



- Body Regions Susceptible to Musculoskeletal Injuries in Canadian Armed Forces Pilots
- 'More Important than Winning': A Retrospective Online Research Survey Evaluating the Effects of Participating in an Adaptive Sports Program for Wounded, Injured and Ill Australian Defence Force Veterans







PEOPLE PURPOSE PASSION

**THE PATHWAY  
TO THE FUTURE**

**2022 AMMA  
CONFERENCE**

HOTEL GRAND CHANCELLOR  
HOBART, 6-9 OCTOBER 2022



**2022.AMMA.ASN.AU**

---

# Table of Contents

## Editorial

..... 5

## Original Articles

Fundamental Inputs to (ADF Health) Capability: Organisation ..... 7

Changes in Patient Profile and Neurosurgical Procedures in a Large Military Hospital  
in Colombia Before and After the Peace Process: A Retrospective Analysis of Clinical Records ..... 16

The Case of The Soldier Who Failed to Return:  
Reflections on Psychodynamic Psychotherapy with Combat Veterans ..... 20

Body Regions Susceptible to Musculoskeletal Injuries in Canadian Armed Forces Pilots..... 28

Chronic Traumatic Encephalopathy/Traumatic Encephalopathy  
Syndrome in Military Personnel ..... 40

Cultivating Family Resiliency in the Context of the Military  
to Civilian Transition and Mental Health Problems..... 49

Changes in Stigmatising Beliefs and Help-Seeking Intentions Following a Recreational  
Peer-Based Program for Young People Affected by Military Associated Parental Mental Illness ..... 56

More Important than Winning': A Retrospective Online Research Survey  
Evaluating the Effects of Participating in an Adaptive Sports Program for Wounded,  
Injured and Ill Australian Defence Force Veterans..... 64

Physical and Morphological Component Normative Data Among Spanish Navy Students..... 75

Employment Patterns During Middle Adulthood Among Japanese-American World War II Veterans..... 83

## History

John Keith Henderson: First Australian to Provide Dental Treatment to Troops on Active Service..... 92

Front Cover: Invictus Games Sydney 2018 training squad members and staff with Olympic champion Linley Frame OAM

Photo Credit: Photographer: Leading Seaman Jayson Tufrey, Dept. of Defence©

# Journal of Military and Veterans' Health

## EDITORIAL BOARD

CDRE Andrew Robertson CSC, PSM (Editor in Chief, JMVH)

Associate Professor Martin Richardson (Deputy Editor)

Dr Robert Allen

Professor Martin Bricknell

Dr Daniel Chan

CDRE Michael Dowsett

Dr Helen Kelsall

Dr Jonathan Lane

COL Prof Peter Leggat, AM

Dr David Robertson

Air Commodore Rowan D Story AM, RFD (Retd)

Jason Watterson

Dr Kerri-Ann Woodbury

# Australasian Military Medicine Association

## PATRON

Rear Admiral Sarah Sharkey  
Surgeon General Australian Defence Force  
Commander Joint Health MBBS, MBA, MPP,  
AFRACMA

## COUNCIL

President	GPCAPT Geoff Robinson, NSC
Vice President	Dr Nader Abou-Seif
Secretary	Dr Janet Scott
Treasurer	CAPT Ian Young, AM
Journal Editor	Dr Andrew Robertson, CSC, PSM
Council Members	Dr Peter Hurly O.St.J., D.S.D., J.C.D Rachelle Bonner MAJ Brendan Wood C.St.J, DSD RNZAMC
Past President	Dr Greg Mahoney
Public Officer	Ms Paula Leishman

## STATEMENT OF OBJECTIVES

The Australasian Military Medicine Association is an independent, professional scientific organisation of health professionals with the objectives of:

- Promoting the study of military medicine
- Bringing together those with an interest in military medicine
- Disseminating knowledge of military medicine
- Publishing and distributing a journal in military medicine
- Promoting research in military medicine

Membership of the Association is open to doctors, dentists, nurses, pharmacists, paramedics and anyone with a professional interest in any of the disciplines of military medicine. The Association is totally independent of the Australian Defence Force.

JMVH is published by the  
Australasian Military Medicine Association  
227 Collins Street Hobart Tas 7000 Australia  
Ph: +61 3 62347844  
Email: [editorial@jmvh.org](mailto:editorial@jmvh.org)

---

# Editorial

## THE FALL OF SINGAPORE IN 1942



Having just returned from Singapore, where I was fortunate enough to view both the World War II fortifications at Fort Siloso and the excellent exhibition on the fall and occupation of Singapore at the National Museum of Singapore, I was reminded that, after initial air attacks in December 1941, Singapore fell after 7 days of fighting on 15 February 1942, just over 80 years ago. While the gun emplacements at Fort Siloso were primarily designed to repel a sea attack from the south, and contrary to certain mythology that the guns were useless in the subsequent invasion, the guns were turned 180 degrees to fire across the island to support Allied

troops who were resisting the rapidly advancing Japanese forces. Ion Idriess, in his book 'The Silent Service',<sup>1</sup> describes the rescue of hundreds of troops by HMAS Yarra, HMAS Wollongong, HMAS Bendigo and HMIS Jumna from the sinking 'Empress of Asia' in the initial air attacks and the amazing work that the medical staff, such as SBA Jim Walsh of HMAS Bendigo, did in treating badly wounded and burnt soldiers pulled from the water that day. Much of this selfless work has not been recognised or has been forgotten over the last 80 years and bears reflecting on as geopolitical tensions rise again in Asia and other parts of the world.

Our third issue of 2022 contains a diverse range of articles from ADF organisational capacity, health and fitness training, and traumatic encephalopathy through to excellent articles on resilience, transition from the military and psychotherapy in veterans. There is also an enlightening article on the first Australian to provide dental services to troops on active service. We continue to attract a good range of articles, including from overseas, as is demonstrated in this issue with articles from Canada, Colombia, Spain and the United States. Other military and veterans' health articles, however, are always very welcome, and we would encourage all our readers to consider writing on their areas of military or veterans' health interest. We would particularly welcome papers based on presentations given at or planned for our 2022 conferences, but welcome any articles across the broader spectrum of military health.

**Dr Andy Robertson, CSC, PSM**  
**Commodore, RAN**  
**Editor-in-Chief**

1. Jones TM, Idriess IL. The silent service: action stories of the Anzac Navy. Angus and Robertson; 1944.





# BE PART OF SOMETHING BIGGER

We are delivering clinical care to  
Australian Defence Force personnel.

It's the way these roles work together  
that makes ADF Health Services greater  
than the sum of its parts.



To find out more about  
how you can be part of  
something bigger, call  
1800 115 536 or visit  
[serco.com/ahsc](https://serco.com/ahsc)



"It's an amazing environment,  
a great team and I haven't  
looked back since I joined."  
Kendal Brown  
Registered Nurse

Discover Kendal's  
ADF Health Services story  
at [serco.com/ahsc](https://serco.com/ahsc)

serco

AUSTRALIAN  
DEFENCE FORCE  
HEALTH SERVICES

# Fundamental Inputs to (ADF Health) Capability: Organisation

N Westphalen

## Introduction

A previous series of papers have analysed the following functions and roles of military health services necessary to conduct their three elemental and distinct yet intrinsically interlinked missions: providing treatment services, enabling operational capability and facilitating civilian re-integration:<sup>1</sup>

- 'Military health support', pending a better term indicating that, whether deployed or not, *all* ADF commanders have missions to perform that require *targeted* health service support<sup>2</sup>
- Casualty evacuation<sup>3</sup>
- Humanitarian aid/disaster relief<sup>4</sup>
- Military medicine capabilities in support of the ADF's aviation, diving and submarine operations, as well as chemical, biological, radiological and nuclear defence<sup>5,6</sup>
- Assessing health-related suitability for military employment and deployment<sup>7, 8, 9</sup>
- Occupational and environmental health<sup>10</sup>
- Health promotion<sup>11</sup>
- Treatment services.<sup>12</sup>

It should be noted that these functions and roles are listed in priority order: as one heads *up* the list, the level of military expertise required to conduct them *increases*.

These papers have explained why excessive workplace illness and injury rates confirm the need to improve the management of hazards associated with ADF workplaces, with better emphasis on prevention. To this end, a submission by the Royal Australasian College of Physicians to the 2019 Productivity Commission inquiry into veteran's health advocated that this would best be achieved by premising the ADF's health services on a systems-based occupational health strategic model.<sup>13</sup> Implementing such a model would entail reassessing the following Fundamental Inputs to (in this case ADF health) Capability or FICs per the *Defence Capability Development Handbook*:<sup>14</sup>

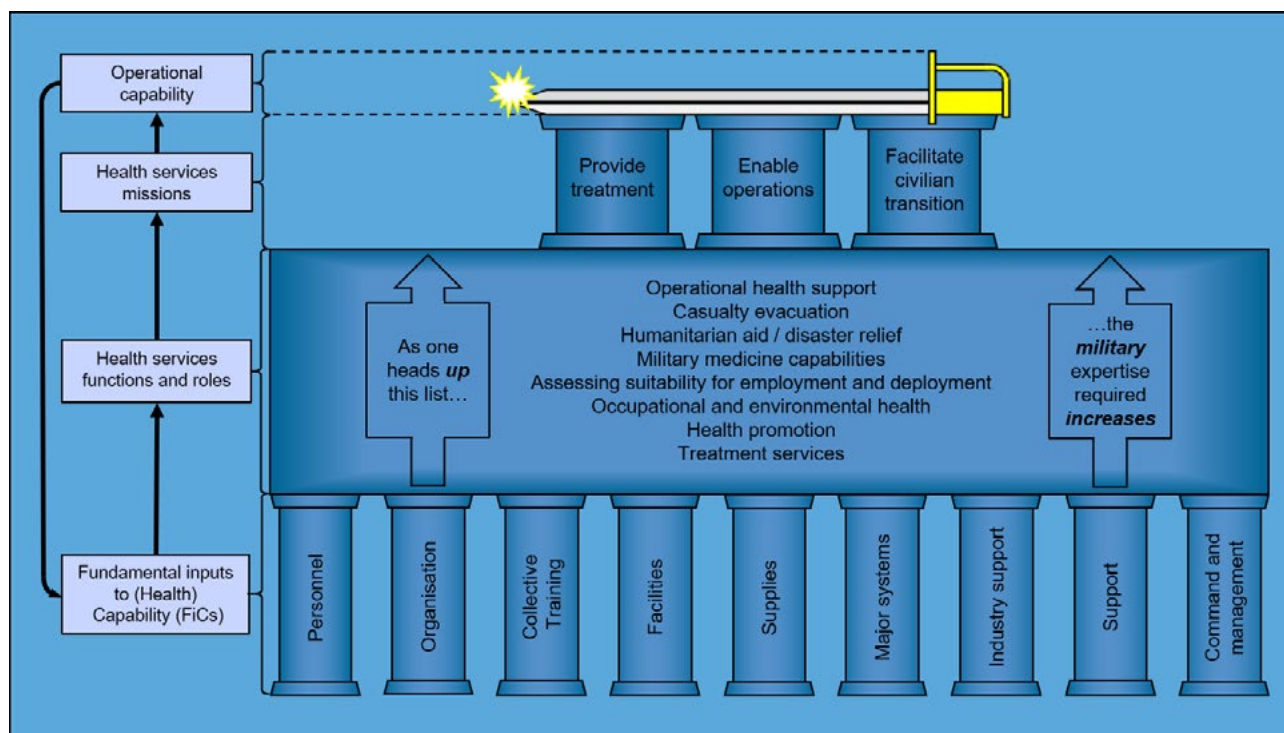
- Organisation
- Personnel
- Collective training
- Facilities
- Supplies
- Major systems
- Support
- Industry
- Command and management.

This paper was originally the *second* of a new series that will analyse the ADF's health FICs that enable operational capability via its health services missions, functions and roles: in this instance the 'organisation' FIC (Figure 1). The paper *originally* intended to be first (to be published in due course) provides an overview to this new series.

Readers should also note that this new series is extensively based on the previous 'functions and roles' papers.

## *The Capability Development Handbook*

The *Capability Development Handbook* describes the 'organisation' FIC as employing the—in this case, health—capability within flexible and functional groupings, which have the right balance of competencies, structures, and command and control to do what the capability needs to do.<sup>15</sup> To this end, the first issue for consideration is that the ADF's resources are finite: having the right number of the right people with the right skill sets in the right places at the right time will fail without a structure to guide and direct what they should be doing and how to go about it; on the other hand, having a structure that provides perfect guidance will likewise fail without people to implement it. Therefore, the ADF health services need to be organised in a manner that reflects the limited resources available while maximising effectiveness in conducting their missions. This entails applying a risk management approach regarding health organisational structures that may be less-than-ideal but reflect the resources



**Figure 1: Operational capability and its relationship to military health services missions, functions and roles, and FICs.**

available. This may have implications for some health professionals (in particular reservists) who choose to participate in organisations like the ADF, whose primary reason to exist does *not* entail providing health care.

#### Separated versus integrated mission health structure?

To this end, there are two options for how the ADF's health services can be organised: one comprising three separate components (one for each mission) or one with multiple components (however many), each of which contributes to conducting all three missions. However, although they are *separate*, the extent to which these missions are inextricably *linked* demands the latter.

Although their emphasis will vary depending on *what*, *how* and *when* they contribute to providing health services for *who* and what *their* missions are, the mission statements for *each* component within the ADF health services should refer to how they each contribute to *all three missions*. This could perhaps be achieved per the following template:

*'The mission of [name of ADF health component] is to:*

- [directly or indirectly provide/enable/support] ADF treatment services for [ADF target population(s)], by [nature of contribution(s)];*

- [directly or indirectly provide/enable/support] the [ADF target population(s) missions], by [nature of contribution(s)]; and*
- [directly or indirectly provide/enable/support] the civilian re-integration of the [ADF target population(s)], by [nature of contribution(s)].'*

It seems reasonable to assert that this approach will facilitate ascertaining the appropriate health service organisational structures to conduct these missions.

#### Health service structural development: Top-down versus bottom-up?

The next two options for creating a military health service organisational structure entail starting at the top or 'strategic' level and working down to the bottom or 'tactical' level (such as individual clinics and other ADF health capability enablers) or vice versa. This paper asserts that a 'top-down' approach is more likely to impose one-size-fits-all solutions to accommodate the lowest common denominator, thereby leaving some clinics under-resourced for solving problems they *do* have and others over-resourced for solving problems they *do not* have. Furthermore, this approach is more likely to result in top-heavy structures that do not reflect the health services' size or skill set composition.



On the other hand, a 'bottom-up' approach, based on factors such as each clinic's location (within Australia, at sea or overseas), their target population demographics and the operations *they* perform, would better enable the higher ADF health organisation to direct the functions and roles required by each clinic to conduct their missions. This would mean the former only have to manage how each of its clinics *adapt* to changes in their target population(s) and operation(s) over time.

## Base health services: Geographic versus functional structure?

The next issue pertains to the 'operational level' organisational structure between the 'tactical level' clinics (and other ADF health service providers and enablers) in the base setting, and the higher 'strategic level' ADF health agency. Analysing the current structure requires some historical background.

All three services—Navy and Army since Federation and Air Force after WWI—initially organised their bases geographically. This made sense when interstate communications were limited to telegraphs and what would now be called 'snail mail', moved via ship or train. As communications improved, by the late 1970s the Air Force and Navy health services had become functionally-based organisations, whereby each base health facility reported to a Command Medical Officer at the relevant single-service Support Command. This reflected the high mobility of Navy and Air Force ships and aircraft from their bases and, particularly, Navy's posting pattern (see below).<sup>16,17</sup>

On the other hand, the Army health services remained geographically organised as part of the broader Army 'Military District' structure into the 1990s. This reflected its initial composition as a regionally-based part-time militia, which was legally barred from deploying overseas until the current Australian Regular Army (ARA) was established in 1947. However, even then, Army maintained this organisational health structure, firstly because the ARA still typically remained in or near their home bases in peacetime, and secondly because of the need to support Army's non-deployable reserve elements.<sup>18</sup>

Hence, with the formation of the Defence Health Service in 1997 as part of the Defence Efficiency Review (DER), the geographical health organisation Army had had since 1903 underwent only minor changes before its application to the Navy and Air Force health services Australia-wide. This may have made sense if:

- Their remit only entailed providing treatment services without considering their other two

missions: indeed, that was the assumption when these changes were made. However, this would have undermined the DER program's primary aim of making economies<sup>19</sup> in the context whereby health services had long been considered an obvious exemplar of something Defence could easily unify or contract out.<sup>20,21,22,23</sup>

- All ADF bases have the *same* missions. However, the extent to which (for example) *Stirling* mostly supports ships and submarines while Swanbourne exclusively supports special forces personnel and Pearce mostly supports flying training renders this premise at best arguable.
- All ADF members have the *same* likelihood of being posted to *any* ADF base. However, despite the increasingly joint nature of the ADF's bases, something like 80 per cent of personnel remain likely to be posted to a mostly Navy, Army or Air Force base for the foreseeable future.
- All ADF members had the *same* posting patterns *between* bases. However, unlike Army and Air Force, whose non-deployable personnel can remain posted to their unit unless it actually deploys, Navy's minimum crewing policy for Fleet units means that its non-deployable seagoing members must be landed ashore. The ensuing unplanned postings for compassionate, disciplinary, medical and other purposes mean that Navy's posting processes are far more dynamic.<sup>24</sup>
- How Army deploys overseas (i.e. large numbers on an occasional or periodic basis, generally requiring several days or even weeks notice) also applies to Navy and Air Force.<sup>25,26,27</sup> However, not only does Navy have up to 1600 personnel at sea at any one time, but can adapt its operational tempo at far less notice, as shown by its response to Cyclone Tracy in 1974,<sup>28</sup> the first Operation DAMASK deployment prior to the 1991 Gulf War,<sup>29</sup> and the 2001 evacuation from Honiara in the Solomons (Operation PLUMBOB).<sup>30</sup>

Hence, despite a succession of reorganisations since 1997, the ADF's geographically-based military health organisational structure remains unfit for purpose. In particular:

- Continuity of patient care for non-Army members has been fragmented by the extent to which they are posted anywhere within Australia (or, in Navy's case, ships that routinely deploy overseas). Using the previous example, this paper asserts that it is far more important to ensure continuity of care between *Stirling*,

*Kuttabul* and *Coonawarra* (and the ships they support) than between *Stirling*, *Swanbourne* and *Pearce*.

- It should be noted that ADF members only have to be medically suitable to perform the intrinsic requirements of their employed job. Hence, unless all ADF members have the same job requirements, using the ADF Military Employment Classification (MEC) system to apply a single medical standard (as opposed to the standards themselves) does *not* comply with the *Disability Discrimination Act 1992*.<sup>31,32</sup>
- The misuse of the MEC system as a *patient* rather than *personnel* management tool has led to the Chiefs of Air Force and Navy losing control of the health aspects of their personnel 'raise/train/sustain' role.<sup>33</sup> This assertion is based on the increasing proportion of Navy members deemed *not* fully employable and deployable,<sup>34</sup> and the assumption that MOs with comparable workplace experiences as their clientele will provide better-quality medical employability advice than those without. The latter primarily refers to not just *preventing* those from deploying who should *not*, but also ensuring that those who *can* deploy are able to do so. Besides ensuring compliance with the *Disability Discrimination Act 1992*, this attribute would have maintained credibility with the personnel managers by enabling their clientele's employability and deployability (hence operational capability) without unnecessarily impinging on their health. It also would have maintained credibility with their clientele by not needlessly hindering their promotions, courses and/or career progression.<sup>35</sup>
- It has failed to enable the service chief's workplace *health* (as opposed to *safety*) obligations per the *Work Health and Safety (WHS) Act 2011*.<sup>36</sup> This began sometime around 2001 when responsibility for the ADF's occupational health services was moved from the Defence Health Services to the current Defence WHS Branch, with the following consequences:
  - Attempting to provide WHS policy support and advice across *all* of Defence has failed to address the generally higher levels of health risks faced by uniformed personnel, as indicated by their excessive compensatable illness and injury rates.<sup>37,38</sup> This has been compounded by the WHS issues for Defence civilians being more familiar and, in that sense, 'easier' to manage. Hence, the single services have had to fill the ensuing gaps

with their own WHS services, which lack the resources to put the 'H' in 'WHS'.

- The services' inability to put their 'H' in 'WHS' is compounded by Joint Health Command (JHC) considering occupational health a WHS branch responsibility and a distraction from providing treatment services. At the same time, the WHS branch remains unable to fulfil its occupational health responsibilities without developing a parallel health service to JHC. This has been demonstrated by the Occupational Medicine/Occupational Hygiene (OMOH) project between JHC and the WHS Branch, which was instituted in 2010 in response to a succession of fairly egregious occupational health failures<sup>39,40</sup> but has made no progress since.<sup>41,42,43</sup>

### Deployed health service structure

From a health perspective, many (not all) deployed health units come under the J07 (Director Health) at Headquarters Joint Operations Command (HQJOC). While accepting this situation is unlikely to change in the foreseeable future, the following issues should be noted for consideration:

- The terms 'deployed' and 'non-deployed' have been used more or less synonymously with 'operational' and 'non-operational' since the 1990s: this reflected Army's succession of Middle East deployments from 2003 to 2021 and Air Force's OKRA deployments from 2014 to 2020.
- However, with the end of these deployments, more ADF operations for the foreseeable future will *not* entail physically basing anyone overseas: although Air Force will continue to routinely cycle aircraft to Butterworth, most of its operational taskings will be flown from Learmonth, Tindall, Darwin, Scherger, Amberley, Williamtown, Edinburgh and/or Pearce, while Navy and Army will provide Amphibious Task Groups that *operate* overseas but remain *based* in Sydney and Townsville. Hence, although the health clinics at these bases clearly do not *deploy*, they just as clearly will be providing health support for these *operational* units, thereby blurring their current characterisation as health services without an operational role.
- As previously indicated, not all ADF deployments are force-assigned to HQJOC: both Air Force and Navy routinely deploy aircraft and ships independently, many of which still need health support. This means Air Force for example, could have two units doing similar things in the

face of similar health threats but with different health support arrangements, simply because one is force-assigned to JOC and one is not. This reflects the extent to which HQJOC has had a top-down 'one-size-fits-all' approach to health support that is intrinsically inefficient and potentially hazardous.<sup>44</sup> This issue confirms the need for greater accountability by at least some J07s at HQJOC and other joint headquarters with respect to applying an informed risk management approach to managing the *environmental* operational and non-operational health threats confronted by their force-assigned units.

## The way forward

There are three components—mostly longer-term—to facilitating the ADF health services' 'operational capability' and 'civilian transition' missions in addition to their 'treatment service' mission: the first entails changing JHC's current geographic organisational structure for its base health services into a functional one; the second involves moving the ADF MEC functions to the single-service health directorates, and the third is to return the ADF's occupational health functions to JHC.

**A new functional organisation.** In lieu of multiple regional health services, this would entail putting the JHC clinics with mostly Air Force clientele under an O6 Director Air Force Health Services (DAFHS); those with mostly Navy clientele under an O6 Director Navy Health Services (DNHS); and those with mostly Army clientele under an O6 Director Army Health Services (DAHS). These O6s would have two reporting chains: one to a JHC one-star Director Defence Health Services, the other to their single-service chiefs through the latter's existing O6 health directors.

This functionally-based structure would have the following benefits:

- It gives the clinics the means to conduct all three missions rather than just one. The fact that 80% of the ADF members at most bases still being expected to be single service explains the O6 Directors' Canberra presence under a JHC DDHS: while they would each focus on managing how their clinics support their single-service populations, they clearly need to liaise with each other regarding the remaining 20% from the other services.
- It makes the clinics more accountable to the Service chiefs regarding the latter's 'raise/train/sustain' role and their health-related Person(s)

Conducting a Business Unit (PCBU) obligations per the *WHS Act*.

- Noting the extent to which the ADF relies on the military capabilities provided by aircrew, divers and submariners, who not only comprise 12.5% of *all* ADF members but also make up 15–20% of all Air Force and Navy members (compared to only about 5% for Army),<sup>45</sup> it makes sense that the health services that support them should be functionally organised.
- Given how they deploy and their far larger proportion of reservists, this structure would still allow Army to maintain its geographic-based structure under a DAHS. However, centralising the Navy and Air Force health command and management functions will reduce their personnel duplication among multiple 'garrison' headquarters, improving their utilisation.

**A new MEC process.** In lieu of a single JHC agency being responsible for providing medical employment advice, moving this function to the single-service health directorates would:

- improve accountability to the Service chiefs with respect to applying the ADF MEC system as a *personnel* rather than *patient* management system
- improve the quality of the advice being provided to the single-service personnel management agencies, both through personal experience of the clientele's working environment and by improved supervision of MEC Review treating MOs and confirming authorities
- extend the current processes for the ADF's SPEC personnel to its single-service populations.

**A new occupational health structure.** In lieu of the Defence WHS Branch maintaining its current responsibilities across Defence, moving its occupational health functions to JHC would acknowledge the extent to which the ADF population is first and foremost a *workforce* that requires a range of health services related to preventing *avoidable* workplace-related illness and injury. This will extend their current 'ambulance down in the valley' role to enable operational capability and facilitate their clientele's eventual transition to the civilian community.<sup>46</sup> Doing so will also fulfil the intent of the failed OMOH project by enabling the processes by which the clinics can fulfil their responsibilities to the Service chiefs regarding the latter's 'raise/train/sustain' role and health-related PCBU obligations per the *WHS Act*.



## Conclusion

There has been a longstanding misperception within Defence (including elements within its health services) that, as they only exist to provide treatment services, its health services are an obvious exemplar of something that can be easily unified or contracted out. However, this fails to recognise the other two missions of health services that support *military workforces* rather than civilian populations: enabling operational capability and facilitating their eventual transition to the civilian community.

Previous papers have explained why excessive workplace illness and injury rates confirm the need to improve the management of hazards associated with ADF workplaces, with better emphasis on prevention. Figure 1 summarises these papers by showing the relationships between ADF operational capability, the three health service missions necessary to enable that capability, the eight health service functions and roles enabling those missions, and the nine FICs they need to conduct them. It also demonstrates how occupational health is intrinsic to *all* the components of a holistic military healthcare system.

This paper explains why the health 'organisation' FIC is not fit-for-purpose in its current form: in particular, the misapplication of a geographically-based organisational structure that does not enable operational capability beyond one of the services in general and Navy in particular. This had been compounded by the misuse of the ADF MEC System as a patient rather than a personnel management tool, and JHC's non-accountability for enabling the service chief's *health*-related PCBU obligations.

The proposed organisational changes per this paper will allow JHC to manage the 'what' regarding the functions and roles that the ADF's clinics need to perform for them to conduct all three missions via its one-star Director Defence Health (not just 'Clinical') Services, whose subordinate single-service O6 health directors manage the 'how' while also supporting the single-service chiefs' 'raise/train/sustain' role and PCBU obligations via the latter's health directorates.

As applied to the ADF health services, Figure 1 remains consistent with the meaning of the word 'joint', as defined by the then CDF in 2017:

*'I look at where we've come to now from back then [1999] and we are well ahead, with a far better understanding that joint isn't doing everything the same. Joint is about bringing the best of the three services and the public service together to get the best combination you can for that particular operation.' [underlining added].<sup>47</sup>*

## Disclaimer

The views expressed in this article are the author's and do not necessarily reflect those of the RAN or any other organisations mentioned.

---

Corresponding Author: Neil Westphalen,  
[neil.westphalen@bigpond.com](mailto:neil.westphalen@bigpond.com)

Authors: N Westphalen<sup>1,2</sup>

Author Affiliations:

1 Royal Australian Navy – Directorate of Navy Health  
CP4-7-150

2 University of New South Wales Canberra at ADFA

## References

- 1 Westphalen N. Colonel Arthur Graham Butler's 'Allegiances': Today's 'Military Health Service Missions. *Journal of Military and Veteran's Health*. Apr 2021;29(2):17-28. Available from: <https://jmvh.org/article/colonel-arthur-graham-butlers-allegiances-todays-military-health-service-missions>.
- 2 Westphalen, N. 'Military Health Support' in the Australian Defence Force', *Journal of Military and Veteran's Health*, Oct 2021, 29(4):16-26. Available from <https://jmvh.org/article/military-health-support-in-the-australian-defence-force>.
- 3 Westphalen, N. 'Casualty Evacuation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Jan 2020;28(1):29-38. Available from: <https://jmvh.org/wp-content/uploads/2020/04/AMMA-JMVH-Jan-2020.pdf>.
- 4 Westphalen N. Humanitarian Aid / Disaster Relief in the Australian Defence Force: Health Aspects. *JMVH*. 2021 Jul;28(3):15-25. Available from: <https://jmvh.org/article/humanitarian-aid-disaster-relief-ha-dr-in-the-australian-defence-force-health-aspects>.
- 5 Westphalen, N. 'Military Medicine Capabilities in the Australian Defence Force', *Journal of Military and Veteran's Health*, May 2020;28(2):39-49. Available from: <https://jmvh.org/article/military-medicine-capabilities-in-the-australian-defence-force>.

- 6 Heslop DJ, Westphalen N. 'Medical CBRN Defence in the Australian Defence Force', *Journal of Military and Veteran's Health*, Jan 2019;27(1):66-73. Available from: <https://jmvh.org/wp-content/uploads/2019/01/Compensation-in-the-Australian-Defence-Force.pdf>.
- 7 Westphalen, N, 'Assessing medical suitability for employment and deployment in the Australian Defence Force', *Journal of Military and Veteran's Health* Jul 2018;26(2):42-48. Available from: <http://jmvh.org/wp-content/uploads/2018/08/AMMA-JMVH-July-2018.pdf>.
- 8 Westphalen, N. 'Compensation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Jan 2019;27(1):58-65. Available from: <https://jmvh.org/wp-content/uploads/2019/01/Compensation-in-the-Australian-Defence-Force.pdf>.
- 9 Westphalen, N. 'Rehabilitation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Oct 2019;27(4):7-14. Available from <https://jmvh.org/wp-content/uploads/2019/10/AMMA-JMVH-October-2019.pdf>.
- 10 Westphalen, N. 'Occupational and environmental medicine in the Australian Defence Force', *Journal of Military and Veteran's Health* January 2017 vol. 25 no. 1 pp. 44-52, available from <http://jmvh.org/wp-content/uploads/2017/02/reprint.pdf>.
- 11 Westphalen N. Health promotion in the Australian Defence Force. *Journal of Military and Veteran's Health*. January 2021;29(1):52-60. Available from <https://jmvh.org/article/health-promotion-in-the-australian-defence-force>.
- 12 Westphalen, N. 'Primary Health Care in the Australian Defence Force', *Journal of Military and Veteran's Health* Jul 2018;25(4):84-89. Available from: <http://jmvh.org/wp-content/uploads/2017/11/AMMA-JMVH-October-2017.pdf>.
- 13 Royal Australian College of Physicians. RACP submission to the draft Productivity Commission report 'A Better Way to Support Veterans'. Feb 2019. Available from: [https://www.pc.gov.au/data/assets/pdf\\_file/0003/236811/subdr234-veterans.pdf](https://www.pc.gov.au/data/assets/pdf_file/0003/236811/subdr234-veterans.pdf).  
Disclaimer: the author was requested to draft this submission, as a member of the AFOEM Faculty Policy and Advocacy Committee (FPAC). It was cleared by the Faculty and College PACs prior to submission.
- 14 Department of Defence. Defence Capability Development Handbook. Canberra ACT: Defence Publishing, Library and Information Service; Dec 2020. Available from: <https://www.defence.gov.au/publications/docs/Defence-Capability-Manual.pdf>.
- 15 Defence Capability Development Handbook. Canberra ACT: Defence Publishing, Library and Information Service; Dec 2020. p. 11-3. Available from: <https://www.defence.gov.au/publications/docs/Defence-Capability-Manual.pdf>.
- 16 See Stephens A. *Going Solo: the Royal Australian Air Force 1946-1971*. Canberra ACT: Australian Government Publishing Service; 1995. p. 77-8.
- 17 See Stevens D. 1983-1991: A period of uncertainty and change. *The Royal Australian Navy. The Australian Centennial History of Defence*. Vol. 3. South Melbourne VIC: Oxford University Press; 2001. p. 253-5.
- 18 See McCarthy D. The Rebirth of the CMF. In: *The once and future Army: a history of the Citizen Military Forces 1947-74. The Australian Army History Series*. Horner D, editor. South Melbourne, VIC: Oxford University Press. 2003. pp. 11-32.
- 19 Andrews E. The Department of Defence. *The Australian Centenary History of Defence*. Vol 5. South Melbourne VIC: Oxford University Press; 2001. p. 278-303.
- 20 Hyslop R. *Personnel care. Australian Naval Administration 1900-1939*. Melbourne: The Hawthorn Press; 1973. p. 116-9.
- 21 Braga S. *The health of the nation, 1921-1926. Anzac Doctor: The Life of Sir Neville Howse, Australia's first VC*. Sydney NSW: Hale and Iremonger; 2000. p. 276-8.
- 22 Walker AS. *The interwar period, 1919-1939. Middle East and Far East. Australia in the War of 1939-1945 Series 5 (Medical)*. 2. Canberra: Halstead Press—Australian War Memorial; 1953. p. 1-25.
- 23 Australian National Audit Office. *Audit Report No. 34 1996-97: Australian Defence Force Health Services Performance Audit*. Canberra, ACT; 1997 27 May 1997.

- 24 This difference in posting practices has posed some challenges for the LHDs. These ships have crews of up to 400 personnel, including up to 100 Army and RAAF members. Their operational capability is seriously impaired if the latter's non-deployable members are not replaced on the same terms as the Navy LHD crew element.
- 25 For example, the 1992 Somalia deployment (Operation SOLACE) only began to leave Townsville piecemeal nine days after its warning order: see Bou, Jean, Bob Breen, David Horner, Garth Pratten, and Miesje De Vogel. 'Australian Force Somalia: Deploying the 1 RAR Battalion Group, December 1992-January 1993.' Chap. 3 In *The Limits of Peacekeeping: Australian Missions in Africa and the Americas 1992-2005*, edited by David Horner. The Official History of Australian Peacekeeping, Humanitarian and Post-Cold War Operations, 55-79. Cambridge UK: Australian War Memorial, 2019.
- 26 For another example, the advanced element for the first Rwanda deployment in 1995 did not leave Australia until ten days after the contingent began concentrating in Townsville, with the remainder following 14 days later. See Bou, Jean, Bob Breen, David Horner, Garth Pratten, and Miesje De Vogel. 'After the Tempest: The First Contingent to Rwanda, August 1994 - February 1995.' Chap. 9 In *The Limits of Peacekeeping: Australian Missions in Africa and the Americas 1992-2005*, edited by David Horner. The Official History of Australian Peacekeeping, Humanitarian and Post-Cold War Operations, 230-69. Cambridge UK: Australian War Memorial, 2019.
- 27 For another example, definitive planning for the initial deployment to East Timor (Operation STABILISE) began on 12 September 1999, followed by arrival of the first troops six days later. Even so, the deployed force did not reach full strength until the following November. See Horner, David. 'Testing the Australian Defence Force.' In *Making the Australian Defence Force*, edited by Peter Dennis and John Coates. The Australian Centenary History of Defence, 7-39. South Melbourne VIC: Oxford University Press, 2001.
- 28 Operation NAVY HELP DARWIN included 3000 personnel aboard the aircraft carrier Melbourne, the destroyers Hobart, Brisbane, and Vendetta, the destroyer escort Stuart, the maintenance ship Stalwart, the oiler Supply, the hydrographic ship Flinders, and the landing craft Balikpapan, Betano, Brunei, Tarakan and Wewak. The first of these ships sailed the day after the cyclone, with all on their way by a day later. See Royal Australian Navy, Disaster Relief - Cyclone Tracy and Tasman Bridge Available from: <http://www.navy.gov.au/history/feature-histories/disaster-relief-cyclone-tracy-and-tasman-bridge>.
- 29 Having received their warning orders on Friday 10 August 1990, Adelaide and Darwin departed Sydney the following Monday, followed by Success the day after. See Horner, David. 'Off to the Gulf: The First Deployment August - September 1990.' Chap. 11 In *Australia and the New World Order: From Peacekeeping to Peace Enforcement 1988-1991*. The Official History of Australian Peacekeeping, Humanitarian and Post-Cold War Operations, 304-19. Port Melbourne VIC: Cambridge University Press - Australian War Memorial, 2011.
- 30 On 6 June 2000, Tobruk was en route from Vila to Bougainville when she was diverted to Honiara for a possible civilian evacuation: on arrival two days later she took on 486 evacuees. See Doolan, Ken. 'Operations PLUMBOB and TREK: The Solomons 2000/2001.' Chap. 12 In *HMAS Tobruk: Warship for Every Crisis*, 127-31. Queanbeyan NSW: Grinkle Press, 2007.
- 31 This particularly refers to ensuring compliance Defence Health Manual Vol 3 Part 6 Chap 8 The Military Employment Classification System And The Maritime Environment (previously ABR 1991 Chapter 8). This reference is only available on the Defence intranet.
- 32 Australian Government. Disability Discrimination Act 1992. Available from: <https://www.legislation.gov.au/Details/C2016C00763>.
- 33 Personal communication with the then Chief of Navy (VADM David Shackleton AO RAN), HMAS Stirling, June 2002.
- 34 Since 1996, the proportion of Navy members with at least one employment restriction has quadrupled, and the proportion of non-deployable Navy members has tripled. See Westphalen N. Navy Employability and Deployability 1996 – 2019: What's Going On? Australian Military Medicine Association Conference; 5 October 2019; Adelaide 2019. Copy held by author.
- 35 Smart AVM T. Graeme Shirtley Oration. 2019 AMMA Conference; 05 Oct 2019; Adelaide Convention Centre. Transcript held by author.



- 36 Australian Government Work Health and Safety Act 2011. Available from: <https://www.legislation.gov.au/Details/C2018C00293>.
- 37 Westphalen, N. 'Compensation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Jan 2019;27(1):58-65. Available from: <https://jmvh.org/wp-content/uploads/2019/01/Compensation-in-the-Australian-Defence-Force.pdf>.
- 38 Westphalen, N. 'Rehabilitation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Oct 2019;27(4):7-14. Available from: <https://jmvh.org/wp-content/uploads/2019/10/AMMA-JMVH-October-2019.pdf>.
- 39 Clarkson J, Hopkins W, Taylor K. Chemical exposure of Air Force maintenance workers: report of the Board of Inquiry into F-111 (fuel tank) desal/reseal and spray seal programs. Canberra, ACT: Air Force Headquarters; 29 Jun 2002.
- 40 Doherty B. Navy asbestos puts thousands at risk: *Sydney Morning Herald*; 7 Jan 2009. Available from: <https://www.smh.com.au/national/pressure-builds-on-defence-force-to-remove-deadly-asbestos-20090108-7cwb.html>.
- 41 Contamination: Four Corners; 9 Oct 2017 [updated 10 Oct 2017]. Available from: <https://www.abc.net.au/4corners/contamination/9032140>.
- 42 Westphalen, N. 'Compensation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Jan 2019;27(1):58-65. Available from: <https://jmvh.org/wp-content/uploads/2019/01/Compensation-in-the-Australian-Defence-Force.pdf>.
- 43 Westphalen, N. 'Rehabilitation in the Australian Defence Force', *Journal of Military and Veteran's Health*, Oct 2019;27(4):7-14. Available from: <https://jmvh.org/wp-content/uploads/2019/10/AMMA-JMVH-October-2019.pdf>.
- 44 For example, in 2003 HQJOC mandated the same post-deployment prophylaxis against leishmaniasis for all force-assigned members in the Middle East, when the Navy element could expect one such case every 1500 years. Besides wasting time and effort, it meant the prophylactic measures were likely to pose a greater threat for Navy personnel than the leishmaniasis it was intended to prevent. It seems likely that others who have been force-assigned to HQJOC or other joint headquarters have more recent examples.
- 45 Westphalen, N. 'Military Medicine Capabilities in the Australian Defence Force', *Journal of Military and Veteran's Health*, May 2020;28(2):39-49. Available from: <https://jmvh.org/article/military-medicine-capabilities-in-the-australian-defence-force>.
- 46 Malins J. The Ambulance Down in the Valley. Available from: <https://www.justice4all.org/wp-content/uploads/The%20Ambulance%20Down%20In%20The%20Valley.pdf>.
- 47 Air Chief Marshal Mark Binskin AC, Chief of the Defence Force. Quoted in McPhedran I. The smack track. Inside the Navy's war: chasing down drug smugglers, pirates and terrorists. Sydney NSW: HarperCollins; 2017. p. 278.

# Changes in Patient Profile and Neurosurgical Procedures in a Large Military Hospital in Colombia Before and After the Peace Process: A Retrospective Analysis of Clinical Records

*H Palmera Pineda, F Montoya, D Rosselli, L Estrada, K Luengas, J C Luque*

## Abstract

**Aim:** Colombia concluded a peace agreement with its largest guerrilla group (known as FARC) in 2016. The study aimed to compare neurosurgical procedures performed at the largest national military hospital during a two-year period at the height of the armed conflict (2003–2004) with a similar period around the official signing of the agreement (2015–2017).

**Methods:** Clinical records of all patients undergoing neurosurgical procedures from January 2003 to December 2004 and from July 2015 to June 2017 were reviewed. Demographic variables and procedures were analysed through basic descriptive statistics.

**Results:** 527 patients' records were retrieved from the first period and 871 from the second; patients were predominantly male (71% and 61%, respectively). Median age increased from 35 years in the first period to 50 years in the second; active personnel decreased from 60% to 31%. Trauma represented 170 of 313 cranial surgeries (54%) in the first period and 96 of 571 (17%) in the latter.

**Conclusion:** Patient profile in this military institution changed from being a war hospital in the middle of the conflict to one with a more 'civilian' pattern of procedures.

**Keywords:** Armed Conflicts; Colombia; Hospital Militar; Military Medicine; Neurosurgery; Neurosurgical procedures.

**Conflict of interest:** The authors certify that they have NO affiliations with or involvement in any organisation or entity with any financial. One of the authors (JCL) is a retired Colonel of the Army; another (FAM) is currently Captain of the Colombian Army.

## Introduction

The Central Military Hospital (Hospital Militar Central or HMC), in the capital city of Bogotá, has been the main reference centre for Colombian military personnel and their families when they require high degrees of subspecialty expertise since its establishment in 1962.<sup>1</sup> It is a 450-bed hospital; 100 of them in the four intensive care units. The Colombian Military Health System covers close to one million active and retired military personnel,

their families, as well as civilians who are part of the Colombian Ministry of Defence. Due to the long-standing internal conflict with guerrilla groups, including the Revolutionary Armed Forces of Colombia (FARC), the HMC has gained important experience in conflict-related severe trauma.<sup>2,3</sup> Several of our publications have recorded the experience in large series of facial gunshot wounds<sup>4,5</sup> and other forms of severe trauma.<sup>6</sup>

Neurosurgical procedures in military hospitals tend to concentrate a large proportion of trauma-related

interventions,<sup>7</sup> particularly when conflicts arise.<sup>8</sup> In peacetime, military neurosurgeons tend to deal with similar patients to their civilian peers.<sup>9</sup> This patient profile change has been described in Bulgaria transitioning from a conflict-ridden Communist republic to a democracy.<sup>6</sup>

According to the National Centre for Historic Memory (Centro Nacional de Memoria Histórica), in Colombia from 1958 to 2012, there were an estimated 218 094 conflict-related deaths, 81% of which were civilians.<sup>10</sup> The highest death toll occurred in 2003–2004<sup>12</sup> with almost 2000 annual conflict-related deaths.<sup>11</sup>

The objective of this study was to compare the sociodemographic profile of neurosurgical patients and the surgical procedures performed at the HMC before and after the Havana Peace Process, signed between the Colombian government and the FARC in Cuba and ratified by Congress in November 2016.<sup>13</sup>

## Methods

The clinical records of all patients undergoing neurosurgical procedures during two different periods were retrospectively analysed. The first period went from January 2003 to December 2004, at the peak of the armed conflict. The second period went from July 2015 to June 2017, around the time the Peace Agreement was signed and ratified. The HMC lacked electronic health records during the first period, and data were retrieved manually. Much valuable information was missing in many of the records in this first group, such as the length of stay, both in the general ward and ICU, and military rank and force; this subsample is reported separately. Data retrieved included gender, age, occupation (rank and force), primary diagnosis and surgical procedures (classified in subcategories).

