ADF deployment						
Missing	983	2.0	0	0.0	983	3.8
yes	32,080	64.1	15,952	65.2	16,128	63.1
No	16,986	33.9	8,529	34.8	8,457	33.1
Months deployed over last 3 years ^a	3.7 (3.7, 3.8)	4.6 (SD)	3.6 (M)	4.5 (SD)		
Months deployed over last 3 years on ship (non-MEAO Navy) ^c	10.6 (10.3, 10.9)	9.7 (SD)	9.8 (M)	9.5 (SD)		
Currently on operational deployment (non-MEAO) ^d		% (95% CI)				
Missing	–	–	252	1.7		
yes	2,453	8.0 (7.5, 8.4)	1,065	7.4		
No	28,395	92.0 (91.6, 92.5)	13,128	90.9		
Length intending to stay in military (non-MEAO) ^d	11.9 (11.7, 12.0)	10.2 (SD)	12.3 (M)	10.4 (SD)		
Length of service in the ADF (years)	11.6 (M)	8.8 (SD)	13.7 (M)	9.3 (SD)	9.7 (M)	7.8 (SD)

a Population prevalence estimated from 23,156 survey responses.

b Length of service among those who have served as a regular or reservist.

- c Population prevalence estimated from 3,156 survey responses.
- d Population prevalence estimated from 13,265 survey responses.

Appendix E: Consent and CIDI completion rates

	Total sample	
	No.	%
Consent to complete a survey questionnaire	26,281	N/A
Consent to being contacted to do a telephone interview/for follow-up studies	20,198	76.9
Consent to allow linkage of information contained in my electronic ADF psychological screening records with the study data	21,768	82.8
Consent to allow CMVH to obtain from the ADF, contact details to invite your partner/spouse to participate in a family study	17,554	66.8
CIDI completed	1,798	6.8

Appendix F: Demographic profile of the CIDI sample

Characteristic	CIDI sample (N=3,688, 100%)		CIDI respondents (N=1,798, 48.8%)		CIDI non-respondents (N=1,890, 51.2%)	
	No.	%	No.	%	No.	%
Sex						
Females	907	24.6	438	24.4	469	24.8
Males	2,781	75.4	1,360	75.6	1,421	75.2
Service						
Navy	837	22.7	384	21.4	453	24.0
Females	227	6.2	100	5.6	127	6.7
Males	610	16.5	284	15.8	326	17.2
Army	1,325	35.9	716	39.8	609	32.2
Females	322	8.7	165	9.2	157	8.3
Males	1,003	27.2	551	30.6	452	23.9
Air Force	1,526	41.4	698	38.8	828	43.8
Females	358	9.7	173	9.6	185	9.8
Males	1,168	31.7	525	29.2	643	34.0
Age	37.3 (M)	9.4 (SD)	38.3 (M)	9.4 (SD)	36.4 (M)	9.3 (SD)
18–27	733	19.9	300	16.7	433	22.9
28–37	1,183	32.1	546	30.4	637	33.7
38–47	1,246	33.8	662	36.8	584	30.9
48–57	500	13.6	271	15.1	229	12.1
58–over	26	0.7	19	1.1	7	0.4

(Continued next page)

Characteristic	CIDI sample (N=3,688, 100%)		CIDI respondents (N=1,798, 48.8%)		CIDI non-respondents (N=1,890, 51.2%)	
	No.	%	No.	%	No.	%
Marital status						
yes	2,862	77.6	1,388	77.2	1,474	78.0
No	826	22.4	410	22.8	416	22.0
Rank						
Officer	1,233	33.4	655	36.4	578	30.6
Non-commissioned officer	1,881	51.0	889	49.4	992	52.5
Other ranks	574	15.6	254	14.1	320	16.9
MEC status						
MEC 1	1,989	53.9	906	50.4	1,083	57.3
MEC 2	1,184	32.1	611	34.0	573	30.3
MEC 3	413	11.2	224	12.5	189	10.0
MEC 4	102	2.8	57	3.2	45	2.4
ADF deployment						
yes	2,288	62.0	1,111	61.8	1,177	62.3
No	1,400	38.0	687	38.2	713	37.7
Length of service in the ADF	15.3 (M)	9.5 (SD)	16.2 (M)	9.8 (SD)	14.3 (M)	9.2 (SD)

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