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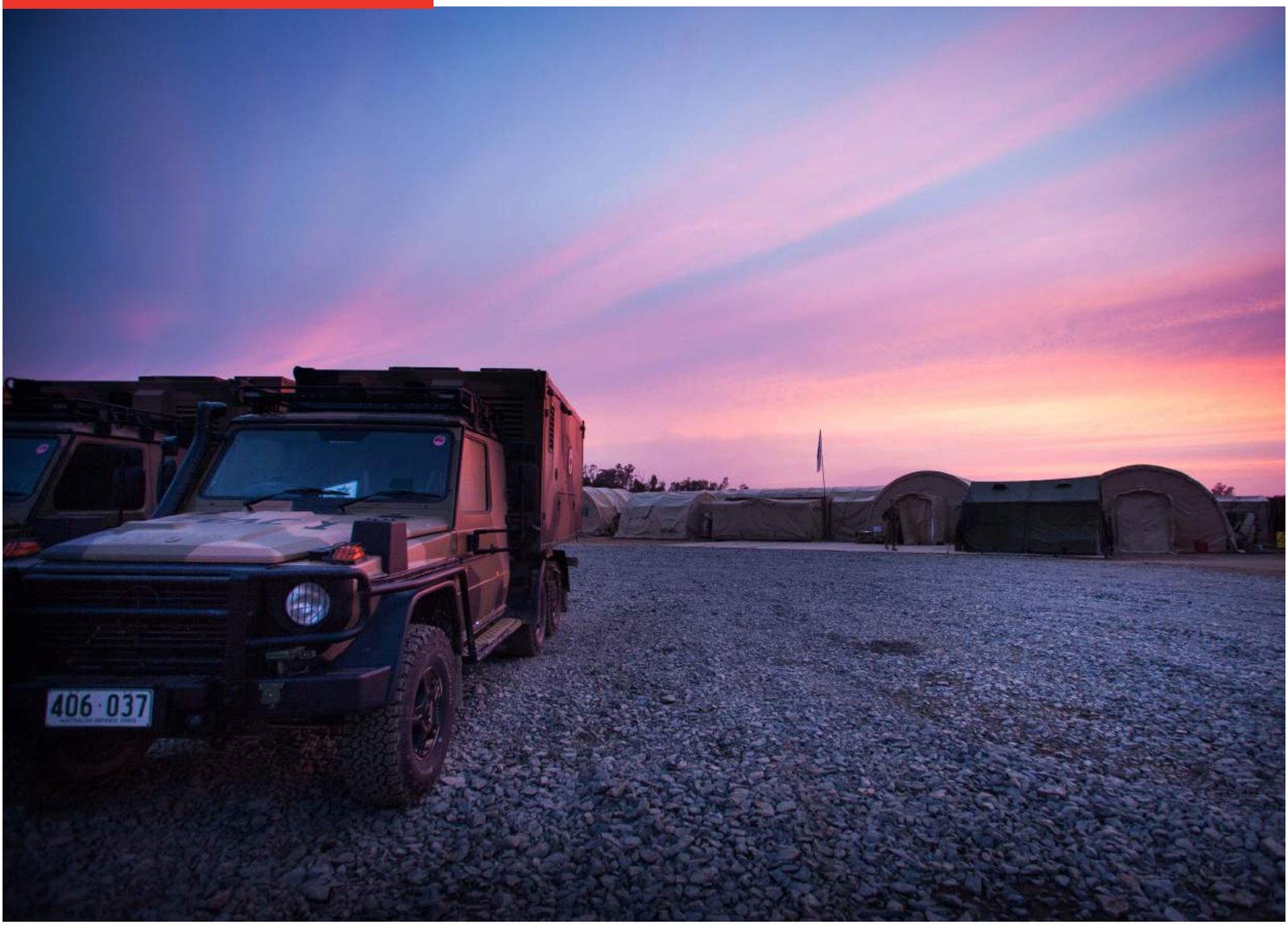

- Effects of Agility Training: A Pilot Study
- Post War: Survive to Thrive Program
- The Camino de Santiago An Ancient Way – A Way Back for Veterans?