All information was collected in pre-designed Excel spreadsheets. In order to analyse the data, frequencies of each variable were obtained, qualitative variables were organised into categories, and descriptive statistical analysis included chi-square and two-tailed *t*-Student tests. For statistical significance, we assumed a *p*-value lower than 0.05. For the chi-square test, when more than 20% of the cells showed a value of expected frequency lower than 5, Fisher's exact test was used.

The research protocol was reviewed and approved by the institution's ethics committee.

## Results

A total of 1 398 patient records were retrieved, 527 from the first period and 871 from the second one (Table 1). The sample was predominantly male, more so in the first period than in the second. As can be seen when comparing means, median or interquartile range, the patients in the first period were younger; a higher proportion were active military personnel. When considering active personnel only, there were no differences in distribution by force (Army, Navy and Air Force) or rank. The main cause of cranial surgery during the period prior to the signing of the Peace Agreement was trauma, while in the post-agreement period, it was vascular pathology. For its part, degenerative spinal pathology was the most important cause of spinal surgery in both periods; however, there was a significant decrease in spinal trauma in the post-agreement period (Table 2).

**Table 1. General characteristics of the 527 neurosurgical patients from the first period (2003–2004) and the 871 from the second period (2015–2017).**

	2003–2004		2015–2017
	N=251	N=276*	N=871
<b>Age (years)</b>			
<b>Range</b>	18–85	18–85	18–94
<b>Mean (SD)</b>	40 (17)	41 (18)	51 (19)**
<b>Median (IQR)</b>	36 (25–51)	35 (26–55)	50 (36–68)**
<b>Males</b>	196 (78%)	180 (65%)	532 (61%)**
<b>Active personnel</b>	153 (60%)		273 (31%)**
<b>Rank</b>			
<b>Officers</b>	17 (11%)		34 (12%)
<b>NCO</b>	53 (34%)		96 (35%)
<b>Soldiers</b>	83 (54%)		142 (52%)
<b>Force</b>			
<b>Army</b>	131 (86%)		237 (87%)
<b>Navy</b>	17 (11%)		20 (7%)
<b>Air Force</b>	5 (3%)		16 (6%)

*SD* standard deviation; *IQR* interquartile range; *NCO* non-commissioned officers

\* These patients had missing data in their clinical records

\*\* *p* < 0.001



**Table 2. Main neurosurgical procedures classified by surgical site and broad categories. Percentages may not add up to 100% due to rounding.**

	2003–2004		2015–2017	
	Cranial surgery N=313	Spinal surgery N=214	Cranial surgery N=571	Spinal surgery N=301
<b>Trauma</b>	170 (54%)	28 (13%)	96 (17%)**	23 (8%)**
<b>Tumour</b>	54 (17%)	10 (5%)	153 (27%)	14 (5%)
<b>Vascular</b>	32 (10%)	2 (1%)	228 (40%)	3 (1%)
<b>Infection</b>	17 (5%)	8 (4%)	16 (3%)	2 (1%)
<b>Degenerative</b>		151 (51%)		249 (83%)
<b>Other</b>	40 (13%)	15 (7%)	78 (14%)	10 (3%)

\*\*  $p < 0.001$  for comparisons between the two time periods

## Discussion

The results presented in this paper show a significant change in one of the surgical departments involved in treating military personnel both during the decades-long armed conflict and in the months surrounding the Colombian Peace Agreement. There have been no significant changes in the population covered by the Colombian Military Health System during this period. Surgical activity is closer to what is expected in a civilian environment, which has seen new technologies introduced in the neurosurgical like minimally invasive techniques, radiosurgery or endovascular procedures. However, together with the medical school of the Military University, the hospital keeps training in trauma management, primarily through its simulation laboratory.

The Colombian peace process took advantage of the lessons of other similar agreements, like the one that ended apartheid in South Africa in the early nineties.<sup>14</sup> Both had strong opposition coming from powerful politicians and a large part of the population.<sup>15</sup> In both cases, fear was used as a weapon to demonise the enemy and to exaggerate events whenever something violent happened in the long process of both of these agreements.

The effects of war on health have been amply discussed,<sup>16,17</sup> and there is an extensive list of both

direct and indirect effects; in Colombia, internal displacement and its social and economic effects are of great importance in many health-related aspects, particularly for the most vulnerable.<sup>18,19</sup> Mental health, both in the military<sup>20</sup> and in the civilian population,<sup>21</sup> has also been the topic of some research. In this paper, we address the direct effects of neurosurgical trauma derived from the Colombian armed conflict on military personnel, an aspect that has not been sufficiently covered in the academic literature.

Despite the limitation of some missing data in the first sample, our results show that highly trained medical specialists that were once dedicating most of their time and medical resources to conflict-related trauma in young men are now involved in a new set of neurosurgical procedures in a vastly different target population. The social value of this trend, though difficult to quantify, must be significant.

*Corresponding Author:*

Harold Palmera Pineda, [har9hol@gmail.com](mailto:har9hol@gmail.com)

*Authors:* H Palmera Pineda<sup>1</sup>, F Montoya<sup>2</sup>, D Rosselli<sup>2</sup>, L Estrada<sup>2</sup>, K Luengas<sup>2</sup>, J C Luque<sup>2</sup>

*Author Affiliations:*

1 Universidad Militar Nueva Granada

2 Bogota Colombia

## References

1. Sotomayor Tribin HA. La medicina y la guerra: el lento despliegue de la medicina militar en Colombia. *Revista Med* 2009;17:293-306.
2. Luque SJ. Heridas penetrantes por armas de fuego en el sistema nervioso central. Primera parte: Aspectos históricos y nociones de balística. *Revista Med* 2007;15:134-8
3. Luque SJ. Heridas penetrantes por armas de fuego en el sistema nervioso central. Segunda parte: Fisiopatología de las lesiones, casos clínicos y manejo. *Revista Med.* 2007;15:306-12

4. Vera Landázuri JL, Delgado Salazar NA, Vitery Erazo L. Caracterización clínica de las fracturas faciales ocasionadas por trauma de guerra o violencia civil en el conflicto armado en Colombia del 2012 al 2013 en el Hospital Militar Central de Bogotá, DC. *Acta Otorrinolaringol Cir Cabeza Cuello* 2017;43:135-40
5. Espinosa-Reyes J, Fonnegra C, Cardona-Gonzalez J, Rosselli D. An explosive case. *Lancet*. 2003;362:2066. doi:10.1016/S0140-6736(03)15102-1
6. Valencia CF, Suárez JA, Cogollos Á, et al. Heridos en combate, experiencia del Grupo de Trauma del Hospital Militar Central de Bogotá. *Rev Colomb Cir* 2015;30:18-23.
7. Ragel BT, Taggard DA, Klimo P Jr, et al. Increasing the neurosurgical caseload at a military hospital: initial experience with a joint military-Veterans Affairs (VA) sharing agreement. *Mil Med*. 2009;174:103-5.
8. Moquin R, Ecklund J. Socioeconomic issues of United States military neurosurgery. *Neurosurg Focus* 2002;12:1-6
9. Enchev Y, Eftimov T. Bulgarian military neurosurgery: from Warsaw Pact to the North Atlantic Treaty Organization. *Neurosurg Focus* 2010;28:1-6
10. Centro Nacional de Memoria Histórica [internet]. Bogotá: [cited 2018 Oct 18]. Available from: <http://www.centrodememoriahistorica.gov.co>
11. Rosselli D, Tarazona N, Aroca A. La salud en Colombia 1953-2013: Un análisis de estadísticas vitales. *Medicina (Bogota)* 2014;36:120-35.
12. Instituto Nacional de Medicina Legal [internet]. Bogotá [cited 2018 Oct 20]. Available from: <http://www.medicinalegal.gov.co>
13. Maldonado AU. What is the Colombian peace process teaching the world? *New Engl J Public Policy*. 2017;29:9.
14. Watts R. Some lessons from the South African peace process. *Med War*. 1996;12(1):35-44.
15. Dávalos E, Morales L F, Holmes J S, Dávalos LM. Opposition support and the experience of violence explain Colombian peace referendum results. *J Polit Lat Am*. 2018;10(2):99-122.
16. Santa Barbara J. Medicine, peace and public policy. *Croat Med J*. 2006;47(2):352-5
17. Kahan E. The peace process in the Middle East: Present situation. *Med Confl Surviv*. 1997;13(2):135-9.
18. Shultz JM, Gómez Ceballos ÁM, Espinel Z, et al. Internal displacement in Colombia: fifteen distinguishing features. *Disaster Health*. 2014;2(1):13-24.
19. Zea MC, Reisen CA, Bianchi FT, et al. Armed conflict, homonegativity and forced internal displacement: implications for HIV among Colombian gay, bisexual and transgender individuals. *Cult Health Sex*. 2013;15(7):788-803.
20. Chimunja Chicue L, Fuentes Alban SC, Ruiz Urbano EM, Castrillón Paz H. Enfermedad mental y factores asociados en oficiales del Ejército Nacional de Colombia en conflicto armado. *Index Enferm*. 2018;27(4):211-5.
21. Hewitt Ramírez N, Juárez F, Parada Baños AJ, et al. Afectaciones psicológicas, estrategias de afrontamiento y niveles de resiliencia de adultos expuestos al conflicto armado en Colombia. *Rev Colomb Psicol*. 2016;25(1):125-40.

# The Case of The Soldier Who Failed to Return: Reflections on Psychodynamic Psychotherapy with Combat Veterans

L D Connor

## Abstract

The effects of war on combat veterans' mental health are numerous and well established. Several effective interventions exist based on cognitive-behavioural therapy that aim to reduce the symptoms of anxiety, depression and PTSD that many veterans struggle with. However, little attention has been paid to psychodynamic psychotherapy and documenting its use in treating the sequelae of war trauma. Furthermore, very few writings discuss how working with combat veterans within a psychodynamic framework can affect the therapist. This paper presents the case of 'Sam', a combat veteran who suddenly disappeared from psychotherapy after some years in treatment. The author reflects on the issues that arose in this course of therapy with the aim to stimulate further reflection in practitioners working with veterans drawing upon a psychodynamic model. It is hoped that readers and organisations supporting veteran mental health will develop an appreciation of the intricacies of psychodynamic psychotherapy with combat veterans, understand the importance of the therapeutic alliance, appreciate the impact that working with combat veterans may have on themselves and the importance of seeking and maintaining high-quality supervision and reflection.

**Keywords:** Combat, Veteran, Psychodynamic, Psychotherapy, PTSD, Trauma

## Introduction

The recent and prolonged wars in Iraq and Afghanistan have brought into stark focus the effects of modern warfare on combat veterans' psychological and physical functioning. Defence forces and civilian support agencies in various countries are being confronted by modern warfare's complex and enduring effects on soldiers. Psychotherapy for combat veterans is necessarily an expanding focus for research and practice driven by the need to address mental health problems resulting from the sequelae of war and occurring in large numbers of military personnel.

The impact of combat experience has been recorded across numerous conflicts throughout the 20th and 21st centuries.<sup>1-3</sup> Recent data compiled by the Australian Defence Force suggests that up to 54% of military members may experience some form of mental health disorder in their lifetime.<sup>4</sup> It is estimated that approximately 8% of Australian Defence Force members will have experienced post-traumatic stress disorder (PTSD) within the last 12 months.<sup>4</sup> Closely linked to PTSD is the concept of

moral injury, which has seen a surge in research and the development of psychotherapeutic interventions in recent years.<sup>5,6</sup> While the statistics vary widely, it is clear that many soldiers who have been exposed to overseas, warlike service and combat conditions *are* likely to experience some form of psychological disorder throughout their lives.<sup>7</sup> Therefore, developing effective therapeutic interventions for depressive, anxiety and traumatic stress disorders is of high importance. Given the dearth of psychodynamically informed papers for combat trauma, as well as case studies and therapist reflections, the author has taken this as an opportunity to present a typical case based on years of working with combat veterans.

This paper is by no means a criticism of manualised cognitive-behavioural-based trauma therapies (CBT), which have a well-established and deserved place in trauma work. It is hoped that this case will encourage comment and reflection from therapists working with a new wave of veterans. The author hopes that these honest reflections will contribute to a deeper understanding and appreciation of themes and interactions that emerge both for the veteran and the therapist within a psychodynamic

framework and ultimately contribute to the broader development of the trauma therapy field.

Studies into the treatments for combat-related trauma come largely from research into the effectiveness of manualised (usually based on cognitive-behavioural theories) interventions.<sup>8–10</sup> Australia's more recent military involvement in the Iraq and Afghanistan conflicts has led to mental health workers drawing upon various manualised psychotherapies to treat veterans diagnosed with traumatic stress disorders, e.g. cognitive processing therapy (CPT).<sup>10</sup>

While trauma focused treatments derived from a CBT paradigm, including CPT,<sup>11</sup> prolonged exposure,<sup>12</sup> eye movement desensitisation and reprocessing,<sup>13</sup> all strive to achieve desensitisation to a trauma stimulus (physical or psychological), these approaches are not explicitly designed to explore the more inaccessible or unconscious aspects of a client's experience of trauma. Furthermore, there has been little focus on the qualitative examination of non-cognitive and/or behavioural therapies that treat the psychological sequelae of participating in war; therapies such as psychodynamic psychotherapy.<sup>14–16</sup>

Psychodynamic theory has its roots in the treatment of trauma, with Freud being one of the main proponents in the treatment of World War I veterans.<sup>17</sup> With modern-day psychodynamic therapists continuing to build on its various theoretical underpinnings, it is an approach that offers much hope in the treatment of combat veterans.<sup>14–16</sup>

The evidence for the effectiveness of psychodynamic psychotherapy is now well established.<sup>18,19</sup> Research over many years clearly demonstrates that psychodynamic psychotherapy results in significant and lasting change in treating multiple psychopathologies.<sup>20</sup> It is used effectively to treat anxiety, depression and trauma and help patients better understand what perpetuates their conflicts and symptoms.

Psychodynamic psychotherapy for combat-related PTSD has been considered in few papers.<sup>14–16,21,22</sup> Ishaq<sup>14</sup> offers an interesting approach to treating PTSD by examining not only the traumatic events themselves but how they interact with the early developmental experiences of the patient. Examining unconscious conflicts, defence mechanisms and counter-transference within the therapeutic frame may lead to the resolution of these conflicts and maladaptive reactions to the trauma. Kudler<sup>15</sup> put forward the need for psychodynamic theory in conceptualising combat-related PTSD in veterans and their families. Importantly Kudler points out that

psychodynamic clinicians focus more on what makes the patient an individual rather than what a group of patients have in common. He goes on to say that 'collaboration between equals is a corrective to the pathological effects of psychological trauma'.<sup>15(p.48)</sup> The capacity for both the therapist and patient (through the therapeutic alliance) to walk together through the processing of traumatic experiences and share their honest thoughts and reactions around this is very much a part of a psychodynamic approach to treating trauma. The exploration, reactions and reflections of both the patient and the therapist are vital in being able to uncover unconscious processes that perpetuate distress.

At its most basic level, psychodynamic psychotherapy works to enhance a client's awareness of the conscious and unconscious factors that maintain psychological pain. Of particular importance is the creation of a 'relational home'<sup>23</sup> where traumatic experiences can be held, explored and worked through. The affective experiences of the client and therapist within the therapeutic setting are treated as valuable data and used to help clients view their traumatic experiences anew. With regular therapy, they develop increasingly sophisticated ways of relating to and coping with these over time.

Cognitive and behavioural based trauma interventions such as CPT and prolonged exposure, assume that the client has complete conscious access to the traumatic experience and their reactions to it. These approaches endeavour to identify faulty cognitions and maladaptive behaviours arising from the event and challenge and restructure them. While a strong therapeutic alliance is important in all psychotherapies, these interventions do not explicitly use it as a vehicle to explore and process the trauma. The reactions, cognitions, affect and reflections of the therapist are not generally acknowledged and used in session in these manualised and time-limited approaches.

Psychodynamic approaches to trauma treatment start with the premise that many critical aspects of the trauma and reactions to it are not immediately available to the patient's consciousness. These distressing reactions, whether cognitive, emotional or physical, must be allowed and encouraged to emerge within a safe, empathically warm and predictable therapeutic relationship. Given time and space, and with interpretations and clarifications (key mechanisms of change in psychodynamic psychotherapy) by the therapist, the patient can then articulate and bring to consciousness contemplations that have been previously inaccessible. The therapist and patient work through defences, repetitions and



beliefs stemming from the trauma. The long-term aim is to emerge with a richer, deeper and more insightful understanding of the trauma, leading to the development of more adaptive and sophisticated coping strategies to manage symptoms.

This paper aims to contribute to a more nuanced understanding of the psychodynamic therapeutic process and the issues that can arise in working with combat veterans. A primary theme of this paper is to highlight the genuine responses and reactions a therapist can have when working with combat veterans. This process is sometimes referred to in terms of projective identification. The capacity to honestly reflect on one's own reactions within supervision to the therapeutic material is vitally important for both the client's treatment and for the psychological wellbeing of the therapist. Understanding this is to be as best prepared as possible in working with traumatised individuals, and therapists should understand that it is ok and normal to react to their clients and their experiences. Accepting this core part of psychodynamic therapy creates an opportunity for honest reflection on the client's responses and one's own responses. This creates fertile ground for clients and therapists to explore more deeply painful experiences that often have never been put into words before.

The fictitious character of 'Sam' described below is an amalgamation of real experiences and stories the author has worked with over many years distilled into one character. He represents a typical patient seen in therapy. Details have been changed substantially, but the themes, emotions and experiences remain the same. The author's responses and thoughts are real and presented honestly and openly. Of particular note about this case is the sudden drop of therapy by a client who had been attending for some years.

Although most therapists would expect to lose a proportion of clients to drop out,<sup>24</sup> the loss of a long-term client to unexplained absence can be disturbing to the therapist and a stimulus for urgent reflection. It is hoped that by reading and reflecting on this piece:

- readers will develop an appreciation of the intricacies of psychodynamic psychotherapy with combat veterans
- will become familiar with how unconscious conflicts (like shame and guilt) drive trauma-based symptoms
- understand the importance of the therapeutic alliance in making these conflicts conscious

- appreciate the impact that working with combat veterans may have on themselves and the importance of seeking and maintaining high-quality supervision and reflection.

### **Sam: The case of the soldier who failed to return.**

Tall, strikingly tattooed and with a broad Australian accent, 25-year-old Sam presented to my office a few weeks after returning to Australia from a deployment to Afghanistan. He had been stationed in a small combat outpost for the previous 5 months. During this time, he experienced the deaths of, and injuries to, close mates and was in the vicinity of numerous explosions. He had been in multiple intense firefights with the enemy. Daily life was tough in the outpost with regular illnesses on top of gruelling heat and energy-sapping foot patrols.

Having referred himself for therapy, his initial appearance showed a high degree of agitation, and he made little eye contact for the first few sessions. He never once sat back in the chair, remaining perched on the edge as if he could spring out the door in a moment. He had to pace around the room at times to ease the pressure on his injured back. He often wore sunglasses inside and during the session. He described feeling profoundly confused and anxious. He worried he could act out violently if someone said the wrong thing to him. His sleep was poor, punctuated by intrusive dreams and agitation, and his general wellbeing suffered. His physical and psychological symptoms impacted his domestic relationship, further exacerbating his distress. His partner was expecting a second child in the coming months. He struck me as deeply loyal to his family, uniform and country and the values and moral thinking he espoused about right and wrong were well articulated and consistent—something that was probably a pre-condition for the guilt that he carried and later revealed.

The early stages of therapy necessarily emphasised the provision of a safe environment in which he could talk freely. I did not feel the need to say very much, and he readily used the therapeutic space. He began to slowly open up about being on patrol; facing the uncertainty of whether or not the next step he took would trigger an improvised explosive device (IED); seeing the severe poverty the locals lived in; seeing how the enemy hid among the civilian population, setting their deadly explosive devices in the fields, rivers and haystacks; wrestling with the vagaries of war; making the decision to shoot or not to shoot. He agonised over his decisions, often made in milliseconds and under fire.

He initially talked about his tours overseas in general terms and often hinted that there were more to his stories but would pull back when I invited him to explore them further. The therapeutic relationship formed a central part of our work and an area we regularly reflected. After a year or so of weekly psychotherapy, he eventually noted he trusted me, never felt judged and found comfort in being able to say whatever came into his mind without fear of being seen as weak or defective. He described feeling safe in therapy and recognised that our sessions differed from the brief and formal psychiatrist appointments he had every two weeks. It took him many more months before he could tell me that he was often brought close to being physically ill throughout our sessions, such was the anxiety attached to his stories and traumas. It often took him many hours to settle physically and emotionally after our sessions.

After 2 years of weekly therapy, it emerged that Sam was struggling with a dilemma. He recognised he was carrying heavy weight and crushing guilt over something he believed he had done but about which he would never truly know what had occurred. I could see that he desperately wanted to share this with me but could barely form the words. Clearly, he had been suffering for years, and while he had received a formal diagnosis of PTSD and depression (he refused medication despite being offered), having these diagnoses did not seem to fully capture the lonely torture he was experiencing. Nor did it bring him any real relief that he was experiencing something real, diagnosable and treatable. Finally, and with great effort, he revealed that he believed he had killed an insurgent during an ambush high up in the mountains of Afghanistan. As soon as he told me, I could see he instantly regretted it. Carefully and sensitively, I reflected on what had just happened, and we spent a great deal of time processing this. He revealed that he was almost certain he had hit the insurgent but never found a body. He would never know if the man he shot had indeed died. He was clearly deeply disturbed by this, and I made it clear that we had reached a vital part of our therapy together.

The end of year holidays came around, and it was a few weeks before we could recommence therapy. Sam missed his next few scheduled appointments, and when he returned, after several attempts to contact him, he appeared distant. It was difficult for him to engage with me, and I encouraged him to share his thoughts about our previous session and unexpected absence and what was happening between us presently. It was then that Sam whispered, 'I hated you for making me talk about killing that man. I hated you for the past couple of months. I was so

angry with you. I hated you for what you made me do.' Initially surprised by his honesty and confidence, I spent some time exploring his thoughts and feelings around this disclosure, and the therapeutic alliance seemed stronger than ever. I was relieved we had reached another important point in therapy and that we could start to deepen our understanding of our relationship and his experience of working through his very personal and painful memories. After two more months, we returned to the story of the ambush, and I gently encouraged him to tell me more about it. With increased confidence, he did so, and even more details spilled out. I dared to think we had truly reached the core of his emotional conflicts and our therapeutic work. Unfortunately, it was after this session that Sam did not come back to therapy. Weeks went by, and he did not respond to my attempts to contact him. It seemed that he was not coming back. I was honestly hurt and discouraged. When it appeared that we were finally facing the crux of his distress, he disappeared.

I now had to make sense of why he ceased therapy when everything seemed to be going so well, the alliance seemingly stronger than ever, the exploration of his admission of hating me and his important disclosure had finally been put into words. The confronting yet essential need for self-reflection and supervision was more urgent than ever, and the idea of presenting a reflective paper based on this case was born.

### Reflections on the sudden ending

After several years of therapy, this abrupt ending had quite an unexpected impact on me despite the warning by Shedler that 'a person who struggles with anger and hostility may struggle with anger towards the therapist'<sup>18(p. 99)</sup>. It had taken years to develop what I had sensed as a meaningful and collaborative relationship with Sam and create a space where he could confront his fears. The sudden cessation of therapy was jarring, and I felt that I had failed as a therapist. I felt lost and unsure of myself. I began to question the whole therapeutic experience. How do I deal with the loss of this important relationship? How do I deal with not knowing what happened to Sam? How do I make sense of the abrupt ending of the therapy? Had I used the 'right' trauma therapy approach with Sam? With these questions in mind, I began to reflect on the importance of owning the aspects of being a therapist; balancing the professional relationship, maintaining the therapeutic frame, engaging and listening with Freudian-inspired 'evenly hovering attention'. After wrestling with these thoughts and using supervision, I saw our work a little more objectively.

I examined my own fantasies about therapy and working with Sam. I recognised how much I liked him and looked forward to our sessions. I recognised how much I had trusted the therapeutic space to help him face the painful memories.

I reflected on how the sheer vastness of unnamed emotions and conflicts that had contributed to so much pain was frightening for both of us. I felt helpless and wondered if I had really been able to sit with and bear witness to the conflict and guilt he felt; if I had truly come across as genuine and authentic. I was reminded of another patient whom I had also worked with for some years, telling me I spoke to him honestly and ‘not out of the back of some textbook’. Had I really empathised enough with Sam?

Though he had told me on several occasions how difficult it was for him to be in therapy with me, he *had* started to notice improvements in his day to day life, and he continued to attend appointments regularly. He no longer had intense outbursts of anger, and he described feeling less nauseous when he talked about his deployment experiences in session. By his own accounts, he was getting better and was slowly facing the gnawing pain of guilt and shame. It was hard for me to be left contemplating his pain. I realised how much I needed to be able to ‘bookend’ my work. I reflected on how sitting with the unknown mirrored his excruciating pain of not knowing what had happened to the man whom he had shot.

Supervision, with a much-respected mentor, was now more vital than ever if I was to find some personal closure to this case. Unfortunately, I will likely never know what happened to Sam, but I have been able to accommodate this experience within the larger frame of my therapy work and use it as a valuable learning tool in teaching and supervising my students.

The abrupt and unexplained dropout from seemingly successful therapy by the client can be disturbing and threatening to the professional adequacy of the therapist. Attempts to account for what looks like a sudden failure of therapy can obviously go two ways—attributing cause to the client or the therapist. Reflections on self-doubt and self-blame can provide a usable foundation for improving one’s capacity as a therapist. The use of supervision is also vital in processing experiences from within the therapy hour that have inevitably left their mark.

### **The unconscious aspects of combat trauma**

The years I spent with Sam allowed me to recognise the absolute importance of allocating time for the

unconscious experience of the trauma to emerge within the therapeutic relationship. I believed that at the beginning of therapy, he did not know what was truly causing his distress. From a psychodynamic perspective, I considered him to be repressing unconscious conflicts and emotions (rather than just avoiding them consciously). What emerged was deeply personal and had not been accessible to him for several years. The therapeutic relationship and frame had been built patiently over time, so we could hold his revelation of hating me between us without trying to restructure, react defensively and simply see it as an irrational thought or emotion to be explained away.

Had I used the more manualised and cognitive trauma interventions with homework tasks and behavioural experiments, I doubt we would have truly gotten to the core of his pain in the way he did. While Sam could recount the bomb blasts and other firefights with relative ease (appropriate fodder for traditional cognitive-based trauma work as he had ready conscious access to these events), it was the agony he experienced over the uncertainty of what had happened to that man he fired at that really caused the most pain and guilt. Carr,<sup>21</sup> referring to Stolorow,<sup>25</sup> locates the source of trauma in the painful emotions associated to the event rather than in the events themselves. This was pain in the form of shame that needed to be shared only after the alliance had solidified, taking some years to do so.

I hypothesised that Sam’s conflicts of shame and guilt over the apparent death of a young insurgent were also unconscious for much of the initial part of therapy. The agitation, nausea, low moods, angry lashing out and anxiety were all likely perpetuated by the deep-seated conflict he felt over the taking of life.

When working with combat veterans, it is vital to maintain curiosity and awareness of potentially underlying unconscious conflicts that perpetuate symptoms and behaviours. It can take quite some time for these to emerge, and the therapeutic relationship forms the vessel in which these can be shared, discussed and worked through, hopefully resulting in symptom reduction and an increased sense of wellbeing.

### **Broader issues in working with combat trauma**

Cases concerning veterans such as Sam and similar PTSD sufferers<sup>21</sup> suggest that psychodynamic psychotherapy can be considered a viable option available to therapists who treat combat trauma

veterans. While it was unfortunate that Sam did drop out of therapy, he *had* made significant strides in being able to confront and begin to process the traumas he experienced. His self-reported improvement in day to day life was a testament to that. The provision of a safe space to explore distressing experiences and emotions *in the context of a therapeutic relationship* is one of the core tenets of psychodynamic approaches.

That being said, psychodynamic therapy theory and techniques can certainly be integrated with more cognitively based trauma therapies such as prolonged exposure, CPT and EMDR. An appreciation for the power of the unconscious and the importance of a strong therapeutic alliance does not stop one from using these standard trauma therapies; it may very well *enhance* the work and outcomes.

What is also important is the recognition that good and effective therapy can take a long time, often far longer than what agencies and manuals suggest.<sup>26</sup> Clients may present on and off to agencies over many years as they struggle to deal with their distress and underlying conflicts. Being able to provide long-term stable therapy is vital for working with this population, given the complexity of their trauma and unconscious emotions/conflicts that drive distress.

Finally, therapists working in the therapeutic relationship with combat trauma survivors can expect to be affected by the content of the therapy and the perceived responses and behaviour of the client. I suggest the anticipation of, and inevitable experience of this, provides an opportunity for the undertaking of ongoing reflective supervision so that the therapist too can experience a safe and non-judgemental space to articulate, explore and process their experiences (both conscious and unconscious) of the client and therapy. Being able to practice effective 'self-care' as a therapist is imperative when working with traumatised individuals. Agencies would be well advised to support and facilitate access to high-quality and ongoing supervision with appropriate supervisors to provide support to therapists in this area.

## Summary and conclusion

Case studies such as the one discussed above reveal several issues pertinent to working with combat veterans within a psychodynamic framework. Not all veterans need to or will be able to engage in such intensive therapy work. Therapists need to be able to ascertain which approach will be most suitable for their client based on a thorough assessment and awareness of the client's personality structure and trauma background. However, even having done this, therapists must also be aware that these clients may continue to struggle with unconscious conflicts, anxiety, depression, shame and guilt and ultimately *still* drop out of therapy. Unresolved endings are an unfortunate yet intrinsic part of working with trauma in these settings.

Therapists should also be prepared for the intensity of the work within the therapeutic relationship, aware of the limits of this relationship and their capacity to reflect openly on the healing function of the relationship. Experiences such as sudden endings or revelations of hate, guilt or shame can be held and explored with the client and reflected upon in supervision. The availability of a safe and stable supervision/reflective space and supervisor is also vitally important when working with this population. It is hoped that this case will further encourage reflection and discussion on trauma, psychotherapy and working within the combat veteran population and that agencies that provide therapy and support to this population consider implementing and maintaining appropriate high-quality supervision for clinicians.

## Acknowledgements:

Sincere thanks to Prof Robert Schweitzer (QUT, Australia) for his encouragement, guidance and review of this piece.

---

*Corresponding Author:*

L D Connor; [liam.d.connor@gmail.com](mailto:liam.d.connor@gmail.com)

*Authors:* L D Connor<sup>1</sup>



## References

1. Carr RB. Two war-torn soldiers: combat-related trauma through an intersubjective lens. *Am J Psychother.* 2013;67(2):109–33.
2. Shephard B. *A War of Nerves: Soldiers and Psychiatrists in the Twentieth Century.* Harvard University Press; 2003. p. 487
3. Molendijk T, Kramer E-H, Verweij D. Conflicting Notions on Violence and PTSD in the Military: Institutional and Personal Narratives of Combat-Related Illness. *Cult Med Psychiatry.* 2016 Sep;40(3):338–60.
4. Van Hooff M, Lawrence-Wood E, Hodson S, Sadler N, Benassi H, Hansen C, et al. Mental Health Prevalence, Mental Health and Wellbeing Transition Study. Department of Defence and the Department of Veterans' Affairs; 2018.
5. Litz B. Adaptive Disclosure: A Combat-Specific PTSD Treatment [Internet]. 2011. Available from: <http://dx.doi.org/10.21236/ada555048>
6. Frankfurt S, Frazier P. A Review of Research on Moral Injury in Combat Veterans. *Mil Psychol.* 2016 Jun 9;28(5):318–30.
7. Richardson LK, Frueh BC, Acierno R. Prevalence estimates of combat-related post-traumatic stress disorder: critical review. *Aust N Z J Psychiatry.* 2010 Jan;44(1):4–19.
8. Creamer M, Forbes D. Treatment of posttraumatic stress disorder in military and veteran populations. *Psychotherapy: Theory, Research, Practice, Training.* 2004;41(4):388–98.
9. Monson CM, Schnurr PP, Resick PA, Friedman MJ, Young-Xu Y, Stevens SP. Cognitive processing therapy for veterans with military-related posttraumatic stress disorder. *J Consult Clin Psychol.* 2006 Oct;74(5):898–907.
10. Forbes D, Lloyd D, Nixon RDV, Elliott P, Varker T, Perry D, et al. A multisite randomized controlled effectiveness trial of cognitive processing therapy for military-related posttraumatic stress disorder [Internet]. *Journal of Anxiety Disorders.* 2012;26:442–52. Available from: <http://dx.doi.org/10.1016/j.janxdis.2012.01.006>
11. Chard KM, Schumm JA, Owens GP, Cottingham SM. A comparison of OEF and OIF veterans and Vietnam veterans receiving cognitive processing therapy [Internet]. *Journal of Traumatic Stress.* 2010. Available from: <http://dx.doi.org/10.1002/jts.20500>
12. Rothbaum BO, Foa EB. Exposure therapy for PTSD. *PTSD Research Quarterly;* 1999
13. Shapiro F. *Eye Movement Desensitization and Reprocessing (EMDR) Therapy, 3rd edition: Basic Principles, Protocols, and Procedures.* Guilford Publications; 2017. p. 568
14. Ishaq M. Psychodynamic Considerations on Clinical Work with Combat Related Post Traumatic Stress Disorder. *Counselling Psychology Review.* 2014 Mar
15. Kudler H. The need for psychodynamic principles in outreach to new combat veterans and their families. *J Am Acad Psychoanal Dyn Psychiatry.* 2007 Spring;35(1):39–50.
16. Schottenbauer MA, Glass CR, Arnkoff DB, Gray SH. Contributions of psychodynamic approaches to treatment of PTSD and trauma: a review of the empirical treatment and psychopathology literature. *Psychiatry.* 2008 Spring;71(1):13–34.
17. Shephard B. *A War of Nerves: Soldiers and Psychiatrists in the Twentieth Century.* Harvard University Press; 2003. p. 487
18. Shedler J. The efficacy of psychodynamic psychotherapy. *Am Psychol.* 2010 Feb;65(2):98–109.
19. King R, Schweitzer R, Giacomantonio G, Keogh T. Psychodynamic Psychotherapy: The Evidence Is In. 2010.
20. Cornelius JT. The Case for Psychoanalysis: Exploring Scientific Evidence. In: Barsness RE, editor. *Core Competencies of Relational Psychoanalysis: A Guide to Practice, Study and Research.* Abignon, Oxon: Routledge; 2018. p. 24–39.
21. Carr RB. Two war-torn soldiers: combat-related trauma through an intersubjective lens. *Am J Psychother.* 2013;67(2):109–33.

22. Levi O, Bar-Haim Y, Kreiss Y, Fruchter E. Cognitive-Behavioural Therapy and Psychodynamic Psychotherapy in the Treatment of Combat-Related Post-Traumatic Stress Disorder: A Comparative Effectiveness Study. *Clin Psychol Psychother*. 2016 Jul;23(4):298–307.
23. Epstein M. *The trauma of everyday life*. Penguin Books; 2014.
24. Imel ZE, Laska K, Jakupcak M, Simpson TL. Meta-analysis of dropout in treatments for posttraumatic stress disorder. *J Consult Clin Psychol*. 2013 Jun;81(3):394–404.
25. Stolorow RD. *Trauma and Human Existence: Autobiographical, Psychoanalytic, and Philosophical Reflections*. Taylor & Francis; 2011. p. 74
26. Gnaulati E, Shedler J. The Tyranny of Time How Long Does Effective Therapy Really Take? [Internet]. Psychotherapy Networker. March/April 2020 [cited 2020 Apr 29]. Available from: [https://www.psychotherapynetworker.org/magazine/article/2436/the-tyranny-of-time/5d2ed7b6-3a2a-4c7c-b491-2a2742748e83/OIM?fbclid=IwAR3IcEsiYpv3s7jjXgc\\_TYB\\_yGshbwYAz4bxaffhnbU8fQ\\_HGWELKNCGnZk](https://www.psychotherapynetworker.org/magazine/article/2436/the-tyranny-of-time/5d2ed7b6-3a2a-4c7c-b491-2a2742748e83/OIM?fbclid=IwAR3IcEsiYpv3s7jjXgc_TYB_yGshbwYAz4bxaffhnbU8fQ_HGWELKNCGnZk)

# Body Regions Susceptible to Musculoskeletal Injuries in Canadian Armed Forces Pilots

*C Edwards, D da Silva, T Nagpal, S Souza, J Puranda, K Semeniuk, K B Adamo*

## Introduction

Musculoskeletal injuries (MSKI) are a common problem for militaries around the globe.<sup>1,2</sup> Countries of the Five Eyes intelligence alliance (Australia, Canada, New Zealand, United Kingdom and the United States of America) spend millions of dollars on direct patient care in the treatment of MSKI. In 2017, Canada allocated nearly CA\$200 million towards implementing strategies related to injury prevention for the Canadian Armed Forces (CAF).<sup>3</sup> The CAF recognises MSKI as a fundamental factor impacting operational readiness and the health of its members, not to mention being the leading cause of medical attrition.<sup>4,5</sup> MSKI are also the most common reason for a CAF member being unable to deploy.<sup>5</sup>

In 2010, Hauret et al. emphasised the need for both chronic and acute injury to be recognised in the US Department of Defence Traumatic Injury Incidence.<sup>2</sup> At the time, only acute traumatic injuries were recorded, excluding common injuries such as tears of the meniscus or rotator cuff, stress fractures and recurrent shoulder dislocations.<sup>2</sup> This recommendation to broaden the scope was significant since chronic injuries are often reported at a higher rate than acute MSKI in most military units.<sup>6,7</sup> These injury types differ based on their origin. An acute injury results from a specific inciting event and has a precise mechanism.<sup>6</sup> A chronic injury, also referred to as repetitive strain injury (RSI) or overuse injury, is caused by the cumulative effect of micro-traumatic forces, is progressive in nature and results from a combination of modifiable and non-modifiable risk factors.<sup>2,8</sup>

The literature is limited surrounding injury trends, mechanisms and occupational factors that contribute to MSKI in the CAF.<sup>9</sup> Between-sex differences in MSKI have been observed in actively serving military members by other nations; however, available data on CAF members is minimal.<sup>9-11</sup> As the Department of National Defence of Canada (DND)

has set a goal of increasing the presence of females in the CAF from 15% to 25% by 2026,<sup>3,9</sup> building knowledge around sex-specific MSKI should be a priority. Furthermore, other nations have observed differences between occupational roles,<sup>6,12-14</sup> with special operations forces, pilots and aircrew reporting significantly greater MSKI rates than other military occupations.<sup>6,13,15</sup>

The CAF and other nations have documented injuries involving the spine and neck of pilots at rates ranging from 70% to over 90%;<sup>1,15-18</sup> other body regions are often not considered. Investigations and reporting of MSKI trends in active CAF members, male or female, are sparse and therefore limit determinations whether sex disparities exist among the 'high risk' occupational trades like pilots.<sup>7,9,17</sup> Personal protective equipment (PPE) such as helmets and night vision goggles (NVGs) have been associated with neck pain intensity and incidence.<sup>17-20</sup> While neck pain and spine injury rates are important to track, especially when up to 80% of pilots report experiencing neck pain during their career,<sup>15,17</sup> understanding MSKI for other body regions is also relevant.<sup>21</sup> Expanding beyond the spine could help reduce pain affecting this body region in pilots, as neck pain is often associated with other factors, including mental health status and injuries to other areas.<sup>21,22</sup> Shoulder injury, for example, is often associated with chronic neck pain that can be reduced with exercise protocols aimed at improving scapular kinematics.<sup>22</sup> Knowledge of MSKI affecting other tissues and joints is imperative for rehabilitation and prevention purposes but has not been explored thoroughly in CAF pilots.<sup>13,23</sup> Describing the different trends, types and associated factors of MSKI among male and female CAF pilots is essential for developing prevention strategies aimed at offsetting the impact on operational readiness and quality of life for these members.<sup>13,15,17,19</sup> Thus, the purpose of this study is to provide a preliminary examination of possible sex disparities in MSKI experienced by actively serving CAF pilots and identify body regions most affected.

## Materials and Methods

### Participants and data collection

From September 2020 to February 2021, data for this cross-sectional study were collected via a questionnaire developed as part of the *'Multi-stage approach to addressing sex-disparities in musculoskeletal injuries in military members'* research project. The aims of this project included assessment of MSKI, reproductive health and barriers to recruitment and retention in the CAF. The study inclusion criteria were: being a member of the CAF (past or present) and ages between 18–65 years. The research team and project stakeholders recruited via posters, social media, newsletters and snowball methods. The questionnaire was accessed, and informed consent was provided via the online cloud-based survey development software SurveyMonkey Inc. (San Mateo, USA). The local Research Ethics Board (H-04-19-3442) approved this study, and the procedures were performed in accordance with the Declaration of Helsinki.

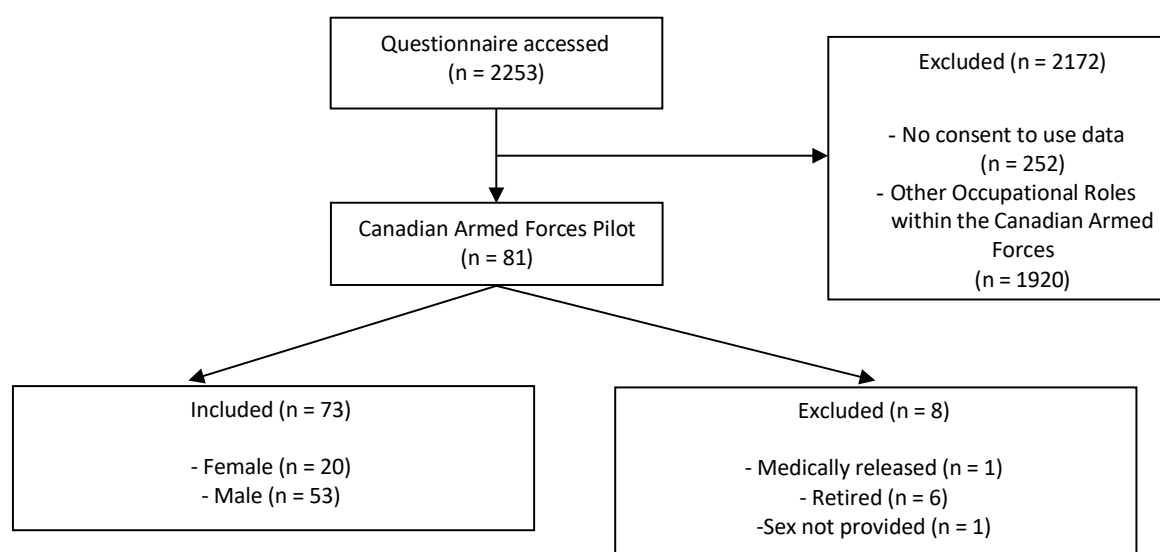
For the present study analysis, data were included only from participants who identified as currently serving CAF pilots. Military Occupational Structure Identification (MOSID) or written response was provided in the descriptive section of the questionnaire to determine if a respondent was a pilot by trade. Actively serving was indicated by a response of *'Regular Force'* or *'Reserves Force Class A, B, C'* to the question *'What category best describes your current status within the CAF?'*. Responses of *'Medically Released'* or *'Retired'* were excluded. No

pilot participants indicated *'Intersex'* or *'Prefer Not to Answer'* in response to *'What was your sex at birth?'*. Between-sex comparisons were conducted between *'Male'* and *'Female'*. Demographic variables reported age (years), current weight (kg), height (m), body mass index (BMI; calculated as  $\text{kg/m}^2$ ) and years of service (years) were collected to characterise the population. Figure 1 illustrates the inclusion process flow chart.

### Musculoskeletal injuries

For clarity on the definition of RSI, questions aimed at gathering chronic injury data were primed with the following statement: *'Now questions on repetitive strain or overuse injuries. By this we mean injuries to muscles, tendons or nerves caused by overuse or repeating the same movement (e.g., ruck marching) over an extended period. For example, carpal tunnel syndrome, tennis elbow, plantar fasciitis or tendonitis. In case of retired/released members, please indicate the most accurate reply while a serving member.'* The participants were then asked, *'While serving, did you ever have any injuries that you felt were due to repetitive strain?'* to which the possible responses were *'Yes'* or *'No'*. If the response was *'Yes'* to an RSI injury, the participant was asked, *'What part(s) of the body were most affected by repetitive strain injuries (select all that apply)?'*. For a complete list of possible body region responses, please see Appendix 1.

Questions aimed at gathering acute injury data were primed with the following statement: *'Now some questions about serious acute injuries. Think about physical injuries, likely caused by a significant level*



**Figure 1. Flowchart of inclusion of participants**



of exertion or a single incident of trauma, which were serious enough to require at least 24 hours off work after it to recover from. For example, a broken bone, a sprain. In case of retired/released members, please indicate the most accurate reply while a serving member.' The participant was then asked, 'While serving, did you ever have any acute injuries that were serious enough to take at least 24 hours off from work?' to which the possible answers were 'Yes' or 'No'. If the participant responded 'Yes' to an acute injury that fit the description, they were asked, 'Of the following injuries, what type(s) did you experience (select all that apply)?' (Appendix 1). They were also asked, 'What part(s) of the body were most affected by acute injuries that were serious enough to take at least 24 hours off from work (select all that apply)?' (Appendix 1).

### Impact of musculoskeletal injury

To understand how RSI impacted the career of participants, they were asked, 'Do you feel any of your repetitive strain injuries impacted your career progression or length?' to which the possible answers were 'Yes' or 'No'. The same question was asked for acute injury.

### Risk factors or mechanisms of musculoskeletal injury

Self-reported mental health and physical health were assessed on a 5-point Likert scale where participants indicated their health status as 'Poor', 'Fair', 'Good', 'Very Good', or 'Excellent'. Responses were then grouped into 'Good to Excellent' and 'Poor to Fair'.

To determine if the injury reported was related to military work, the participants were asked, 'Do you feel that your major repetitive strain injuries were primarily a result of activity or activities related to military work requirements?' and 'Do you feel the activities primarily responsible for causing these acute injuries are related to your military work?'. Possible answers for both questions were 'Yes' or 'No'. Regarding PPE and combat uniform size availability, participants were asked, 'Overall, are/were you satisfied with the available combat uniform/PPE sizing?'. For the analysis, 'Not satisfied' and 'Satisfied' were combined and compared with 'Indifferent', 'Somewhat satisfied', and 'Very Satisfied'. PPE and uniform comfort was determined by 'Overall, how comfortable are/were you in your combat uniform (including PPE)?' with the possible answers being 'Very uncomfortable with movement limitations', 'Somewhat comfortable with some movement limitations', 'Somewhat uncomfortable with some movement limitations', 'Very comfortable

with no movement limitations', or 'Indifferent'. For the analysis, 'Very uncomfortable with movement limitations', 'Somewhat uncomfortable with some movement limitations' were combined and compared with 'Indifferent', 'Somewhat comfortable with some movement limitations', and 'Very comfortable with no movement limitations'. To indicate if PPE or uniform affected work performances, 'Overall, has your uniform/PPE negatively affected your work performance' was asked with possible answers of 'Yes' or 'No'.

### Statistical analysis

Data were presented descriptively as absolute (n) and relative (%) frequencies, as well as mean  $\pm$  standard deviation (SD). Data normality was checked using the Shapiro-Wilk test. Comparisons between sexes for the continuous variables were performed using the independent *t*-test for normally distributed variables and the Mann-Whitney test for the non-normally distributed variables. Chi-square test, Fisher's Exact test and likelihood ratio were used when applicable to determine the association between sex and the MSKI-related variables in the full population and among only those who reported having an injury. Significance level was set at *p*-value < 0.05. All analyses were conducted with IBM SPSS Statistics version 27 (SPSS Inc., Chicago, Ill, USA). The participants who answered 'No' to overall RSI or acute injury were included in all body region and acute injury type analysis as 'No'. Additionally, participants who answered 'No' to overall RSI or acute injury were included as 'No' in the analysis of injury impacting the participants' career.

## Results

### Descriptive data

Of the 2001 participants that gave consent to the questionnaire, 73 respondents indicated they were actively serving pilots using provided MOSID and CAF status. Twenty of the pilots identified as female, 53 as male, with demographic information outlined in Table 1.

### Repetitive strain injuries

Eighty per cent of females compared to 49.0% of males (*p* = 0.017), reported having RSI while serving. Significant differences were also observed when stratified by body region (see Figure 2). The most commonly reported body regions for RSI were neck, lower and upper back.

**Table 1. Characteristics of Canadian Actively-Serving Pilots by Sex (n = 73)**

Category	Total Mean + SD or Frequency (%)	Females Mean + SD or Frequency (%)	Males Mean + SD or Frequency (%)	Between-sex significance (p-value)
n	73	20	53	-
Age	38.7 + 10.3	35.6 + 7.2	39.9 + 11.1	0.146
Height (m)	1.8 + 0.1	1.7 + 0.1	1.8 + 0.1	< 0.001*
Weight (kg)	83.6 + 13.7	83.9 + 11.6	83.5 + 14.3	0.890
BMI (kg/m <sup>2</sup> )	26.3 + 4.2	25.4 + 5.3	26.7 + 3.6	0.053
Years of Service	18.1 + 9.7	15.3 + 6.6	19.2 + 10.5	0.128
Mental Health (% of 'Good', 'very good', and 'excellent')#	84.8	80.0	87.0	0.476
Physical Health (% of 'Good', 'very good', and 'excellent')#	92.4	100.0	89.1	0.312
PPE size availability satisfaction (% of 'not satisfied' and 'somewhat satisfied')†	54.5	68.4	48.9	0.150
Levels of PPE comfort satisfaction (% of 'Very uncomfortable with movement limitations' and 'somewhat comfortable with some movement limitations')†	36.4	68.4	23.4	<0.001*

Data was presented as mean + SD for continuous variables and frequencies (%) for categorical variables. BMI = body mass index; kg = kilograms; m = meters; SD = standard deviation; PPE = personal protective equipment.

Between-sex differences for body weight were compared using independent t-test. All other continuous variables were compared using Mann-Whitney test. Between-sex differences for PPE size and PPE comfort were analyzed using Chi-square and for Mental Health and Physical Health using Fisher Exact test.

\*Significant difference between sexes ( $p < 0.05$ ). #Total sample size is  $n = 66$  ( $n = 20$  females and  $n = 46$  males). †Total sample size is  $n = 66$  ( $n = 19$  females and  $n = 47$  males).

When asked if the reported RSI has impacted career progression or career length, 20.9% of pilots responded 'Yes', with no significant difference between males (18.5%) and females (25.0%;  $p = 0.706$ ).

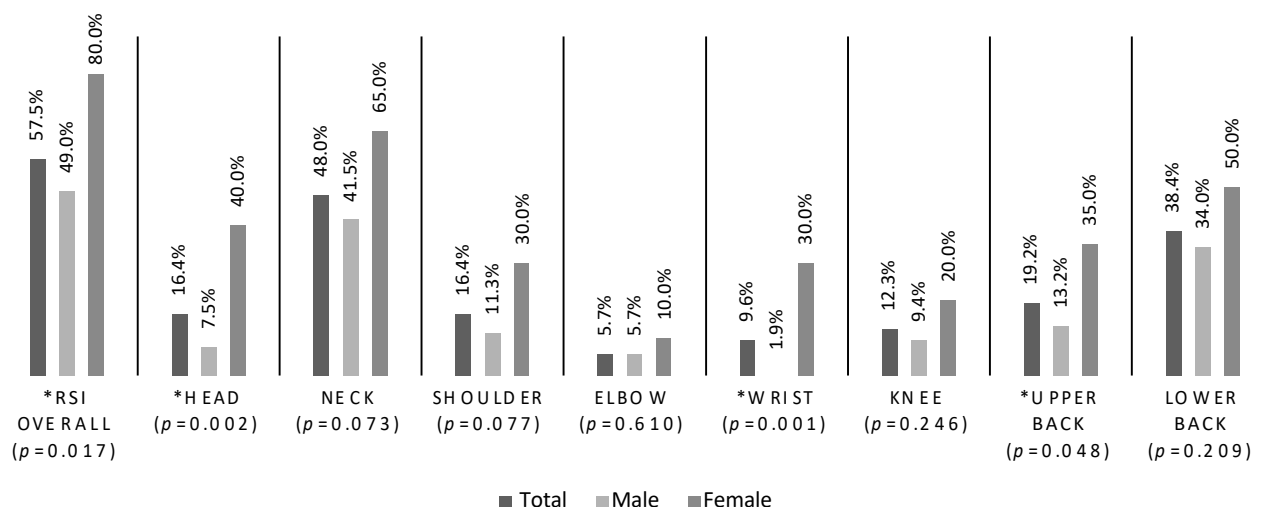
### Acute injuries

Acute injury prevalence for females was 65.0% compared to 43.0% for males ( $p = 0.100$ ). No between-sex differences were observed between acute injury type (see Figure 3b). Sprains and strains were the most commonly reported acute injury type for both males (34.0%) and females (40.0%) with no sex differences ( $p = 0.631$ ). Acute injury rates by body region for total, male and female are outlined in Figure 3a. Head ( $p = 0.044$ ) and neck ( $p = 0.048$ ) injury rates significantly differed between sexes with females reporting higher frequencies.

When asked if the reported acute injuries had an impact on career progression or length, 17.7% of pilots responded 'Yes', with no significant difference between males (19.1%) and females (15.4%) ( $p = 1.000$ ).

### Physical and mental health status

Analysis of physical and mental health was conducted with 20 female and 46 male participants (Total  $N = 66$ ) due to missing data for these additional questions. No significant difference between males (89.1% 'Good' to 'Excellent': 10.9% 'Poor' to 'Fair') and females (100.0% 'Good' to 'Excellent': 0.0% 'Poor' to 'Fair') was observed in physical health rating ( $p = 0.312$ ). Of the pilots who reported RSI, no significant difference was observed in physical health status between males (80.0% 'Good' to 'Excellent': 20.0% 'Poor' to 'Fair') and females (100.0% 'Good' to 'Excellent': 0.0% 'Poor' to 'Fair') ( $p = 0.137$ ). Of the pilots who reported acute injuries, no significant difference in physical health status was observed between females (100.0% 'Good' to 'Excellent') and males (81.2% 'Good' to 'Excellent': 18.2% 'Poor' to 'Fair';  $p = 0.274$ ). Overall, 84.8% of pilots rated their mental health as 'Good' to 'Excellent', while 15.2% reported as 'Poor' to 'Fair', with 80.0% of females and males 13.0% indicating the lower levels ('Poor' to 'Fair'). No difference between females and males for low levels of mental health status in pilots who



**Figure 2. Rates of repetitive strain injuries by body region (Total [n = 73], Males [n = 53], Females [n = 20])**

**\*Significant difference between sexes ( $p < 0.05$ ). RSI = Repetitive Strain Injuries**

had RSI (18.8% vs 12.0%, respectively,  $p = 0.662$ ) or acute injury (30.8% vs 22.7%, respectively,  $p = 0.698$ ) was reported.

### Personal protective equipment

Of the 19 females and 47 males (reduced sample size due to missing data) that responded to the questions related to PPE (n = 66), 42.1% of females indicated their PPE negatively affected work performance compared to 25.5% of males ( $p = 0.185$ ). Lower levels of PPE comfort ('Very uncomfortable with movement limitations' and 'Somewhat uncomfortable with some movement limitations', compared with 'Indifferent', 'Somewhat comfortable with some movement limitations', and 'Very comfortable with no movement limitations') were reported by 68.4% of females compared to 23.4% of males ( $p < 0.001$ ). Female pilots who had RSI reported low levels of PPE comfort at a higher rate than males (75.0% vs 21.7%, respectively,  $p < 0.001$ ). Similarly, female pilots who had acute injuries reported lower levels of PPE comfort at a higher rate than males (83.3% vs 20.0%, respectively,  $p < 0.001$ ).

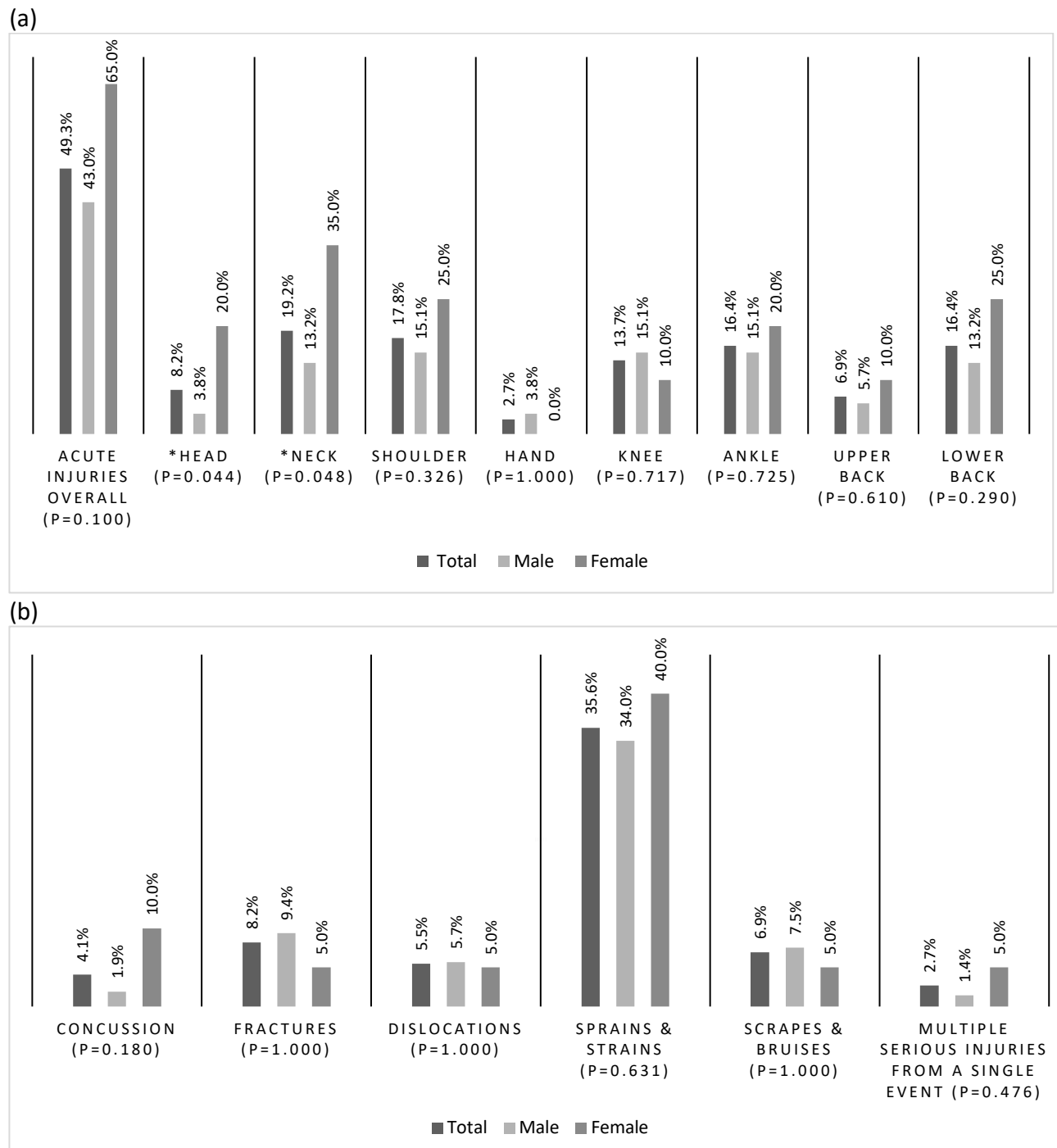
Overall, no significant difference was observed in PPE size availability ( $p = 0.150$ ), with low levels of satisfaction ('Not Satisfied' to 'Satisfied' compared to 'Indifferent', 'Somewhat Satisfied', and 'Very Satisfied') reported by 68.4% for females and 48.9% for males. Pilots who had RSI reported low levels of satisfaction with PPE size availability ('Not Satisfied' to 'Satisfied' compared to 'Indifferent', 'Somewhat Satisfied' and 'Very Satisfied') at rates of 75.0% for females compared to 47.8% for males ( $p = 0.090$ ).

No sex-disparity detected between female and male pilots with acute injury reporting low levels of satisfaction with PPE size availability (83.3% vs 55.0%, respectively,  $p = 0.139$ ).

### Discussion

Findings from this exploratory study suggest that sex-related differences in MSKI exist among pilots in the CAF. In particular, several sex-related differences were observed for injury types, and certain areas of the body were affected at a greater frequency than others. While the most reported anatomical regions affected by RSI, regardless of biological sex, were the back (upper and lower), shoulders and neck, females reported more RSI of the head, neck and upper back compared to their male counterparts. Female pilots also presented a higher prevalence of overall RSI. Body regions most commonly affected by acute injury were the neck, shoulder, knee and ankle. The rate of acute injury to the head and neck was higher for females *versus* males. Our findings are in agreement with other reports on pilots, with the neck being the most common region affected by RSI and acute injury,<sup>13,18,20,24</sup> and we add novel information highlighting greater susceptibility among female CAF members.

The female spine differs from the male in that the thoracic region is less kyphotic and the cervical spine is almost straight (slight kyphotic), whereas the male cervical spine is typically lordotic and the thoracic spine more kyphotic.<sup>25</sup> These anatomical differences tend to contribute to an increased risk of whiplash trauma and more severe clinical outcomes for females in automobile crashes.<sup>25,26</sup> While whiplash



**Figure 3. Rates of Acute Injury by Body Region (a) and by Type (b). Total [n = 73], Male [n = 53], And Female [n= 20]**

**\*Significant difference between sexes ( $p < 0.05$ )**



was not expressly examined, this study differs from others involving military pilots in that we also described acute injury types. To this point, though sex disparities were not found for acute injury type, sprains and strains were identified as the most common form of acute injury. This information can guide targeted prevention strategies that include protective measures for body regions most at risk of sprains and strains.

Beyond the neck, other body regions most affected by RSI in our findings are in accordance with previous reports of upper-body injury and pain among both fixed and rotary wing pilots.<sup>13,17,20,27</sup> More research is needed to inform physical training, PPE and MSKI education strategies to address the increased risk of injury in the female pilot.

As mentioned previously, associations between mental and physical health factors and MSKI risk have been identified in military populations.<sup>1,13,16,20,27</sup> Though perceptions of mental health have been associated with injury and pain in body regions around the spine,<sup>1</sup> our findings indicate the majority of CAF pilots perceiving their mental health as 'good' to 'excellent', regardless of sex or injury history. Exploring psychosomatic factors associated with MSKI in CAF pilots might offset performance deficits that can occur when experiencing pain.<sup>16</sup> Although most of the respondents in the present analysis indicated high mental health status, future studies might evaluate mental health using validated assessment measures to assess the impact this may have on injury risk. Regarding physical health, similar to Tegern et al.,<sup>13</sup> our results suggest most CAF pilots, irrespective of sex and injury status, perceive their physical health as 'good' to 'excellent'. Our questionnaire did not include physical fitness levels beyond achieving the minimum fitness standard of the CAF, though other nations have identified high levels of physical fitness as protective against MSKI in pilots.<sup>27</sup> Future research is recommended to objectively assess physical health markers and define optimal levels of physical fitness for CAF pilots to be protected against MSKI. Physical training programs aimed at supporting the CAF pilot should consider total physical output (occupational, physical training and lifestyle) as high volumes of physical activity have been identified as a risk factor for MSKI;<sup>27-29</sup> longitudinal studies to better understand the effect of exercise training type, intensity and load are recommended.

PPE (e.g., helmets, body armour and NVGs) has previously been associated with MSKI in pilots.<sup>17,27,30</sup> Our findings suggest that PPE and uniform size availability is less than satisfactory for CAF pilots.

Low levels of satisfaction with PPE comfort were consistently reported in pilots with both RSI and acute injury, with females being more affected. Poorly fitting PPE is a common problem for females in tactical roles.<sup>31</sup> Small innovations have been made, including the creation of ballistic vests designed for the female torso.<sup>32</sup> Other militaries and police forces now provide body armour tailored to the female anatomy, though it is not currently available for CAF members.<sup>31</sup> Introducing ballistic vests specifically designed for females would benefit pilots as unisex body armour is wide at the chest, limiting shoulder flexion required for tasks like shooting and operating an aircraft.<sup>31</sup> Investigations into PPE and uniform size and procurement of equipment designed for the tactical female may benefit MSKI reduction strategies, as has been previously recommended.<sup>30</sup>

The participants in the present study were not asked to identify their aircraft, and determining MSKI risk differences based on plane or helicopter models is beyond the scope of this study. However, when comparing neck pain intensity and incidence in CAF helicopter crews, CH-146 Griffon aircrew appear to be at higher risk than others due to aircraft design and physical demands during flight.<sup>17</sup> Sustained awkward postures, combined with vibration, G-force and PPE, are frequently cited as mechanisms for MSKI in male pilots.<sup>17,20,24,27,33</sup> A review of the literature and recent data suggest that no between-group differences in MSKI rates exist between fixed and rotary wing male pilots, justifying our inclusion of both.<sup>13,24</sup>

This study represents a secondary analysis of data from a self-report questionnaire that was aimed at understanding MSKI, reproductive health and other health-related factors in the CAF. The questions were not aircrew or pilot-specific; investigation to better understand mechanisms and factors associated with MSKI in this population is recommended. While the sample size available for this analysis was small, it has a higher representation of female pilots compared to other studies ( $n = 20$  in our study vs  $n = 10$  from previous research), allowing for between-sex comparisons.<sup>18</sup> Further, this study has a representation of 27.4% female, which is higher than the Royal Canadian Airforce membership of 17% female.<sup>34</sup> Another strength is the inclusion of both RSI and acute injury data. The cross-sectional design does not permit establishment of causality; as such, our findings are intended to be used as a guide for future investigations aimed at identifying causal factors of MSKI among CAF pilots.

Despite generally reporting good levels of perceived physical and mental health, MSKI rates for CAF

pilots are high. In addition, female CAF pilots appear to be at greater risk of RSI, and sex disparities exist in body regions most affected by MSKI. Research is needed to guide strategies aimed at mitigating sex disparities in MSKI and reducing the overall burden of these injuries on CAF pilots.

---

*Corresponding Author: Kristi Adamo,  
[Kristi.Adamo@uottawa.ca](mailto:Kristi.Adamo@uottawa.ca)*

*Authors: C Edwards, D da Silva, T Nagpal, S Souza,  
J Puranda, K Semeniuk, K B Adamo*

*Author Affiliations:*

*1 University of Ottawa – Faculty of Health Sciences*

*2 Brock University*

### **Appendix 1– List of questions and answers from the survey used to determine the information analysed in the present study (n = 16 questions).**

**Question:** Which category best describes your current status within the CAF?

**Answer:**

- a) Regular Force
- b) Reserve Force Class A, B, C
- c) Retired
- d) Medically Release
- e) Other - please specify:

**Question:** What was your sex at birth?

**Answer:**

- a) Male
- b) Female
- c) Intersex
- d) Prefer not to answer

**Question:** Overall, are/were you satisfied with the available combat uniform/PPE sizing?

**Answer:**

- a) Not satisfied
- b) Satisfied
- c) Indifferent
- d) Somewhat satisfied
- e) Very Satisfied

**Question:** Overall, how comfortable are/were you in your combat uniform (including PPE)?

**Answer:**

- a) Very uncomfortable with movement limitations
- b) Somewhat comfortable with some movement limitations
- c) Somewhat uncomfortable with some movement limitations
- d) Very comfortable with no movement limitations
- e) Indifferent

**Question:** Overall, has your uniform/PPE negatively affected your work performance?

**Answer:**

- a) Yes
- b) No

### **Repetitive Strain Injury**

Now questions on repetitive strain or overuse injuries. By this we mean injuries to muscles, tendons or nerves caused by overuse or repeating the same movement (e.g., ruck marching) over an extended period. For example, carpal tunnel syndrome, tennis elbow, plantar fasciitis or tendonitis. In case of retired/released members, please indicate the most accurate reply while a serving member.

**Question:** While serving, did you ever have any injuries that you felt were due to repetitive strain?

**Answer:**

- a) Yes
- b) No

**Question:** What part(s) of the body were most affected by repetitive strain injuries (select all that apply)?

**Answers:**

- a) Head, Eyes, Ears (e.g., eye strain)
- b) Neck,
- c) Shoulder,
- d) Upper arm
- e) Elbow,
- f) Lower arm

- g) Wrist (e.g., carpal tunnel)
- h) Hand
- i) Thumb (e.g., BlackBerry thumb)
- j) Other fingers (e.g., sniper finger) Hip
- k) Thigh
- l) Knee (e.g., bursitis)
- m) Lower leg (e.g., shin splints)
- n) Ankle (e.g., Achilles tendonitis)
- o) Foot (e.g., plantar fasciitis)
- p) Toes
- q) Upper back or upper spine, excluding neck
- r) Lower back or lower spine
- s) Chest, excluding back and spine
- t) Abdomen or pelvis, excluding back and spine
- u) Other - please specify:

Question: Do you feel any of your repetitive strain injuries impacted your career progression or length?

Answer:

- a) Yes
- b) No

Question: Do you feel that your major repetitive strain injuries were primarily a result of activity or activities related to military work requirements?

Answer:

- a) Yes
- b) No

### Acute Injury

Now some questions about serious acute injuries. Think about physical injuries, likely caused by a significant level of exertion or single incident of trauma, which were serious enough to require at least 24 hours off work after it to recover from. For example, a broken bone, a sprain. In case of retired/released members, please indicate the most accurate reply while a serving member.

Question: While serving, did you ever have any acute injuries that were serious enough to take at least 24 hours off from work?

Answer:

- a) Yes
- b) No

Question: Of the following injuries, what type(s) did you experience (select all that apply)? Answers:

- a) Concussion/head injury
- b) Broken or fractured bones
- c) Dislocation
- d) Sprain or strain, including torn ligaments and muscles
- e) Scrapes, bruises, blisters, including multiple minor injuries
- f) Multiple serious injuries, resulting from a single event (exclude multiple minor injuries)
- g) Other - please specify:

Question: What part(s) of the body were most affected by acute injuries that were serious enough to take at least 24 hours off from work (select all that apply)?

Answers:

- a) Head, eyes, ears (e.g., eye strain)
- b) Neck
- c) Shoulder, upper arm
- d) Elbow,
- e) Lower arm,
- f) Wrist,
- g) Hand,
- h) Breast,
- i) Hip,
- j) Thigh,
- k) Knee, lower leg,
- l) Ankle, foot
- m) Other - please specify:

Upper back or upper spine, excluding neck lower back or lower spine

chest, excluding back and spine abdomen, excluding back and spine pelvis, excluding back and spine

Question: Do you feel that any of your acute injuries impacted your career progression or length?

Answer:

a) Yes

b) No

Question: Do you feel the activities primarily responsible for causing these acute injuries are related to your military work?

Answer:

a) Yes

b) No

Health Status

The following questions relate to your perceptions about physical and mental health in general. For retired/released members, please indicate the most accurate reply while a serving member.

Question: In general, how would you rate your physical health?

Answer:

a) Poor

b) Fair

c) Good

d) Very Good

e) Excellent

Question: In general, how would you rate your mental health?

Answer:

a) Poor

b) Fair

c) Good

d) Very Good

e) Excellent

## References

1. Cohen SP, Gallagher RM, Davis SA, Griffith SR, Carragee EJ. Spine-area pain in military personnel: a review of epidemiology, etiology, diagnosis, and treatment. *The Spine Journal*. 2012;12(9):833-842.
2. Hauret KG, Jones BH, Bullock SH, Canham-Chervak M, Canada S. Musculoskeletal injuries: description of an under-recognized injury problem among military personnel. *American Journal of Preventive Medicine*. 2010;38(1):S61-S70.
3. c2017 Strong, secure, engaged: Canada's defence policy (Ottawa: National Defence) 113 (2018).
4. Poisson R. The imperative of military medical research and the duty to protect, preserve, and provide advanced evidence-informed care. *Journal of Military, Veteran and Family Health*. 2015;1(1):11-13.
5. Serré L. A comparative analysis of medically released men and women from the Canadian Armed Forces. *Journal of Military, Veteran and Family Health*. 2019;5(2):115-124.
6. Reynolds K, Cosio-Lima L, Bovill M, Tharion W, Williams J, Hodges T. A Comparison of Injuries, Limited-Duty Days, and Injury Risk Factors in Infantry, Artillery, Construction Engineers, and Special Forces Soldiers. *Military Medicine*. 2009;174(7):702-708. doi:10.7205/milmed-d-02-2008
7. Guerin ES, Barbara Correlates of acute and repetitive strain injuries among Canadian Armed Forces personnel: Health and Lifestyle Information Survey analyses (Unclassified). Vol. R009. DRDC-RDDC; 2020. R0009.
8. Bahr R, Holme I. Risk factors for sports injuries—a methodological approach. *British Journal of Sports Medicine*. 2003;37(5):384-392.
9. Barbeau P, MSc, Michaud A, BSc, Hamel C, MSc, et al. Musculoskeletal Injuries Among Females in the Military: A Scoping Review. *Military Medicine*. 2020. doi:10.1093/milmed/usaa555
10. Molloy JM, Pendergrass TL, Lee IE, Chervak MC, Hauret KG, Rhon DI. Musculoskeletal injuries and United States Army readiness Part I: overview of injuries and their strategic impact. *Military Medicine*. 2020;185(9-10):e1461-e1471.



11. Nindl BC, Jones BH, Van Arsdales SJ, Kelly K, Kraemer WJ. Operational physical performance and fitness in military women: physiological, musculoskeletal injury, and optimized physical training considerations for successfully integrating women into combat-centric military occupations. *Military Medicine*. 2016;181(suppl\_1):50-62.
12. Abt JP, Sell TC, Lovalekar MT, et al. Injury epidemiology of US Army special operations forces. *Military Medicine*. 2014;179(10):1106-1112.
13. Tegern M, Aasa U, Ång BO, Larsson H. Musculoskeletal disorders and their associations with health- and work-related factors: a cross-sectional comparison between Swedish air force personnel and army soldiers. *BMC Musculoskeletal Disorders*. 2020;21:1-14.
14. Bedno S, Hauret K, Loring K, Kao T-C, Mallon T, Jones B. Effects of Personal and Occupational Stress on Injuries in a Young, Physically Active Population: A Survey of Military Personnel. *Military Medicine*. 2014;179(11):1311-1318. doi:10.7205/milmed-d-14-00080
15. Murray M, Lange B, Nørnberg BR, Søgaard K, Sjøgaard G. Specific exercise training for reducing neck and shoulder pain among military helicopter pilots and crew members: a randomized controlled trial protocol. *BMC Musculoskeletal Disorders*. 2015/08/19 2015;16(1):198. doi:10.1186/s12891-015-0655-6
16. Ång BO. Impaired neck motor function and pronounced pain-related fear in helicopter pilots with neck pain-A clinical approach. *Journal of Electromyography and Kinesiology*. 2008;18(4):538-549.
17. Adam J. Results of NVG-induced neck strain questionnaire study in CH-146 Griffon aircrew. 2004.
18. van den Oord MHAHMSC, De Loose VPT, Meeuwssen TM, Sluiter JKP, Frings-Dresen MHWP. Neck Pain in Military Helicopter Pilots: Prevalence and Associated Factors. *Military Medicine*. Jan 2010 2017-11-01 2010;175(1):55-60.
19. Ang BO. Impaired neck motor function and pronounced pain-related fear in helicopter pilots with neck pain – A clinical approach. *Journal of Electromyography and Kinesiology*. 2007;18(4):538-549. doi:10.1016/j.jelekin.2007.01.002
20. Posch M, Schranz A, Lener M, et al. Prevalence and potential risk factors of flight-related neck, shoulder and low back pain among helicopter pilots and crewmembers: a questionnaire-based study. *BMC Musculoskeletal Disorders*. 2019;20(1):44-44. doi:10.1186/s12891-019-2421-7
21. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. *BMJ*. 2017;358:j3221. doi:10.1136/bmj.j3221
22. Edwards CM. Exercise Programs Targeting Scapular Kinematics and Stability Are Effective in Decreasing Neck Pain: A Critically Appraised Topic. *Journal of Sport Rehabilitation*. 2021:1-4. doi:10.1123/jsr.2020-0448
23. Lawson BK, Scott O, Egbulefu FJ, Ramos R, Jenne JW, Anderson ER. Demographic and occupational predictors of neck pain in pilots: analysis and multinational comparison. *Aviation, Space, and Environmental Medicine*. 2014;85(12):1185-1189.
24. Shiri R, Frilander H, Sainio M, et al. Cervical and lumbar pain and radiological degeneration among fighter pilots: a systematic review and meta-analysis. *Occupational and Environmental Medicine*. 2015;72(2):145-150.
25. Sato F, Odani M, Miyazaki Y, Yamazaki K, Östh J, Svensson M. Effects of whole spine alignment patterns on neck responses in rear end impact. *Traffic Injury Prevention*. 2017;18(2):199-206. doi:10.1080/15389588.2016.1227072
26. Stemper BD, Yoganandan N, Pintar FA. Gender dependent cervical spine segmental kinematics during whiplash. *Journal of Biomechanics*. 2003;36(9):1281-1289. doi:10.1016/S0021-9290(03)00159-3
27. Rintala H, Häkkinen A, Siitonen S, Kyröläinen H. Relationships Between Physical Fitness, Demands of Flight Duty, and Musculoskeletal Symptoms Among Military Pilots. *Military Medicine*. 2015;180(12):1233-1238. doi:10.7205/MILMED-D-14-00467
28. Sell TC, Abt JP, Nagai T, et al. The Eagle Tactical Athlete Program Reduces Musculoskeletal Injuries in the 101st Airborne Division (Air Assault). *Military Medicine*. 2016;181(3):250-257. doi:10.7205/MILMED-D-14-00674

29. Zambraski EJ, Yancosek KE. Prevention and rehabilitation of musculoskeletal injuries during military operations and training. *Journal of Strength and Conditioning Research*. 2012;26 Suppl 2(Supplement 2):S101-S106. doi:10.1519/JSC.0b013e31822e7721
30. Runge CE, Moss KM, Dean JA, Waller MJ. Self-reported pain or injury from equipment used on military deployment. *Occupational Medicine*. 2021;71(2):79-85. doi:10.1093/occmed/kqab010
31. Niemczyk SE, Arnold L, Wang L. Incompatible functions: Problems of protection and comfort identified by female police officers required to wear ballistic vests over bras. *International journal of Fashion Design, Technology and Education*. 2020;13(2):165-172. doi:10.1080/17543266.2020.1758800
32. Lăzăroaie C, Zecheru T, Lăzăroaie M, Toma D. Design and Performance Characteristics of New Female Bulletproof Vests. *International conference KBO*. 2017;23(3):204-207. doi:10.1515/kbo-2017-0177
33. Karakolis T, Farrell P, Fusina G. Neck overuse injury in CH-146 Griffon Helicopter aircrews. *Procedia Manufacturing*. 2015;3:4205-4212.
34. Men and Women in the Canadian Armed Forces (Her Majesty the Queen in Right of Canada) (2019).

# Chronic Traumatic Encephalopathy/Traumatic Encephalopathy Syndrome in Military Personnel

P S Kim, R G Beran

## Introduction

Australian Defence Force (ADF) service members' occupational history, consisting of repeated minor traumatic brain injury (TBI) with accompanying cognitive, behavioural, mood and movement disorders, are cardinal symptoms suggestive of the diagnosis of traumatic encephalopathy syndrome (TES) and chronic traumatic encephalopathy (CTE).

In 2015, Beran<sup>1</sup> published an opinion piece alerting the medical and legal profession that litigation, relating to TBI/CTE in the sporting profession, is on the rise in the US and that litigation initiated by service members injured with TBI is likely to follow that trend. In 2018, Beran and Bhaskar<sup>2</sup> published case reports of two ADF service members exposed to blast injuries and subsequently suffered from learning and memory difficulties and Parkinsonism. These cases were indicative of TES. In 2017, Beran's prediction was realised when the *Kennedy v McCarthy*<sup>3</sup> hearing took place in the US District Court for the District of Connecticut.

*Kennedy v McCarthy*<sup>3</sup> was a nationwide class action lawsuit initiated by two veterans against McCarthy, the Acting Secretary of the US Army, commenced on behalf of approximately 50 000 war veterans who were discharged dishonourably due to bad tempers amounting to misconduct. These veterans argued that their bad tempers were a consequence of TBI induced mental health injury, such as a post-traumatic stress disorder (PTSD), and that their behaviours may have been caused by a psychiatric condition or brain damage resulting from injuries they acquired during their course of employment as a soldier. The veterans requested their misconduct be re-determined and to set aside the determination to discharge them dishonourably. McCarthy denied these allegations.

In November 2021, the US District Court for the District of Connecticut<sup>4</sup> ordered McCarthy to

automatically reconsider the decisions, in certain circumstances, involving cases where there were demonstrable PTSD and/or TBI. As a result, thousands of unfavourable decisions were reviewed and the status of more than 51 400 dishonourably discharged veterans was reversed.<sup>5</sup>

CTE is a topic of significant interest for legal medicine practitioners as, according to the ADF statistics, there are 59 095 service members employed by the ADF, of which 28 878 were full-time and 17 454 part-time.<sup>6</sup> A further 1227 defence personnel were deployed to active operations.<sup>7</sup> Exposure to TBI within the military is not restricted to the battlefield. It may be encountered during training, sporting activities, in various non-combat activities and in the Army Reserve setting. *Kennedy v McCarthy* demonstrated the potential for a significant scale class action lawsuit in Australia, initiated by injured service members, against the ADF.

This paper reviews the medical and the tort of negligence aspects of TES and CTE as may be pertinent to the ADF.

## Clinico-pathogenesis of CTE

TBI delivers shearing forces to the brain. The force is predominantly focused at the base of the sulci, at the grey and white matter interface, causing a direct injury to the neural and the glial cells, and damaging the blood-brain barrier.<sup>8</sup> In response to the injury, inflammation ensues and allows the macrophages to enter the brain through the permeable blood-brain barrier.<sup>8</sup> The activated macrophages and the microglial cells release interferon-gamma, inducing a marked increase in HLA Class 1 protein expression.<sup>8</sup> This signals phosphorylation of tau proteins (hyperphosphorylation), resulting in the accumulation of the hyperphosphorylated tau (p-tau).<sup>9</sup>

The p-tau is a microtubule-associated protein<sup>10</sup>. It maintains the tubules' stability and structure and

transports macromolecules from the cell body to the distal part of the neuron.<sup>10</sup> Excessive p-tau proteins tangle to form neurofibrillary tangles (NFT).<sup>10</sup> Accumulation of NFTs destabilises the tubules, causing progressive cell dysfunction and death, analogous to lipid storage disease, such as Tay-Sachs disease.<sup>8</sup>

Grossly identifiable changes in the brain are more apparent in advanced CTE but unusual in mild CTE (acknowledging that CTE remains a postmortem diagnosis).<sup>12</sup> Characteristic macroscopic alterations include generalised cerebral atrophy with disproportionate atrophy of the medial temporal lobe, mammillary body atrophy, thinning of the hypothalamic floor, marked dilation of the lateral and third ventricles, cavum septum pellucidum with fenestrations and pallor of the substantia nigra.<sup>11</sup>

In 2017, McKee's<sup>12</sup> work was endorsed by the National Institute of Neurological Disorders and Stroke and the National Institute of Biomedical Imaging and Bioengineering (NINDS/NIBIB) as requisite for a pathological diagnosis of CTE. CTE can be diagnosed by identifying *'the pathognomonic lesion (which) consists of p-tau aggregates in neurons, astrocytes and cell processes around small vessels in an irregular pattern at the depths of the cortical sulci'*. The extensiveness of the distribution of p-tau NFT in the brain can be used to stage CTE.<sup>13</sup>

## Clinical presentation

McKee et al.<sup>13</sup> conducted a retrospective review of the 85 patients posthumously diagnosed with CTE and confirmed that patients with CTE might be asymptomatic. They may also present with symptoms of headaches, mood changes (depression, mood swings, apathy, anxiety, agitation), changes in behaviour (impulsivity, aggressive behaviour), cognitive function changes (loss of attention and concentration, short-term memory loss, explosivity, poor judgement and decision-making, language difficulties), suicidality, symptoms of motor neurone diseases (MND), Parkinsonism or PTSD.<sup>14</sup> Like other neurodegenerative conditions, CTE can only be diagnosed with a postmortem examination of brain tissue prepared with tau immunochemical stain.<sup>14</sup>

In 2021, the NINDS Consensus Group endorsed the clinical and research diagnostic criteria for TES.<sup>14</sup> Clinical features, symptoms and signs of CTE individuals during their lifetime were analysed by comprehensively reviewing the literature.<sup>15</sup> The NINDS concluded that CTE diagnosed individuals suffered from a similar cluster of clinical features during their lifetime and called this TES. The TES diagnostic criteria allowed the diagnosis of CTE-

like illnesses in vivo and allowed TES individuals to be characterised into four categories: suggestive of CTE; possible CTE; probable CTE; and definite CTE.<sup>15</sup> Each of these categories has different sensitivity and specificity in their ability to predict the CTE diagnosis<sup>15</sup>. Research on TES individuals would provide helpful information and insight into CTE, especially if the TES individual's brains can be collected postmortem to validate the correlation between the TES and CTE.