The Journal of the Australasian Military Medicine Association

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Table of Contents

Letter to the Editor

Original Articles

Review Articles

Commentary

Front Cover

Title: "Sunrise over 2GHB deployed in SWBTA, Ex Hamel 2018"

Photo courtesy of Colonel Murray Hayes, RAADC

Volume 27 Number 2; April 2019

Journal of Military and Veterans' Health

Australasian Military Medicine Association

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.

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227 Collins Street Hobart Tas 7000 Australia
Ph: +61 3 62347844
Email: editorial@jmvh.org

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Editorial

Repatriation

In early 1917, even before victory was assured, Prime Minister 'Billy' Hughes promised the country's armed forces that 'When you come back we will look after you'. Repatriation or 'Repat' was born. The theme of this issue is 'repatriation' – a very Australian concept that is as relevant today as it was in 1917. Repat was not just about getting the troops home after the Great War, but aimed to meet the varying needs of returning veterans and their dependants, whether that was education, employment, healthcare, housing or war pensions.[1] Subsequent waves of veterans after the Second World War, Korean War, Vietnam War and more recent conflicts in East Timor, Iraq and Afghanistan ensured that the need for the Repatriation Department, established in 1918 and now the Department of Veterans' Affairs, has never disappeared.[1] Various military doctors who had served with the A.I.F. took up roles with the Repatriation Department. Sir Neville Howse VC, KCB, KCMG, after a distinguished career in the Army, including as the commander of the ANZAC medical services during the First World War, was to serve as the Minister for Repatriation from 1923 to 1929. My great uncle, Gordon Robertson, having served as a Regimental Medical Officer with the 30th Battalion of the A.I.F during 1918, also went on to work with the Repatriation Department during the 1930s.[2]

Our second issue of 2019 contains a diverse range of articles, with several addressing the theme of 'repatriation' in its broadest context. These include papers on disability reporting, disability benefits, management of PTSD in veterans and a perspective on the benefits of walking the Camino de Santiago. Operational papers look at the training of recruits, perceptions of treating battle casualties and a review of haemostasis in military trauma. Finally, there is a historical paper that looks at why we wear the uniforms we wear. We continue to get a good range of articles, but other military and veterans' health articles 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 our 2019 themes of recovery, rehabilitation and repatriation, but welcome any articles across the broader spectrum of military health.

Dr Andy Robertson, CSC, PSM
Commodore, RANR
Editor-in-Chief

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Paramedics in the ADF – A Time For Change?

Commander Neil Westphalen, Royal Australian Navy *23 November 2018*

Dear Sir,

The July 2018 JMVH article regarding paramedics in the Australian Defence Force (ADF)[1] requires further elaboration regarding its scope and conclusions.

The article describes how the expanding professional profile of paramedics in the civilian health system is not being reflected in current career options within the ADF, and that new roles could be based on Physician Assistant and Emergency Care Practitioner roles, as implemented in the United States and United Kingdom respectively. It then indicates that, although developing roles for paramedics would require organisational change, it does not replace the need for medics or medical and nursing officers. Finally, the article advocates the need to identify a best-fit role that recognises paramedic education, skill and experience on comparable terms as other ADF health professionals.

The author seems unaware of the long history and extent to which paramedic or 'paramedic-like' health practitioners have within the ADF, in particular Navy. The first 'proto-paramedic' course was developed at the RAN Medical Training School (MTS) at HMAS *Cerberus* in 1981, in response to an ongoing shortfall in Navy medical officer recruiting after the Vietnam War that precluded the previous practice of putting doctors aboard every Fleet unit.[2]

The Advanced Clinical Course (ACC) was developed and managed by Lieutenant Commander Sheena Frances Macdougall RANNS, supported by (among others) the Officer In Charge MTS (Lieutenant Commander Phillip John 'Phil' Davies RAN), the MTS Chief Instructor (Chief Petty Officer MEDL John Robert Hornsby), and the Medical Officers In Charge RAN Hospital *Cerberus* (Commander Geoffrey James Alexander 'Geoff' Bayliss followed by Commander Kerry Ronald Delaney RAN). Lieutenant Commander Macdougall had extensive experience as a theatre sister and was responsible for developing a range of Navy medical courses since the late 1960s; Lieutenant Commander Davies was an ex-operating theatre sailor with extensive seagoing experience; Commander Bayliss was a general physician and Commander Delaney an anaesthetist.[3]