## CTE investigations

Most investigations help diagnose acute TBI but are not valuable for diagnosing CTE.<sup>15</sup> Effective diagnostic biomarkers provide the potential to diagnose CTE antemortem. The investigations, using biomarkers aiming to detect the tau pathology, are promising as tauopathy is the underlying pathology of CTE.<sup>15</sup> These investigations are still in an experimental stage, and their results are inconclusive as the outcomes of these tests are limited by small sample sizes, absence of control groups and, most importantly, the lack of postmortem validation.<sup>15</sup>

The following are the biomarkers of interest:

- tau-PET imaging offers encouraging predictive value. 2-(1-[6-[(2-[fluorine-18]fluoroethyl)(methyl)amino]-2-naphthyl]-ethylidene)malononitrile (FDDNP) is a radiotracer that binds specifically to  $\beta$ -sheet pleated sheets, which are present in tau and amyloid NFTs. When FDDNP binds to the NFTs, it allows the positron emission tomography (PET) scan to detect the neurofibrillary tangles.<sup>16</sup> It cannot differentiate different types of NFTs, such as amyloid in Alzheimer's disease and p-tau in CTE, but the pattern of distribution of the NFTs allows one to differentiate between Alzheimer's disease and CTE.<sup>17</sup> Chen et al.<sup>18</sup> demonstrated that the FDDNP-PET scanning of the brains of service members with histories of repeated TBI with suspected CTE showed binding patterns similar to those of retired football players. The illuminated binding pattern was distinct from that seen in Alzheimer's disease and normal aging. Chen's result suggested a potential value of FDDNP-PET for early detection, monitoring and treatment of CTE in vivo in the CTE suspected population.
- Diffusion tensor imaging (DTI) is a magnetic resonance imaging (MRI) technique used to investigate the white matter integrity that is not visible with standard cerebral computer tomography (CT) or standard MRI. It relies on the property of thermal Brownian motion of water molecules and measures the flow of the



water molecules along the axons (white matter).<sup>19</sup> A damaged axon will impede the flow of the water molecules along its axon and represents a breach in the white matter integrity.<sup>20</sup> McCunn et al.<sup>21</sup> used DTI to compare the white matter integrity of healthy civilian subjects and healthy service members exposed to TBI. Compared to the healthy civilian control, they found that service members exposed to TBI had increased white matter irregularities. Although this finding does not diagnose CTE, prospective monitoring of these individuals may reveal an interesting association between TBI and CTE.

- Functional MRI (fMRI) can also evaluate structural and functional changes in the brain after a TBI.<sup>22</sup>

Numerous other tests have the potential to predict an in-vivo diagnosis of CTE. Further research on individual, or a combination of, biomarkers may improve the accuracy of diagnosis of CTE pathology in individuals diagnosed with TES.<sup>15</sup>

## CTE cases in the military setting

The relationship between the type and severity of repetitive TBI and CTE in military settings varies. The accurate prevalence of repetitive TBI in the ADF is not measurable as many service members do not report their TBI experience(s).<sup>2</sup> Although exposure to a single TBI<sup>23</sup> was associated with the development of CTE, the consensus is that the CTE arises from repeated TBIs reaching a cumulative dose, in a dose-dependent manner<sup>24</sup>, to develop permanent brain damage.

Beran and Bhaska<sup>25</sup> reported two cases of veterans of the ADF who presented with TBI.

- The first case was a 39-year-old Caucasian male soldier who presented with 5 years of deteriorating memory, failing to recognise close acquaintances, difficulty recalling and difficulty retaining specific information. He was exposed to at least 10 blast injuries within 5–50 metres from explosions during deployment. There was no loss of consciousness (LOC) from any of the blast exposures. In 2011, he was within 5–10 metres of a controlled detonation when he felt *'shockwaves through his body when exposed to the explosion'*. In 2009, he reported firing a 66-mm rocket launcher 60 times within a day. He described the rocket launcher as a *'shoulder-fired concussion weapon'*. He also had five episodes of concussions while playing rugby. Clinical tools used to evaluate the soldier's cognition function did not confirm his subjective complaints. Considering that the soldier was

exposed to a significant history of repeated TBIs, this is a case that would have benefited by monitoring him to assess whether the symptoms eventuate into TES/CTE.

- The second case was a 39-year-old male soldier who complained of difficulty with anger control, episodes of altered consciousness—which he claimed to be epileptic seizures, gait disturbance with bradykinesia, freezing and bizarre movements, impaired cognition, sleep apnoea requiring continuous positive airway pressure, and various tics and tremors. There was a robotic gait, slow movements, pill-rolling tremor, stuttering and freezing on clinical examination. His memory was also impaired. An MRI of his brain, 48-hour sleep-deprived EEG and DTI MRI were all unremarkable. He initially responded satisfactorily to antiparkinsonian medications. An application of TES criteria on Case #2's clinical features classified him as having 'probable CTE'. Close monitoring of Case #2 was a missed opportunity to gain an insight into the pathogenesis of CTE.

Goldstein et al.<sup>21</sup> performed comprehensive neuropathological analyses of postmortem brains obtained from a case series of four military veterans with known blast exposure, with and without concussive injury. A comparison of their pathological findings against the CTE brains of young American football players demonstrated a remarkable similarity. This suggests that CTE from various professions may have common underlying causation.

McKee et al.<sup>26</sup> reported a case study of five US Military veterans as follows:

1. The first case was a 28-years-old veteran with two combat deployments. He had four episodes of concussion—two before enlisting and two during the combat deployments. He had a concussion without LOC on the first deployment, which was not reported. On the second deployment, there was a concussion with transient LOC following a motor vehicle–bicycle collision. He was subsequently diagnosed with PTSD and committed suicide 2 years later.
2. The second case was a 28-years-old male veteran who experienced several blast exposures during multiple deployments. He was diagnosed with PTSD at age 25. He was shot and killed by the police at the age of 27 when he fired on police and other civilians.
3. The third case concerned a 45-year-old male who became disoriented for 30 minutes after the blast exposure from a single close-range improvised explosive device (IED). Prior to

enlistment, he had a concussion at age 8 following a motor vehicle accident. He was subsequently diagnosed with anxiety and depression and died 2 years later from a ruptured giant basilar aneurism.

4. The fourth case was a 34-year-old male who had two concussions with LOC when exposed to two IED blast exposures, 1 and 6 years before his death. LOC was noted on both occasions, and he subsequently developed depression, anxiety and executive dysfunction. He died from unrelated aspiration pneumonia.
5. The fifth case involved a 22-year-old male who had a concussion without LOC when exposed to a single close-range IED blast 2 years before his death. He was subsequently diagnosed with PTSD 3 months before dying from an intracerebral haemorrhage. He had a history of numerous concussions before enlisting, arising from 2 years of high school football and multiple physical altercations.

In this study, four of the five veterans died from cerebrovascular events years after blast exposures. McKee et al.<sup>26</sup> speculated a possible association between the blast injuries and damage to the vascular integrity as the likely causative factor for these deaths.

Omalu et al.<sup>27</sup> described CTE in a 27-year-old US Marine Corps veteran who was deployed twice and was exposed to mortar and IED blasts, one of which occurred within less than 50 m. He was subsequently diagnosed with PTSD and died by suicide.

McKee et al.<sup>28</sup> reported a postmortem examination of 85 CTE brains from various professions, including 21 veterans. The review of these veteran's medical records showed:

- sixteen were also athletes
- nine veterans were deployed to combat zones
- three veterans had moderate-to-severe TBI while in service (one case from contusion, one case from poorly controlled post-traumatic epilepsy and one case with a traumatic spinal cord injury)
- three veterans were exposed to blasts from the IED and explosive ammunition
- three veterans were diagnosed with PTSD, of whom two were exposed to blasts from IEDs, and one experienced repetitive concussions during combat and in civilian life.

Service members with CTE had TBIs from various sources. Some TBIs occurred before enlisting

and others after the enlistment, from various circumstances: sporting activities related and unrelated to their duties; military exercises such as training activities; combats; accidents; and personal activities unrelated to their duty.

Bieniek et al.<sup>29</sup> reported a retrospective review of available records of 1721 patients from their brain bank and identified 66 brains of former athletes with a history of exposure to contact sports. Of the 66 brains of former athletes, 22 had CTE, 35 served in US Armed Forces, six were in combat and three were exposed to blast injuries. They found that CTE was not more prevalent in veterans than athletes and that there was no significant statistical relationship between CTE and the age at symptom onset, symptom duration, age at death, height, education, substance abuse, alcohol or tobacco usage and military service. This study raised the possibility that CTE occurrence may not be related to TBI or military service. It may be a mere coincidence.

## Analysis of military CTE cases

The literature review revealed less than 100 reported CTE cases in service members. Except for two cases presented by Beran and Bhaskar, most of the cases reported insufficient clinical details to fully explore the association between the TBI and TES/CTE. There is a common thread of issues arising from these cases:

- CTE was identified in service members of the US Military or ADF.
- CTE was identified in service members exposed to TBIs. Not all individuals had LOC and some did not report the incidence.
- The exposure to TBI occurred in various settings: during a military deployment; during battle; during military training; during exercise; due to a motor vehicle accident; while playing sports; accidental falls; and as the result of pre-existing illnesses, such as an epileptic seizure. Some TBIs pre-existed their enlistment and occurred outside their military duties.
- Blast injuries were the most common form of reported TBI.
- Most service members diagnosed with CTE had the clinical features of the TES during their lives.
- Most CTE-like illnesses began many years after exposure to repeated TBI.

TBI was a ubiquitous clinical feature, connecting the service members to CTE. Not all individuals who were diagnosed with postmortem CTE had clinical TES. Although TBI may have caused a permanent brain

injury that altered one's personality to compel them to become mass murderers and attempt suicide, there is no evidence to support that CTE was the cause of these acts. Despite CTE in military settings, especially concerning the blast injuries, being a mass media sensation, the epidemiological basis linking the TBI causing CTE, at this stage, appears to be not supported by solid evidence. More research is urgently needed to gain further insight into the cause-and-effect relationship between TBI and CTE to safeguard both service members and the ADF's medical and legal interests.

### Epidemiology of military TBI, TES and CTE

Military health policy needs to provide evidence-based practice to their service members. Although the knowledge of CTE is evolving, many factors are unknown. The following are the epidemiological inferences that can be drawn from the literature review:

- CTE is a distinct disease entity that can be diagnosed only postmortem, using the NINDS criteria.
- The history of CTE patients demonstrates that they suffered from a cluster of clinical features collected and called TES.
- TES can be diagnosed using NINDS' TES criteria which will help to characterise the likelihood of CTE in a TES diagnosed individual.
- No test can reliably diagnose TES/CTE in vivo, but the investigations that aim to detect the underlying tau pathology in the brain are promising.
- Exposure to repetitive TBIs and subsequent development of TES/CTE is strongly associated, but the cause-and-effect relationship is unproven.
- Service members exposed to repetitive blast injuries have been diagnosed with CTE.
- The true prevalence and incidence of CTE, both in service members and the general population, is unknown.
- An individual's risk factors and predisposing factors for developing CTE are unknown.
- The threshold of cumulative TBIs and the effect of various types of TBI required to develop CTE is unknown.
- TBIs are strongly associated with adverse health and mental consequences.
- Research commitments into understanding CTE are becoming more available but limited, especially in military settings.

The outcome of the International State-of-the-Science Meeting, exploring the potential relationship between blast-related trauma and CTE development,<sup>30</sup> is helpful for the ADF. Although the scientific evidence is limited, the panel acknowledged an association between TBI and CTE. The panel recommended the following:

- A coordinated brain bank is established within the Department of Defence to accept the brains of the deceased veterans to study the prevalence of CTE.
- There is a need for access to blast-exposed tissue samples to explore potential associations between blast exposure and CTE development, including non-blast risk factors, such as genetic susceptibility, age, gender and co-morbidities (i.e. drug and alcohol abuse, and cardiovascular disease).
- Close monitoring of validated diagnostic and screening tools is needed to facilitate antemortem diagnosis of CTE.
- Establish an independent panel to determine whether ongoing longitudinal studies would help determine CTE development and candidate risk factors.
- A prospective longitudinal clinical study to recruit high-risk service members with a history of exposure to TBIs to determine the relationship between the TBI and CTE and help establish a dose-response relationship between TBI and CTE.
- Prevention and mitigation strategies are formulated and implemented to prevent blast-related TBI, including modifying training protocols to reduce blast exposure, improve education and personal protective equipment, and return-to-duty guidelines after blast exposures.
- Westphalen<sup>31</sup> identified that the ADF regularly conducts a periodic health assessment before deployment and review of service members after they are discharged. Health promotion activities/programs are also available to promote and enhance physical resilience. There is a system in place for prospective researchers to take an opportunity to collect data on the at-high-risk group of service members prospectively. In his review of veteran health claim statistics in the ADF, 30–40% of all health claims were from musculoskeletal injury and fractures, which may be associated with significant TBIs. The author concluded that there is room to improve the management of occupational and environmental health hazards, with more emphasis on

prevention than treatment. TES/CTE may also be preventable and could be integrated into such health promotion programs and periodic health assessments.

### Ongoing CTE research

The cause-and-effect of TBI and CTE is speculative. The potential impact of recurrent TBI in causing a permanent brain injury and TES/CTE is unknown and has a low probability. Should TES/CTE eventuate, in the context of TBI, it is a debilitating and fatal condition for service members. Acknowledging the social and health significance of a high-risk impact on the probability of an event, generous funding of research into this field is noted, especially by the US Military.

In 2016, the US Military established a neurotrauma consortium (CENC) and initiated a multicentre observational study<sup>32</sup>. It is a longitudinal, prospective study to establish and comprehensively evaluate a cohort of at least 1000 US service members who served in recent military conflicts, to better understand the possible chronic and late-life effects of TBI. The participants will be interviewed every 5 years to monitor the development of TES clinical features. The significance of this study is to identify the link between TBI and TES/CTE. The data collected from this study will give insightful epidemiological information to establish causation and prevent and manage TES/CTE.

In 2019, a 4-year prospective study recruited 240 males participating in high-risk professional American football meeting the TES diagnostic criteria for a prospective 3-year follow-up study designed to detect and diagnose CTE during the life of former footballers and to gain insight into the risk factors, pathogenesis, epidemiology, treatment and prevention of CTE.<sup>33</sup> A similar study in the ADF would be helpful to gain an insight into the TES/CTE in the setting of its services' members. A routine application of the NINDS' TES diagnostic criteria<sup>15</sup> would also be helpful in diagnosing TES early in their members' careers.

In 2019, multinational prospective research of former National Rugby League (NRL) players, Retired Professional Rugby League Players Brain Health Study, began collaborating with the National Rugby League, the University of Newcastle, Harvard Medical School and the University of Sydney's Sydney Brain Bank.<sup>34</sup> The research aims to collect brain donations from deceased former NRL players to diagnose a possible CTE and to prospectively document their detailed medical history. A similar study could be devised for the service members of the ADF and

would be helpful to gain further insight into the CTE, and possibly TES, in the ADF setting.

In 2009, a TBI and long-term quality of life study of service members was drawn from the Royal Melbourne Hospital trauma registry.<sup>35</sup> The findings suggested that TBI has long-term consequences across all aspects of service members' lives. They experienced worse general health, elevated probability of depression, social isolation and worse labour force participation rates. In 2017, a study investigated the impact of potentially traumatic events on mental health outcomes of service members of ADF.<sup>36</sup> The members who were deployed to combat, packer or relief work in a war zone or region of terror, were more likely to have mental health adversities, such as depression, PTSD and alcohol use disorder. Thomas<sup>37</sup> showed that the prevalence of mental health problems and functional impairment among active component and National Guard soldiers, 3 and 12 months following combat(s) in Iraq was significantly higher than the non-deployed soldiers. Their results concurred with a growing body of literature demonstrating the association of combat in Iraq and Afghanistan with post-deployment mental health problems, particularly PTSD and depression<sup>35</sup>. Further studies are required to determine the true prevalence of mental illnesses in ADF service members who participated in combat deployments. Some of these service members may have experienced unreported TBIs. A TBI registry appears already to be in existence, and it presents another opportunity for the ADF to gain insight into the long-term effect of TBI in service members.

### Legal medicine

For an individual to be successful in the tort of negligence, they must satisfy the three elements of the duty of care: establish the duty of care; establish that there was a breach of the care; and establish that there is legal causation that is not too remote.

The ADF owes two paramount duties to their service members. Firstly, the duty to warn of the TES/CTE. Secondly, the duty to diagnose and treat the TBI to avoid developing TES/CTE. Although the cause-and-effect relationship between TBI and CTE is not established convincingly, its association is widely accepted. The Court is unlikely to be sympathetic to a plea of 'we did not know'. The ADF must uphold these duties.

A duty to warn of the risk involves seeking service members to undertake their service to the ADF, knowing that they are at risk of developing TES/CTE, appears fundamental. Service members must understand that this material risk may eventuate,



and they must voluntarily agree to undertake their services within the ADF with the full knowledge of such risk. If the ADF was found to have breached its duty to warn of the TES/CTE risks, the Court may impose legal liability on the ADF for the tort of negligence should the Court believe that the members were not warned and would have acted differently had they been adequately warned.

A duty to diagnose and treat involves the ADF actively seeking to accurately and timely diagnose the suspected TBIs, so that service members can receive appropriate and timely treatment to avoid developing TES/CTE. The ADF needs to warn and educate its members about the material risks of TES/CTE, potentially arising from repeated TBIs. It also needs to have a system in place to diagnose and manage TBIs. A clear and detailed contemporaneous documentation of TBI incidences, treatment records, updated protocols and education programs would assist in documenting the requisite standard of care. It may need to expand the size of the team to deal with administering and coordinating the task. The scientific and medical knowledge about TES/CTE will need continuous monitoring and updating. It is a relentless task but is important because if a service member fails to receive the appropriate treatment for TBI due to inadequate systematic measures being in place, the potentially neglectful conduct of the ADF may be inferred as arising from a breach of the duty of care relevant to diagnosis and treatment, which may be difficult to defend, legally, in the tort of negligence.

A duty of maintaining ongoing research is a subset of the duty to diagnose and treat within this context and may represent an applicable duty to the ADF. In *South Eastern Sydney Area Health Service & Anor v King*<sup>38</sup>, a doctor administered chemotherapy to a child to treat a rare brain cancer. The cocktail of medications was administered to the child in a prescribed dosage based on a protocol established by a US-based study group. The US group amended their protocol to reduce the dosage of one of the chemotherapy medications to avoid causing paraplegia. The doctor administering the chemotherapy was unaware of this amended protocol and relied on the superseded protocol. The child subsequently developed paraplegia. Hunt AJA found that:

- the doctor 'has a duty to exercise reasonable care and skill in the provision of professional advice and treatment, and that the standard expected of a medical practitioner is that of an ordinary skilled person exercising and professing to have that special skill'<sup>39</sup>
- the doctor had 'an obligation to remain informed of any relevant changes occurring in the

treatments being administered as within that duty'<sup>40</sup>

- the doctor 'by proceeding with the treatment of the respondent without ensuring that he had been placed in as good a position as if he had conducted a literature search and any necessary follow-up inquiries himself, he failed in his duty to the respondent in the particular circumstances of this case to be in possession of all the necessary up-to-date information in relation to that treatment'.<sup>41</sup>

This case is relevant to TBI/TES/CTE management in the military context as the ADF must remain informed of any relevant development(s) in the scientific and medical knowledge relating to TBI/TES/CTE. The duty to possess all the necessary up-to-date information concerning CTE is not a passive expectation but represents an active obligation. The duty is to actively pursue the possession of all the necessary up-to-date information on TBI/TES/CTE for the interests of service members of the ADF.

## Conclusion

More things are unknown than are known about TES/CTE in the military setting. Whether in isolation or following multiple mild impacts, TBIs appear to be the requisite precondition for the development of TES-CTE and deserve greater attention.

The ADF owes a legal duty of care to its service members. The duty to warn of the CTE and diagnose and treat TBI/TES/CTE are essential obligations that the Court may place upon the ADF should litigation ensue. The ADF's policy should align with these duties to escape legal liabilities from the tort of negligence. The ADF has the duty and an active obligation to be self-informed about the most up-to-date information about CTE. Despite the current understanding of CTE growing daily, there remains a 'dearth of ongoing commitment to research in this field by people with specialised and developed skills',<sup>1</sup> especially within the ADF. In contrast to the US Military services, the literature on the impact of TBI/TES/CTE on Australian service members is scarce. More research is needed to understand the pathogenesis of CTE and its risk factors, to safeguard thousands of service members who put their lives on the line to protect the freedoms that we enjoy.

Corresponding Author:

Peter Sang-Hui Kim, [peter@peterkim.com.au](mailto:peter@peterkim.com.au)

Authors: Peter S Kim<sup>1</sup> and Roy G Beran<sup>2</sup>

Author Affiliations:

1 Australasian College of Legal Medicine

2 University of New South Wales Faculty of Medicine

## References

- 1 Beran RG. Traumatic brain injury – A time to reappraise – a wake up call. *J Military Veteran Health*. 2015;23(2):20-24.
- 2 Beran RG, Bhaskar S. Concussion within the Military. *J Military and Vet Health*. 2018;26(3):20-27.
- 3 *Kennedy and Carson v Speer 2017*, Case 3:16-cv-02010-WWE. Available from: [https://law.yale.edu/sites/default/files/area/clinic/vlsc\\_kennedy\\_v\\_speer\\_amended\\_complaint\\_4-17-2017.pdf](https://law.yale.edu/sites/default/files/area/clinic/vlsc_kennedy_v_speer_amended_complaint_4-17-2017.pdf)
- 4 *Kennedy v. McCarthy 2020*, Case 3:16-cv-02010-CSH Document 198-2. Available from: [https://law.yale.edu/sites/default/files/area/clinic/vlsc\\_kennedy\\_v\\_mccarthy\\_198.02\\_settlement\\_agreement.pdf](https://law.yale.edu/sites/default/files/area/clinic/vlsc_kennedy_v_mccarthy_198.02_settlement_agreement.pdf)
- 5 Kime, P. Army to Review Thousands of 'Bad Paper' Discharges in Court Settlement. *Military.com*. 2021. Available from: <https://www.military.com/daily-news/2021/04/29/army-review-thousands-of-bad-paper-discharges-court-settlement.html>.
- 6 Department of Defence. Defence Annual Report 2019-20. 2021. p116-117.
- 7 Department of Defence. Operations. Australian Government. 2021. Available from: <https://www1.defence.gov.au/operations>.
- 8 Demock M, Kornguth S. A mechanism for the development of chronic traumatic encephalopathy from persistent traumatic brain injury. *Journal of experimental neuroscience*. 2019;13:1-5.
- 9 Neumann H, Schmidt H et al. Major histocompatibility complex (MHC) class I gene expression in single neurons of the central nervous system: differential regulation by interferon (IFN)-gamma and tumor necrosis factor (TNF)-alpha. *J Exp Med*. 1997;185:305-316.
- 10 Weingarten MD, Lockwood AH et al. A protein factor essential for microtubule assembly. *Proc Natl Acad Sci USA*. 1975;72:1858-1862.
- 11 McKee AC, Stein TD et al. The neuropathology of chronic traumatic encephalopathy. *Brain pathology*. 2015;25(3):350-364.
- 12 McKee AC, Cairns NJ et al. The first NINDS/NIBIB consensus meeting to define neuropathological criteria for the diagnosis of chronic traumatic encephalopathy. *Acta Neuropathol*. 2016;131(1):75-86.
- 13 McKee AC, Stein TD et al. The spectrum of disease in chronic traumatic encephalopathy. *Brain*. 2013;136(1):43-64.
- 14 Katz DI, Bernick C et al. National Institute of Neurological Disorders and Stroke Consensus Diagnostic Criteria for Traumatic Encephalopathy Syndrome. *Neurology*. 2021;96(18):848-863.
- 15 Aldag M, Armstrong RC et al. The biological basis of chronic traumatic encephalopathy following blast injury: a literature review. *Journal of neurotrauma*. 2017;34(s1):s-26.
- 16 Small GW, Kepe V et al. PET scanning of brain tau in retired national football league players: Preliminary findings. *Am J Geriatr Psychiatry*. 2013;21(2):138-144.
- 17 Barrio JR, Small GW et al. In vivo characterization of chronic traumatic encephalopathy using [F-18] FDDNP PET brain imaging. *Proc Natl Acad SciUSA*. 2015;112:E2039-2047.
- 18 Chen, Stephen T. et al. FDDNP-PET Tau Brain Protein Binding Patterns in Military Personnel with Suspected Chronic Traumatic Encephalopathy. *Journal of Alzheimer's Disease*. 2018;65(1):79-88.
- 19 Mori S, Zhang J. Principles of Diffusion Tensor Imaging and Its Applications to Basic Neuroscience Research. *Neuron*. 2006;51(5):527-539.
- 20 Johnson VE, Stewart W, Smith DH. Axonal pathology in traumatic brain injury. *Experimental neurology*. 2013;246:35-43.
- 21 McCunn P, Richardson JD et al. Diffusion Tensor Imaging Reveals White Matter Differences in Military Personnel Exposed to Trauma with and without Post-traumatic Stress Disorder. *Psychiatry Research*. 2021;298:113797.
- 22 Gavett BE, Cantu RC et al. Clinical appraisal of chronic traumatic encephalopathy: current perspectives and future directions. *Current opinion in neurology*. 2011;24(6):525-531.
- 23 Goldstein LE, Fisher AM et al. Chronic traumatic encephalopathy in blast-exposed military veterans and a blast neurotrauma mouse model. *Science translational medicine* 2012;4(134):134ra60-134ra60.
- 24 Montenigro PH, Alosco ML et al. Cumulative Head Impact Exposure Predicts Later-Life Depression, Apathy, Executive Dysfunction, and Cognitive Impairment in Former High School and College Football Players. *Journal of Neurotrauma*. 2017;34(2):328-340.

- 25 Beran RG, Bhaskar, S. Concussion within the Military. *J Military and Vet Health*. 2018;26(3);20-27.
- 26 McKee AC, Daneshvar DH. The neuropathology of traumatic brain injury. *Handb Clin Neurol*. 2015;127:45-66.
- 27 Omalu BI, DeKosky ST et al. Chronic traumatic Encephalopathy in a National Football League player. *Neurosurgery*. 2005;57:128-34.
- 28 McKee AC, Robinson ME. Military-related traumatic brain injury and neurodegeneration. *Alzheimers Dement*. 2014;10(3):242-53.
- 29 Bieniek KF, Ross OA et al. Chronic Traumatic Encephalopathy Pathology in a Neurodegenerative Disorders Brain Bank. *Acta Neuropathol*. 2015;130(6):877-889.
- 30 Leggieri MR, Gupta RK et al. International state-of-the-science meeting exploring the potential relationship between blast-related trauma and the development of chronic traumatic encephalopathy." *Journal of neurotrauma*. 2017;34;s1-3.
- 31 Westphalen N. Health promotion in the Australian defence force. *Journal of Military and Veterans Health*. 2021;29(1):52-60.
- 32 Walker, William C., et al. The Chronic Effects of Neurotrauma Consortium (CENC) multi-centre observational study: description of study and characteristics of early participants. *Brain injury*. 2016;30(12):1469-80.
- 33 Alosco, Michael L., et al. Developing methods to detect and diagnose chronic traumatic encephalopathy during life: rationale, design, and methodology for the diagnose CTE Research Project. *Alzheimer's Research & Therapy*. 2021;13(1):1-23.
- 34 The University of Newcastle. Concussion research proves game-changing. Available from: <https://www.newcastle.edu.au/research/stories/research-impact/concussion-research-proves-game-changing>.
- 35 Hawthorne G, Russell G et al. Traumatic Brain Injury and Long-Term Quality of Life: Findings from an Australian Study. 2009;26(10):1623-33.
- 36 Wade D, Mewton L. The impact of potentially traumatic events on the mental health of males who have served in the military: Findings from the Australian National Survey of Mental Health and Wellbeing. 2017;51(7):693-702
- 37 Thomas, Jeffrey L., et al. Prevalence of mental health problems and functional impairment among active component and National Guard soldiers 3 and 12 months following combat in Iraq. *Archives of general psychiatry*. 2010;67(6):614-623.
- 38 *South Eastern Sydney Area Health Service & Anor v King* 2006. NSWCA 2
- 39 *Rogers v Whitaker* 1992. 175 CLR 479 at 12. (Unanimous decision of JJs: Mason, Brennan, Dawson, Toohey, and Mchugh)
- 40 *South Eastern Sydney Area Health Service & Anor v King* 2006. NSWCA 2, 24. (Hunt AJA)
- 41 *Ibid*, 71. (Hunt AJA)

# Cultivating Family Resiliency in the Context of the Military to Civilian Transition and Mental Health Problems

*K Wynia Baluk, D Norris, K D Schwartz, J Whelan, H Cramm*

## Introduction

Relinquishing military employment has the potential to be a life transition laden with emotional, financial, relational and physical stressors for Canadian Armed Forces (CAF) families.<sup>1-2</sup> This article explores how intimate partners of CAF veterans who have operational service in Atlantic Canada and live with a mental health problem cultivate family resiliency during the military to civilian transition (MCT). MCT refers to the period when military members begin the process of adjusting to civilian ways of life after release from service.<sup>3</sup> During this transition, veterans must reconfigure their social identity and develop a revised sense of purpose in daily life in light of civilian and military cultural differences.<sup>4-5</sup> Stressors associated with MCT include reverse culture shock,<sup>6-7</sup> identity shifts,<sup>8</sup> difficulties finding employment<sup>9</sup> and managing service-related health problems.<sup>10</sup>

Military family research indicates that families may be impacted by the same MCT stressors, which they can support veterans in managing.<sup>2-3,11-13</sup> A veteran's mental health problem may serve as another compounding challenge for families moving through MCT, which can negatively impact family relationships.<sup>2,14-16</sup> As reported in more detail in a previous publication using this same sample,<sup>17</sup> while many participants in this study had a family member with a clinically diagnosed mental disorder (e.g., post-traumatic stress disorder [PTSD]), we use the broader term mental health problem to include both diagnosed and undiagnosed (i.e., subthreshold or prodromal) emotional, social and psychological issues that can compromise a veteran's wellbeing.

Although the majority of CAF veterans, regardless of their mental and physical health, reported a smooth MCT in 2016 through participation in the Life After Service Study (LASS), 32% experienced this time as difficult, 28% reported a difficult MCT for

their partners and 17% reported a difficult MCT for their children.<sup>18</sup> An understanding of how families 'rebound from or withstand'<sup>19(p.261)</sup> MCT stressors could support service providers and policymakers in promoting military and veteran family wellbeing. Little is known about how families collectively experience MCT in general. We contribute to this understanding by investigating how six females who are intimate partners of CAF veterans in Atlantic Canada describe the familial resilience processes and protective factors that supported them in addressing their family's MCT and mental health stressors.

Due to our small sample size, the research presented here is not generalisable to the larger population of veteran families. However, as an exploratory study, the stories of the participating women and the common themes provide insight into the challenges of moving through MCT with a veteran family member experiencing a mental health problem. These insights will inform programs and policies focusing on the familial transition through MCT.

## Family resiliency

Families are 'complex adaptive systems' shaped by interactions between and among interdependent members and across broader social contexts.<sup>20(p15)</sup> Family resiliency is conceptualised here as the outcomes that arise when a family exercises resilience processes and protective factors to adapt to, withstand or rebound from stressors.<sup>19,21-23</sup> Protective factors are the 'resources, processes or mechanisms that counter family risks'.<sup>23(p25)</sup> Exercising family resilience may include finding meaning in adversity, adjusting familial roles with changing circumstances, communicating effectively and leveraging social supports.<sup>19-23</sup> Families deemed resilient arrive at 'a level of functioning at or above their pre-crisis level'.<sup>24(p.284)</sup> They can balance the demands of their stressors with their strengths and capacities.



Family resiliency discussions within military contexts should consider the complexity and diversity characterising contemporary military families and career trajectories.<sup>25</sup> The nature of military career trajectories, culture, operational stress injuries (OSIs), ways of life, sense of belonging and purpose, and institutional supports intrinsic to military contexts could influence how CAF families experience and respond to stressors. This study was grounded in a theoretical framework that brings to light the complexity and diversity of military families within the context of family resiliency development.

This study used findings from a narrative review of military family resiliency literature as its theoretical framework to explore how veteran families in Atlantic Canada cultivate resiliency while experiencing the challenges of MCT and a mental health problem. This narrative review articulated a synthesis of existing resilience models to frame factors influencing a family's MCT experiences of stress and resiliency.<sup>26</sup> The synthesis of resilience models underscores family resiliency as an outcome influenced by family characteristics, resilience processes and the family-context interactions at each level of social analysis in Bronfenbrenner's ecological systems model.<sup>26</sup>

Bronfenbrenner's model leads researchers to consider the influences of social spaces where family members interact with one another (micro), spaces where two or more microsystems interact (meso), spaces where families are impacted by external institutions (exo), culture and ideological systems (macro), and the influence of time (chrono).<sup>27</sup> Integrating insights from military family resiliency literature with Bronfenbrenner's model, the synthesis guiding this study encompasses an awareness of psychological, familial, community, institutional and cultural factors that can encumber or promote family resiliency. An awareness of these factors can aid researchers in recognising the multidimensional nature of family resiliency within military contexts.

### Method

To explore how veteran families in Atlantic Canada cultivate resiliency while experiencing the challenges of MCT and a mental health problem, a secondary thematic analysis of six interviews from a larger Canadian study was conducted. This process was guided by the synthesis of military family resiliency literature<sup>26</sup> and served as a vehicle for identifying factors, processes and social contexts at each level of the ecological model that may facilitate family resiliency. The original study was funded by Veterans Affairs Canada (VAC). It received ethical clearance from the research ethics review boards at the three

Canadian universities affiliated with the principal investigators. As this analysis only utilised data from Atlantic Canada, it received clearance from the one ethics board.

### Participants

The larger Canadian study used purposive sampling to recruit participants for in-depth qualitative interviews about their familial experiences during MCT with a mental health problem. Participants were all family members of former Regular Force or Reserve Class C CAF personnel experiencing a mental health problem who were released in the past 5 years. CAF Regular Force veterans typically have long-term contracts and could be ordered to serve overseas. Reserve Class C Veterans are contracted to serve full-time in a Regular Force establishment or on a specific domestic or international operation. The sample was Canada wide, with 27 participants recruited proportionately from the Atlantic, Central and Western regions.

This study used purposive sampling to select all participants in the original study who were from Atlantic Canada and intimate partners of CAF veterans (n=6) to create the context for a focused analysis. The veterans had served full-time at an operational level, had a mental health problem and were released in the past 5 years. These veterans held various positions within the CAF, ranging from a logistics officer to a medical technician. Five of the six veterans were members of the Regular Force, while one veteran was a Reservist. The participants included five heterosexual couples and one lesbian couple. Participants had been living with their veteran partners between 14 and 22 years and were between the ages of 36 and 61. Five of the six participants had between two and four children under the age of 18 living with them. All participants provided insights into their specific lived experiences with MCT and mental health stressors at micro, meso and exosystem levels of analysis.

### Data analysis

Thematic analyses aid researchers in 'identifying, analysing and reporting patterns' within qualitative data.<sup>28(p. 79)</sup> Researchers drew on the thematic analysis method outlined by Braun and Clarke (2006), whereby themes are treated as patterned responses and meanings that directly relate to a study's goals, questions and theory.<sup>28</sup> All themes were thus related to the intra-familial factors and conditions, the family's social context and family processes that impact how a veteran family in Atlantic Canada may cultivate resiliency while managing the veteran's

mental health challenges through MCT. This analysis method entails gaining familiarity with the data, generating initial codes that denote a feature of the data, identifying themes among the initial codes and ensuring each theme is supported with sufficient evidence.<sup>28</sup> MAXQDA, a qualitative research software program, served as the platform engaging in the coding process and reflexive practices.<sup>29</sup>

## Results

Participants recounted familial experiences with managing stressors and mental health problems during MCT, provided a context for examining the factors, processes and interactions that supported family resiliency. These stressors included feeling isolated after losing military-related relationships and social support, mental and physical health difficulties, finding appropriate health services in civilian society and feeling uncertain about their ability to cover daily expenses. Using Bronfenbrenner's levels of social analysis, we describe the intra-familial strengths, resilience processes and social supports that reinforced resilience within the participants' families.

### Microsystem and mesosystem levels of analysis

**Familial loyalty:** An intra-familial strength at the microsystem level that supported the cultivation of family resiliency was remaining loyal and committed to family relationships. A participant stressed that, throughout their MCT journey, her 'end goal was always to keep the family together'. Another reported that she and her partner were 'trying to figure out how to be together as a unit'. Familial loyalty was reinforced by the presence of solid relational history and the ability to empathise with other members. A participant reported that 'if it was just a brand new boyfriend, there's no way I'd be here'. Another asserted that 'you got to continue to have that empathy that you have for that person and what they're going through'. This commitment to maintaining the integrity of the family unit, regardless of challenges, supported families in withstanding stressors.

**Self-care:** Engaging in self-care also supported families at a microsystem level in withstanding stressors. This was exemplified when a participant stated, 'My priority was me so that I could be the best for my family'. Three participants also maintained family stability in MCT stressors through familial rituals. These rituals involved repeated family practices and routines: 'We played board games together Friday nights. We did stuff together. We hung out. I started running. My husband started running with me'. Maintaining or developing familial rituals

and self-care routines aided participants in cultivating resiliency.

**Communication and problem-solving capacities:** Participants also gained clarity on their microlevel situations through the processes of communication and problem-solving. A participant described how she gained new communication skills and capacities while managing MCT and mental health problems: 'To get through this, you have to develop some additional skill sets to find your way, to help de-escalate, to have better insight, to just be a little bit more honest'. The perspective gained through problem-solving and communication may reinforce a family's capacity to make decisions that support the cultivation of family resiliency.

**A contextualised and realistic understanding of stressors:** Participants also developed a contextualised understanding and a realistic outlook of stressors. This resilience process aided the participating families in reconciling losses and capitalising on MCT opportunities. One participant asserted, 'actually we can recognize at this point probably some positives associated with not being in the military anymore'. While grieving the loss of her husband before the onset of trauma-related symptoms, another participant articulated that she still desired to reframe the negative and recognise what is positive about their situation.

*You grieve the loss and then you have to be able to see if you can accept it. I think some of my struggle right now from time to time is just saying, 'Can you accept the way life is now. All the good and bad that comes with it'.*

The act of accepting one's losses while identifying opportunities supported families in maintaining a hopeful perception of their situations.

**Informal social supports:** We conceptualised informal supports as the emotional and practical resources that were offered voluntarily by friends, family and other community members. The potential of an informal support network to ease familial stressors was apparent when one participant described the factors that supported her family through MCT.

*[X]'s mum, once he was hospitalized, came to stay with us to, to help support both me and to sort of help support [X]'s needs. So great family support. I work in the system surrounded by therapists all day, so I have really great co-workers, really great friends.*

The participant whose partner served as a Reservist also described the importance of supports and resources established within her family's civilian

and military community throughout her partner's career. These supports helped to alleviate stressors associated with relocating to a new community and relinquishing military employment. By buffering stressors, social supports operating at the mesosystem level facilitated the development of intra-familial capacities at the microsystem level.

### Exosystem level of analysis

**Formal social support:** Five of the six participants reported the importance of their formal support networks in responding resiliently to MCT and mental health stressors. We conceptualised formal supports as the emotional and tangible resources administered by established institutions. Participants discussed the value of respite, health and financial support offered by VAC, social support groups offered by Operational Stress Injury Social Support (OSSIS) clinics and the Couples Overcoming PTSD Everyday (COPE) group therapy program. COPE directly targets MCT and mental health stressors by bringing families together and offerings skills and knowledge that enhance resilience. A participant described how her partner was initially 'completely resistant' to the idea of joining a peer-support group for veterans with OSIs but now 'looks forward to it'. Another asserted that her family would be 'in trouble' without VAC services. Australian equivalents to the Canadian supports discussed here may include the benefits and pensions provided through the Australian Government's Department of Veterans' Affairs and the tailored military and veteran mental health supports provided by Open Arms Counselling.

Access to services that offset psychological and emotional stressors fortified family resilience. A participant attributed the skills developed via COPE to her family being at a 'better place' as compared to when they initially felt the impacts of MCT and mental health problems. Another noted that her son 'had adapted very well' during MCT after receiving counselling through VAC and the school system. A participant also recognised how her family was now able to better manage the veteran's mental health problems: 'In the beginning, I began to recognize what was going on, and now, through therapy and everything, he will recognize his triggers as well'. The participating families thus leveraged external resources at the exo-level of Bronfenbrenner's model to alleviate familial stressors.

### Discussion

The synthesis of family resiliency modelling proved useful in identifying the nuanced and varying paths to resiliency described by participants.<sup>26</sup> Researchers, service providers and policymakers

can use this synthesis to understand the contextual factors, familial characteristics and resilience processes that support families in withstanding MCT stressors and veteran mental health problems. Findings from this study exemplify the claim that 'although stress is inevitable, crisis is not'.<sup>30(p72)</sup> Policies and services grounded in understanding contextual and intra-familial factors that support or hinder family resiliency could mitigate familial crises within veteran families journeying through MCT while managing a mental health problem.

### Capitalising on resilience processes and intra-familial strengths

These findings contribute to an expanded understanding of the resilience processes that families cultivate and how these processes are manifested within CAF families experiencing a veteran's mental health problem while journeying through MCT. By empathising with others and recognising both losses and opportunities, the participants demonstrated how contextualising stressors as 'comprehensible, meaningful and manageable' reinforces efforts to be resilient.<sup>21(p211)</sup> Having a strong relational history of sustaining familial loyalty also revealed how military families might 'develop tolerance' and 'mutual empathy' for each other to support positive adaptation to familial stressors.<sup>21</sup> Findings depict how self-care and family rituals can also assist in this process.<sup>31</sup>

### The value of external social supports

A clear theme within this analysis is that resilience processes can be fortified by informal social support and formal policy and service efforts. The participants' accounts of their familial MCT and mental health experiences align with research showing that robust informal support networks and accessible formal supports can enhance family resiliency.<sup>2</sup> Opportunities to develop skills, acquire knowledge, and sustain emotional and psychological equilibrium are available through supportive networks, buffering the effects of stressors that impede the cultivation of resiliency.<sup>32</sup> Furthermore, veteran families who are socially connected within civilian communities throughout their military careers may have a wider berth of social support that can bolster resiliency.

Maintaining connections with other veterans may also ease the process of establishing a post-military identity.<sup>3,5</sup> This analysis indicates that the same may be true for families undergoing MCT. Therefore, military family members should be encouraged to maintain and foster civilian connections throughout their time in the military and stay connected to veteran families post-MCT. This encouragement may

arise in the form of programs, services and resources offered within military family resource centres and publications geared towards military families, such as the *Canadian Military Family Magazine* and *Defence Family Matters* in Australia.<sup>33-34</sup> Veteran families who can draw on resources within civilian and military spheres may have a stronger foundation to cultivate resiliency.

The participants' accounts of cultivating family resiliency support the claim that resilience should be recognised as a product of social interactions.<sup>26-27</sup> Formal and informal supports, such as psychotherapy and social support groups, can encourage the enactment of intra-familial resilience processes and strengths. The salient role of having adequate access to social supports external to the family also speaks to the utility of the ecological systems model.<sup>27</sup> Familial resources within mesosystems and exosystems, such as the COPE program and support received from co-workers, friends and family, influenced the participating families on a microsystem level by providing them with skills and knowledge that supported efforts to adapt to stressors. Findings illustrate how intra-familial circumstances and processes can interact with external familial conditions.

### The value of family support

Lastly, these findings affirm that MCT stressors and mental health problems can create a context for the cultivation of family resiliency where family support is essential to a veteran's wellbeing.<sup>2</sup> The six females involved in this research described responses that supported their families in adapting to, rebounding from or withstanding significant MCT and mental health stressors. These responses included maintaining familial loyalty during times of stress, empathising with family members and those outside the family to gain perspective on their stressors, taking time for self-care, engaging in problem-solving and effective communication, and drawing on their formal and informal support networks. The intimate partners in this research provided veterans with emotional support, encouragement and advocacy. This finding is consistent with recent research indicating that 71% of Regular Force Veterans who reported having someone to rely on during an emergency identified their partners.<sup>18</sup> Likewise, 76% of veterans who require help with daily living indicated that their partner provided this support.<sup>18</sup>

### Limitations and future research

These findings should be considered in light of this study's limitations, particularly the use of secondary

data. The principal author, who primarily took on the role of data analysis, did not conduct the interviews and thereby did not have an opportunity to establish rapport with participants. Having rapport with participants and collecting data can create a rich context for data analysis, which is not possible when using secondary data. To help address this limitation, the principal author sought guidance and wrote this article with those involved in the original study's primary data collection phase.

Similarly, the principal author did not have the opportunity to further explore potential emerging themes, probe or ask additional questions. The original study was conducted with different research questions in mind. While interview questions provided insight into this study's research questions, they were not targeted at eliciting accounts of family resiliency. For example, the original study did not thoroughly explore the macrosystem level factors that may have influenced family resilience. These macrosystem factors may include systemic and military cultural issues, such as the stigmatisation of mental illness and non-traditional family structures. These factors could prevent families from capitalising on or obtaining resources available to other families because they live in different social and geographic locations.<sup>35</sup> The noted importance of keeping families together and having extended family supports may be particular to Atlantic Canadian families and may not be reflective of MCT families generally. Future research can explore how these macrosystem forces shape how families cultivate resiliency during MCT and a mental health problem.

Exploring family resiliency based on accounts from individuals is also a limitation. Participants offered one perspective on familial experiences that may differ from their veteran partners or other family members. Future research could expand the current understanding of the cultivation of family resiliency during MCT by including the voices of CAF veterans and other family members. Future research could also enhance this understanding by attending to the voices of children and parents of veterans, males and LGBTQIA2+ individuals. As a result of gender ideologies and differing familial roles, these groups can offer insights into the familial MCT experience that may differ from those of intimate partners who are female, such as the individuals involved in this study.

### Conclusion

This article explores how veteran families can develop the capacity to withstand potential stressors associated with MCT and having a veteran family



member with a mental health problem. We employed a thematic analysis and a synthesis of military family resiliency literature to analyse interview data involving intimate partners of veterans in Atlantic Canada with a mental health problem who are going through MCT. An overarching theme was that formal supports could play a central role in cultivating family resiliency. Service providers and policymakers who promote the wellbeing of families should consider possible barriers to accessing social supports. When faced with the stressors associated with MCT and a veteran experiencing a mental health problem,

families can capitalise on resilience processes and intra-familial strengths while being shored up by an informal and formal social support network.

---

*Corresponding Author:*

Kaitlin Wynia Baluk, [wyniak@mcmaster.ca](mailto:wyniak@mcmaster.ca)

Authors: K Wynia Baluk<sup>1</sup>, D Norris<sup>2</sup>, K D Schwartz<sup>3</sup>, J Whelan<sup>2</sup>, H Cramm<sup>4</sup>

*Author Affiliations:*

1 McMaster University – Health, Aging and Society

2 Mount Saint Vincent University – Family Studies

3 University of Calgary - Educational Psychology,

4 Queen's University – Rehabilitation Therapy

## References

1. Blackburn D. Out of uniform: psychosocial issues experienced and coping mechanisms used by Veterans during the military-civilian transition. *J Mil Veteran Fam Health* 2017;3(1):62-69.
2. Cramm H, Norris D, Schwartz KD, et al. Impact of Canadian Armed Forces Veterans' mental health problems on the family during the Military to Civilian Transition. *Mil Behav Health* 2020;8(2):148-158.
3. Castro CA, Dursun S, MacLean MB, et al. Essential components for a successful military-to-civilian transition. In: Castro CA, Dursun S., editors. *Military Veteran Reintegration*. London, UK: Elsevier; 2019. p. 245-251.
4. Brunger H, Serrato J, Ogden J. "No man's land": the transition to civilian life. *J Aggress Confl Peace Res* 2013;5(2):86-100.
5. Albertson K. Relational legacies impacting on veteran transition from Military to Civilian Life: Trajectories of acquisition, loss, and reformulation of a sense of belonging. *Illn Crises Loss* 2019;27(4):255-273.
6. Koenig CJ, Maguen S, Monroy JD, et al. Facilitating culture-centered communication between health care providers and veterans transitioning from military deployment to civilian life. *Patient Educ Couns* 2014;95(3):414-420.
7. Redmond SA, Wilcox S., Campbell S, et al. A brief introduction to the military workplace culture. *Work* 2015;50(1):9-20.
8. Herman A, Yarwood R. From service to civilian: The geographies of veterans' post-military lives. *Geoforum* 2014;53:41-50.
9. Pease JL, Billera M, Gerard G. Military culture and the transition to civilian life: Suicide risk and other considerations. *Soc Work* 2016;61(1):83-86.
10. Thompson JM, Dursun S, VanTil L, et al. Group identity, difficult adjustment to civilian life, and suicidal ideation in Canadian Armed Forces Veterans: Life After Service Studies 2016. *J Mil Veteran Fam Health* 2019;5(2):100-114.
11. Hachey KK, Sudom K, Sweet J, et al. Transitioning from military to civilian life: The role of mastery and social support. *J Mil Veteran Fam Health* 2016;2(1):9-18.
12. Dekel R, Monson CM. Military-related posttraumatic stress disorder and family relations: Current knowledge and future directions. *Aggress Violent Behav* 2010;15(4):303-309.
13. Beks T. Walking on eggshells: The lived experience of partners of veterans with PTSD. *Qual Rep* 2016;21(4):645-660.
14. Marek L, D'Aniello C. Reintegration stress and family mental health: Implications for therapists working with reintegrating military families. *Contemp Fam Ther* 2014;36(4):443-451.
15. Dekel R, Goldblatt H, Keidar M, et al. Being a wife of a veteran with posttraumatic stress disorder. *Fam Relat* 2005;54(1):24-36.
16. Sayers SL, Farrow VA, Ross J, Oslin DW. Family problems among recently returned military veterans referred for a mental health evaluation. *J of Clin Psychiatry*. 2009;70(2):163.

17. Schwartz KD, Norris D, Cramm H, Tam-Seto L, Mahar A. Family members of Veterans with mental health problems: Seeking, finding, and accessing informal and formal supports during the military-to-civilian transition. *J Mil Veteran Fam Health* 2021;7(1):21-34.
18. VanTil L, Sweet J, Thompson J, et al. Well-being of Canadian regular force veterans, findings from the LASS 2016 survey. Charlottetown (PEI). Research Directorate, Veterans Affairs Canada; 2017. p.41. Available from: [http://publications.gc.ca/collections/collection\\_2017/acc-vac/V32-340-2017-eng.pdf](http://publications.gc.ca/collections/collection_2017/acc-vac/V32-340-2017-eng.pdf)
19. Walsh F. The concept of family resilience: crisis and challenge. *Fam Process* 1996;35(3):261-281.
20. Masten A. Resilience theory and research on children and families: Past, present, and promise. *J Fam Theory Rev* 2018;10(1):12-31.
21. Walsh F. Traumatic loss and major disasters: Strengthening family and community resilience. *Fam Process* 2007;46(2):207-227.
22. Patterson J. Integrating family resilience and family stress theory. *J Marriage Fam* 2002;64(2):349-360.
23. Henry CS, Sheffield Morris A, Harrist AW. Family resilience: Moving into the third wave. *Fam Relat* 2015;64(1):22-43.
24. Hawley DR, DeHaan L. Toward a definition of family resilience: Integrating life span and family perspectives. *Fam Process* 1996;3(3):283-298.
25. Meadows SO, Beckett MK, Bowling K, et al. Family resilience in the military: Definitions, models, and policies. *Rand Health Q* [internet] 2015 [cited 2020 Dec];5(3). Available from: <http://www.rand.org/t/rr470>
26. Cramm H, Norris D, Venedam S, et al. Towards a model of military family resiliency: A narrative review. *J Fam Theory Rev* 2018;10(3):620-640.
27. Bronfenbrenner U. Toward an experimental ecology of human development. *Am Psychol* 1977;32(7):513-531.
28. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3(2):77-101.
29. MAXQDA. Home [Internet]. Berlin (GM): VERBI Software; 2022 [cited 2022 Jan 7]. Available from: <https://www.maxqda.com>
30. Boss P. Family stress management: A contextual approach, 2nd ed. Thousand Oaks, CA: SAGE; 2002.
31. Macdermid Wadsworth SM. Family risk and resilience in the context of war and terrorism. *J Marriage Fam* 2010;72(3):537-556.
32. Bowen GL, Martin, JA. The resiliency model of role performance for service members, veterans, and their families: A focus on social connections and individual assets. *J Hum Behav Soc Environ* 2011;21(2):162-178.
33. Canadian Military Family Magazine. Home [Internet]. Petawawa (CAN): Canadian Military Family Life Magazine; 2022 [cited 2022 Jan 7]. Available from: <https://www.cmfmag.ca>
34. Australian Government Department of Defence. Defence Life Magazine [Internet]. Canberra (AU): Australian Government; 2022 [cited 2022 Jan 7]. Available from: <https://defence.gov.au/members-families/DFM/default.asp>
35. Shaw J, Mclean KC, Taylor B, et al. Beyond resilience: Why we need to look at systems too. *Psychol Violence* 2016;6(1):34-41.

# Changes in Stigmatising Beliefs and Help-Seeking Intentions Following a Recreational Peer-Based Program for Young People Affected by Military Associated Parental Mental Illness

*V Williams, F P Deane, C Giles, L Knight*

## Abstract

Children living in Defence families affected by parental mental illness face increased stressors, pressure for self-sufficiency and potential exposure to adverse outcomes, including future mental illness. Little is known about the impact of mental health early interventions on the help-seeking tendencies of military young people affected by parental mental illness. Similarly, the responsiveness of this cohort to peer-based mental health literacy interventions aimed to dispel misconceptions and stigmatising beliefs about mental illness and help-seeking is not well understood. The current study measured key aspects of belief-related mental health knowledge and intentions to seek help from a range of formal and informal sources of 236 Australian young people aged 7–18 years, living with parents affected by military-associated mental health problems. Findings suggest that young people in the Defence community are most likely to seek help from their parents and show changes in beliefs about mental illness and intentions to seek help from some help sources following a brief (2-hour) group intervention. Help-seeking intentions from telephone helplines increased for the cohort, and males were more inclined to seek help from a friend after intervention.

Limitations including the absence of a comparison or control group, issues in data measurement protocols and a need for long-term follow-up were future research directions.

**Keywords:** Youth; Mental health; Stigma; Help-seeking

## Introduction

Young people living in military families face novel complexities compared to those experienced by most of their peers.<sup>1</sup> These include adjustment to frequent relocations, disruption to friendships, education and community networks, reduced access to parenting resources of the non-deployed parent and stress among family relationships.<sup>2,3</sup> Within this context, attributes such as self-sufficiency and toughness are desirable for military-connected young people (and their parents)<sup>4</sup> and are reflected in stigmatised beliefs regarding mental illness that are frequently cited as barriers to help-seeking within the Defence community.<sup>5</sup>

Unsurprisingly, mental health service usage rates by military-connected individuals in need of support can be as low as 15%.<sup>6,7</sup> Prior unhelpful experiences with support providers who showed a limited understanding of military-specific issues and difficulty maintaining connection and trust with supports as a consequence of relocation are factors that further negate mental health help-seeking by those within the Defence community.<sup>5</sup> Reducing stigma and other barriers to help-seeking and increasing access to adequate mental health supports remain a key priority of the Australian Defence Force (ADF).<sup>7,8,9</sup>

Strengths and resilience factors are noted for young people living in military-connected families amid an overall increased risk of mental health and other adverse outcomes.<sup>10</sup> The risks are compounded for young people living with parents who experience a military-associated mental illness.<sup>10, 4</sup> In the general community, parental mental illness affects about one in five children.<sup>11</sup> Recent data collected in relation to ADF families suggest a 12-month prevalence of mental illness in recently transitioned (ex-serving) personnel of 46%.<sup>12</sup> Post-traumatic stress disorder (PTSD) is a complex mental health condition specifically noted within the military context, frequently occurring with one or more other mental health conditions.<sup>13</sup>

Children who experience parental mental illness face an increased risk of social isolation, disrupted parent-child relationships, carer's responsibilities, academic difficulties, emotional and behavioural issues, and a higher likelihood of personal mental illness.<sup>11,13</sup> Therefore, the provision of programs and supports aiming to reduce these risks by intervening early and effectively is a necessary endeavour.<sup>14</sup> A systematic review regarding the impact of mental health early interventions for young people affected by parental mental illness reported a 40% reduction of risks for those receiving interventions, including reduced evidence of internalising and externalising problems compared to young people who did not receive intervention.<sup>15</sup>

According to Jorm and colleagues, the concept of mental health literacy is a key aspect of effective mental health early intervention.<sup>16</sup> Mental health literacy refers to an individual's ability to recognise mental health problems and maintain helpful attitudes and skills to enable effective help-seeking.<sup>16</sup> Previous research has indicated those with higher levels of mental health literacy are more likely to seek help early and appropriately for emerging mental health issues.<sup>17</sup> Help-seeking is described as an active form of coping involving communication with others in response to distress or a perceived problem, with the aim of recovery or reducing the problem.<sup>18</sup>

Interventions delivered to young people across the past decade have integrated psychoeducation and peer-group formats endorsed by program participant groups.<sup>19</sup> One example of a peer intervention is the CHAMPS program that has been delivered in Australia.<sup>20</sup> There is a paucity of research relating to the impacts of such interventions for military-connected young people affected by parental mental illness who present unique and complex intervention needs as a cohort. It is plausible that the barriers to engagement with mental health early intervention

are magnified for military-connected young people, given the specific stigma and related factors outlined above. Extending current peer-group programs by grouping participants with peers who share a Defence community background and embedding the interventions within a recreation-camp format may support greater engagement of this hard-to-reach cohort of young people.

The current study was exploratory and sought to gather feedback on the help-seeking intentions of young people (aged 7–18 years) whose parents experience military-service associated mental illness collected before and after intervention. Additionally, we explored whether young people from a designated military cohort experience changes in mental health knowledge related to myths and misconceptions about mental illness by comparing pre- and post-intervention feedback. We hypothesised there would be improvements in mental health knowledge and help-seeking intentions from pre- to post-camp assessments. Gender effects were assessed for changes in help-seeking intentions, with positive changes hypothesised as less likely for males who are reluctant help-seekers in general<sup>21</sup> and potentially more so within the context of self-sufficiency noted in Defence communities.<sup>4,5</sup>

## Materials and methods

### Participants

The sample comprised 236 young people aged 7–18 years ( $M = 11.59$ ,  $SD = 2.48$ ) from four Australian states/territories (NSW 64.2%, QLD 12.1%, ACT 17.7%, and NT 6.0%). All were participants in the Australian Kookaburra Kids Foundation (AKKF) 'Defence Kids' 2-day camp program between February 2017 and December 2019. Young people from ex-serving (44%) and serving (56%) Defence families were referred by their parents to the Defence Kids program. Invitation to participate in the evaluation research was voluntary, with participation having no bearing on program inclusion or access to any AKKF service or support. Parent and participant consent prior to commencement was required for inclusion in the study, and individual consent from each young person at the time of data collection. Data were collected from 89% of the program attendees. Proportionally, 59.7% of the sample identified as female, 39.6% male and 0.7% as other. The intervention components were delivered to age-matched participant groups to ensure content was developmentally relevant, with the percentages of participants in each age category presented in Table 1.

**Table 1. Participant number and percentage by age category**

Age category (years)	N	Per cent (%)
7-9	49	20.8
10-12	84	35.6
13-15	58	24.6
16-18	15	6.4
Missing	30	12.7

### Design and measures

The study received ethical approval from the Department of Defence and Veterans' Affairs Human Research Ethics Committee (ID 028-18) and adopted a pre-post design investigating variables of mental health knowledge and help-seeking intentions. The measures were selected based on evidence of their use in previous research. In the case of the mental health knowledge measure (Children's Knowledge Scale of Mental Illness, 23), the measure was derived from specific feedback from young people living in families affected by parental mental illness regarding unhelpful stigmatising myths and misconceptions of mental illness, therefore explicitly deemed relevant to the current study. Measures were scored as per published methods, with higher scores representing more of the measured attribute. Participant experience items, including satisfaction with the program and intent to continue, were also administered. Table 2 provides descriptions and references for the study measures (excluding client experience items).

### Procedure

Participants were administered the study measures shortly after arriving at the Defence Kids camp and again at the end of camp. The intervention was delivered in two 1-hour long 'Chat Groups' on Saturday and Sunday morning, comprising two trained facilitators and age and gender-matched participants in groups of 8–10. Participants undertook a range of other social and recreational activities (e.g., canoeing, art/crafts, giant rope swing, meals) while grouped with the same peers and facilitators from their Chat Group. Interventions were delivered by trained AKKF personnel who work from standardised Chat Group Facilitator Manuals with delivery methods adapted to match the age group of participants. Facilitators are AKKF employees, volunteers and mental health qualified clinical consultants aged 21 years who have received formal program induction and training, and are eligible to work with children (i.e., have successfully completed working with children and police checks). Participants work from and receive a take-home resource ('Kookabook') adapted to the developmental stage and aimed at promoting intervention consistency and generalisability. Chat Group content and activities comprised evidence-based mental health literacy components including psychoeducation and skills-building to promote active help-seeking. Table 3 details the aims, approaches and examples of differentiation of early intervention components in Chat Groups.

Onsite support to participants, including proactive check-ins with Chat Groups, in-the-moment support to manage emotional distress and triage acute needs, and liaison to support referral of any ongoing mental health needs, were provided for the duration of the camp program by the mental health qualified

**Table 2. Study measures, references and internal consistency (Cronbach's Alpha) values**

Dependent variable	Measure	Description and information
Mental health knowledge	Children's Knowledge Scale of Mental Illness <sup>18</sup>	7-item measure with response format (true, false, don't know) tapping young people's knowledge of unhelpful myths and misconceptions experienced by children whose parents have a mental illness. Sample items include, 'A mental illness can be caught by the flu', or 'Many parents get a mental illness because of the way their children behave'. Authors: Grove, Reupert & Maybery, 2015.
Help-seeking intentions	General Help-Seeking Questionnaire <sup>19</sup>	An 11-item scale asking respondents, 'If you were having a personal or emotional problem, how likely is it that you would seek help from the following people?' Responses are made using a 7-point scale from 'extremely unlikely' to 'extremely likely'. Used extensively > 10 research projects investigating help-seeking intentions. Authors Wilson, Deane, Ciarrochi & Rickwood, 2005.



**Table 3 Overview of the aim, methods and sample differentiations within the manualised Chat Group early intervention component of Defence Kids**

Therapeutic aim/intent	Intervention/method	Differentiation samples
<p>Access to a safe, relatable peer social context</p> <p>Opportunity for supported and successful peer interaction</p> <p>Proactive and scaffolded opportunity to communicate about mental health and wellbeing</p> <p>Provision of developmentally relevant knowledge and skills-building opportunities</p> <p>Opportunity for exploration and growth in healthy help-seeking attitudes and behaviours</p> <p>Durable and ongoing opportunity to 'sub-clinical' mental health support, triage and referral-on opportunities as needed</p>	<p>Didactic and interactional teaching (psycho-education)</p> <p>Direct instruction</p> <p>Skills modelling</p> <p>Social narratives</p> <p>Scripting</p> <p>Cognitive-behavioural interventions</p> <p>Self-management</p> <p>Peer-mediated instruction and intervention</p> <p>Reinforcement</p> <p>Clinical triage</p> <p>In-vivo clinical support (as required)</p>	<p>Activity: 'Identifying signs and symptoms of mental illnesses'.</p> <p>In this activity, young people learn about symptoms associated with a range of mental illnesses and apply their knowledge via an interactive activity.</p> <p>It utilises psychoeducation (didactic and interactional teaching), peer-mediated instruction and intervention, and reinforcement.</p> <p>To apply and demonstrate their knowledge, young people listen to a symptom/characteristic and move to a placeholder label (e.g., depression) to indicate their response. Questions (peer-led) and conversation to clarify and deepen understanding is facilitated around the response activity.</p> <p>Differentiation 1: Males</p> <p>Increased activity and physicalisation is provided by the differentiation.</p> <p>Individuals each stand at a placeholder. A ball is provided to one participant, when the symptom/characteristic is described the ball-holder throws (or rolls) the ball to the person standing at the appropriate place.</p> <p>Differentiation 2: Developmental stage (age)</p> <p>Individuals from older age groups tend to engage less with this active task than younger participants.</p> <p>An option to allow interactional learning but reduce physical mobility is to equip participants with 'true'/'false' cards or flags. The facilitator reads out symptom/characteristic and raises a placeholder label. The participating young people signal either 'true' or 'false' that the symptom matches the indicated placeholder/label.</p>

**Table 4. Pre- and post-test means and rank order for mental health knowledge and help seeking intentions from different sources**

	Pre-test			Post-test			
Variable	Mean	Rank	SEM	Mean	Rank	SEM	n
Mental health knowledge	4.79	na <sup>b</sup>	0.18	5.89	na	0.13	123
Intentions to seek help							
Friend	4.78	2	0.17	4.66	2	0.16	111
Parent	5.20	1	0.19	5.26	1	0.18	110
Other relative	4.57	3	0.17	4.23	4	0.18	107
Teacher	3.45	6.5	0.18	3.24	8	0.18	109
Other adult (e.g. coach)	3.22	8	0.16	3.14	9	0.15	112
School welfare team	3.54	5	0.17	3.33	7	0.17	111
Mental health professional	4.16	4	0.19	4.24	3	0.16	112
Phone helpline	3.06	9	0.17	3.82	5	0.17	112
Doctor/GP	3.45	6.5	0.19	3.54	6	0.17	101
Religious leader/chaplain	2.25	10	0.16	2.29	10	0.15	111
No one <sup>a</sup>	2.53	na	0.19	2.57	na	0.18	108
<p>Note: Minor variation in sample sizes for each variable due to missing data resulting ranging from n = 101 to n= 123,</p> <p><sup>a</sup> indicates reverse scored item with scores closer to 1 indicating higher help seeking intentions <sup>b</sup> "na" indicates not applicable.</p>							

clinical consultants. Across the programs described here, targeted support by clinical consultants was provided to 16% of participants.

## Results

Data from hand-written questionnaires were entered and analysed using IBM SPSS. Participant experience feedback indicated 89% experienced the Defence Kids program as 'good' or 'great', with 90% endorsing 'yes' to return to the program and likely to recommend it to a friend or someone else with similar needs.

Items from the Children's Mental Health Knowledge Scale were recoded to reflect 'correct' or 'incorrect' responses, with scores of 7 indicating correct responses on all items. Mean scores for total mental health knowledge were created for pre- and post-responses and each help-seeking item. Paired samples *t*-tests were used to determine whether hypothesised changes in dependent variables were evident. Table 4 presents the mean scores before and after intervention along with findings of paired *t*-tests for significance. There was a significant increase in mental health knowledge from pre- to post-test,  $t(123) = -5.90, p < .01$ .

A 2 (pre-post) by 2 (gender) mixed ANOVA with age entered as a covariate was calculated for all intentions items. Given that only one participant indicated they identified as neither male nor female, this case was excluded from the analysis. There were also four cases for which data for gender were missing. Prior to analyses, assumptions were tested. There were only two significant ANOVAs; for intentions to seek help from friends and a

helpline. Intentions to seek help from 'friends' had a moderate negative skew at both pre- and post-test time points. The variable was squared, resulting in the transformed variable meeting the normality assumption. Intentions to seek help from a helpline were normally distributed at both time points and did not require transformation. The results for intentions to seek help from friends were highly similar for the transformed and untransformed variables, so results from the untransformed variables are reported for ease of interpretation. For both analyses Box's test was nonsignificant, and both met the assumption of sphericity (Bartlett's test). Levene's test was also nonsignificant, indicating analyses met the assumption of homogeneity of variances.

There was a significant time by gender interaction for intentions to seek help from a friend,  $F(1, 101) = 9.88, p = .002$ . Means and standard deviations are provided in Table 5. This indicates that males increased their intentions over time while females decreased their intentions to seek help from friends over time.

For intentions to seek help from a helpline there was no significant interaction effect ( $F(1, 102) = 0.99, p = .32$ ) but there was a significant main effect for time ( $F = (1, 102) = 14.46, p < .001$ ). This indicated a significant increase in intentions to seek help from a helpline over time.

There were no other statistically significant effects on intentions to seek help for any of the other eight help sources.

In theory, an increase in mental health knowledge may contribute to increased help-seeking intentions. In order to explore the relationship between changes in mental health knowledge and changes in help-

**Table 5. Means and standard deviations for help seeking intentions which were significant in time by gender ANOVAs**

		Pre-test		Post-test	
Help-seeking intentions	N	Mean	SD	Mean	SD
Friends					
Males	41	4.27	1.88	4.83	1.65
Females	63	4.98	1.72	4.56	1.75
Helpline					
Males	41	3.12	1.76	4.12	1.78

seeking intentions, change scores were calculated by subtracting the pre-test scores from post-test scores for total mental health knowledge measure and for help-seeking intentions from each source (and no-one). Only one of the 11 Spearman's correlations was significant between changes in mental health knowledge and intentions to seek help from a school welfare officer or school nurse ( $r(110) = .27, p = .002$  [1-tailed]). This is a small to moderate positive relationship indicating that improvements in mental health knowledge are associated with increases in help-seeking intentions from school welfare officers or school nurses.

## Discussion

Support was found for hypothesised improvements in mental health knowledge throughout the peer support group. The mental health knowledge measure captures the capacity of young people to correctly identify misconceptions and unhelpful beliefs about mental illness known to be relevant to this cohort (i.e., children whose parents are living with mental illness). This change occurred over a relatively brief mental health intervention (i.e., 2 x 1-hour sessions). Without a control group, we cannot causally attribute such changes to the intervention; however, these initial correlational findings are promising.

Potentially, such changes in this element of mental health literacy could positively impact the developmental and psychological trajectory of young people in this cohort who may have otherwise retained inaccurate beliefs such as 'many parents get a mental illness because of how their children behave' or 'I am probably the only person in my school who has a parent with a mental illness'. Previous research, including economic modelling research on mental health early interventions, suggests the impact of these changed beliefs may be substantial and lifelong for the young people themselves and the broader community.<sup>15,18</sup>

Our results indicate that young people living with parents affected by military-associated mental health problems are most likely to seek help from their parents, followed by friends, other relatives and then a mental health professional. This order appears to remain relatively stable from pre- to post-test. Previous research has highlighted Defence communities' close-knit and self-sufficient nature due to active service challenges. The findings highlight the critical importance of supporting positive help-seeking attitudes among military parents and the need for adequate resources to equip these parents in understanding and supporting their children in

times of need. While generalisability and familial information sharing are indirectly supported in the Defence Kids program, the findings demonstrate considerable scope for holistic family interventions, as highlighted in previous research.<sup>7,10</sup>

Reliable changes in help-seeking intentions following intervention were evident for only two help-seeking sources. The first was for telephone helplines (such as Kids Helpline). There was no interaction effect for gender, with result patterns suggesting both males and females increased their intentions to seek help from this source. Although these changes cannot be causally attributed to the intervention, it is notable that one of the key Chat Group activities related to help-seeking focused on calling a helpline. This activity involved a real-time demonstration of placing a call to Kids Helpline. The skills demonstration, modelling and practice aimed to increase participants' generalisability and the likelihood of positive behavioural change. This result reminds us of the merit in skills demonstration and role-plays, which may be integrated with other aspects of Chat Group or similar early interventions for greater effect.

There was a significant time by gender interaction for intentions to seek help from a friend while controlling for the effects of age. Males have previously been indicated to deny the presence of mental health problems and feel compelled to keep problems to themselves.<sup>25</sup> In this study, males were significantly more inclined to seek help from a friend after the intervention than they were before. In contrast, females were slightly less likely to seek help from friends (but not significantly so when age was controlled). This finding may highlight the importance of cohort-specific peer groups in allowing males to gain confidence to discuss mental health and other topics that can be experienced as 'personal'. By sharing ideas and skill-building in a safe and relatable group, male participants may feel more confident and able to share with their 'everyday' friends. However, study limitations prevent more definitive conclusions regarding mechanisms of change and signal the need for further qualitative and follow-up research.

This research provides valuable preliminary insights into the impact of mental health literacy interventions and help-seeking intentions on a group of young people previously not studied. However, there are notable limitations in the current research, additional to those noted above. Data collection was hindered by a pen and paper methodology that may be burdensome for participants and lack suitability for the diverse ages of participants. A significant issue regarding the appropriateness of

the standardised measures for the younger children must be acknowledged. While all data was screened prior to manual entry and analysis, it is reasonable to acknowledge that younger participants did not have an equitable opportunity to present their feedback due to this limitation. Improvement of data collection protocol and processes is highlighted for future directions.

The current study is a real-world application of a mental health promotion program aimed at a target group of young people and, therefore, focused primarily on ensuring intervention delivery. The absence of a comparison or control group is a notable limitation of this study that needs to be addressed in future research (e.g., via a quasi-experimental replication of the current research, possibly utilising a time-delayed method). In addition, no information about the long-term impacts of the intervention is known, which highlights the need for longitudinal follow-up that addresses changes to actual help-

seeking behaviour. Future research addressing these issues will ensure continued progress in understanding and supporting the mental health early intervention needs of young people affected by military-associated parental mental health concerns.

## Acknowledgments

We would like to acknowledge the participation of Defence Kids and the support of their families. The dedication of AKKF volunteers in supporting the Defence Kids programs is also acknowledged, along with the support of key agencies, including the Department of Veterans' Affairs.

*Corresponding Author: Virginia Williams,  
[virginia.williams@kookaburrakids.org.au](mailto:virginia.williams@kookaburrakids.org.au)*

*Authors: V Williams<sup>1</sup>, F P Deane<sup>2</sup>, C Giles<sup>1</sup>, L Knight<sup>1</sup>*

*Author Affiliations:*

*1 Australian Kookaburra Kids Foundation - Research*

*2 Univeristy of Wollongong*

## References

1. Moore KD, Fairchild AJ, Wooten NR, Usar LG & Ng ZJ. Evaluating behavioural health interventions for military-connected youth: A systematised review. *Military Medicine*. 2017;182(11):1836-1845. Doi:10.7205/MILMED-D-17-00060
2. Puksar K, Sun R, Gleeson A, Lampi T, Nichols D & Khan N. MilTeen Chat App to promote coping resilience in military youth. *Journal of Military and Veterans Health*. 2018;26(1): 42-45
3. Williamson V, Stevelink SAM, Da Silva E, et al. A systematic review of wellbeing in children: a comparison of military and civilian families. *Child Adolesc Psychiatry Ment Health*. 2018;12(46). Available from: <https://doi.org/10.1186/s13034-018-0252-1>
4. Coleman SJ, Stevelink SAM, Hatch SL, Denny JA & Greenberg N. Stigma-related barriers and facilitators to help seeking for mental health issues in the armed forces: a systematic review and thematic synthesis of qualitative literature. *Psychological Medicine*. 2017;47:1880-1892.
5. Iverson AC, van Staden L, Hughes JH, Greenberg N, Hotopf M, Rona RJ, Thornicroft G, Wessely S, Fear NT. The stigma of mental health problems and other barriers to care in the UK Armed Forces. *BMC Health Services Research*. 2011;11(31)
6. Hooff MV, McFarlane AC, Davies CE, et al. The Australian Defence Force Mental Health Prevalence and Wellbeing Study: design and methods. *Eur J Psychotraumatol*. 2014;5. doi:10.3402/ejpt.v5.23950
7. Smart D, Muir S & Daraganova G. Family Wellbeing Study: Summary Report. Canberra: Department of Defence and Department of Veterans' Affairs, 2018
8. Dunt D. Review of Mental Health Care in the ADF and Transition Through Discharge. Department of Defence and Veterans Affairs; Commonwealth Government of Australia, 2009
9. Cederbaum JA, Gilreath TD, Benbenishty R, Astor RA, et al. Well-being and suicidal ideation of secondary students from military families. *Journal of Adolescent Health*. 2014;54. Available from: <https://dx.doi.org/10.1016/j.jadohealth.2013.09.006>
10. Reupert AE, Maybery DJ & Kowalenko NM. Children whose parents have a mental illness: Prevalence, need and treatment. *Medical Journal of Australia*. 2012;Suppl. 1:7-9. doi: 10.5694/mjao11.11200
11. Daraganova G, Smart D & Romaniuk H. Family Wellbeing Study: Part 1: Families of Current and Ex-Serving ADF Members: Health and Wellbeing. Canberra: Department of Defence and Department of Veterans' Affairs. 2018.

12. Plass-Christl A, Klasen F, Otto C, Barkmann C, Hölling H, Klein T, Wiegand-Grefe S, Schulte-Markwort M & Ravens-Sieberer U. Mental Health Care Use in Children of Parents with Mental Health Problems: Results of the BELLA Study. *Child Psychiatry and Human Development*. 2017;1-10. doi: 10.1007/s10578-017-0721-4
13. McGaw V, Reupert A & Maybery D. Military PTSD: A qualitative systematic review of the experience of families, parents and children. *Journal of Child and Family Studies*. 2019;28(11):2942-2952.
14. Siegenthaler E, Munder T, Egger M. Effect of preventive interventions in mentally ill parents on the mental health of the offspring: systematic review and meta-analysis. *J Am Acad Child Adolesc Psychiatry*. 2012;51:8-17
15. Jorm AF. Why We Need the Concept of "Mental Health Literacy", *Health Communication*. 2015;30(12):1166-1168. Available from: <https://doi.org/10.1080/10410236.2015.1037423>
16. Rickwood D, Deane, FP, Wilson CJ & Ciarrochi J. Young people's help seeking for mental health problems. *Australian e-Journal for the Advancement of Mental Health*. 2005;4(3):1-34
17. Ratnayake P & Hyde C. Mental health literacy, help-seeking behaviour and wellbeing in young people: Implications for practice. *Educational and Developmental Psychologist*. 2019;36(1):16-21. Available from: <https://doi.org/10.1017/edp.2019.1>
18. Gladstone BM, Boydell KM, Seeman MV & McKeever PD. Children's experiences of parental mental illness: a literature review. *Early Intervention in Psychiatry*. 2011;5:271-289. Available from: <https://doi.org/10.1111/j.1751-7893.2011.00287.x>
19. Goodyear M, Cuff R, Maybery D & Reupert A. Champs, *Australian e-Journal for the Advancement of Mental Health*. 2009;8(3):296-304. DOI:10.5172/jamh.8.3.296
20. Addis M & Mahalik J. Men, masculinity, and the contexts of help seeking (Abstract). *The American Psychologist*. 2003;58(1):5-14. Available from: <https://doi.org/10.1037/0003-066X.58.1.5>
21. Bale J, Grove C & Costello S. Building a mental health literacy model and verbal scale for children: Results of a Delphi study. *Children and Youth Services Review*. 2020;109(104667). Available from: <https://doi.org/10.1016/j.childyouth.2019.104667>
22. Grove C, Reupert A & Mayberry D. Peer connections as an intervention with children of families where a parent has a mental illness: Moving towards an understanding of the process of change. *Children and Youth Services Review*. 2015;48:177-185.
23. Wilson D, Deane FP, Ciarrochi J & Rickwood D. Measuring help-seeking intentions: properties of the General Help-Seeking Questionnaire. *Canadian Journal of Counselling*. 2005;39(1):15-28.
24. Hisle-Gorman E, Harrington D, Nylund CM, Tercyak KP, Anthony BJ & Gorman GH. Impact of parents wartime military deployment and injury on young children's safety and mental health. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2015;54(4):294-301
25. Ogrodniczuk JS, Oliffe JL & Black N. Canadian Men's Perspectives of Depression: Awareness and Intention to Seek Help. *American Journal of Men's Health*. 2017;11(4):877-879. <https://doi.org/10.1177/1557988316669617>



# 'More Important Than Winning': a Retrospective Online Research Survey Evaluating the Effects of Participating in an Adaptive Sports Program for Wounded, Injured and Ill Australian Defence Force Veterans

A Lewis

## Abstract

**Background:** The Australian Defence Force (ADF) Adaptive Sports Program offers participation in recreational and competitive sports to wounded, injured or ill veterans to support rehabilitation, recovery and social reintegration. There has been limited research on the impact of sport participation on the physical and mental health and wellbeing of current and former serving ADF veterans.

**Purpose:** This study was designed to investigate the effects of adaptive sports program participation on individuals' physical and mental health and wellbeing.

**Material and methods:** Ethics approval was granted from the Departments of Defence and Veterans' Affairs Human Research Ethics Committee. A survey was sent to 210 ADF Adaptive Sports Program participants in training camps for preselection for the Invictus Games and Warrior Games 2018–2020. Survey questions invited participants to reflect on their involvement in the program over the previous 2 years.

**Results:** Responses were received from 29% of program participants. Among the 60 respondents, 78% reported greater engagement in physical activity after participation, and 89% reported that they had experienced a positive effect on their rehabilitation pathway.

**Conclusion:** These preliminary findings demonstrate that the Adaptive Sports Program increases physical activity and supports rehabilitation, recovery and reintegration for engaged participants competing in local and international events. However, further research is needed to identify outcomes in the wider group of program participants and confirm that the program is an effective strategy for supporting wounded, injured and ill veterans.

**Keywords:** wounded, injured and ill defence personnel; adaptive sports; physical activity; mental health; wellbeing; rehabilitation, recovery; reintegration.

**Conflict of interest:** Anna Lewis is a Specialist Reserve Physiotherapist Officer in the Royal Australian Air Force and receives wages for duties as Principal Research Investigator for the ADF Adaptive Sports Program. There are no other competing interests relevant to the writing and submission of this report.

### Introduction

In the Australian Defence Force (ADF), there are many positive outcomes and intangible benefits acquired during military service. Life in the military has a positive effect on the wellbeing of the vast majority of serving personnel. However, defence personnel may sustain both mental and physical injuries due to the unique nature of their service. Of the approximately 6000 personnel discharged from the ADF each year, an estimated 18% are discharged for medical reasons.<sup>1</sup>

Wounded, injured and ill ADF veterans can experience loss of identity, self-esteem, occupation and social connection after transitioning from Defence. The Australian Government Productivity Commission noted in its 2019 inquiry report<sup>1</sup> that '[W]hile most ADF members successfully transition and quickly re-establish civilian lives, some struggle to address the challenges they experience when they leave the military' and that 'sometimes the impacts of service do not become apparent until many years after discharge'. The inquiry recommended that Australia's veteran support system should be 'more focused on wellness and ability (not illness and disability)'.<sup>1</sup>

The Productivity Commission findings are supported by another review that notes the 'type, intensity and duration of service, along with the transition from full-time military to civilian life, may have a negative effect on veterans' wellbeing'.<sup>2</sup> These consequences, coupled with an increasing population of veterans, necessitate greater attention to the unique needs of veterans' physical, mental and social wellbeing through transition to civilian life.<sup>2</sup> Focusing on these attributes is consistent with the World Health Organization's definition of health as a 'state of complete physical, social and mental well-being and not merely the absence of disease or infirmity'.<sup>3</sup>

Physical activity is increasingly promoted in the rehabilitation of wounded, injured and ill defence veterans because of its physical and mental health benefits. Documented benefits include increased overall health, mood, energy levels and social engagement,<sup>4</sup> weight loss among the overweight and obese,<sup>4</sup> and behaviour changes (e.g. smoking cessation, reduction in alcohol use and reduction in angry outbursts).<sup>5</sup> Veterans also report important benefits of motivation, reduction in pain levels, and feelings of safety and connection during group exercise programs, due to the camaraderie experienced when engaging in a group.<sup>5</sup>

Adaptive sports are physical activities and sports either purpose-designed for people with a disability

or modified to accommodate people with a disability and their different ability levels while maintaining the integrity of the original sport.<sup>6,7</sup>

Since World War II, adaptive sports programs have been designed for the rehabilitation of wounded, injured and ill service members returning from combat, focusing on those with spinal cord injuries or amputations.<sup>6-8</sup> In the USA, the number of adaptive sports programs offered by the US Department of Veterans Affairs and community-based organisations increased in the early 2000s, in response to high rates of physical disabilities and post-traumatic stress disorder (PTSD) among military service people returning from conflicts in Iraq and Afghanistan.<sup>9</sup>

Reported benefits of adaptive sport for participants include building social networks, experiencing success, opportunities to positively compare themselves with others without disabilities, and a greater sense of normalcy.<sup>6</sup> Participation in adaptive sports has been demonstrated to improve quality of life in people with a range of disabilities, improve self-esteem, athletic identity and self-efficacy among people with spinal cord injuries, and improve balance in people with visual impairment.<sup>7</sup>

Among wounded, injured and ill veterans, participation in adaptive sports has been associated with significant reductions in total mood disturbance, tension, depression and anger, and a significant increase in vigour.<sup>9</sup> A study of US combat veterans with traumatic amputations sustained during military deployments between 2003 and 2013 found that those who participated in adaptive sports programs were more likely to report they enjoyed a meaningful life than those who did not participate.<sup>8</sup> Improvements in depression, sleep and quality of life have been reported among veterans with posttraumatic stress disorder (PTSD) participating in physical training,<sup>10</sup> while scuba diving has been associated with a reduction in social dysfunction and depressive symptoms among ex-military amputees experiencing comorbid anxiety and/or chronic psychological adjustment disorders.<sup>11</sup>

The ADF Sports Cell (ADFSC) was established in 2018 under the ADF Joint Capabilities Group.<sup>12</sup> The ADFSC provides the governance and structure to ensure integrity, transparency and accountability of the ADF Adaptive Sports Program, alongside the Conventional and Pacific Sports Programs. The Director-General ADF Sport commands the three programs through a program lead in each program who develops policy, objectives and their program's strategic direction.

Preceding this, the ADF Adaptive Sports Program was established in 2017 in response to the recognition that sport has a 'multiplying' effect on the recovery, rehabilitation and reintegration of wounded, injured and ill current serving veterans through a holistic and therapeutic approach. The ADF Adaptive Sports Program partners with Veteran Sport Australia, established as a legacy organisation following the Invictus Games in Sydney 2018,<sup>13</sup> and other organisations, and involves a wide range of sports within participants' communities. The program is designed to integrate the support systems of health, sport and social engagement to help wounded, injured and ill current and former serving personnel to succeed in their recovery and rehabilitation. The ADF recognises that participation in sport both supports physical and mental health and helps the Australian community develop a better understanding of the challenges faced by wounded, injured and ill veterans, particularly during the transition to civilian life.

This preliminary research study aims to provide insight into the effects of ADF Adaptive Sports Program participation on individuals' physical and mental health and wellbeing. This understanding will support the development of appropriate programs for wounded, injured and ill serving and former serving veterans, assist the program to prioritise appropriate resources to maximise benefits for participants, and inform further research.

## Materials and methods

### Study design

This cross-sectional study investigated health and wellbeing outcomes of participation in the ADF Adaptive Sports Program by wounded, ill and injured veterans from 2018 to 2020 through a retrospective survey. Consistent with the Roundtable of Australian Veterans' Ministers, the term 'veteran' with respect to the program is defined as current and former serving ADF personnel who have served at least one day in the ADF.<sup>1</sup>

### Ethics approval

Ethics approval was granted from the Department of Defence and Veterans' Affairs Human Research Ethics Committee on 27 June 2019 (Protocol Number 129-9). An amendment to permit the researchers to obtain free-text answers from participants was approved on 27 May 2020.