In many respects, the ACC was ahead of its time: information sought from civilian ambulance services and other navies regarding their courses was conspicuously absent, to the extent that some of these organisations requested the ACC documentation. It therefore became necessary to use computer-generated clinical incidence data (derived from the six-monthly medical journals produced by all fleet units) to ascertain the most common, and the most important, medical conditions to be expected at sea.[4]

The next challenge entailed balancing what the medical officers believed the ACC sailors needed to know, against the instructor feedback regarding their ability to understand and apply it. Hence, despite Navy Office direction, the ACC had considerable emphasis on basic anatomy, physiology, history taking and examination, while its scope became much broader than nursing care and medical emergencies.[5]

The first course commenced after three months' development, when it was only about 25 per cent complete. Lessons were therefore often still being written the night before delivery, while course instruction was initially provided by more-or-less anyone with the relevant background knowledge and interest. The first ACC was six months' duration but subsequent courses have been up to 12.[6]

The benefit of the ACC quickly became apparent when a sailor ruptured his urethra falling across a hatchway, for which he received a suprapubic catheter for the three days it took for his ship to return alongside. A commanding officer with a myocardial infarction likewise demonstrated the ACC's benefits with respect to teaching, at times, very junior medical sailors how to take charge of such patients. At the same time, the ACC and subsequent courses' premise on 'first doing no harm' remains central to the ethos of the Navy Health Services.[7]

First ACC Course, RAN Medical Training School HMAS Cerberus, 1981. Left to right: POMEDU Robert 'Zac' Fazackerley, LCDR Sheena Macdougall *(standing)*, LSMEDU Charles 'Charlie' Darmanin, and POMEDH Kenneth 'Ken' O'Keefe. The first ACC had eight students. *(Via Sheena Macdougall)*

The ACC became a prerequisite for medical sailor promotion to Petty Officer in about 1988. It was renamed the 'Phase 3' course sometime during the early 1990s, and received its current Clinical Manager (CM) title in the early-mid 2000s. The CM course has since been conducted by several civilian tertiary institutions, with additional Navy-specific modules at the RAN Medical School at HMAS *Penguin*.

It is my understanding that the current ADF Medics Course results in a civilian Diploma of Paramedic Practice, and that the current 10-month Navy CM course substantially contributes towards a bachelor degree, with only a small number of additional modules required thereafter to achieve this qualification. While they are not supported by Defence, I also understand that several CMs are undertaking postgraduate education towards a range of master's qualifications, including paramedic practice.

It should also be noted that apart from a small number of ex-dental sailors, all other Permanent Navy Medical Administration Officers (MAO) are ex-medical sailor changeovers with prior CM experience. Although their MAO roles often (but not always) preclude them from undertaking clinical roles (usually because of currency maintenance difficulties), they clearly have an excellent understanding of paramedic training and scopes of practice. Likewise, experienced Navy medical and dental officers who work with CMs every day have a very good understanding of these attributes.

Referring again to the article, the author also seems unaware that Navy employed two nursing officers as Nurse Practitioners (NPs) from 2009, although the intent to employ them in a seagoing role regrettably did not come to fruition. Furthermore, Navy also had at least one Australian-trained Physician Assistant (PA) at that time, who unfortunately could not be employed as such because the civilian regulatory environment did not yet exist (as the article correctly indicates).

Notwithstanding their considerable overlap, it is important to appreciate the differences between NPs and PAs: in short, PAs work under medical officer direction (which can be conducted remotely), while NPs have a specific scope of practice.

It is also important to understand how Navy employs its CMs. Following their training, they usually undergo a brief period of consolidation ashore before joining their ship as a Leading Seaman or newly promoted Petty Officer, for a posting of up to two years, which may include a cumulative total of up to 18 months at sea.

During this time, CMs only have a medical officer embarked when required for overseas deployments, subject to availability. On coming ashore, they undertake a range of clinical and non-clinical supervisory duties at a 'garrison' health facility, or a range of teaching or other duties elsewhere. CMs can expect several such posting cycles throughout their Navy career.

CMs provide protocol-based treatment in accordance with the Primary Clinical Care Manual provided by Queensland Health,[8] under remote supervision by the Duty Fleet Medical Officer at Fleet Headquarters in Sydney. It should be noted that this process is routinely applied for ships deployed as far from Australia in recent times as off Casablanca in the Atlantic Ocean, and between Guam, Midway Island and Oahu in the Pacific.

However, it is also essential to appreciate the full range of medical functions and roles undertaken by CMs during their sea time. These include:

- Implementation and compliance with the extant operational health support plan produced by Fleet Headquarters or Joint Operations Command.
- Initiating and/or providing maritime forward aeromedical evacuations (AME) to/from their ship, and/or preparing patients for tactical and strategic AME as directed. It should be noted maritime time/distance considerations mean this can take several days.[9]

- Supporting maritime humanitarian aid / disaster relief operations (including merchant ships).
- Supporting (and in some cases providing) military medicine capabilities such as aviation, submarine and (especially) diving medicine.
- Facilitating/supporting the assessment of ADF personnel regarding their health-related suitability for employment and deployment (typically via the ADF Medical Employment Classification System).
- Facilitating occupational and environmental health services as required (in particular shipboard occupational hygiene).
- Supporting health promotion services (in particular vaccination programs).
- Providing shipboard treatment services during operations, exercises and other deployments including
    - routine primary health care
    - health support for 'routine' seagoing Disease and Non-Battle Injury (DNBI) emergencies (typically workplace and sporting injuries and acute mental health events)
    - health support for 'special' seagoing DNBI emergencies such as toxic hazards, man overboard, and aviation, diving and submarine incidents and accidents
    - limited seagoing DNBI inpatient services
    - initial Battle Casualty (BCas) resuscitation and stabilisation pending evacuation (which may take several days).

It can therefore be seen that shipboard treatment services constitutes only one of the functions and roles undertaken by CMs. Furthermore, it is also essential to appreciate the Fundamental Inputs to Capability (FIC) tasks they also undertake to bring these functions and roles to life, such as:

- Managing their junior medical sailors if/when embarked, including individual training. The latter also includes ship's company first aid.
- Conduct collective training, in particular Ship's Medical Emergency Teams (SMET) training and exercises.
- Maintaining their ship's Action Medical Organisation.
- Maintaining their ship's medical facilities, such as the sickbay, emergency operating stations and first aid posts.
- Maintaining their ship's medical stores, in collaboration with the ship's (non-medical) Supply Department.
- Managing and utilising their ship's medical and other information technology systems.
- Participating in their ships' military health command and management functions via their commanding officer and several health technical authorities ('garrison' health services when alongside, Joint Operations Command when force assigned; otherwise Fleet Headquarters when at sea).
- Seeking the administrative and other support functions they require from their ship's non-health staff (in particular the Supply Department who provide most of the SMETs).[10]

Hence, it is Navy's CMs rather than its professional health officers, who are the mainstay of health support for ADF maritime operations.

To conclude, Navy's nearly 40 years of experience with its CMs confirm that the article has considerable merit with respect to advocating a role for paramedics that reflects their education and expertise. Among other benefits, expanding Navy CMs scope of clinical practice to finally include patients ashore as well as afloat would greatly facilitate their job satisfaction and therefore retention. Furthermore, their seagoing experience would greatly enhance the ADF's health services with respect to supporting and sustaining an occupational and environmental health paradigm.[11]

There are however, some caveats:

- The successful introduction of the first ACC sailors in 1981 on the one hand, and the lack of progress with respect to Navy NPs and PAs since 2009 on the other, confirm the need to identify a health capability gap first and then ascertaining the best option to fill it.
- It is also essential that the appropriate civilian regulatory environment exists such that Defence health providers for non-deployed ADF members have the same scope of practice as they would for Australian civilians.
- The scope of practice for Defence paramedics must extend far beyond pre-hospital emergencies. While these have much of the excitement and interest, the majority of their day-to-day workload can be expected to entail far more mundane primary healthcare conditions (in particular workplace and/or sports injuries, and mental health issues).