### Study personnel

Veterans who attended program events from 2018 to 2020 were invited to participate in the study. Wounded, injured and ill veterans who have been, or will be, discharged from the ADF due to a medical condition are eligible to participate in the ADF Adaptive Sports Program. Events included Invictus Games (Sydney 2018), the planned Hague 2020 games (postponed to 2022), Warrior Games USA (Colorado Springs 2018, Florida 2019) and domestic training camps for preselection. All participants (n=210) in these events were invited to enrol in the study.

### Survey questionnaire

A survey was designed to evaluate the effects of participation in the Adaptive Sports Program on health and wellbeing outcomes.

Part 1 consisted of 22 multiple-choice questions in a simple format that could be completed on a computer or mobile phone via the Qualtrics XM online survey platform (<https://www.qualtrics.com/au>).

Five questions collected information on serving status, gender, service, age at date of proposed discharge and number of deployments undertaken while actively serving. Six questions asked participants about their level of engagement in the ADF Adaptive Sports Program, their subjective evaluation of their rehabilitation progress while involved in the program, and their intention to continue participating in the program and other partnership programs such as Veteran Sport Australia.<sup>13</sup> These questions used a Likert scale. The remaining 11 questions asked about activities that promote or maintain health and wellbeing, including exercise, eating, social interaction and leisure for personal health. These questions were modelled on the Health Promoting Activities Scale (HPAS).<sup>14,15</sup> The HPAS has been validated in a large population of Australian women who care for a child with a disability or have a typically developing child. The HPAS has strong correlations with mental health<sup>14,15</sup> and physical activity.<sup>16</sup> Due to the unavailability of a scale validated in a military population, the HPAS was adapted for this descriptive study. The complete survey can be viewed in Table 1.

Part 2 invited free-text responses to two topics: '*What impact, if any, has the Adaptive Sports Program had on your rehabilitation pathway?*' and '*Please provide suggestions on how the Adaptive Sports Program could assist the rehabilitation of wounded, ill and injured (WII) veterans*'.

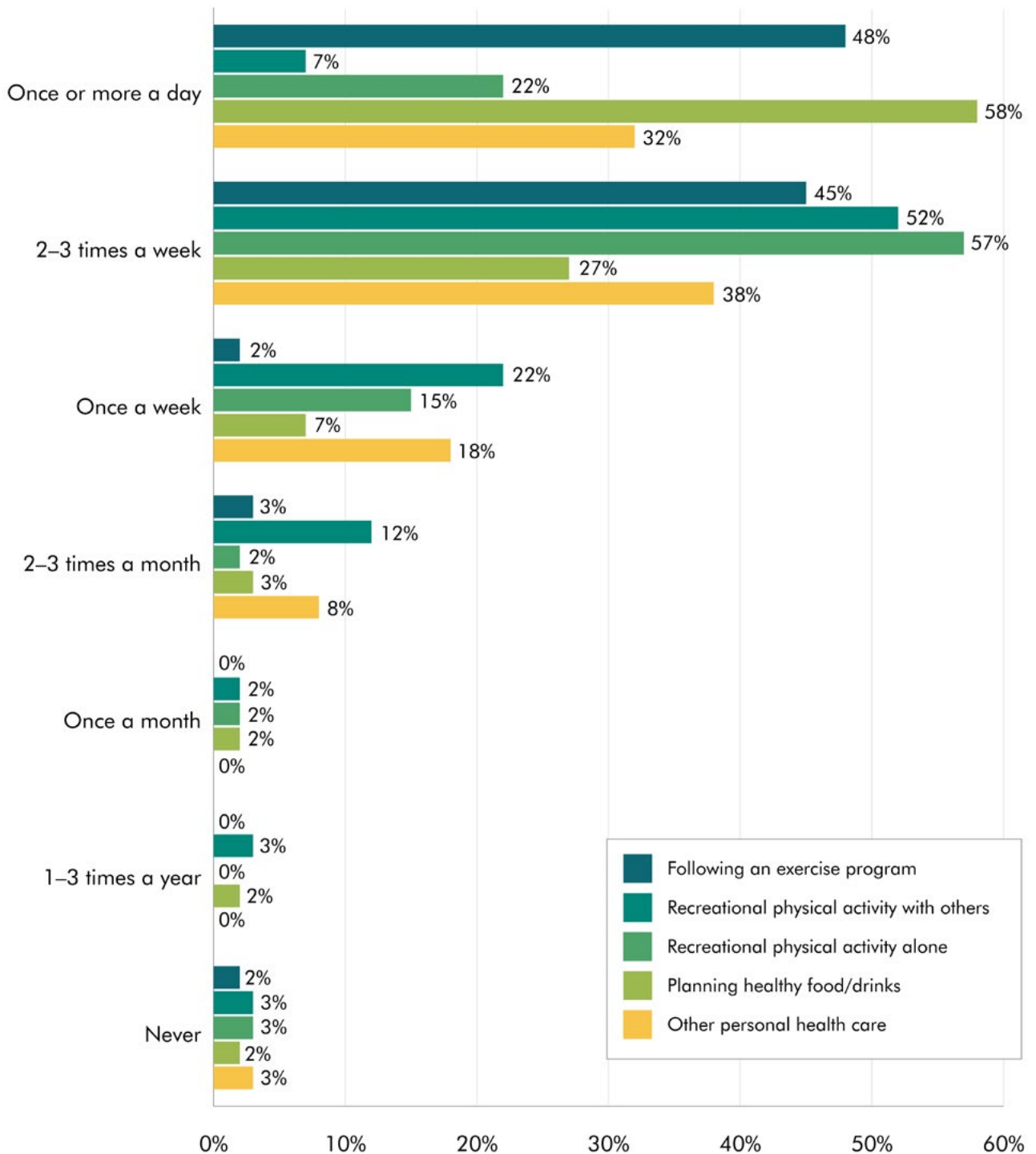
Table 1. Survey questions

Question	Responses choices
<b>Demographics</b>	
Are you a serving or ex-serving Australian Defence Force member?	Current serving member / Ex-serving member
What is your gender?	Male / Female / Identify as other / Prefer not to answer
Which service do you belong to?	Royal Australian Air Force / Royal Australian Navy / Australian Regular Army
How many deployments have you served on?	None/One/Two/Three or more
At what age will you/or did you discharge from the ADF?	18-24 / 25-34 / 35-44 / 45-54 / 55 and older
<b>Change in physical activity and rehabilitation</b>	
How much has your engagement in physical activity/ training changed since becoming involved in the Adaptive Sports Program (ASP)?	Much more than prior to the ASP / Somewhat more than prior to the ASP / No change / Somewhat less than prior to the ASP / Much less than prior to ASP
Since participating in the Adaptive Sports Program, to what extent have you been involved in a community-based sports program?	Much more / Somewhat more / About the same/Somewhat less / Much less
What effect has your involvement in the Adaptive Sports Program had on your rehabilitation from injury/illness?	Extremely positive / Somewhat positive / Neither positive nor negative / Somewhat negative / Extremely negative
<b>Future participation in adaptive sports</b>	
How likely are you to reapply for Adaptive Sports Programs in the future? e.g. Invictus Games, Warrior Games	Extremely likely / Somewhat likely / Neither likely nor unlikely / Somewhat unlikely / Extremely unlikely
How likely are you to approach organisations (e.g. Veteran Sport Australia, local RSL,* Soldier On,† or Mates for Mates‡) to be involved in the Adaptive Sports Program?	
How likely are you to recommend the ADF Adaptive Sports Program to other current or ex-serving ADF members?	
<b>Health and wellbeing self-care behaviours and social engagement</b>	
How often do you engage in personal health care tasks of planning to eat healthy food/drinks?	Once or more a day / 2-3 times a week / Once a week / 2-3 times a month / Once a month / 1-3 times a year / Never
How often do you engage in a physically active recreational pursuit that you do alone?	
How often do you engage in a physically active recreational pursuit that you do with other people?	
How often do you engage in spiritual or rejuvenating personal time?	
How often do you engage in social activities with people who are important to you?	
How often do you take time out for yourself to spend time as you wish?	
How often do you engage in a quiet, physically inactive leisure pursuit that you do alone?	
How often do you engage in a quiet, physically inactive leisure pursuit that you do with others?	
How often do you engage in social activities with people who are supportive towards you?	
How often do you engage in personal health care tasks of following an exercise program?	
How often do you engage in any other personal health care tasks?	

\* Returned and Services League of Australia; † Soldier On Australia, and Mates4Mates are charities supporting serving and former serving veterans and their families

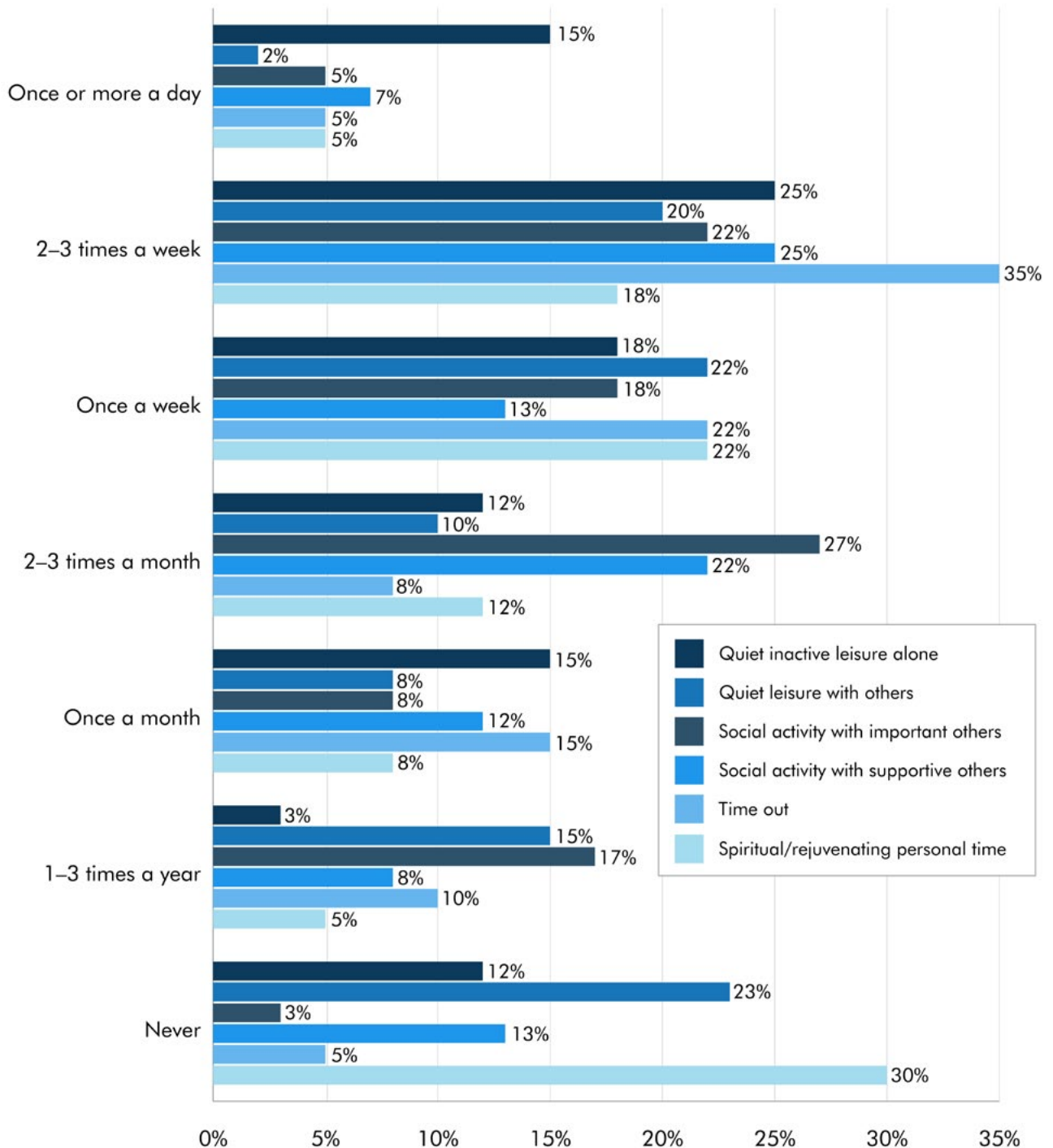
The order and format of questions have been adjusted, and question group headings added for publication. Terminology for self-care behaviours adapted from HPAS.<sup>16</sup>

**Figure 1. Items adapted from the Health Promoting Activities Scale - self-care behaviors, physical health and activity (n=60)**





**Figure 2: Items adapted from the Health Promoting Activities Scale - self-care, social activity and mental health (n=60)**



Analysis was performed on aggregated de-identified responses and presented as frequency distributions (Figures 1 and 2). Responses received for part 2 were collated according to common themes.

### Survey process

In September 2019, 210 Adaptive Sports Program participants were invited by email to participate in the research survey and were given an information and consent form explaining the aims of the study and how the data would be used. Enrolment in the survey was voluntary. In accordance with ethics requirements, each participant's information and consent form was signed by both the study participant and the Principal Research Investigator, then filed in a secure defence electronic filing system with all study correspondence.

Participants were invited by email to direct any queries or anxiety about the study to either the Principal Research Investigator, the Head Coach or the Director-General ADF Sport, whose contact details were provided.

Those who provided written consent to participate were sent a link to the online survey (Part 1). Reminders inviting participation in the study were sent in January and April 2020, with a closure date of 1 June 2020. The raw data report of de-identified responses was extracted from Qualtrics XM on 15 June 2020.

Following an amendment to ethics approval on 27 May 2020, a further survey (Part 2) was sent to those who had provided signed consent to participate in Part 1.

On completion of the research study, participants who indicated they would be interested in the study outcome will be given the opportunity to review the study results.

## Results

### Survey Part 1

Of 60 participants (29% of eligible participants) who provided consent to participate and responded to the first survey, the majority 78% (n=47) were male (Table 2). Sixty-seven per cent (n=40) were former serving members, and 68% (n=41) will transition from the ADF under 45 years. The majority 60% (n=36) were from the Australian Regular Army (ARA), with 23% (n=14) from the Royal Australian Navy (RAN) and 17% (n=10) from the Royal Australian Air Force (RAAF). A greater proportion of participants had served on three or more deployments, 45% (n=27) compared to no deployments 27% (n=16).

Responses measuring the extent of change in engagement in physical activity/training after participation in the ADF Adaptive Sports Program (Table 3) showed 47 participants (78%) engaged more: either 'much more' than before the program 40% (n=24) or 'somewhat more' than before the program 38% (n=23). Only one participant (2%) reported that they engaged in physical activity 'much less' than before the program. Significantly, 57% of participants reported an 'extremely positive' effect on rehabilitation from injury/illness through participation in the program and 32% reported a 'somewhat positive' effect. Most participants (61%) reported greater involvement in a community-based sports program: 14 (23%) reported 'much more' involvement and 23 (38%) 'somewhat more' involvement, while 19 participants (32%) reported 'about the same' involvement.

Results for the likelihood of reapplying for adaptive sports programs in the future (Table 4) showed 86% positive responses: 41 (68%) reported being 'extremely likely' and 11 (18%) 'somewhat likely'. Only three participants (5%) reported being 'extremely unlikely' to reapply for participation. Similar results were reported for likelihood of approaching other support organisations, (e.g. Veteran Sport Australia) to be involved in the program, with 85% positive responses: 32 (53%) participants reported being 'extremely likely' and 19 (32%) 'somewhat likely'. Only 4 (7%) participants reported they were 'extremely unlikely' to approach other organisations. Ninety-two per cent of participants reported they were likely to recommend the ADF Adaptive Sports Program to other veterans: 51 (85%) were 'extremely likely' and 4 (7%) 'somewhat likely'. One participant (2%) reported they were 'extremely unlikely' to recommend the program.

Responses to the questions adapted from the HPAS on post-program self-reported health and wellbeing self-care behaviours and social engagement are shown in Figures 1 and 2. The majority of participants reported a high level of self-care on all measures, including exercise: 29 (48%) participants reported that they followed an exercise program at least daily, and another 27 (45%) 2 to 3 times per week.

### Survey Part 2

Eight (13%) of the 60 participants who consented to the study responded to the second survey, which invited free-text responses. One survey was blank and therefore void. There were no responses to question 1 (impact of the program on individuals' rehabilitation).

**Table 2. Demographics of study participants (n=60)**

<b>Service status</b>	Current serving veterans 20 (33%)		Former serving veterans 40 (67%)		
<b>Gender</b>	Female 13 (22%)		Male 47 (78%)		
<b>Service</b>	Royal Australian Air Force 10 (17%)		Royal Australian Navy 14 (23%)	Australian Regular Army 36 (60%)	
<b>Deployments</b>	None 16 (27%)	One 10 (17%)	Two 7 (12%)	Three or more 27 (45%)	
<b>Age at discharge (years)</b>	18–24 0 (0%)	25–34 18 (30%)	35–44 23 (38%)	45–54 11 (18%)	55 and over 8 (13%)

**Table 3. Changes in physical activity and rehabilitation (n=60)**

Survey question	Response n (%)	
How much has your engagement in physical activity/training changed since becoming involved in the Adaptive Sports Program (ASP)?	Much more than prior to the ASP Somewhat more than prior to the ASP No change Somewhat less than prior to the ASP Much less than prior to ASP	24 (40%) 23 (38%) 10 (17%) 2 (3%) 1 (2%)
Since participating in the Adaptive Sports Program, to what extent have you been involved in a community-based sports program?	Much more Somewhat more About the same Somewhat less Much less	14 (23%) 23 (38%) 19 (32%) 2 (3%) 2 (3%)
What effect has your involvement in the Adaptive Sports Program had on your rehabilitation from injury/illness?	Extremely positive Somewhat positive Neither positive nor negative Somewhat negative Extremely negative	34 (57%) 19 (32%) 2 (3%) 4 (7%) 1 (2%)

**Table 4. Likelihood of future participation in adaptive sports (n=60)**

Survey question	Response n (%)	
How likely are you to reapply for Adaptive Sports Programs in the future? e.g. Invictus Games, Warrior Games	Extremely likely Somewhat likely Neither likely nor unlikely Somewhat unlikely Extremely unlikely	41 (68%) 11 (18%) 4 (7%) 1 (2%) 3 (5%)
How likely are you to approach organisations (e.g. Veteran Sport Australia, local RSL,* Soldier On,† Mates for Mates‡) to be involved in the Adaptive Sports Program?	Extremely likely Somewhat likely Neither likely nor unlikely Somewhat unlikely Extremely unlikely	32 (53%) 19 (32%) 3 (5%) 2 (3%) 4 (7%)
How likely are you to recommend the ADF Adaptive Sports Program to other current or former serving ADF members?	Extremely likely Somewhat likely Neither likely nor unlikely Somewhat unlikely Extremely unlikely	51 (85%) 4 (7%) 2 (3%) 2 (3%) 1 (2%)

\* Returned and Services League of Australia; † Soldier On Australia, and Mates4Mates are charities supporting serving and former serving veterans and their families

Responses to question 2 (suggestions for how the Adaptive Sports Program could assist rehabilitation of wounded, injured and ill veterans) ranged from one to several points. Themes included improving access to sporting activities and training equipment (4 participants)—for example, through subsidies or grants, placing greater emphasis on community sporting involvement (3 participants), and setting up a mentorship system (2 participants). Other suggestions included establishing links to health providers (e.g. nutritionists), and changes to program organisation such as competitive categories and selection criteria. One participant proposed that the selection process should place a greater emphasis on the program's potential to enhance an individual's rehabilitation.

Two responses encapsulated the aims of the program:

*Place more emphasis on the activity; participation and connections are more important than winning or being the best at something.*

*The program is about recovery and not winning medals...*

Some respondents also commented on the benefits of adaptive sports in general or the ADF Adaptive Sports Program:

*Having a team of other wounded veterans playing adaptive sports gives a safe place to talk to each other.*

*Adaptive sports give better chances of a level base line so despite variations of injury you can play the sport at the same level...*

### Adverse events

Throughout the conduct of this study, no adverse events occurred as a consequence of participation in this research study, as confirmed by regular interim reports submitted (as per the ethics guidelines) to the Departments of Defence and Veterans' Affairs Human Research Ethics Committee.

### Discussion

This survey was the first formal evaluation of the ADF Adaptive Sports Program. The findings are consistent with previous anecdotal feedback provided to staff at camps: that engagement in adaptive sports supports the rehabilitation of wounded, injured and ill veterans through stronger connections to their community.

Evidence supports the importance of the collective interconnection of the three key domains of physical, mental and social health and wellbeing.<sup>2</sup> Issues in

one or more of these domains, by default, become risk factors for issues in other domains. For example, Adaptive sports programs provide opportunities for health-promoting activity and help veterans experience the physical, emotional and social benefits of sport to enhance rehabilitation, recovery and reintegration.

A key objective of an effective transition from military to civilian life is the restoration of health and wellbeing through timely and effective rehabilitation, support and social integration.<sup>1</sup>

The findings of this preliminary study validate the program by demonstrating that, while it continues to evolve, 89% of participants reported a positive influence on their rehabilitation. Recommendations for program improvement include further engagement with stakeholder and partner organisation Veteran Sport Australia, which provides broader access to national programs to support wounded, injured and ill veterans and promotes their participation in sport within the community. Implementing and embracing a 'battle buddy' culture<sup>4</sup> within community sport has the potential to provide physical and emotional support for participants and their families.

Targeted program promotion to veterans discharging from ADF, particularly the 18% discharging for medical reasons,<sup>1</sup> with timely follow-up at designated intervals (e.g. at 3, 6 and 12 months), has the potential to engage veterans early in their transition and rehabilitation pathway. The ASP requires appropriate resources, financial and personnel, to support this. Providing veterans with funding through subsidies and grants could also facilitate engagement in community sport. Ongoing participation in community sport should precede enrolment in key events such as Invictus Games or Warrior Games.

Our findings are consistent with those of previous survey-based studies evaluating adaptive sports. A recent cross-sectional survey-based study by Lee-Hauser<sup>17</sup> found that participation in a large organised adaptive sports program, such as the US National Veterans Wheelchair Games, had positive associations with daily function, quality of life and community participation. Funding for further research evaluating the impact of community sport participation on the physical and mental health and wellbeing of ADF veterans is required. In particular, community sport not associated with major event selection should be targeted. An overarching research strategy plan developed between ADF and stakeholder organisations is critical to achieve better outcomes for ADF veterans.



### Evidence gaps

Other authors have noted important gaps in the evidence supporting adaptive sports for mainstream populations, particularly for wounded, injured and ill current and former serving veterans. A recent systematic review<sup>7</sup> noted that evidence for the effectiveness of adaptive sports activities and programs was limited to few sports and few populations (mainly people with PTSD, spinal cord injury, multiple sclerosis or cerebrovascular accidents), mainly from observational studies enrolling selected individuals. The same review noted that important outcomes such as self-esteem/perceived competence, community integration/social functioning and employment were infrequently reported.<sup>7</sup> Few studies have investigated factors affecting the effectiveness of adaptive sports activities or programs (e.g. frequency of duration of participation, demographic factors, type of sport or severity of disability).<sup>7</sup> Few studies have reported outcomes of adaptive sports programs for wounded, injured and ill defence services populations.<sup>17,18</sup> The findings of a recent study of US veterans participating in a sports clinic suggest that short-term benefits on depression, anxiety, social functioning and mood are lost at 3-month follow-up, suggesting that longer-term engagement in physical activity is needed.<sup>18</sup>

### Limitations of this study

A known limitation of this study is selection bias. The study participants were invited to participate retrospectively, and, therefore, the responses received may not be an accurate representation of all wounded, injured and ill veterans who participate in the ADF Adaptive Sports Program. A recent systematic review noted that this was a common shortcoming of research in this field, given that most evidence is from observational studies of people who had agreed to participate in programs.<sup>7</sup> Future surveys assessing the program should be conducted prior to team selection to avoid influencing or distorting responses.

Part of this survey was based on HPAS, a research tool that is psychometrically sound and clinically relevant but was validated for use in another population.<sup>14</sup> A validated research tool for assessing health and wellbeing outcomes developed for wounded, injured

and ill personnel is needed for comparative research in this population.

The second free-text survey was undertaken in response to informal and unsolicited written feedback from program participants, which could not be published without ethics approval. We expected to receive similar comments, which would be available for collation and analysis to guide future program decisions. The low response rate and the unexpected lack of response to the question about the impact of the program on individuals' rehabilitation might reflect participants' loss of engagement due to the time lag between the two phases, concerns that they might be identifiable from their responses, or disinclination to allow personal experiences to be published.

### Conclusion

These preliminary findings demonstrate that the ADF Adaptive Sports Program has positive outcomes on physical activity and supports rehabilitation for participants competing in local and international events. The program has an important role for current serving ADF personnel to support rehabilitation, recovery and reintegration. Further research is needed to identify outcomes in the wider group of program participants to ensure the sustainability and effectiveness of the program.

### Acknowledgements

This research project was funded by the ADF Sports Cell, supporting the reserve salary of the investigator, Dr Anna Lewis.

Dr Tavis Watt, Psychologist, assisted with the design of the research survey. Meducation Australia provided editorial assistance in preparing the manuscript.

---

*Corresponding Author: Anna Lewis,*  
[anna.lewis1@defence.gov.au](mailto:anna.lewis1@defence.gov.au)

*Authors: A Lewis<sup>1,2,3</sup>*

*Author Affiliations:*

*1 ADF – ASFSC Adaptive Sports Program*

*2 RAAF – 1EHS RAAF Base Amberley*

*3 Sports Focus Physiotherapy*

## References

1. Productivity Commission. A better way to support veterans. Overview and recommendations. Report no. 93. Canberra: Australian Government; 2019.
2. Oster C, Morello A, Venning A, et al. The health and wellbeing needs of veterans: a rapid review. *BMC Psychiatry* 2017;17:414.
3. World Health Organization. Constitution of the World Health Organization. Basic Documents, 45th ed., Supplement, October 2006. Geneva: WHO; 2006. Available from: [https://www.who.int/governance/eb/who\\_constitution\\_en.pdf](https://www.who.int/governance/eb/who_constitution_en.pdf).
4. Burgess AW, Thabault P, Kiernan L, et al. College Warrior Athlete Initiative and academic nursing. *J Am Coll Health* 2020;68:839-846.
5. Browne J, Medenblik A, Pebole M, et al. Qualitative analysis of a supervised exercise program for older veterans with PTSD. *Am J Geriatr Psychiatry* 2021;29:565-572.
6. Lee KK, Uihlein MJ. Adaptive sports in the rehabilitation of the disabled veterans. *Phys Med Rehabil Clin N Am* 2019;30:289-299.
7. Greer N, Balser D, McKenzie L, et al. Adaptive sports for disabled veterans. Washington (DC): US Department of Veterans Affairs; 2020.
8. Seay SV. Association between adaptive sports programs and quality of life among amputee veterans: Walden Dissertations and Doctoral Studies; 2018. Available from: <https://scholarworks.waldenu.edu/dissertations/4755>.
9. Lundberg N, Bennett J, Smith S. Outcomes of adaptive sports and recreation participation among veterans returning from combat with acquired disability. *Ther Recreation J* 2011;45:105-120.
10. Hall KS, Morey MC, Bosworth HB, et al. Pilot randomized controlled trial of exercise training for older veterans with PTSD. *J Behav Med* 2020;43:648-659.
11. Morgan A, Sinclair H, Tan A, et al. Can scuba diving offer therapeutic benefit to military veterans experiencing physical and psychological injuries as a result of combat? A service evaluation of Deptherapy UK. *Disabil Rehabil* 2019;41:2832-2840.
12. Australian Government Department of Defence Joint Capabilities Group. Australian Defence Force Sport [web page]. Canberra: Australian Government; [cited 2021 July]. Available from: [https://www.defence.gov.au/JCG/JSSD/ADF\\_Sport/](https://www.defence.gov.au/JCG/JSSD/ADF_Sport/).
13. Veteran Sport Australia. Veteran Sport Australia. The legacy organisation of the Invictus Games Sydney [Web page]. Sydney: VSA; [cited 2021 July]. Available from: <https://veteransport.org.au>.
14. Bourke-Taylor H, Law M, Howie L, et al. Initial development of the Health Promoting Activities Scale to measure the leisure participation of mothers of children with disabilities. *American Journal of Occupational Therapy* 2012;66:e1-e10.
15. Bourke-Taylor H, Lalor A, Farnworth L, et al. Further validation of the Health Promoting Activities Scale with mothers of typically developing children. *Aust Occup Ther J* 2014;61:308-315.
16. Muskett R, Bourke-Taylor HM, Hewitt A. (2017) Intrarater reliability of the Health Promoting Activities Scale. *American Journal of Occupational Therapy*, 71(4), 7104190010p1-7104190010p8.
17. Lee-Hauser CR, Schein RM, Schiappa VJ, et al. Demographic and functional characteristics of National Veterans Wheelchair Games participants: a cross-sectional study. *Mil Med* 2020.
18. Walter K, Otis N, Del Re L, et al. The National Veterans Summer Sport Clinic: change and duration of psychological outcomes. *Psychol Sport Exerc* 2021;55:101939.

# Physical and Morphological Component Normative Data Among Spanish Navy Students

*H Vila, I de Oliveira, J Burgos-Martos, J Cancela-Carral*

## Abstract

**Background:** The acquisition of normative percentile values for fitness could help understand fitness progression in relation to age and grade level and establish cut-off points for low fitness levels in a military population.

**Purpose:** To establish specific normative reference values by gender and academic year over five physical fitness tests taken by naval school cadets, using a nationally representative sample.

**Materials and methods:** 289 students enrolled in the military/civil bachelor's degree at the Naval Military Academy in Marin (265 male and 24 female) participated in this study. The design used was a descriptive-correlational cross-sectional study. Body composition data and results from the Spanish army physical fitness assessment system (2 min push-ups, 1000 m and 50 m races, vertical jump and 50 m swimming) were used. To establish normative values based on gender and the academic year in which the student officers of the Naval Academy are found, percentiles were identified for each of the components of physical fitness and morphology.

**Results:** The findings provide normative data on naval military cadets' physical condition and body composition by gender and academic year. The results showed that men performed better than women in speed (50 m running), upper and lower extremity strength, and cardiorespiratory fitness. Additionally, the results indicate that the higher the academic year, the better the physical condition.

**Conclusion:** These values are useful in the evaluation of this population and provide objective data regarding the maintenance of high levels of physical fitness and for the identification of individual training needs.

**Keywords:** Physical fitness; Normative values; BMI; Military personnel.

## Introduction

The ability of members of the military to develop and maintain high levels of fitness is crucial to their success in the different demands of their jobs.<sup>1, 2</sup> The most generalised method in different military environments worldwide for evaluating soldiers' physical fitness is the Basic Physical Condition Assessment, which combines evaluation of physical capacity with specific demands of the military work.<sup>3</sup> Normative data adjusted for age and sex are available in many countries.<sup>3, 4</sup> These values allow the performance of an individual soldier to be understood when compared to a reference population.

The Uniformed Services University of Health Sciences hosted a conference in June 2006 where several key issues were identified, including 'developing valid and standardised metrics for military personnel'.<sup>5</sup> Normative percentile values for fitness, specific to a military population, could be helpful in developing

a better understanding of fitness progression with age/grade level and could also help to inform the cut-off points established for low fitness levels over all academic years and by gender. In addition, objective measurements in an active population that undergoes year-round military training are important in determining individual fitness levels and in evaluating training programs.<sup>6</sup>

Normative data on physical capabilities are available, though this data focuses on athletes and other specialised populations and does not specifically identify with the military population.<sup>7-9</sup>

Few studies have produced normative data in military populations, and these are mainly oriented towards the risk of injury,<sup>10, 11</sup> and cognitive aspects.<sup>12, 13</sup> To our knowledge, no studies have been published generally for a comprehensive set of physical fitness tests in a military population, nor specifically in a Spanish military population. In addition, when

dealing with the military population, it is important to understand that, among the different armed forces—land, sea and air—cadets and future military professionals present different demands both during the officer training stage and after graduation from different positions reached by cadets. The Spanish Navy has 13 training academies that lead to different command posts. The Naval Military Academy of Marin is only for Naval officers, and it is currently composed of 475 students.

Therefore, the main objective of our study was to present normative reference values for five measures of physical fitness (1000 m, 50 m sprint, push-ups, vertical jump test and 50 m swimming) and of body composition through the body mass index (BMI), by gender and over the whole course of the subjects' academic training (academic years) in one of the most important naval academies in Spain.

## Methods

### Study design

This study was carried out with a quantitative approach, the type of research was descriptive-correlational with a cross-sectional component, and primary and secondary sources of information were used.

### Participants

The study population consisted of 475 Spanish officer students (Male 92%; Female 8%). The sample comprises students who were enrolled in the military / civil degree at the Naval Military Academy of Marin attached to the University of Vigo, during the 2018/2019 academic year. The recruitment period lasted from January to May 2019. Therefore, this study is descriptive to establish a frame of reference from which to work in relation to future officers' physical and morphological condition during their training at naval academies in Spain.

Based on a finite population of cadets who were enrolled in the Naval Military Academy of Marin, a calculation of the sample size was carried out. A total population of 475 student officers was considered, with a confidence level of 95%, a precision level of 98%, a proportion of 7% and an expected loss of 6%, resulting in a sample size of 287 student officers (23 females and 264 male).

As inclusion criteria, it was necessary for the cadets to remain active during the data collection process and to fully comply with all physical assessment tests. As exclusion criteria, any cadets who presented injuries that prevented them from carrying out their training during the academic year were not included.

All cadets who volunteered gave their informed written consent. This study complies with the Declaration of Helsinki regarding the treatment and collection of data.<sup>14</sup> The project was approved by the Ethics Committee of the Faculty of Education and Sports Sciences of the University of Vigo, whose code is CE: 03-719.

### Data collection and measurements

The data collection took place locally at the Naval Military Academy (Marin, Spain) at three different locations: on an athletics track (50 m and 1000 m), in a multipurpose room (vertical jump and push-ups), and a swimming pool (50 m swimming).

The same two test leaders conducted the testing during the study, using the same protocols and equipment over all the data collection periods. Testing was conducted over one week in May, in the morning before breakfast (6:00–7:30 a.m.), with the cadets having fasted overnight. The participants were allowed to drink water before testing. On the first day, the endurance tests (1000 m run) were carried out; on the second day, the swimming test; on the third day, the push-ups and vertical jump and on the fourth day, the 50 m sprint test. The subjects who could not attend on any of the previous days were tested on the fifth day. The anthropometric assessment (weight and height) was carried out in the multipurpose room over the five days before testing. Before carrying out the physical tests, the participants performed 15 minutes of specific warm-ups, oriented towards the physical condition tests that were going to be carried out. The physical condition evaluations were carried out by the same test leaders and physical education teachers from the Naval Academy who conducted these assessments for at least 2 years. The International Working Group of Kinanthropometry (ISAK) technicians carried out the anthropometric assessments.

A basic anthropometric assessment of weight (kg), height (m) and BMI was recorded. The anthropometric measurements followed the protocols of the ISAK<sup>15</sup>. Height was measured using a stadiometer (Model HR001, Tanita Corp., Amsterdam, Netherlands) to the nearest 5mm. Weight was measured using a Tanita (Model TBF300, Tanita Corp., Amsterdam, Netherlands) to the nearest 0.1kg. BMI was calculated by dividing weight by height squared ( $\text{kg}/\text{m}^2$ ).

For the evaluation of physical capacity, the *Sistema de Evaluación Física del Ejército de Tierra* (SEFIET) was used. This evaluation allows an individual physical profile (IPP) to be defined, composed of three digits corresponding to the levels achieved in each of the three traits or groups of physical qualities

(strength, stamina and speed). A Physical Condition Assessment (PCA)<sup>16</sup> was carried out, including the five tests (push-ups, 1000 m running, 50 m running, vertical jump, 50 m swimming) described before.

**2-minute push-ups:** Maximum amount of push-ups completed from a 90° elbow flexion position with hands and tips of toes on the floor. Push-up repetitions were recorded for 2 minutes.

**1000-metre race:** The race started in the standing position (one foot placed in front of the body, pointing directly towards the track; the other foot is placed back with the heel off the ground; and the body is slightly inclined forward) and after the 'ready and go' verbal command. The athletics track was clay with an extension of 400 m in ellipse format. The times taken to complete 1000 m were recorded in minutes and seconds. Times were recorded to an accuracy of a split second.

**50-metre race:** The race starts from the standing position and after the 'ready and go' verbal command as previously described. Time was recorded in seconds.

**Vertical jump:** The participants must establish their starting position by standing at 90° to a wall, with feet shoulder-width apart and arms with 180° shoulder flexion. The participant then performs a vertical jump (in two attempts) using the squat jump (SJ) test, their fingertips touching as high as possible on a ruled surface placed on the wall.

**50-metre swim:** The race starts in a standing position, and after the 'ready and go' verbal command, participants dive into the water from the edge. The distance must be completed using freestyle. Time

was measured in seconds to an accuracy of a split second.

## Data analysis

Descriptive statistics were generated for all study variables. The descriptive analysis was carried out globally and by stratifying the sample according to gender. The descriptive analysis was carried out using measures of central tendency (mean, standard deviations) and confidence interval. Graphic representations were made of each variable analysed, referencing the percentiles 10, 25, 50, 75 and 95 to analyse the behaviour of the variables under study over the 5 years of training. The significance level was set at  $P < 0.05$ . Statistical analyses were performed in IBM-SPSS v.25 (IBM Co., Armonk, NY).

## Results

Two-hundred and eighty-nine Spanish military cadets with a mean age of  $21.86 \pm 3.5$  years,  $176.1 \pm 7.53$  average height and  $73.41 \pm 9.18$  average body weight, participated in this study. The participation rate was higher than 96.3% of the enrolled students. The mean values of the military population are shown in Table 1. The number of military women is much lower than the number of men, and they have a higher average age. In the variables analysed (anthropometric and BMI), women present lower results than those recorded for men.

Tables 2 and 3 provide normative values as tabulated percentiles from 10% to 95% for the five fitness tests and for BMI, by gender and academic year, respectively.

**Table 1. Means and SD for physical fitness and morphological component normative values among Spanish Navy students**

	All (n=289)			Hombre (n=265)		Female (n=24)	
	mean	sd	CI (95%)	mean	sd	mean	sd
Age (years)	21,86	3,50	21,49 to 22,33	21,77	3,30	22,83	5,22
Height (cm)	176,10	7,53	175,34 to 177,13	177,16	6,81	164,50	4,83
Weight (Kg)	73,41	9,18	72,37 to 74,60	74,60	8,49	60,36	5,82
BMI (kg/m <sup>2</sup> )	23,63	2,17	23,35 to 23,88	23,75	2,14	22,33	2,21
1000 m running (min)	03:22,98	00:15,51	03:21,12 to 03:24,83	03:20,40	00:12,47	03:53,57	00:15,99
50 m running (s)	6,95	0,49	6,88 to 6,99	6,86	0,37	8,01	0,50
Push-ups (reps)	42,65	11,11	41,37 to 44,04	43,69	10,54	29,25	9,49
Vertical jump (cm)	55,22	6,65	54,53 to 56,11	56,19	5,79	43,15	4,70
50 m swimming (s)	37,78	6,01	37,13 to 38,58	37,23	5,64	45,05	5,80



Table 2. Percentile values summary statistics by gender among Spanish Navy students: Physical fitness and morphological component

	n	Percentiles											
		10	20	25	30	40	50	60	70	75	80	90	95
All same													
BMI (kg/m <sup>2</sup> )	289	20,15	21,25	21,68	22,00	22,50	22,90	23,25	23,80	24,23	24,75	26,15	27,76
1000 m running (min)	271	03:16,70	03:22,00	03:23,70	03:25,50	03:29,40	03:33,70	03:37,60	03:41,40	03:42,90	03:44,00	03:54,20	03:58,80
50 m running (s)	269	7,03	7,34	7,38	7,41	7,52	7,62	7,70	7,80	7,84	7,96	8,11	8,27
Push-ups (reps)	269	52,05	49,20	44,40	43,38	42,35	39,00	35,75	33,50	29,95	27,25	25,20	21,60
Vertical jump (cm)	269	57,73	56,15	55,00	54,25	52,95	51,50	49,50	48,10	46,55	45,88	45,50	42,45
50 m swimming (s)	269	34,45	36,50	36,83	37,30	38,90	41,00	42,50	43,50	44,30	45,30	47,50	49,18
Men													
BMI (kg/m <sup>2</sup> )	265	21,15	21,80	22,02	22,45	23,20	23,65	24,20	24,75	25,20	25,50	26,55	27,77
1000 m running (min)	249	03:00,30	03:05,00	03:08,00	03:10,00	03:13,00	03:17,00	03:20,00	03:25,00	03:27,00	03:28,40	03:35,70	03:39,00
50 m running (s)	249	6,65	6,80	6,86	6,90	7,00	7,09	7,19	7,30	7,31	7,40	7,50	7,66
Push-ups (reps)	249	63,00	58,00	54,80	53,00	52,00	48,00	43,50	41,00	39,30	36,00	33,00	27,80
Vertical jump (cm)	249	65,95	63,00	61,00	60,00	59,00	57,00	55,00	53,40	52,00	51,50	51,00	47,00
50 m swimming (s)	249	31,70	33,00	33,25	34,00	35,00	37,00	38,00	39,00	40,00	41,00	45,00	48,00
Women													
BMI (kg/m <sup>2</sup> )	24	19,15	20,70	21,35	21,55	21,80	22,15	22,30	22,85	23,25	24,00	25,75	27,75
1000 m running (min)	22	03:33,20	03:39,00	03:39,50	03:41,00	03:45,80	03:50,50	03:55,20	03:57,80	03:58,75	03:59,60	04:12,80	04:18,60
50 m running (s)	20	7,40	7,87	7,90	7,91	8,04	8,15	8,21	8,29	8,37	8,52	8,72	8,88
Push-ups (reps)	20	41,10	40,40	34,00	33,75	32,70	30,00	28,00	26,00	20,60	18,50	17,40	15,40
Vertical jump (cm)	20	49,50	49,30	49,00	48,50	46,90	46,00	44,00	42,80	41,10	40,25	40,00	37,90
50 m swimming (s)	20	37,20	40,00	40,40	40,60	42,80	45,00	47,00	48,00	48,60	49,60	50,00	50,35

Table 3. Percentile values summary statistics by academic level among Spanish Male Navy Students: Physical fitness and morphological component

	n	Percentiles												
		10	20	25	30	40	50	60	70	75	80	90	95	
1° Level														
BMI (kg/m²)	73	20.62	21.40	21.55	21.74	22.36	23.30	23.64	24.18	24.25	24.60	26.32	27.30	
1000 m running (min)	73	03:08.10	03:13.00	03:15.500	03:17.10	03:21.80	03:25.00	03:27.00	03:29.90	03:32.00	03:36.20	03:44.30	03:56.90	
50 m running (s)	73	6.50	6.60	6.70	6.80	7.00	7.10	7.20	7.30	7.40	7.50	7.80	8.20	
Push-ups (reps)	73	55.00	54.00	51.00	50.00	46.00	44.00	41.00	39.00	36.00	34.00	31.00	22.00	
Vertical jump (cm)	73	62.00	58.00	55.00	55.00	55.00	52.00	51.00	50.00	49.00	47.00	46.00	44.00	
50 m swimming (s)	73	32.60	35.00	35.50	36.00	37.00	38.00	39.00	40.00	41.00	43.80	48.40	59.30	
2° Level														
BMI (kg/m²)	50	20.76	21.50	21.60	21.80	22.50	23.00	23.20	24.00	24.30	24.68	25.70	26.58	
100 0m running (min)	45	03:02.00	03:11.00	03:12.00	03:13.00	03:19.00	03:21.50	03:25.00	03:29.00	03:30.00	03:32.00	03:44.00	04:10.00	
50 m running (s)	45	6.40	6.50	6.57	6.60	6.65	6.70	6.80	6.90	7.00	7.10	7.80	8.20	
Push-ups (reps)	45	63.00	60.00	56.00	53.00	51.00	49.00	42.00	41.00	37.00	36.00	35.00	28.00	
Vertical jump (cm)	45	69.00	66.00	62.00	61.00	60.00	58.00	57.00	56.00	54.00	52.00	51.00	44.00	
50 m swimming (s)	45	30.00	32.00	32.50	33.00	36.00	37.00	39.00	40.00	41.00	41.50	44.00	45.50	
3° Level														
BMI (kg/m²)	44	21.20	21.80	22.23	22.39	23.06	23.65	23.98	24.52	25.30	25.50	26.00	28.40	
1000 m running (min)	40	03:08.80	03:14.80	03:15.00	03:18.00	03:20.00	03:22.00	03:24.00	03:26.30	03:28.00	03:31.00	03:34.60	03:41.50	
50 m running (s)	40	6.38	6.40	6.45	6.50	6.60	6.70	6.80	6.90	7.00	7.10	7.40	7.60	
Push-ups (reps)	40	60.00	58.00	50.00	48.00	45.00	41.00	40.00	37.00	33.00	30.00	30.00	29.00	
Vertical jump (cm)	40	70.00	65.00	63.00	61.00	60.00	60.00	58.00	57.00	56.00	55.00	54.00	50.00	
50 m swimming (s)	40	31.90	33.00	33.70	34.70	36.00	38.00	39.40	40.00	41.00	41.50	44.50	54.10	
4° Level														
BMI (kg/m²)	57	20.72	22.00	22.10	22.46	23.60	24.10	24.92	25.22	25.50	26.10	27.30	28.00	
1000 m running (min)	54	02:59.60	03:06.40	03:09.20	03:11.00	03:14.20	03:19.00	03:22.00	03:23.10	03:25.00	03:27.00	03:29.70	03:33.40	
50 m running (s)	54	6.33	6.50	6.55	6.60	6.70	6.90	6.95	7.00	7.10	7.20	7.40	7.50	
Push-ups (reps)	54	63.00	60.00	55.00	54.00	50.00	45.00	43.00	40.00	39.00	34.00	33.00	30.00	
Vertical jump (cm)	54	68.00	66.00	62.00	61.00	60.00	59.00	58.00	57.00	56.00	55.00	54.00	53.00	
50 m swimming (s)	54	32.00	33.00	33.50	34.00	35.20	37.00	38.00	39.00	39.50	40.40	44.70	47.30	
5° Level														
BMI (kg/m²)	41	21.38	22.50	23.20	23.34	23.62	24.20	24.74	25.38	25.80	26.14	27.06	28.35	
1000 m running (min)	37	02:58.60	03:04.20	03:06.00	03:08.80	03:12.80	03:16.00	03:17.60	03:19.00	03:19.00	03:21.60	03:27.80	03:42.00	
50 m running (s)	37	6.36	6.42	6.50	6.55	6.70	6.80	6.90	7.00	7.10	7.20	7.30	7.50	
Push-ups (reps)	37	65.00	64.00	53.00	51.00	50.00	48.00	45.00	42.00	41.00	40.00	39.00	33.00	
Vertical jump (cm)	37	67.00	64.00	62.00	61.50	61.00	59.00	57.00	55.00	53.00	52.00	51.00	50.00	
50 m swimming (s)	37	29.60	31.00	32.00	32.50	35.00	36.00	36.50	37.00	37.50	37.80	40.00	40.50	

The results of all the variables analysed show that males obtain the best results. The variables of BMI, 1000 m running, push-ups and vertical jump show significant differences between P10 and P95 for both genders.