- Furthermore, future Navy CMs, PAs and NPs must also accept that most of their overall workload will continue to pertain to the non-treatment-related functions and roles, and the FIC management listed previously.
- Finally, the significant career implications with respect to ADF members whose long-term suitability for employment and deployment is in doubt, means that the medical decision-making for such cases must remain the responsibility of the treating paramedic's supervising medical officer. This further reinforces the assertion elsewhere that the need for all Defence primary healthcare providers to be good clinicians, must be comparable to their need to understand the duties their patients undertake.[12]

I trust this letter is a constructive elaboration of the issues raised in the article.

Disclaimer

The views expressed in this article are mine alone. They do not necessarily reflect those of the RAN or any other organisations mentioned. Likewise, any factual errors are my responsibility.

Yours sincerely
Dr Neil Westphalen
Commander, Royal Australian Navy

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Military Medical Personnel's Perceptions of Treating Battle Injuries

Anna Abelsson, Lars Lundberg

Abstract

Purpose: To evaluate military personnel's self-rated perceptions of their knowledge, experience and training after high-fidelity battle injury simulation.

Design: 26 military medical personnel participated in this quantitative study. Data was collected using a questionnaire after a six-day exercise where participants self-rated 10 statements regarding having sufficient medical, practical and ethical knowledge, experience and training. Descriptive and inferential analyses were conducted to obtain the results.

Results: Nurses rated themselves statistically significantly higher than medics in having sufficient medical knowledge and experience, practical knowledge, experience and training, as well as ethical knowledge and experience. The nurses also rated themselves statistically significantly higher than physicians in having practical knowledge, experience and training. Physicians' self-rated perception was low regarding sufficient knowledge, experience and training in practical skills. Physicians, nurses and medics all reported low ratings for sufficient training in ethical issues.

Discussion: Military medical personnel are required to have the knowledge and skills to work autonomously in challenging and threatening environments. For personnel that seldom see battlefield-like injuries, a clinical placement in a country with a high frequency of battlefield-like injuries would be advisable. A comparison between subjective and objective assessments may identify deficiencies in competence, which can negatively impact quality of care.

Keywords Emergency care, ethics, questionnaire, physician, nurse, medic

Introduction

Simulation in the Swedish Armed Forces

Learning through simulation can contribute to the development of theoretical and practical knowledge for both civil and military healthcare professionals.[1,2] Experience from simulations prepares medical personnel for handling similar complex situations in the future.[3] The practical knowledge acquisition that occurs in simulation is applied and integrated as practical skills.[4] In health care, practical skills consist of complex and professionally performed care actions.[5] In simulation, scenarios and events can be engineered based on the existing skill levels of medical personnel. From this, inexperienced medical personnel can learn basic skills and experienced medical personnel can adjust, improve and consolidate prior skills.[6]

Learning through simulation takes place in an environment controlled by a facilitator. The environment can be free from the normal stimuli that are often found in real-life situations. By allowing the environment to affect the simulation, the learning situation can be strengthened and enable medical personnel to link their learning to a specific environment or situation.[7,8] Power et al.[9] have previously described how simulation in the Irish Defence Forces was considered relevant and applicable to personnel in the service within and outside of the country borders. The use of simulation in Swedish military medical education can largely be linked to military activities, as learning takes place in military locations. The training can take place in a field hospital or in a simulated hostile, unpredictable and challenging combat environment. This contributes to a more lifelike situation related to the shifting military prehospital-care work environment.

Medical personnel in the Swedish Armed Forces

The Swedish Armed Forces (SwAF) primarily focuses on the United Nations' international peacekeeping and humanitarian missions. Swedish military medical personnel are employed either full-time or part-time as reserves. The education levels of the SwAF medical personnel are medics with a medical education within the armed forces. The medics have a 14-month theoretical and practical education, followed by clinical placement at civilian hospitals and in the ambulance service. Registered nurses have a basic three-year bachelor's degree, followed by one year of clinical practice and subsequent specialisation in the form of a one-year master's degree in, for example, prehospital care, anaesthesia or intensive care. The physicians have a basic five-and-a-half-years of medical school, two years of internship and a five-year specialisation practice in, for example, surgery, anaesthesiology or emergency medicine.

All medical personnel are prepared for military medical care through specific military medical courses, including face-to-face lectures, practical training sessions and patient simulations. All education aims at creating a capable workforce; able to undertake their military duties wherever they will be sent. The SwAF provide medical care to both military personnel and to civilians. This care may include adults as well as children.

Medical knowledge, practical skills and ethical foundation in the Swedish Armed Forces

All military medical personnel are required to have the medical knowledge and practical skills to work autonomously, often in a challenging environment, unlike other healthcare settings.[10] In twentieth-century warfare, haemorrhage is the main cause of mortality,[11] which, in the field, can often be difficult to detect due to the coverage of body armour.[12] Body parts, such as the lower extremities, pelvis and face, are without protection and therefore, more exposed to gunshot wounds and injuries from explosive devices. Thoracic injuries caused by blasts are also related to a high incidence of morbidity and mortality.[11,13] In trauma care, the potential to prevent deaths is increased. Malekpour et al.[14] show how trauma education with a focus on assessment, resuscitation of patients and management of life-threatening injuries is associated with reduced mortality.

All medical personnel, both military and civilian, share the same ethical foundation in the care of patients. Military medical personnel are trained to perform according to professional moral values.[15] Moral skills are the will and ability to identify situations where the medical personnel's or patient's dignity is at stake; to act in an ethical way and be able to take responsibility for themselves and others.16 Promoting moral skills helps soldiers manage ethical dilemmas responsibly.[17] When the patient loses control of their injured body and encounters a frightening, unfamiliar emergency situation, the medical personnel become responsible for the patient's survival.[18] For all personnel in emergency care, it is vital not to compromise the patient's dignity when survival is the focus and forget the individual behind the injury.[19] The care of severely injured patients requires broad, but profound expertise for medical personnel. The military medical personnel require quality medical knowledge and practical skills, as well as a solid ethical foundation. This increases the need for training and feedback after caring for trauma patients.

The aim of this study was to evaluate military personnel's self-rated perceptions of their knowledge, experience and training after high-fidelity battle injury simulation.

Method

Quantitative data was collected through participants' written evaluation of 10 statements regarding having sufficient knowledge, experience and training of medical, practical and ethical issues, including one statement concerning feedback. Descriptive and inferential analyses were conducted.

Participants

Participants in this study consisted of 26 military medical personnel – 20 males and 6 females – all stationed at a military field hospital. Professions included physicians (n=5, 5 males), nurses (n=11, 7 males, 4 females) and medics (n=10, 8 males, 2 females). The ages ranged from 21 to 51 years (mean 34). The experience from emergency care ranged from 1 to 15 years (mean 4). Inclusion criteria were military medical personnel participating in a six-day long SwAF military exercise, including high-fidelity trauma simulation in a military hospital setting. All participants had previous experience of simulation training.

Data collection

The participants served at the military hospital for 12-hour shifts, one shift per day, during the six-day exercise. Battlefield-trauma patients were constantly being transported from the prehospital setting to the military hospital. Patients were ground transported

in Sisus, armoured personnel carriers configured to ambulances. They were also flown into the hospital with Blackhawk helicopters during all hours of the day. No actual patients were treated in the hospital during the exercise; therefore, all patients were simulated. The scenarios were made more immersive through the use of moulaged patients. In total, 60 patient scenarios were completed during the six-day exercise. Every participant partook in at least 30 patient scenarios as a member of the medical team including physicians, nurses and medics.