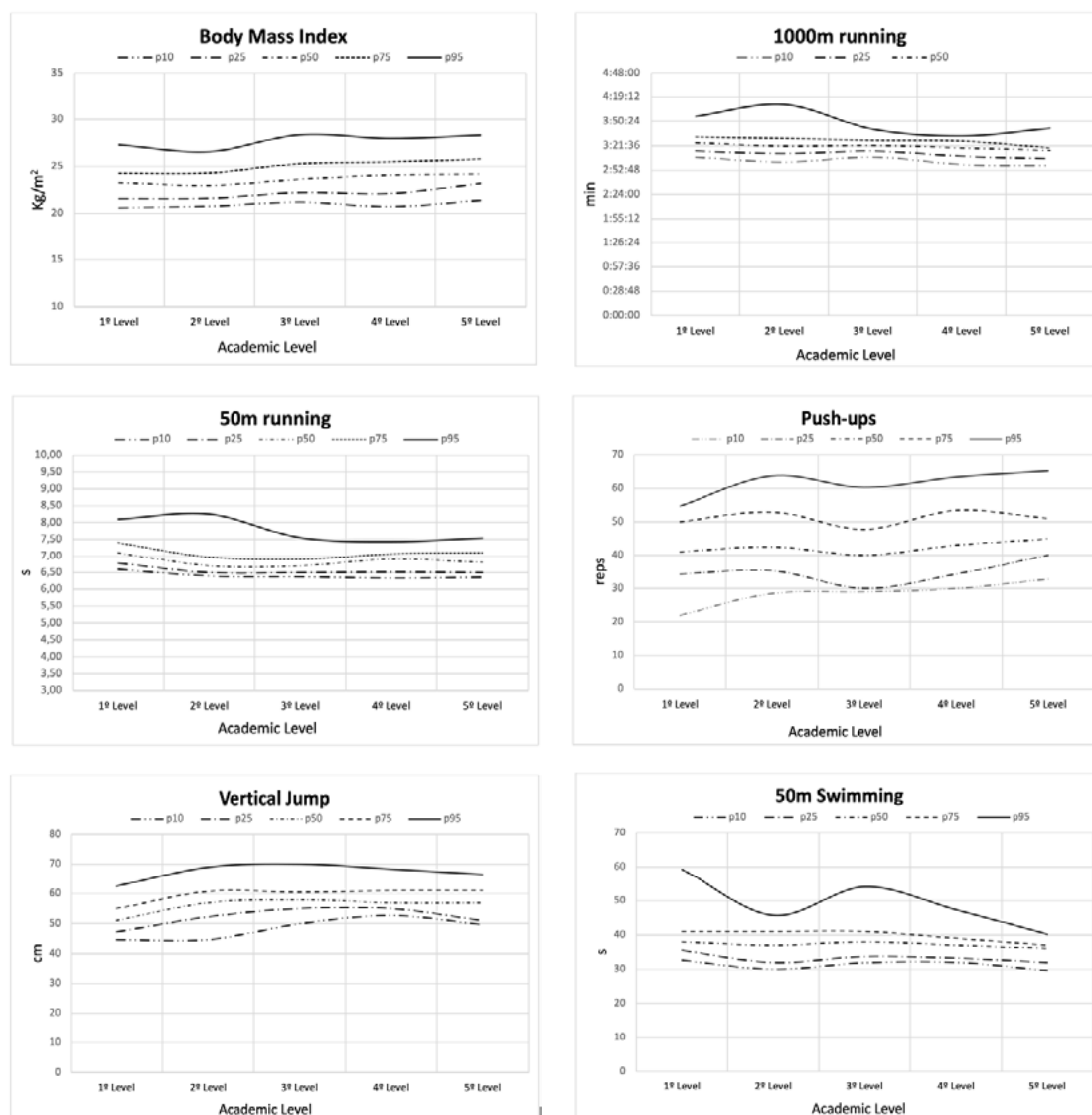
The results indicate that the higher the academic year, the better the subjects' physical condition. The behaviour of BMI does not follow clear lines, reaching values close to those of obesity at P95. Figure 1 shows the percentile curves (P10, P25, P50, P75 y P95) of body composition and physical capacities by academic year and for males. The BMI presents a trend of higher years, higher values. For the push-ups, undulating behaviour is demonstrated by year over all percentiles (except P10). In the evaluations of

running speed, the values show improvements in all percentiles from the first to the fifth year.

## Discussion

The main objectives of this study were to provide reference values for general physical condition and body composition by gender and academic year among naval military students. This study attempts to establish a frame of reference from which to work in relation to the physical and morphological condition of future officers in the training stage at naval academies in Spain. Our research provides objective data to help identify individual training needs and enable comparison with other populations of similar characteristics. The results showed that

**Figure 1.** Percentile curves (P10, P25, P50, P75 and P95) of BMI and physical abilities by academic level for males.



men performed better than women in speed (50m running), upper and lower extremity strength, and cardiorespiratory fitness. The results also reflect an improvement in the physical condition of military personnel throughout the training process.

Having normative values allows us to compare the evolution of the subjects over time and assess the need to update the conditional demands required for the performance of their professional duties. However, this is the first research study published examining a population with these characteristics. The main strength of this study, and in terms of the normative values provided here, is the strict standardisation of fieldwork (the tests and demands are the same) among the military community. However, this strength, in turn, does not allow us to compare the data of this sample with that of populations of similar age ranges (university students, athletes, etc.), since being tests designed by the Army,<sup>16</sup> no comparative values were found.

There is some overlap in the evaluated fields (aerobic power, strength, speed) but not in the kinds of tests or tests carried out when comparing the results with evaluations of armies from other countries,<sup>17,18</sup> with the exception of the push-up test, which is included in the evaluations of American and Australian soldiers. Regarding the values demonstrated by other military corps for the number of push-ups carried out, in the study by Pierce et al.<sup>19</sup> of American soldiers (275 men and 46 women), both women and men presented a high mean number of repetitions. This behaviour is also observed in the study presented by Carstairs et al.<sup>3</sup> for Australian soldiers. In the study presented by Dada et al.,<sup>6</sup> American infantry soldiers (1573 male and 643 female) had higher mean values than those of this study. However, for other military corps (Army Soldiers in basic combat training and operational units), the mean values (4987 male and 528 female) of repetitions completed are close to our study. The results suggest the need to improve upper body strength exists for both genders since the values of P10 and P20 are those that most closely approximate the values that the other studies presented, meaning that only a small part of the sample analysed here approaches those levels of fitness.

A rising trend is recorded as the course progresses in our study regarding BMI values. However, it should be stated that this rise may be due to an increase in muscle mass since physical exercise decreases fat mass and waist circumference, as is also observed in the study by Janssen et al.<sup>20</sup> and decreases visceral fat, as observed by Ross et al.,<sup>21</sup> therefore, those findings could interfere with the BMI interpretation.<sup>22</sup> In the study presented by Kyröläinen et al.,<sup>23</sup> high

BMI values were found in a military population, but also low values for stamina, whereas subjects' physical condition improves over each academic year in this study. The study presented by Pierce et al.<sup>19</sup> concludes that military body composition standards require a careful balance between physical performance, health and military readiness. Finally, the study by Aandstad et al.,<sup>2</sup> with a sample of 153 Norwegian cadets, observed a rising tendency in body weight, BMI, fat-free mass and body fat percentage, in addition to an increase in muscular strength and stamina over 3 years at the academy. Statistically significant differences are not shown in such studies, but it appears that the increase in muscle power and strength occurs simultaneously as the increases in body weight, fat and BMI accordingly.

## Conclusion

The findings provide normative data on naval military cadets' physical condition and body composition by gender and academic year. These values are useful for evaluating this population and provide objective data helpful towards maintaining a high level of physical fitness and identifying the individual training needs of this population. Future research might focus on evaluating the physical condition in other Spanish naval academies and maybe try to establish a correlation between their physical condition while cadets and the demands placed on their leadership positions once they graduate.

## Acknowledgements

The authors thank all the cadets who voluntarily participated in the study, the leadership of the Naval Academy and the Francisco Osorio endowed chair.

## Conflicts of Interest

None declared.

## Funding

This study was not funded.

---

### Corresponding Author:

Helena Vila, [evila@wigo.es](mailto:evila@wigo.es)

Authors: H Vila<sup>1</sup>, I de Oliveira<sup>2</sup>, J Burgos-Martos<sup>3</sup>, J Cancela-Carral<sup>4</sup>

### Author Affiliations:

1 Universidad de Vigo Facultad de Ciencias de la Educación y del Deporte - Special Didactics

2 Universidade de Vigo – Department of Functional Biology and Health Services

3 Universidade de Vigo – Department of Physical Education, Military Naval Academy in Marin

## References

1. Varley-Campbell J, Cooper C, Wilkerson D, et al. Sex-Specific Changes in Physical Performance Following Military Training: A Systematic Review. *Sport Med.* 2018;48(11):2623–2640.
2. Aandstad A, Sandberg F, Hageberg R, et al. Change in anthropometrics and physical fitness in Norwegian cadets during 3 years of military academy education. *Mil Med.* 2020;185(7–8):E1112–1119.
3. Carstairs GL, Ham DJ, Savage RJ, et al. A box lift and place assessment is related to performance of several military manual handling tasks. *Mil Med.* 2016;181(3):258–264.
4. Nindl BC, Jaffin DP, Dretsch MN, Cheuvront SN, et al. Human performance optimization metrics: consensus findings, gaps, and recommendations for future research. *J Strength Cond Res.* 2015;29(11).
5. Deuster PA, O'Connor FG, Henry KA, et al. Human performance optimization: An evolving charge to the Department of Defense. *Mil Med.* 2007;172(11):1133–1137.
6. Dada EO, Anderson MK, Grier T, et al. Sex and age differences in physical performance: A comparison of Army basic training and operational populations. *J Sci Med Sport.* 2017;20:S68–73.
7. Lockie RG, Moreno MR, Lazar A, et al. The physical and athletic performance characteristics of division I collegiate female soccer players by position. Vol. 32, *J Strength Cond Res.* 2018. 334–343 p.
8. Wik EH, Auliffe SM, Read PJ. Examination of Physical Characteristics and Positional Differences in Professional Soccer Players in Qatar. *Sports.* 2018;7(1):9.
9. Strotmeyer ES, Winger ME, Cauley JA, et al. Normative values of muscle power using force plate jump tests in men aged 77–101 years: The osteoporotic fractures in men (MROS) study. *J Nutr Heal Aging.* 2018;22(10):1167–1175.
10. Pletcher ER, Williams V, Abt JP, et al. Normative data for the neurocom sensory organization test in us military special operations forces. *J Athl Train.* 2017;52(2):129–136.
11. Karch SJ, Lawson BD, Milam LS. Defining normal balance for army aviators. *Mil Med.* 2019;184(7–8):E296–300.
12. Carretta TR, King RE, Ree MJ, et al. Compilation of cognitive and personality norms for military aviators. *Aerosp Med Hum Perform.* 2016;87(9):764–771.
13. Cai W, Dong W, Pan Y, et al. Reliability, validation and norms of the Chinese version of Anxiety Sensitivity Index 3 in a sample of military personnel. *PLoS One.* 2018;13(8):1–15.
14. World Medical Association (AMM). Declaración de Helsinki de la AMM - Principios éticos para las investigaciones médicas en seres humanos. World Med Assoc Inc. 2013;1–8.
15. Ross WD, Marfell-Jones MJ. Cineantropometría. In: Macdougall DJ, Wenger HA, editors. *Evaluación fisiológica del deportista.* Barcelona: Paidotripo; 2013.
16. MADOC España. MV3-101. Manual del Sistema de Evaluación Física Individual del Ejército de Tierra. 2010.
17. Vanderburgh PM. Occupational relevance and body mass bias in military physical fitness tests. *Med Sci Sports Exerc.* 2008;40(8):1538–1545.
18. Pihlainen K, Santtila M, Häkkinen K, et al. Associations of physical fitness and body composition characteristics with simulated military task performance. *J Strength Cond Res.* 2018;32(4).
19. Pierce JR, DeGroot DW, Grier TL, et al. Body mass index predicts selected physical fitness attributes but is not associated with performance on military relevant tasks in U.S. Army Soldiers. *J Sci Med Sport.* 2017;20:S79–84.
20. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. *Am J Clin Nutr.* 2004;79(3):379–384.
21. Ross R, Freeman JA, Janssen I. Exercise alone is an effective strategy for reducing obesity and related comorbidities. *Exerc Sport Sci Rev.* 2000 Oct;28(4):165–170. Available from: <http://europepmc.org/abstract/MED/11064850>
22. Confortin FG, Soeiro M. Estado nutricional dos alunos soldados bombeiros militares versus soldados bombeiros do oeste do estado de santa catarina. *Rev Bras Nutr Esportiva.* 2014;8(44):103–109.
23. Kyröläinen H, Häkkinen K, Kautiainen H, et al. Physical fitness, BMI and sickness absence in male military personnel. *Occup Med C.* 2008;58(4):251–256.



# Employment Patterns During Middle Adulthood Among Japanese-American World War II Veterans

*K Schaper, M-A Mackintosh, E Willis, L White*

## Introduction

An enduring question in military research is how military experiences influence post-service psychosocial outcomes, such as employment. Of interest is how military service and combat exposure affect employment patterns in middle adulthood (age 45–64). Middle adulthood represents an opportunity to study long-term consequences or delayed onset of issues related to military service. Employment is essential as it is a primary source of income, it secures health insurance, and most workers in this period are financially preparing for retirement.

Military service has affected post-service employment variably. For example, veterans may find positions similar to those they held in service,<sup>1</sup> and service can support higher education via the GI Bill and the development of job-related skills or personal characteristics—attributes that employers value<sup>2</sup>—resulting in higher veteran employment rates.<sup>3</sup> Further, veterans may maintain steady employment over civilians due to a health advantage presented as medical care access in the military, physical screening upon entry and requirements to maintain a standard of physical fitness.<sup>4</sup> Conversely, absence from the labour market due to active service could put veterans behind civilians in job tenure, military skill transfer to the civilian labour market and employer evaluation of military service.<sup>5</sup> Military service has also been associated with physical or mental health problems,<sup>6,7</sup> which may hinder steady employment. Further, others found no differences in career trajectories and promotion rates outcomes.<sup>8</sup>

Mixed findings were found among veterans-only analyses. In combat exposure research, some analyses identified an association between combat exposure and unemployment;<sup>9</sup> some reported that combat exposure predicted a greater likelihood of being employed and earning more;<sup>7</sup> and others found that combat exposure did not affect outcomes such as occupational attainment<sup>10</sup> or years employed.<sup>11</sup>

These mixed results underscore the need to study military service and employment in middle adulthood. Additionally, the minority population increase within the US Military inserts an important factor in this topic. US Military minority populations have consistently grown since World War II (WWII), when minority groups represented approximately 5.5% of veterans, to post-9/11, when minorities represented 33.6% of veterans.<sup>12</sup>

This research is important because military experience might influence employment patterns differently among and between minority groups. For example, research suggested that the military offered better opportunities (e.g., use of the GI Bill)<sup>13</sup> for those who had a troubled past or faced an uncertain future.<sup>14</sup> This was significant for minorities who might otherwise encounter difficulty finding and securing employment.<sup>2,5,15</sup> Known as the bridging hypothesis,<sup>16</sup> research frequently suggested that military service economically benefited disadvantaged groups (often ethnic minority groups) compared to non-veteran counterparts and other veterans.<sup>1,2</sup> However, research is lacking among Asian-American veterans and civilians.

The current sample includes Japanese-American WWII military veterans from Hawaii. Nearly 30 000 Japanese-Americans served in WWII.<sup>17</sup> Many were drafted prior to the US involvement in the war, but after the Pearl Harbor bombing and internment of approximately 130 000 Japanese-Americans on the US mainland, enlistment became voluntary after President Roosevelt declared the formation of the 442nd, an all Japanese-American Army Regiment.<sup>17</sup>

In Hawaii, Japanese-Americans' experiences differed. They represented approximately 30% of the population, and many were not interned as they served in critical community leadership roles. However, many Japanese-American men in Hawaii served in the military, most notably in the 442nd Regiment and 100th Battalion.<sup>17</sup>

The current study will use this cohort to investigate how military experience affects employment stability, focusing on middle adulthood. Three questions were examined: (1) What is the relationship between military service and employment stability among veterans and civilians; (2) Among those with histories of job loss, what is the relationship between military service and unemployment severity among veterans and civilians; and (3) What is the relationship between level of combat exposure and employment stability among veterans?

## Method

**Participants:** Data for the current study were drawn from the Honolulu Heart Program (HHP) longitudinal study developed in 1965 to prospectively measure heart disease and stroke among 8006 Japanese-American men living in Hawaii born between 1900 and 1919.<sup>18</sup> The 8006 HHP participants represented approximately 66% of the entire population of Japanese-American men living on Oahu island. Of the 8006, approximately 1479 served in WWII. Few participants reported internment of themselves or family members.

At each HHP exam, participants were assessed on several topics, including employment and medical and family history. A sample of 5433 participants was identified after eliminating participants born before 1910 ( $n = 2573$ ). An additional 760 participants were excluded due to missing military service information ( $n = 21$ ), death ( $n = 170$ ), or incomplete employment data from the first three HHP examinations ( $n = 569$ ), resulting in a final sample of 4673 (1235 veterans, 3438 civilians) for current analyses. These criteria included men who likely did not have prior war experience until WWII and to ensure sufficient data were present to establish employment stability patterns for veteran and civilian comparisons.

A comparison of the excluded group ( $n = 760$ ) and the final sample ( $n = 4673$ ) revealed several significant differences. The excluded group were older in 1941, and a greater proportion reported being a smoker, consuming more alcohol per month, and having less education and more medical problems (e.g., high blood pressure, diabetes). The excluded group also had more individuals who were unmarried and did not own a home.

Data from the first three exams were used to address the first two questions. Each exam period was 2–3 years (Exam 1 1965–1968, Exam 2 1967–1970, and Exam 3 1971–1975), and participants completed all three exams in an average of 6.1 years ( $SD = 0.32$ ). Average age at Exam 1 for all participants was 51.0

years ( $SD = 2.9$ ). For the third, veterans-only question, 477 veterans who completed Exam 6 (1997–1999) were analysed. Exam 6 included questions about combat exposure and military-related information (e.g., receipt of VA care).

**Dependent variables:** All information was gathered via self-report. Employment stability served as the outcome to address Questions 1 and 3. At each exam, participants were asked about present employment. Employment was positively coded regardless of hours per week or consistency of job type across time. Retirement was an option to describe current employment status at each exam. Responses were compiled into an employment status (employed [E], unemployed [U] and retired [R]) variable for each exam.

Sequence of employment status at each of the three exams was used to determine employment stability patterns. Employment stability was dichotomised into two categories: stable and unstable. Stable employment included five combinations: employed at all three exams (E, E, E) or employed at two consecutive exams (e.g., [E, E, U/R] or [U, E, E]). Unstable employment included nine combinations and included patterns of sporadic employment (e.g., [E, U, E]) or only one report of employment (e.g., [U, E, U/R]). Thirteen uncommon combinations (e.g., [R, R, U]) were dropped, excluding 31 individuals.

The second question examined unemployment severity among participants by analysing unstable employment patterns ( $n = 449$ ). To facilitate analysis, the nine unstable employment patterns were dichotomised into mild ( $n = 386$ ) and severe ( $n = 63$ ) unemployment. The sequence of unemployment status at each of the three exams was considered to determine these binary categories. Four mild unemployment combinations were identified with one report of unemployment (e.g., [E, U, E], [E, U, R]). Five severe unemployment combinations were defined by the presence of at least two reports of unemployment (e.g., [E, U, U], [U, E, U]).

**Control variables:** Most control variables were taken from Exam 1, which included age in 1941, marital status, home ownership, education level, number of children, monthly alcohol consumption and number of medical conditions (0–5, including heart attack, high blood pressure, diabetes, stroke, other heart diseases). Medical conditions were chosen because the age of the cohort was a risk factor for these conditions; they might interfere with the ability to maintain steady employment and were used in previous research.<sup>19</sup> WWII military service status was a binary variable derived from information gathered

from Exams 1 and 6. Receipt of VA care was taken from the Exam 6 interview.

During Exam 6, participants with military service were administered the Combat Exposure Scale (CES), a 7-item scale assessing combat exposure.<sup>20</sup> A total score (possible range 0–41) is the sum of converted individual item scores. The total score is divided into five categories, indicating combat exposure severity. For current analyses, categories were collapsed into three categories: no combat exposure (CES total = 0), low exposure (CES total = 1–16), and moderate to severe exposure (CES total  $\geq$  17). No combat exposure indicated that veterans reported deployment to a combat theatre but reported no combat exposure.

*Analyses:* For each research question, initial logistic regression analyses were run, and each model included military service indicators or severity of combat as well as all control variables. Four interactions were included for Questions 1 and 2: military service by age in 1941, living situation, education and total medical conditions. For Question 3, which analysed veteran data only, an interaction between combat exposure and total medical conditions was included. Variables with a *p*-value less than or equal to 0.25 from the Wald test were kept in the final model. This cut-off was used to capture potentially meaningful variables that a smaller *p*-value may miss.<sup>21</sup> As the main variables of interest, military service or combat exposure was forced into the final models. Results

**Table 1. Characteristics of veterans and civilians at Exam 1**

	Veterans n = 1235	Civilians n = 3438	<i>p</i>
Age in 1941 (yr.), mean + sd	24.3+2.2	26.3+2.7	<.0001a
Number of children mean + sd	2.3+1.4	2.8+1.6	<.0001
Alcohol consumption (oz./month) mean + sd	12.5+20.6	14.0+24.3	0.0183
Number of medical conditions mean + sd	0.26+0.50	0.32+0.56	0.0003
Marital Status, N (%)			
Married	1152 (94.4%)	3244 (93.4%)	0.1875b
Not married	82 (5.6%)	193 (6.6%)	
Living Situation, N (%)			
Own home	981 (79.4%)	2626 (76.4%)	0.0295
Other	254 (20.6%)	811 (23.6%)	
Education, N (%)			
Less than high school	418 (33.8)	1618 (47.1%)	<.0001
High school	556 (45.1%)	1336 (38.8%)	
More than high school	260 (21.1%)	483 (14.1%)	
Employment stability, N (%)			
Stable	1107 (89.6%)	3117 (90.7%)	0.258
Unstable	128 (10.4%)	321 (9.3%)	
Employment instability, N (%)			
Mild	115 (89.8%)	271 (84.4%)	0.136
Severe	13 (10.2%)	50 (15.6%)	
Combat exposure, N (%) <sup>c</sup>			
None	208 (43.6%)		
Light	134 (28.1%)		
Moderate to severe	135 (28.3%)		
Receiving VA Care, N (%) <sup>c</sup>			
Yes	70 (14.7%)		
No	406 (85.3%)		

<sup>a</sup>*p*-values for continuous variables are determined by t-test for independent samples.

<sup>b</sup>*p*-values for categorical variables are determined by chi-square tests of association.

<sup>c</sup>n = 477; participants were used from Exam 6

**Table 2. Logistic regression comparing veterans and civilians on employment stability**

Variable	OR	95% CI	<i>p</i>
Age in 1941	0.80	0.77-0.83	<.0001
Number of children	1.05	0.98-1.12	0.160
Veteran status	0.46	0.32-0.68	<.0001
Number of medical conditions	0.74	0.62-0.90	0.002
Highest education (ref: less than high school)	$X^2(2) = 0.51, p = 0.775$		
High school	0.96	0.73-1.22	0.663
More than high school	0.89	0.63-1.26	0.502
Military service*Medical conditions (ref: civilian*medical conditions)	$X^2(1) = 2.14, p = 0.143$		
Veteran*medical conditions	0.76	0.53-1.10	0.143
Military service*Education (ref: civilian*less than high school)	$X^2(2) = 4.37, p = 0.113$		
Veteran*high school	1.51	0.92-2.45	0.101
Veteran*more than high school	1.84	0.96-3.49	0.064

**Table 3. Logistic regression comparing veterans and civilians on unemployment severity**

Variable	OR	95% CI	<i>p</i>
Age in 1941	0.94	0.84-1.05	0.253
Veteran status	0.01	0.01-2.64	0.095
Number medical conditions	1.66	1.16-2.39	0.006
Unmarried	2.17	0.60-7.81	0.235
Own home	0.62	0.33-1.14	0.125
Highest education (ref: less than high school)	$X^2(2) = 2.94, p = 0.229$		
High school	1.33	0.69-2.54	0.394
More than high school	0.50	0.16-1.57	0.232
Military service*Age 1941 (ref: civilian*Age 1941)	$X^2(1) = 2.91, p = 0.088$		
Veteran*Age 1941	1.24	0.94-1.59	0.088
Military service*Education (ref: veteran*less than HS)	$X^2(2) = 3.54, p = 0.170$		
Veteran*high school	0.23	0.05-1.16	0.068
Veteran*more than high school	0.10	0.13-7.75	0.999

**Table 4. Logistic regression using combat exposure to predict employment stability among veterans**

Variable	OR	95% CI	<i>p</i>
Age in 1941	0.85	0.72-1.00	0.054
Number medical conditions	0.25	0.10-0.64	0.004
Number of children	1.46	1.08-1.98	0.015
Combat exposure (ref: no combat)	$X^2(2) = 3.51, p = 0.173$		
Light combat	0.35	0.11-1.06	0.063
Moderate to severe combat	0.46	0.13-1.58	0.216
Combat exposure*Medical conditions (ref: no combat*medical conditions)	$X^2(2) = 3.06, p = 0.216$		
Light combat*medical conditions	4.69	0.57-38.59	0.151
Moderate to severe combat*medical conditions	2.95	0.61-14.24	0.177

of the initial logistic regressions are not included here. Analyses were completed using SAS Enterprise Guide 5.1.

## Results

Table 1 provides the demographics of the sample. Civilians were older in 1941, reported more children and medical conditions at Exam 1, and consumed more alcohol monthly. A higher percentage of veterans reported owning a home and graduating from college. Among the 477 veterans who reported combat experience, the mean total CES score was 9.6 (SD = 11.3).

Both veterans and civilians had stable employment patterns (89.6% veterans, 90.7% civilians). During Exam 1, employed veterans and civilians were mostly in skilled or clerical/sales positions. Further, most veterans (84.8%) and civilians (80.0%) reported working at a position that matched their usual job. Among the participants who were employed at all three exams, 49.3% of civilians and 50.3% of veterans maintained the same type of job.

Table 2 depicts results from the final logistic regression that examined employment stability and military service (Question 1). The overall model was significant  $X^2(9) = 157.05, p < .001$ . Neither of the interactions were statistically significant; thus, the main effects of military service, education and the number of medical conditions on employment stability can be interpreted directly. Military service was significant in relation to employment stability. Compared to civilians, veterans were less likely to report employment stability in middle adulthood (OR = 0.46, 95% CI [0.32, 0.68]). Compared to younger

participants, those who were older in 1941 (OR = 0.80; 95% CI [0.77, 0.83]) were less likely to report employment stability. Finally, those who reported more medical conditions at Exam 1 (OR = 0.74; 95% CI [0.62, 0.90]) were less likely to report employment stability.

Table 3 shows results from the logistic regression that examined military service and employment stability among those with histories of job loss (Question 2). Among the participants in this analysis ( $n = 449$ ), unemployment severity was primarily mild (86.0%). The final model was significant:  $X^2(10) = 19.32, p = 0.036$ . Neither of the interactions were significant, and the main effects of military service, age in 1941 and education are interpreted directly. Veteran status did not predict unemployment severity (OR = 0.01; 95% CI [0.01, 2.64]). Similar to Question 1, the main effect for the number of medical conditions was significant (OR = 1.66; 95% CI [1.16, 2.39]), indicating that participants with more medical conditions were more likely to report severe unemployment.

Results related to Question 3, which examined combat exposure and employment stability among veterans only, are shown in Table 4. The final logistic regression model ( $n = 477$ ) was significant  $X^2(7) = 18.09, p = 0.01$ . The combat exposure by medical conditions interaction was not significant,  $X^2(2) = 3.06, p = 0.22$ . Veterans with no combat exposure served as the reference group in these analyses, though the level of combat exposure did not predict employment stability,  $X^2(2) = 3.51, p = 0.17$ . Significant predictors of employment stability for this veteran sample included age in 1941, total medical conditions and number of children. Veterans were less likely to experience employment stability if they



were older in 1941 (OR = 0.85; 95% CI [0.72, 1.00]) or reported more medical conditions (OR = 0.25; 95% CI [0.10, 0.64]). Veterans experienced greater employment stability when they had more children (OR = 1.46, 95% CI [1.08, 1.98]).

### Discussion

The current study examined the influence of WWII military service and combat exposure on employment outcomes during middle adulthood among a large community sample of Japanese-American males living in Hawaii. Employment outcomes included stable employment and unemployment severity patterns over time. Results suggest that most veterans and civilians were steadily working by middle adulthood, but military service and combat exposure had minimal significant effect on employment.

Several findings are noted. First, military experience pointed towards a negative effect on employment stability in middle adulthood. It is possible that absence from the labour market or skill incompatibility with civilian jobs hindered post-service employment stability.<sup>5</sup> However, in combination with education level, a marginally significant effect for military service at the highest education level was detected, similar to previous research.<sup>7</sup> Nearly half of US veterans took advantage of the GI Bill for education and training at the end of WWII.<sup>22</sup> It is possible that higher education, along with work ethic or other skills learned from the military, gave veterans advantages in finding and maintaining employment.

Second, more medical conditions were associated with worse outcomes in each model, like previous research.<sup>6</sup> Civilians reported more conditions at Exam 1, which could be due to veterans' younger age, greater educational attainment, the military health standard, and greater health practices related to military service, including health care access.<sup>23</sup> Although veteran status and medical condition interaction were non-significant, research suggests that the 'healthy warrior effect' dissolves, and veterans' health declines faster than civilians.<sup>24</sup> Thus, employment status during middle adulthood into retirement could indicate how the effect presents and changes.

Third, age in 1941 played a role in employment stability. Questions 1 and 3 showed that older age in 1941 was associated with poorer employment stability. These findings suggest that older age of societal and economic upheaval periods may disrupt an established life course, leading to difficulty with long-term employment.<sup>14,25</sup>

Fourth, number of children was associated with an increased likelihood of employment stability in the veterans-only analysis (Question 3). More children could encourage a person to keep a job for financial support. In combination with age, this finding suggests that veterans who were older at service entry possibly started their families prior to service. Upon return, they likely encountered urgency to find and maintain employment to support their families, thus maintaining any employment position available.<sup>14,25</sup> Other analyses of HHP data found that some veterans were more likely to marry at an older age,<sup>25</sup> and separate analyses by Mackintosh and colleagues (unpublished data, 2018) found veterans were slightly more likely to have fewer children. These findings suggest that veterans' need for steady employment extended into middle adulthood because they supported young families.

Finally, the trends identified in several interactions suggest that military service and combat exposure could interact with other variables that affect employment. In several studies, military service was linked to mental health problems associated with employment outcomes.<sup>6,3</sup> Regarding combat exposure, an interaction between combat exposure and coping strategy type was significant in predicting achievement.<sup>10</sup> Future studies should examine risk and protective factors (not analysed in this study) that might be related to employment and military service, and combat exposure.

We acknowledge that examining Japanese-American men in Hawaii who were veterans of WWII represents a specific person, place and time. The current study represents an opportunity to study military service and employment stability in middle adulthood among a veteran cohort not often studied. However, prior analyses from the HHP have yielded results consistent with observations in other populations.<sup>27</sup> To date, studies with middle-aged veterans and employment did not analyse race,<sup>11</sup> or if included, they did not examine Japanese- (or Asian-) Americans<sup>1,7</sup> or middle adulthood employment.<sup>5,6</sup> Reasonably, the inclusion of race will be limited by veteran population diversity and the study of wartime military service, and middle adulthood will be limited by the timing of service era; thus, the current study provides insight into these topics.

The sample is also specific to place. These soldiers returned home to Hawaii, where Japanese-American men likely had a different experience during and after WWII than Japanese-American men on the US mainland.<sup>28</sup> While they may have encountered racism during active duty,<sup>17</sup> upon returning to Hawaii, they likely experienced familiarity and acceptance.

Thus, they might not have encountered difficulty finding and keeping employment, as reported in high employment stability rates. Our findings suggested that in combination with education, veterans had an advantage, like other studies.<sup>15</sup> The consideration that military service could favour veterans within minority groups (i.e., bridging hypothesis) was not demonstrated in current stability and unemployment severity rates. We acknowledge the specificity of our sample and note that Asian-Americans are the majority group in Hawaii. This limits our interpretation both within the context of the bridging hypothesis and the generalisation of our findings. However, these observations highlight interesting intersections of pre-military socioeconomic status, race, military service and human capital.

Further, it is noted that the high employment stability rate of the current study may also reflect the post-WWII cultural era, even years later. The effect of military service on one's life may be moderated by the social and economic environment of the culture to which they are returning.<sup>29</sup> Further, at the time of Exam 1, Hawaii had recently become a US state, and the economy was flourishing;<sup>30</sup> offering many jobs, which could have contributed to high employment stability rates.

**Strengths:** The study cohort represented approximately 80% of the Japanese-American men living on Oahu in 1965 and who were born between 1910 and 1919, minimising participation bias. The focus on health in the original study<sup>17</sup> also minimises bias related to occupation or military service and supports the validity of the data considered in our models of employment stability. The longitudinal study design and low attrition rates between examinations also support the generalisation and validity of the reported results.

The current study examined employment across time, whereas others used different methods such as a single question,<sup>3</sup> income<sup>2,7</sup> and occupational attainment.<sup>7,25</sup> The use of multiple time points offers a reasonable estimate of employment stability. Further, changes in unemployment were examined over time, which is essential because unemployment during middle adulthood may affect later-life economic wellbeing.

**Limitations:** Limitations of the sample include a possible selection bias for better physical health and social responsibility. HHP participants survived the war, returned and remained on Oahu until 1965, and agreed to participate in a large, federal lifetime research investigation of heart disease and stroke.<sup>18</sup> All data used for these analyses were collected by

interview and self-report, without further validation efforts.

The dataset had limited information about pre-war characteristics; other studies reported that pre-war differences between groups partly explain military service effects.<sup>13</sup> Others reported that employment stabilises by middle adulthood.<sup>25</sup> The current study did not identify consistent, significant differences between groups as employment information immediately following the war is missing. This study began approximately 20 years after the war, representing a significant amount of time to stabilise employment. Further, we used three timepoints across six years to establish an employment pattern. Thus, our definition and label of employment stability/instability may not accurately depict the participant's employment during the study period. However, our analyses provide a glimpse into employment patterns during an adult's earning career.

We had limited data on veteran-specific variables. Future research should control for disability status, military benefit use and VA care use. Although VA care is currently non-significant, it should be examined in contrast to obtaining insurance from employment. Additionally, military-related illnesses should be identified and tracked as other influences on employment stability.

Despite concerns about military service and combat exposure on employment stability, findings suggest that veterans did not encounter difficulty in maintaining employment in middle adulthood. Continued examination of longitudinal data is essential to elucidate issues related to an ageing veteran population.<sup>29</sup> However, individuals and experiences are unique; learning how some persevere while others do not provide valuable information for future cohorts. Issues that occurred immediately post-war may persist or dissipate with time, whereas other issues may arise years after service. Identifying these issues and the related factors are important for the treatment or prevention of issues and may inform decision makers on how to allocate services and funding to anticipate and address the needs of veterans.

## Acknowledgements

This work was supported by a grant from the Alzheimer's Association (ZEN-12-239028), the Chia-Ling Chang Fund of the Hawaii Community Foundation, and an award from the Office of the Assistant Secretary of Defense for Health Affairs (W81XWH-15-1-0431). Additional resources were

provided by the Department of Veterans Affairs, VA Pacific Islands Health Care System. Opinions, interpretations, conclusions and recommendations are those of the authors and are not necessarily endorsed by the Department of Defense. The authors thank Marnie Meyer for reviewing the drafts and providing valuable feedback.

## Corresponding Author:

Kim Schaper, [schaper12@gmail.com](mailto:schaper12@gmail.com)

Authors: K Schaper<sup>1</sup>, M-A Mackintosh<sup>1,2</sup>, E Willis<sup>3</sup>, L White<sup>1</sup>

## Author Affiliations:

1 Pacific Health Research and Education Institute

2 National Center for PTSD, Dissemination and Training Division

3 University of Central Florida Department of Psychology

## References

1. Kleykamp M. A great place to start? The effect of prior military service on hiring. *Armed Forces Soc.* 2009;35(2):266-285.
2. Bennett PR, McDonald KB. Military service as a pathway to early socioeconomic achievement for disadvantaged groups. In Wilmoth JM, London AS, eds. *Life-Course Perspectives on Military Service*. New York, NY: Routledge; 2013; p. 119-143.
3. Anderson KH, Mitchell JM. Effects of military experience on mental health problems and work behavior. *Med Care.* 1992;30(6):554-563.
4. Kang HK, Bullman TA. Mortality among U.S. veterans of the Persian Gulf war. *N Engl J Med.* 1996;335(20):1498-1504.
5. Kleykamp M. Labor market outcomes among veterans and military spouses. In Wilmoth JM, London AS eds. *Life-Course Perspectives on Military Service*. New York, NY: Routledge; 2013; p. 144-164.
6. Horton JL, Jacobson IG, Wong CA, et al. The impact of prior deployment experience on civilian employment after military service. *Occup Environ Med.* 2013;70(6):408-417.
7. Sheffler JL, Rushing NC, Stanley IH, et al. The long-term impact of combat exposure on health, interpersonal, and economic domains of functioning. *Aging Ment Health.* 2016;20(11):1202-1212.
8. Elder GH Jr, Shanahan MJ, Clipp EC. When war comes to men's lives: life-course patterns in family, work, and health. *Psychol Aging.* 1994;9(1):5-16.
9. Maclean A. The things they carry: Combat, disability and unemployment among US men. *Am Sociol Rev.* 2010;75(4):563-585.
10. Suvak MK, Vogt DS, Savarese VW, King LA, King DW. Relationship of war-zone coping strategies to long-term general life adjustment among Vietnam veterans: Combat exposure as a moderator variable. *Pers Soc Psychol Bull.* 2002;28(7):974-985.
11. McCarren M, Janes GR, Goldberg J, et al. A twin study of the association of post-traumatic stress disorder and combat exposure with long-term socioeconomic status in Vietnam veterans. *J Trauma Stress.* 1995;8(1):111-124.
12. United States Department of Veterans Affairs. National Center for Veterans Analysis and Statistics. Profile of Veterans: 2016 Data from the American Community Survey. February 18, 2018. [cited March 26]. Available from: [https://www.va.gov/vetdata/docs/SpecialReports/Profile\\_of\\_Veterans\\_2016.pdf](https://www.va.gov/vetdata/docs/SpecialReports/Profile_of_Veterans_2016.pdf)
13. Sampson RJ, Laub JH. Socioeconomic achievement in the life course of disadvantaged men: Military service as a turning point, circa 1940-1965. *Am Sociol Rev.* 1996; p. 347-367.
14. Elder GH Jr, Meguro Y. Wartime in men's lives: A comparative study of American and Japanese cohorts. *Int J Behav Dev.* 1987;10(4):439-466.
15. Fredland JE, Little, RD. Socioeconomic status of world war II veterans by race: An empirical test of the bridging hypothesis. *Soc Sci Q.* 1985;66(3):533-551.
16. Browning HL, Lopreato SC, Poston DL Jr. Income and veteran status: Variations among Mexican Americans, blacks and anglos. *Am Soc Rev.* 1973;38:74-85.
17. Sterner CD. *Go for Broke: The Nisei Warriors of World War II Who Conquered Germany, Japan and American Bigotry*. Clearfield, UT: American Legacy Historical Press; 2015.
18. White L, Petrovitch H, Ross GW, et al. Prevalence of dementia in older Japanese-American men in Hawaii: The Honolulu-Asia Aging Study. *JAMA.* 1996;276(12):955-960.