The simulated patient scenarios consisted of a wide range of typical battlefield injuries, for example, traumatic cardiac arrest, traumatic leg amputation, shrapnel injury to lower extremities and groin, injury to shoulders, lung and throat, and blast injuries from explosive devices. There was also a constant minor flow of non-battle patients. These patients presented with minor surgical injuries, cardiovascular disease, gynaecological problems and various gastrointestinal disorders. All moulage patients were educated and trained on symptoms and signs of their specific injury or disease. When a patient suffered from, for example, a cardiac arrest or an emergency tracheotomy had to be carried out, all medical personnel switched without interruption from the patient to a manikin lying on an adjacent patient bed.

Patients requiring a higher level of care were air transported with a TP-84 Hercules to a university hospital. Patients who died were initially cared for by the personnel at the hospital and then transported. Patient outcome aim was equal to a normal military care-giving situation. Deceased patients and patients discharged from the hospitals were again moulaged and sent back as new patients.

Ethical issues were incorporated into the patient scenarios, such as dealing with dying and dead patients from different cultural backgrounds. Feedback sessions were held as informal discussions in the team, including the researcher as facilitator after the simulated scenario had ended and before the next scenario started. The feedback aimed to support the learning experience.

At the end of the six-day exercise, participants were asked to rate 10 statements on a 5-point Likert scale, ranging from *strongly agree, agree, neither agree nor disagree, disagree* and *strongly disagree*. The statements were aimed at responding to the participants' self-rated perceptions of having sufficient knowledge, experience and training in medicine, practical skills and ethics in the care of battlefield-trauma patients. The statements were:

1. *I have sufficient **medical knowledge** to perform battlefield trauma care on a patient.*
2. *I have sufficient **medical experience** to perform battlefield trauma care on a patient.*
3. *I have sufficient **medical training** to perform battlefield trauma care on a patient.*
4. *I have sufficient **practical skills knowledge** to perform battlefield trauma care on a patient.*
5. *I have sufficient **practical skills experience** to perform battlefield trauma care on a patient.*
6. *I have sufficient **practical skills training** to perform battlefield trauma care on a patient.*
7. *I have sufficient **ethical knowledge** to perform battlefield trauma care on a patient.*
8. *I have sufficient **ethical experience** to perform battlefield trauma care on a patient.*
9. *I have sufficient **ethical training** to perform battlefield trauma care on a patient.*
10. *I have the opportunity to receive **feedback** after caring for real trauma patients in order to improve my knowledge, practical skills and ethical knowledge, experience and training after caring for trauma patients.*

Data analysis

Descriptive and inferential analyses were conducted using IBM Statistical Package for the Social Sciences (SPSS) 24.0. Descriptive analysis (central tendency and distribution) was used to describe the data, whereas inferential statistics (z-test, post-hoc Tukey) compared potential differences in variables between groups. The level of significance used was set at α=0.05.

Ethical consideration

The study followed the ethical principles in accordance with the World Medical Association[20] regarding anonymity and integrity. Ethical approval was obtained from the Swedish Armed Forces Centre for Defence Medicine. All participants received oral information about the study and participated on a voluntary basis. All participants who were asked to participate accepted.

Results

The results of the study are summarised in Table 1 as self-rated perceptions regarding having sufficient knowledge, experience and training in medical/practical skills/ethical aspects. A five-point Likert scale was used, where the score 1 indicates strongly disagree and the score 5 indicates strongly agree. Regarding the participants' self-rated perceptions on

the 5-point Likert scale, Table 1 shows 10 statistically significant differences between the nurses group and the physicians and medics. There was no statistically significant difference between the physicians and medics.

Of the 10 statements, nurses self-rated their sufficiency highest on eight statements, while doctors and medics self-rated their sufficiency highest on one statement each. The medics self-rated their sufficiency lowest on seven statements.

Table 1: Participants' self-rated perception on the 5-point Likert scale (mean, SD) regarding having sufficient medical/practical/ethical aspects of knowledge, experience and training, including the opportunity to receive feedback after caring for a real trauma patient.