19. Voss MW, Birmingham WC, Wadsworth L, et al. Honest labor bears a lovely face: Will late-life unemployment impact health and satisfaction in retirement? *J Occup Environ Med.* 2017;59(2):184-190.
20. Keane TM, Fairbank JA, Caddell JM, et al. Clinical evaluation of a measure to assess combat exposure. *Psychol Assess.* 1989;1(1):53-55.
21. Bursac Z, Gauss CH, Williams DK, et al. Purposeful selection of variables in logistic regression. *Source Code Biol Med.* 2008;3(1):17.
22. Education and training, History and timeline. United States Department of Veterans Affairs. November 21, 2013. [cited March 26, 2018] Available from: <https://www.benefits.va.gov/gibill/history.asp>
23. MacLean A. A matter of life and death: Military service and health. In Wilmoth JM, London AS, eds. *Life-Course Perspectives on Military Service.* New York, NY: Routledge; 2013: p. 200-220.
24. Wilmoth JM, London AS, Parker WM. Military service and men's health trajectories in later life. *J Gerontol B Psychol Sci Soci Sci.* 2010;65B:744-755.
25. Elder GH, Jr. Military times and turning points in men's lives. *Dev Psychol.* 1986;22(2):233.
26. Mackintosh, M., Schaper, K., Willis, E., Edland, S., Liu, C., & White, L.R. Effects of military service on marital stability among world war II U.S. veterans of Japanese descent. *Mil Med* 2018;183(9-10);e525-e531.
27. White LR, Edland SD, Hemmy LS, et al. Neuropathologic comorbidity and cognitive impairment in the Nun and Honolulu-Asia Aging Studies. *Neurology*;86(11):1000-1008.
28. Chin A. Long-run labor market effects of Japanese American internment during world war II on working-age male internees. *J of Labor Econ.* 2005;23(3):491-525.
29. Spiro A, Settersten RA, Aldwin, CM. Long-term outcomes of military service in aging and the life course: A positive re-envisioning. *Gerontologist.* 2016;56(1):5-13.
30. Latson, J. How statehood changed Hawaii's economy. August 21, 2015. [cited March 27, 2018]. Available from: <http://time.com/3994194/hawaii-statehood-economic-effects>

# John Keith Henderson: First Australian to Provide Dental Treatment to Troops on Active Service

*C Daly*

## Abstract

The Royal Australian Army Dental Corps regards John Keith Henderson as the first Australian to provide dental treatment to troops on active service. At the time, he was a third-year dental student at the University of Sydney who had enlisted as a Private in the Australian Army Medical Corps at the outbreak of World War I. He served in the Australian Naval and Military Expeditionary Force that deployed to German New Guinea in 1914. The lessons learnt from the emergency dental treatment he provided to Australian personnel in that campaign contributed to the formation of an Army Dental Service in 1915. Henderson transferred to the Australian Imperial Force as an infantry soldier, fought at Gallipoli and was later killed in action as a Captain in France in 1916.

**Conflict of Interest:** None

## Introduction

The Royal Australian Army Dental Corps (RAADC) considers John Keith Henderson to be the first Australian to render dental treatment to troops in the field.<sup>1</sup> What makes Henderson's story unique is that he was a dental student and a Private in the Australian Army Medical Corps (AAMC) when he undertook dental duties on active service overseas in the first months of World War I. Although Henderson has been referred to in several publications,<sup>1,2,3,4,5,6,7</sup> inaccuracies have appeared, and original sources have not been reported for some of the facts presented. To date, there has been no publication that has dealt explicitly with Henderson. Given his importance to the concept of providing dental support to deployed troops and the subsequent formation of the Australian Army Dental Service in World War I, there is a need for a comprehensive account concerning J K Henderson.

## Lack of Army dental service

At the outbreak of World War I in August 1914, no system existed in the Australian Army for the provision of dental treatment.<sup>8</sup> While the AAMC itself had no regular medical officers other than Surgeon-General W D Williams,<sup>9</sup> it had medical officers serving in militia medical units who could be mobilised in

times of war.<sup>8</sup> There was also an AAMC Reserve of officers created initially in 1903 from doctors who had previously held commissions in the Army Medical Corps of the various Australian states prior to federation.<sup>5</sup> The lack of a dental service was not the fault of the AAMC. As early as 1906, Surgeon-General Williams had recommended the formation of a dental service, but as there was no precedent in the British Army, his recommendation was rejected by the Military Board.<sup>8</sup> In times of war, it was expected that medical officers would provide any necessary dental treatment required in the field, and they were each issued with four pairs of dental forceps for this purpose.<sup>8</sup> However, most medical officers had no experience in extracting teeth.<sup>1</sup>

## Outbreak of war and ANMEF

Following the declaration of war on 4 August 1914, Britain accepted on 10 August the Australian government's offer of raising an expeditionary force of 20 000 men, to be known as the Australian Imperial Force (AIF), that would be placed at the disposal of the British.<sup>9</sup> On 8 August, a cable was also received from the British Government requesting that Australia 'take speedy action against the German colonies' in what was then called German New Guinea.<sup>10</sup> Therefore, at the same time as the AIF was being organised, it was decided to



form a second force, separate from the AIF, to occupy German possessions in New Guinea and New Britain and to destroy German wireless stations that were essential to the activity of warships of the German East Asia Squadron.<sup>10</sup> This force, known as the Australian Naval and Military Expeditionary Force (ANMEF), would consist of six companies drawn from the Royal Australian Naval Reserve (600 men), one battalion of infantry (1023 men), two machine gun sections, a signalling section and a detachment of the AAMC.<sup>10</sup> Colonel William Holmes, a militia officer, was appointed Commander of the ANMEF on 10 August and tasked to have the ANMEF ready for 'foreign service' in 6 days.<sup>5</sup>

Because of the need for rapid organisation of the force, enlistment for the infantry battalion, the machine gun and signalling sections, and the medical complement began in Sydney on the day following Colonel Holmes's appointment.<sup>10</sup> A large number of volunteers gathered at Sydney's Victoria Barracks and were then marched to the nearby Sydney Royal Agricultural Society Showground to be examined by medical officers from militia units who had been called up for service.<sup>8</sup> It soon became apparent that although medically fit, the men's dental health 'left much to be desired'.<sup>5</sup> As there was no Army Dental Service to render the force dentally fit, the dental profession stepped in on a gratuitous and patriotic basis to perform the necessary treatment<sup>2,7,8</sup> with the Dental Association of New South Wales sending volunteer dentists to the Sydney Agricultural Showground as an 'honorary Dental Corps' before the Minister of Defence knew anything about it.<sup>4</sup> There, they set up dental surgeries in the Lindeman wine kiosk using loaned chairs, mostly barbers' chairs, and were supported with a £100 (\$AU200) donation from the Red Cross,<sup>4</sup> equivalent to \$AU12 105 in 2021. On 17 August, Colonel Holmes acknowledged the voluntary treatment rendered by the civilian dentists to 600 of his men in the preceding few days.<sup>10</sup> This ad hoc arrangement for the dental treatment of recruits reflected the complete lack of planning for military dentistry that then saw Australian troops in both the ANMEF and AIF sent overseas without dentists.

### ANMEF medical detachment

The medical detachment of the ANMEF comprised four medical officers, one Warrant Officer and 35 other ranks.<sup>2</sup> Colonel Holmes obtained the services of Dr Neville Howse, who had won Australia's first Victoria Cross while serving as a medical officer during the Boer War with the New South Wales Army Medical Corps,<sup>5</sup> and was an honorary Major in the AAMC Reserve, as the Principal Medical Officer with

the rank of Lieutenant Colonel.<sup>2</sup> The other medical officers selected were Captain Frederick Maguire from a militia Field Ambulance unit and Captains John Donaldson and Brian Pockley, both of whom had been recently commissioned in the AAMC militia.<sup>2</sup> The other personnel selected had either received AAMC training, held some civil qualification in first aid, or had nursing experience.<sup>2,5</sup> No female nurses were recruited.

One of those selected for the medical unit was Private John Keith Henderson, who had Army service number 36, indicating that he was among the first of over 300 000 Australians who enlisted for service in World War I. Henderson wrote 'dental student' on his enlistment papers in the section asking his 'trade or calling'.<sup>11</sup> Previous publications have incorrectly stated that Henderson was a dentist,<sup>5</sup> a dental surgeon<sup>12</sup> or a fourth-year dental student<sup>1,2,3,4,7</sup> with only 3 months left to graduate.<sup>1,3</sup> Investigation of the University of Sydney archives shows that he was a third-year dental student in the four-year course when he enlisted in August 1914<sup>13</sup> and not a final year student as reported previously. Apart from being a third-year student with another 15 months left to complete the Bachelor of Dental Surgery course, his subsequent dental service is even more noteworthy because he had only entered the dental course the year before, having been a medical student prior to that.

### Education and enlistment

J K Henderson, who stated his age as 23 years and 6 months on his enlistment papers, was born in London in 1891 and arrived in Sydney the following year aged one.<sup>11,14</sup> He was educated at Sydney Grammar School,<sup>14</sup> where he completed his secondary schooling in 1908. Known as 'Keith' at school and 'Chook' to his friends and family, Henderson passed the matriculation examination for the University of Sydney in November 1908 and entered its Faculty of Medicine as a first-year medical student in March 1909.<sup>16</sup> The university records show that he did not pass his 1909 examinations but repeated the first year successfully in 1910, entering second-year medicine in 1911.<sup>17</sup> Unfortunately, he did not pass his examinations that year and repeated second-year medicine in 1912<sup>18</sup> but again failed to pass.<sup>19</sup> In 1913, he transferred into second-year dentistry,<sup>19</sup> passed the annual examinations and entered third-year dentistry in 1914.<sup>13</sup> His university career from 1909 to 1914 indicates that he was not the type to give up easily, a suggestion supported by his being a university middleweight boxing champion during that time.<sup>20</sup>

Henderson's recruitment into the medical unit of the ANMEF was secured by Lieutenant Colonel Howse,<sup>2</sup> who, according to his biographer, was aware of the poor dental health of many of the ANMEF recruits.<sup>5</sup> As a medical officer who had served two tours of duty in South Africa during the Boer War of 1899–1902,<sup>5</sup> Howse would also have had first-hand experience of the dental problems encountered in that conflict. At the outset of the Boer War, the British made no provision for emergency dental care of the deployed forces. This resulted in 6942 admissions to hospital for dental reasons and 2451 troops being invalided back to Britain for dental reasons.<sup>21</sup> In 1900, a British dentist went out to South Africa for 6 months as part of a field hospital funded by public subscription. He reported that disease, neglect and the hard rations had caused significant problems with the men's teeth and that those who lost their teeth were no longer fit for service.<sup>22</sup> Eventually, four contract dentists were sent from Britain to South Africa in early 1901.<sup>21</sup> As Howse was responsible for selecting the members of his unit, he would likely have taken the opportunity to recruit someone with dental training, even if that

person was a dental student. It is possible that Henderson may have been brought to the attention of Howse by one of the medical officers, Captain Brian Pockley. Henderson and Pockley had been classmates in first-year medicine in 1909<sup>16</sup> and had also served together as office-bearers in the Sydney University Athletic Club in 1911.<sup>17</sup>

Whatever the mechanism of Henderson's selection, Howse signed his medical examination certificate on 17 August 1914, and Colonel Holmes signed the certificate of Commanding Officer on the same date appointing Henderson to the AAMC.<sup>11</sup> From the entries recorded on those papers enlisting Henderson in the ANMEF 'for a period not exceeding six months', we know that he was 5 feet 9.5 inches (176.5 cm) tall, weighed 11 stone 12 pounds (75 kg), had a 'fair complexion' and 'very fair hair'. This description is at odds with the RAADC corps history which describes Henderson as a 'redhead'.<sup>1</sup> On 18 August, the force boarded the P&O liner *Berrima*, which had been commissioned as a transport in the Royal Australian Navy and converted to carry



**Figure 1.** Onboard HMAT *Berrima*, August 1914. Front row left to right: CAPT F A Maguire, CAPT B C Pockley and far right, CAPT J E Donaldson. Middle row second from right: PTE J K Henderson. Back row second from left: SGT W R Dovey. (Photograph from Mackenzie10 p. 208).

four 120 mm naval guns, and sailed from Sydney harbour the next day.<sup>10</sup> Prior to departure, those ANMEF members who were graduates or students of the University of Sydney had a group photograph taken on the deck of the *Berrima*, which included Henderson, along with Captains Maguire, Pockley and Donaldson of the AAMC (Figure 1).

### Rabaul campaign and occupation

The *Berrima* reached Palm Island near Townsville on 24 August, where the troops spent over a week in training before proceeding to Port Moresby. On 7 September, the *Berrima* departed Port Moresby for Rabaul in convoy with Royal Australian Navy ships comprising two cruisers, three destroyers, two submarines and several support ships that joined the battle cruiser HMAS *Australia* under the command of Rear Admiral Patey.<sup>10</sup> In modern parlance, this would be called an amphibious task force; the size of this fleet was to protect the force from the German cruisers *Gneisenau* and *Scharnhorst* suspected to be in the area. The first Australian land action of World War I occurred in the early hours of 11 September 1914 when the ANMEF landed at Kabakaul near Herbertshoe to the southeast of Rabaul on the island of New Britain.<sup>10</sup> They encountered strong opposition but were able to capture the German wireless station after casualties on both sides. One of the casualties was Henderson's former classmate Captain Brian Pockley who selflessly took off his Red Cross armband and gave it to a Naval Reservist so the latter could safely move a wounded man back to the beach. The Germans respected the Red Cross and did not fire. However, when Pockley moved forward without his Red Cross armband, he was shot and badly wounded. He was evacuated back to the *Berrima* where he died. Pockley was the first member of the Australian Army to lose his life in World War I.<sup>10</sup>

### Henderson's dental service

Following the fall of Rabaul and the German surrender, the existing German hospitals at Rabaul, Herbertshoe and Madang were taken over, and Lieutenant Colonel Howse made Rabaul the Australian base hospital staffed by the AAMC.<sup>5</sup> Howse departed for Australia on 4 October 1914 to join the AIF and was replaced as Principal Medical Officer by Captain Frederick Maguire who was promoted to Major.<sup>5,10</sup> Previous publications have reported the amount of dental treatment done by Henderson in Rabaul but have not cited the source of the data.<sup>1,3,7</sup> The source was Major Maguire, who reported that Private Henderson performed some 108 dental extractions, 160 fillings and 50 dressings for abscessed teeth between August and December.<sup>2</sup>

The term 'dressings for abscessed teeth' means the emergency removal of infected dental pulp and root canal tissue, often with the intention of draining pus via the root canal system, followed by the placement of medicaments to disinfect the tooth internally and then the placement of a temporary filling. In relation to the emergency dental care provided by Henderson, Major Maguire acknowledged that 'a material amount of disability—not to speak of inconvenience and suffering—was saved by the work done'.<sup>2</sup>

Henderson was promoted to Corporal in the AAMC on 1 February 1915.<sup>11</sup> His dental services were also acknowledged and appreciated by fellow ANMEF personnel. In a letter from Rabaul to Sydney Grammar School, Sergeant Wilfred Dovey wrote, '*Keith Henderson is putting in splendid work on the men's teeth*'.<sup>15</sup> Unfortunately, Henderson could not undertake any denture construction or repairs due to a lack of the necessary equipment and materials, and Major Maguire reported that this resulted in five men becoming unfit for further service with the ANMEF.<sup>2</sup> Part of the requirements for third-year dental students at the University of Sydney in 1914 included the performance of 40 amalgam fillings under supervision, of which 20 had to be preceded by root canal treatment.<sup>13</sup> At the time of Henderson's enlistment in August 1914, he had just completed two of the three academic terms for the year and would likely have completed around two-thirds of his clinical requirements by then. The fact that he then performed 160 fillings and 50 dressings for abscessed teeth over the next 4 months to the Principal Medical Officer's satisfaction, suggests that he was considered a competent dentist despite his student status.

It has been previously reported that when Henderson embarked for service, he supplied his own dental instruments<sup>6,7</sup> by taking his student dental kit with him.<sup>1,3</sup> However, no references have been cited for these claims. The most likely source is Major Frederick Maguire, who recorded that Henderson 'provided himself with a small kit of dental instruments' when he went to Rabaul.<sup>2</sup> Dental students at the University of Sydney were required to purchase an instrument kit for use in their clinical training, especially in the area of restorative dentistry, right up until the 1980s, so Henderson most likely took his student kit with him. Dental forceps for extracting teeth would have been available from the medical officers' kits,<sup>8</sup> and Henderson may have obtained other specialised forceps and dental elevators prior to embarkation to extract severely broken down teeth or root stumps.

It would have been necessary for Henderson to take dental filling materials such as amalgam and



cements with him to Rabaul, as well as medicaments for treating infected dental pulps and root canals. As there was no establishment for a dental service within the AAMC, it would not have been possible to obtain such dental materials through the army logistics system. Such materials may have been donated by the Dental Association clinic at the Sydney Agricultural Showground or possibly purchased prior to embarkation using some of the donated Red Cross funds. However, no evidence can be found to support this speculation. There is no information available about whether there was a German dentist in Rabaul at the time of the Australian military occupation whose instruments and dental materials might have been used by Henderson. Whereas the Official History documents the presence of German doctors in Rabaul who worked under the supervision of the AAMC, no mention is made of any German dentist.<sup>10</sup>

### Formation of Army Dental Service

When Major Maguire returned to Australia in February 1915, he produced a report strongly advocating the need for the provision of dental treatment to troops on active service, which attracted the attention of the Minister for Defence.<sup>2</sup> At the same time, large numbers of personnel who had just arrived in Egypt with the AIF were presenting to sick parades requiring dental treatment, but for which no provision had been made. This necessitated referral to qualified and unqualified dentists in Cairo who had to be paid by the soldiers themselves.<sup>8</sup> This situation led the recently promoted Colonel Neville Howse, now Assistant Director of Medical Services for the AIF, to do as he had done with Henderson in Rabaul and use any dentally qualified personnel he could find within the AIF in Egypt to provide treatment at the Australian General Hospital.<sup>8</sup> Following the landing at Gallipoli, Howse again employed the same arrangements there, but men were often sent back to Egypt for dental treatment, meaning they could be away from their units for weeks at a time.<sup>5</sup> Like Maguire, Howse pushed for dentists to be appointed to the AAMC to provide health support for the Army overseas.<sup>8</sup>

The Australian Department of Defence finally acted, and in June 1915, Military Order number 387 authorised the formation of a dental service within the AAMC to comprise 13 dental officers, 13 Staff-Sergeant dental technicians and 13 dental assistant Privates.<sup>8</sup> By November 1918, the dental service had grown significantly, and there were 130 dental officers serving abroad with the AIF.<sup>6</sup> Writing after the war, Frederick Maguire commented that the report he had made on the importance of dental treatment

to deployed troops as demonstrated by Private Henderson in Rabaul 'may have influenced the subsequent appointment of dental surgeons to the AIF'.<sup>2</sup> It seems reasonable to conclude that Maguire's report, followed by requests for dental personnel from Howse in Egypt and then Gallipoli, contributed significantly to the formation of the Australian Army Dental Service in World War I.

### Egypt and Gallipoli

Following the completion of his 6 months service at Rabaul, Corporal Henderson returned to Australia on 4 March 1915,<sup>11</sup> where he transferred to the AIF on 27 March.<sup>23</sup> During the next few months, he underwent infantry training that included a course at the School of Musketry at Randwick in Sydney.<sup>11</sup> After serving as an acting Sergeant for a month with the 20th Battalion, he was commissioned as a 2nd Lieutenant on 6 July 1915 before being posted to the Infantry Depot at Liverpool military camp, New South Wales.<sup>11</sup> On 9 August, he sailed for Egypt as a member of the 8th Reinforcements, 13th Australian Infantry Battalion.<sup>23</sup> While doing police duty in Cairo, Henderson visited Staff-Sergeant Sidney Ratcliff, who had embarked with the first contingent of the Army Dental Service in July 1915, and was serving as a dental technician at the No. 2 Australian General Hospital there.<sup>24</sup> Following his return to Sydney, Ratcliff gave a lecture to dental students at the University of Sydney early in 1916. In that lecture, he discussed his experiences overseas and mentioned his meeting with Henderson, whom he described as a credit to the university and the dental undergraduates, and whom he hoped would be given all assistance possible to complete his dentistry studies once he returned from the war.<sup>24</sup>

On 7 October 1915, Henderson was admitted to No. 1 Australian General Hospital at Heliopolis, near Cairo, with a gastrointestinal infection and was discharged 4 days later.<sup>11</sup> At that time, gastrointestinal infections were common among Australian troops in Egypt and believed to be due to defective sanitation procedures in the training camps, especially measures to prevent food contamination by flies.<sup>8</sup> Following his discharge from hospital, Henderson was taken on strength by the 13th Battalion on 23 October at Mudros, on the Greek island of Lemnos, an important base for British and ANZAC forces engaged with the Turks in the Dardanelles, approximately 160 km away.<sup>11</sup> He was posted to C Company of the 13th and landed at Gallipoli on the night of 31 October 1915.<sup>25</sup> Henderson fought on Gallipoli until 14 December when he was evacuated to the hospital ship *Caledonia* and then admitted to hospital two days later at Mudros with a diagnosis of 'pyrexia of unknown origin'.<sup>11</sup>

While Henderson was in hospital, the ANZAC forces withdrew from Gallipoli over several nights, with the 13th Battalion completing its withdrawal to Mudros on the night of 19 December and the early hours of 20 December.<sup>25</sup> By daybreak on 20 December 1915, all ANZAC forces had left Gallipoli. Henderson was moved to No. 24 Casualty Clearing Station convalescent depot at Mudros East on 21 December with the diagnosis of 'malaria' before being discharged back to his battalion.<sup>11</sup> The 13th Battalion was moved back to Egypt, where it was reinforced with new recruits from Australia after the losses at Gallipoli and Henderson was promoted to 1st Lieutenant on 20 January 1916.<sup>11</sup> He was then promoted to Captain on 1 March 1916,<sup>11</sup> coinciding with a reorganisation of the Australian forces that saw the 13th Battalion split into two, with one half allocated to the 45th Battalion and the other half remaining with the 13th Battalion. Henderson remained with the 13th as Officer Commanding C Company.<sup>25</sup>

### France

Henderson's battalion arrived in France on 6 June 1916<sup>11</sup> as part of the Australian 4th Division of I ANZAC Corps. After field training, the 13th Battalion moved into the front line at Fleurbaix, near the border with Belgium, where the Battalion had its first experience of trench warfare and German bombardments and sustained their first casualties on the Western Front.<sup>25</sup> In the middle of July, the

Battalion moved south to Warloy, near Albert, in preparation for a planned offensive at Pozieres.

The war diary of the 13th Battalion records that it went into the front line near Pozieres on 10 August 1916, where it was involved in constant fighting and sustained many casualties from heavy and accurate German artillery barrages.<sup>25</sup> Captain Henderson was reported in the Official History as commanding the right flank of the 13th as the Australians advanced to within 275 m of Mouquet Farm during the early hours of 13 August.<sup>12</sup> On the night of 14 August, the Australians again mounted a night attack on the German trenches at Mouquet Farm. At 10 p.m., the first wave of the 13th Battalion, comprising A, D and Captain Henderson's C Company, advanced in an attacking line from the 'hopping-out' trench.<sup>25</sup> They encountered a German trench after 70 m and took it following a fight and then continued to advance towards Mouquet Farm. A second enemy trench 'full of Germans' was then captured approximately 140 m from the 'hopping-out' trench. Just after midnight, the Germans counter-attacked strongly at the front and on the exposed right and left flanks where the supporting battalions had failed to move up. The 13th Battalion was forced into a fighting retreat back to the 'hopping-out' trench, taking their wounded from the enemy trenches with them. At dawn on 15 August, the Battalion was relieved and moved to the rear, marching back into Warloy later that night.<sup>25</sup> For the period 7–15 August inclusive, the 13th



**Figure 2. Officers of 13th Battalion, Egypt 1916. Middle row left to right: LT C B Meyer, LT J K Henderson. (Australian War Memorial photograph. Accession number H15116).**



incurred a total of 386 casualties at Pozieres;<sup>25</sup> about a third of its strength.

In the night action of 14 August 1916, the 13th Battalion sustained 117 casualties including two officers and 22 other ranks listed as missing. Captain J K Henderson and Lieutenant Cyril Meyer were the two officers reported as missing in action.<sup>25</sup> Lieutenant Meyer had joined the 13th in March 1916 in Egypt<sup>26</sup> and appears in a photograph taken of 13th Battalion officers at that time standing next to Henderson (Figure 2). In October 1916, word was received that Lieutenant Meyer had been located as a prisoner of war in Germany and in November, it was learned that he had been admitted to hospital there in September with shrapnel injuries sustained on 14 August, necessitating a leg amputation.<sup>26</sup> There was no information as to the fate of Henderson. At a court of inquiry held by the 13th Battalion on 23 January 1917, 5 months after he had been reported missing, Captain John Keith Henderson was officially listed as 'killed in action' on 14 August 1916, with the finding certified by AIF Headquarters on 12 March 1917.<sup>11</sup>

### The fate of Captain Henderson

During World War I, the fate of missing Australian personnel was investigated by the Australian Red Cross Wounded and Missing Enquiry Bureau.<sup>27</sup> Working with the British Red Cross and other Red Cross societies, prisoner of war lists were obtained and searched, and statements collected from anyone who had been in the same action or might have heard about what had happened. Captain J K Henderson's Red Cross file<sup>28</sup> contains eight statements from hospital patients, five of whom reported him killed, two that he was wounded, and one that 'he was never seen again' after leading his men 'over the top'. Three of the statements were obtained in England in October and November 1916, while the others were obtained between January and September 1917 from three patients in Australia and one each in France and England.

Of the eight statements, five gave first-hand accounts and three reported what others had told them. Two of the first-hand accounts referred to Captain Henderson by his nickname of 'Chook' Henderson, one stating that he was a 'good officer' and the other that he was 'one of the best officers'. All the statements varied in their descriptions of what took place on the night of 14 August 1916. One stated that Henderson was wounded in the legs, but before getting him out, they were 'bombed' (grenaded) out of the trench and had to leave him behind. Another said that he was wounded in a charge and seen to fall. Other statements recorded that he was 'blown to

pieces with a shell', another that he was killed by a 'whizbang' (a light shell fired by a small calibre field gun) and died a few minutes after being hit, and yet another that he was killed 'as we were going over'. It is unknown what evidence was presented at the 13th Battalion court of enquiry in January 1917 that led to the finding of 'killed in action', and the Red Cross reported in May that year that their attempts to obtain the evidence had been unsuccessful.<sup>28</sup> The proceedings of that court of enquiry cannot be located in the National Archives of Australia.

One of the statements obtained by the Red Cross in October 1916 included information that Henderson's body had been brought in by the battalion that relieved the 13th Battalion.<sup>28</sup> This was the 51st Battalion that took over the 13th's position at 5 a.m. on 15 August.<sup>25</sup> The 51st Battalion's war diary<sup>29</sup> records that it remained in place all that day in expectation of a counterattack and that they were heavily shelled. At dusk, patrols were sent out to look for wounded and guide in men lying out in no-man's land all day. However, no attack was made on the German trenches near Mouquet Farm where Henderson had presumably been hit. The 4th Battalion replaced the 51st at 6 a.m. on August 16th. The 4th Battalion did not move forward either but was heavily shelled before being attacked by the Germans.<sup>30</sup> Given that the relieving battalions did not venture forward, it seems unlikely that Henderson's body was recovered by them. In August 1917, a year after his being reported missing, the Red Cross concluded that they had been unable to obtain any definite information regarding Captain Henderson's fate.<sup>28</sup>

### Further information

Back in Sydney, Henderson's father had contacted the Department of Defence in Melbourne on two occasions in October 1916, seeking details about his son, who had by then been missing for 2 months.<sup>11</sup> He was informed each time that no details were available but was reassured that the Imperial authorities were doing their utmost to obtain all available information regarding those reported as missing.<sup>11</sup> Henderson's father then wrote to Lieutenant Colonel Leslie Tilney, the Commanding Officer of the 13th Battalion. Lieutenant Colonel Tilney had been sent to hospital in France on 21 August 1916, a week after the action at Pozieres, and had been evacuated to England 10 days later.<sup>31</sup> He was invalided back to Perth in October 1916 and was discharged from the AIF on 30 November.<sup>31</sup>

Tilney replied to Henderson's father in early 1917 and told him that following the action of 14 August 1916, it was thought possible that his son had been

wounded and carried back, and so inquiries were made at adjacent dressing stations and hospitals, but no trace of him could be found.<sup>20</sup> Tilney, who had served in the Boer War and also won a DSO as a Major on Gallipoli,<sup>31</sup> wrote, *'It is most difficult to get reliable information of happenings in night attacks, usually individuals cannot see anything except in their immediate vicinity, and in the heat and excitement often do not get a clear impression of what is going on. Very often, too, the only ones who could throw light on certain incidents are killed or wounded themselves'*. In his opinion, so much time had elapsed without information about *'dear old chook'* that it had to be concluded *'he must have made the supreme sacrifice for his country's cause'*. He concluded his letter with the words, *'I have lost a valued friend, but you, his parents, something infinitely greater'*.<sup>20</sup>

### Further dental service

It is not known whether Henderson performed any dental treatment when serving in Egypt, Gallipoli or France. This seems unlikely as the Army Dental Service had been formed and deployed overseas by the time he reached those theatres.<sup>8</sup> However, it is known that he took his dental instruments with him when he embarked for overseas service in August 1915 because when the AIF returned his belongings to his family in Sydney in May 1917, they contained a *'case of dental instruments'*.<sup>11</sup>

### Commemoration

Captain J K Henderson has no known grave, and his name is commemorated at the Australian National Memorial at Villers-Bretonneux in France, along with the names of over 10 700 other Australian service members killed on the Western Front whose resting places are unknown.<sup>32</sup> Henderson is also recorded on the Roll of Honour at the Australian War Memorial and a plaque at the base of the War Memorial Carillon at the University of Sydney that contains the names of 205 undergraduates, graduates and staff of the university who died in World War I.

It is probable that Henderson's remains may still lie in the Pozieres-Mouquet Farm battlefield area. The Germans held the land around Mouquet Farm, where Henderson was last seen alive, until finally being driven out on 26 September 1916.<sup>33</sup> Given that Henderson was killed on 14 August and it was summer, his remains, if recovered, would likely have been buried by the Germans. The battlefield at Pozieres received the longest and most intense artillery bombardment of all the Australian battlefields of the entire war,<sup>33</sup> meaning that many bodies were likely obliterated or buried by the heavy shelling. The three Australian divisions involved in that battle suffered 23 000 casualties in less than 7 weeks in 1916, leading the official war historian, C E W Bean, to comment that the less than 2 km-long Pozieres ridge *'marks a ridge more densely sown with Australian sacrifice than any other place on earth'*.<sup>33</sup>

### Conclusion

Due to his work in Rabaul, Henderson holds a place of honour within the RAADC as the first Australian to provide dental treatment to troops on active service. The lessons learnt from his service in Rabaul in 1914 were important in the momentum to establish an Army Dental Service as part of the AAMC in World War I. This led to the formation of the Australian Army Dental Corps in 1943 during World War II, which then was granted the *'Royal'* prefix in 1948 and became the RAADC.<sup>1</sup> Since then, the RAADC has continued to provide healthcare support to Australian troops deployed on operations overseas, continuing the service begun by Private John Keith Henderson in 1914.

---

*Corresponding Author:*

*Lieutenant Colonel Christopher Daly (Ret'd),*  
[chrisdaly45@gmail.com](mailto:chrisdaly45@gmail.com)

*Authors: C Daly<sup>1</sup>*

*Author Affiliations:*

*1 Independent Researcher*

### References

1. Handbook of the Royal Australian Army Dental Corps. Chapter 2. RAADC mythology and a brief history. [cited 29 Sep 2021] para. 202, 206, 210, 217, 218, 229. Available from: <https://web.archive.org/web/20110602065226/http://www.army.gov.au/RAADC/History.asp>
2. Maguire FA. The Capture of Rabaul. In: Butler AG, editor. Official History of the Australian Army Medical Services, 1914-1918. Volume 1 – Gallipoli, Palestine and New Guinea. Part 3 – The Occupation of German New Guinea. Melbourne: Australian War Memorial; 1938. p. 783-785.
3. Wright NT. The genesis of the Royal Australian Army Dental Corps – the original six. Aust Dent J. 1977;22(3):172-176.
4. Halliday RW, Watson AO. A History of Dentistry in New South Wales 1788 to 1945. Sydney: Australian Dental Association; 1977. p. 185-186.

5. Tyquin MB. Neville Howse: Australia's First Victoria Cross Winner. Melbourne: Oxford University Press; 1999. p. 13, 21, 22, 24, 26, 27, 30, 31, 33, 36, 37, 59.
6. Kuusk S. Origins and development Royal Australian Army Dental Corps. Sabertache. 2006;47(3):23-30.
7. Kuusk S. Fang Farriers, Australian army dentistry in war and peace: a history of the Royal Australian Army Dental Corps. Volume 1, 1914-1939. Adelaide: Sven Kuusk. 2015. p. 30.
8. Butler AG. Official History of the Australian Army Medical Services, 1914-1918. Volume 1 – Gallipoli, Palestine and New Guinea. Part 1 – The Gallipoli Campaign. Melbourne: Australian War Memorial; 1938. p. 6, 20, 26, 79, 80, 414, 520.
9. Bean CE. Official History of Australia in the War of 1914-1918. Volume 1. The story of ANZAC from the outbreak of war to the end of the first phase of the Gallipoli campaign, May 4, 1915. Sydney: Angus and Robertson; 1941. p. 32-36, 59.
10. Mackenzie SS. Official History of Australia in the War of 1914-1918. Volume 10. The Australians at Rabaul. Sydney: Angus and Robertson; 1939. p. 23-33, 58, 59, 208.
11. National Archives of Australia: B2455. HENDERSON, John Keith - Captain. [cited 14 Aug 2021]. p. 1-5, 10, 11, 15, 17, 19, 25, 52, 58-60. Available from: <https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/Viewimage.aspx?B=5338816>
12. Bean CE. Official History of Australia in the War of 1914-1918. Volume 3. The Australian Imperial Force in France, 1916. Sydney: Angus and Robertson; 1941. p. 756.
13. Calendar of the University of Sydney for the year 1914. Sydney: Angus and Robertson; 1914 [cited 29 Aug 2021]. p. 205, 376, 468. Available from: <https://calendararchive.usyd.edu.au/Calendar/1914/1914.pdf>
14. AWM Roll of Honour Circular. 1927 [cited 30 Sep 2021]. Available from: <https://s3-ap-southeast-2.amazonaws.com/awm-media/collection/RCDIG1068872/document/5570655.PDF>
15. Old Boys' Notes. The Sydneian 1914;222:22. [cited 6 Sep 2021] Available from: [https://sgsvideos.s3.amazonaws.com/files/the-sydneian/1910-1919/222 The Sydneian DEC 1914.pdf](https://sgsvideos.s3.amazonaws.com/files/the-sydneian/1910-1919/222%20The%20Sydneian%20DEC%201914.pdf)
16. Calendar of the University of Sydney for the year 1909. Sydney: Angus and Robertson; 1909 [cited 20 Aug 2021]. p. 278, 279, 393, 394. Available from: <https://calendararchive.usyd.edu.au/Calendar/1909/1909.pdf>
17. Calendar of the University of Sydney for the year 1911. Sydney: Angus and Robertson; 1911 [cited 21 Jul 2021]. p. 336, 440, 524. Available from: <https://calendararchive.usyd.edu.au/Calendar/1911/1911.pdf>
18. Calendar of the University of Sydney for the year 1912. Sydney: Angus and Robertson; 1912 [cited 13 Aug 2021]. p. 463. Available from: <https://calendararchive.usyd.edu.au/Calendar/1912/1912.pdf>
19. Calendar of the University of Sydney for the year 1913. Sydney: Angus and Robertson; 1913 [cited 24 Aug 2021]. p. 367, 462. Available from: <https://calendararchive.usyd.edu.au/Calendar/1913/1913.pdf>
20. Beyond 1914. The University of Sydney and The Great War. John Keith Henderson. Attached documents.
21. Woods SH. An outline of dentistry in the British army, 1626-1938. Proc R Soc Med. 1938;32(2):99-112.
22. Newland-Pedley F. Dental surgery with the field force in South Africa. Lancet 1901;157(4036):55-57.
23. AWM 23/30/2 - 13 Infantry Battalion – 1 to 8 Reinforcements. Nominal Roll. [cited 18 Sep 2021]. Available from: <https://www.awm.gov.au/collection/C1378923>
24. Ratcliff SC. Dentistry at the front. The Commonwealth Dental Review 1916;13(6):241-246.
25. AWM4 Subclass 23/30 - 13th Infantry Battalion. War Diary. [cited 10 Aug 2021]. Available from: <https://www.awm.gov.au/collection/C1339128>
26. Australian National Archives: B2455. MEYER, Cyril Bernard – Lieutenant. [cited 20 Sep 2021]. p. 35, 50, 51. Available from: <https://recordsearch.naa.gov.au/SearchNRetrieve/Interface/Viewimage.aspx?B=8012583>
27. Australian Red Cross records held at the Australian War Memorial (1DRL/0428). [cited 23 Sep 2021]. Available from: <https://www.awm.gov.au/articles/encyclopedia/redcross>

28. Australian Red Cross Society Wounded and Missing Enquiry Bureau files, 1914-18 War. 1DRL/0428. Box 131. Wallet 9. Captain Henderson, John Keith. [cited 2 Sep 2021]. Available from: <https://www.awm.gov.au/collection/C1414585>
29. AWM4 Subclass 23/68 – 51st Infantry Battalion. War Diary. [cited 29 Aug 2021]. Available from: <https://www.awm.gov.au/C1339114>
30. AWM Subclass 23/21 – 4th Infantry Battalion. War Diary. [cited 29 Aug 2021]. Available from: <https://www.awm.gov.au/collection/C1339162>
31. National Archives of Australia: B2455. TILNEY, Leslie Edward – Lieutenant Colonel. [cited 23 Sep 2021]. p. 3, 32. Available from: <https://recordsearch.naa.gov.au/SearchNRRetrieve/Interface/ViewImage.aspx?B=8391308>
32. Commonwealth War Graves Commission. John Keith Henderson. 13th Bn., Australian Infantry, AIF [cited 13 Sep 2021]. Available from: <https://www.cwgc.org/find-records/find-war-dead/casualty-details/1461849/john-keith-henderson>
33. Bean CE. ANZAC to Amiens. Canberra: Australian War Memorial; 1983. p. 262-264.

Notes



[illegible]

Notes



## AUSTRALASIAN MILITARY MEDICINE ASSOCIATION



# BECOME AN AMMA MEMBER TODAY

Further your knowledge  
of Military Medicine  
and Veterans' Health

# Only \$164 per year

\*Full Membership (Student discount available)

**Enter  
discount code  
JMVH for  
\$40.00  
discount**

**Annual Membership  
spans 1 July 2022 -  
30 June 2023**

**Jenna Tomlin  
AMMA Secretariat  
secretariat@amma.asn.au**

### Other great Membership benefits:

- Interact with peers, community and the fellowship
- Stay connected with the Australian and New Zealand Army, Navy and Air Force
- Receive a copy of AMMA's publication, Journal of Military and Veterans' Health (JMVH) published four times annually. We welcome contributions from new authors and reviewers. Please visit [www.jmvh.org](http://www.jmvh.org)
- As a member you are entitled to access reduced registration fees to attend AMMA education opportunities, including the Annual Conference and Workshops
- Take advantage of your membership to gain access to the Awards & Grants available. These are awarded annually and open to all members
- Become more involved in AMMA – all members have the opportunity to nominate for the AMMA Council
- All new members receive a membership certificate and welcome pack, and will be acknowledged and welcomed at AMMA's Annual General Meeting held in conjunction with the annual conference
- AMMA membership entitles you to voting rights at the Annual General Meeting
- Opportunity to purchase AMMA Merchandise

**To join, please view [amma.asn.au/membership](http://amma.asn.au/membership) and enter the discount code JMVH**





## Medical and Military History in South Africa

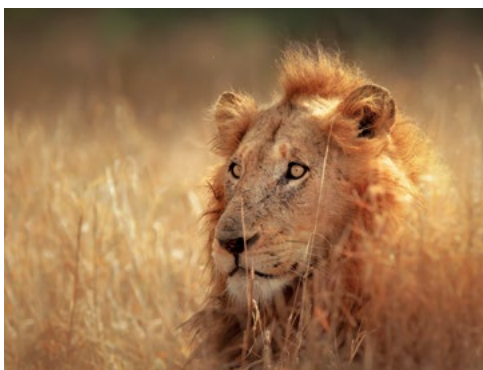
16 – 30 Jan 2023

3 nights Johannesburg – 3 nights Kruger National Park – 2 nights Eswatini – 2 nights Ladysmith – 4 nights Cape Town

This tour takes you on a personal and historical journey through South Africa, revealing its medical, military and cultural history, as well as many faces of this beautiful and diverse land.



Visit Adler Medical Museum, renowned and historic Groote Schuur Hospital, the Siege Museum in the historic town of Ladysmith and explore the battlefields of the Anglo-Zulu and Boer Wars.



Spot the 'Big Five' on game drives in Kruger Park and Milwane, take the spectacular Panorama Route, stay in Swazi 'beehive' huts and explore the famous Stellenbosch wine region with tastings.

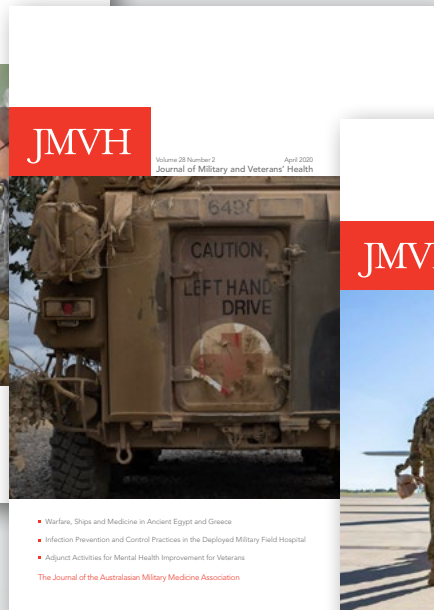


Experienced Australian tour leader Dr Paul Luckin and national guide Frank Mbete led the previous tour together; they both worked in South Africa during apartheid and provide rare personal insights into this period.

Book or find out more at:

Email: [info@jonbainestours.com.au](mailto:info@jonbainestours.com.au) • Tel: 03 9343 6367

[www.jonbainestours.com/military](http://www.jonbainestours.com/military)



# Do you have an article of interest to our readers?

The Journal of Military and Veteran's Health is a peer reviewed quarterly publication published by the Australasian Military Medicine Association.

Authors are invited to submit articles of relevance to the Editor for consideration for publication in the Journal of Military and Veterans' Health (JMVH).

Categories include:

Original Research/Original Articles

Short Communication

Review Articles

Reprinted Articles

Case Studies

Biographies

History

Book Reviews

Commentary

View from the Front

See the **JMVH** website for authors' instructions and submit your article online at [www.jmvh.org](http://www.jmvh.org)

# JMVH





#### DISCLAIMER

The views expressed in this journal are those of the authors, and do not reflect in any way official Defence Force policy, or the views of the Surgeon General, Australian Defence Force, or any Military authority

[www.jmvh.org](http://www.jmvh.org)