Items	Doctor		Nurse		Medic
	Mean SD	Sig.	Mean SD	Sig.	Mean SD
Medical knowledge	3.40 1.14		4,00 *1 1,09	.020	2,60 *1 1,07
Medical experience	2.60 1.82		3.55 *2 1.44	.025	1.90 *2 0.88
Medical training	2.80 1.10		3.36 1.29		2.30 1.16
Practical skills knowledge	2.40 *3 0.89	.049	3.82 *3,4 1.08	.036	2.60 *4 1.07
Practical skills experience	2.00 *5 1.22	.023	3.55 *5,6 1.13	.001	1.60 *6 0.70
Practical skills training	2.00 *7 1.22	.014	3.45 *7,8 0.82	.005	2.10 *8 0.74
Ethical knowledge	3.60 1.67		3.91 *9 0.83	.033	2.70 *9 0.82
Ethical experience	3.40 1.67		3.64 *10 1.03	.009	2.00 *10 0.94
Ethical training	2.80 1.48		2.55 1.44		1.90 0.99
Opportunity for feedback after a real trauma patient	2.25 1.26		2.45 1.13		2.80 0.92

**= statistically significant difference at 5% level analysed with z-test (post-hoc Tukey). The number (1-10) indicates pairwise comparison.*

Medical knowledge/experience/training

There was a statistically significant difference between nurses and medics regarding self- rating of having sufficient medical knowledge, where the medics self-rated lower. Physicians also self-rated lower in comparison to nurses regarding sufficient medical knowledge, medical experience and medical training.

Practical skills knowledge/experience/training

There were also statistically significant differences between the group of nurses and the groups of physicians and medics in the practical skills statements regarding having sufficient knowledge, experience and training. For the statement regarding practical skills, nurses self-rated sufficiency relatively high compared to other statements, while both doctors and medics self-rated this statement as one of the lowest in their own groups.

Ethical knowledge/experience/training

Self-rating of sufficient ethical knowledge and ethical experience differed significantly between nurses and medics, where the medics answers rated lower on both statements. For having sufficient ethical knowledge, doctors self-rated themselves high compared to other statements, while nurses and medics self-rated this statement among the highest within their groups. Regarding having sufficient ethical training, the groups of nurses and medics self-rated themselves relatively low.

Opportunity to receive feedback

Medics self-rated the feedback statement highest of all three groups, whereas physicians rated the same statement lowest. This indicates that physicians feel they have fewer opportunities for feedback after caring for a trauma patient than nurses or medics (Table 1).

Discussion

Previous research has shown how the link between theoretical education and practical training needs to be strengthened to improve military medical education in the Nordic countries.[21] Through simulations, the necessary knowledge and skills can be taught to deal with new, sometimes dangerous and complex or unexpected situations.[22] Both physicians and nurses rated themselves high on sufficient medical knowledge. Holmberg et al.[24] argue that care requires both general and specific knowledge, but that medical personnel can have knowledge without having immediate experience of it. Medical knowledge of care for critically ill or injured patients is classified as essential[23] and can be obtained via simulation.[24] Solid medical knowledge and experience can be a way to protect oneself against stressors leading to mental health problems common among military medical personnel caused by caring for severe polytrauma casualties.[25]

Conversely, all three professions ranked low on having sufficient medical training. This shows that the simulation of, for example, patients exposed to trauma needs to be introduced early in military healthcare training. Furthermore, there is a need for continuous simulation of these patient cases. This contributes to acquiring experience of military medical care.[21] A study by Jen Heng et al.[24] found that the participants ranked the opportunity for development of a single simulation as 4.42 on a 5-degree Likert scale, indicating the value of simulation. Good medical training in cardiopulmonary resuscitation and airway management appear to be important areas for physicians and nurses in emergency care.[23,24] Finnegan et al.[10] believe that clinical placement in civilian hospitals during the person's training needs to be supplied in areas with patients presenting similar injury patterns to those in military emergency care. Clinical placements should also include other areas, such as pain management, elective surgery, medical assessment units, paediatrics, burn units and plastic surgery.[10]

For sufficient practical skills knowledge, experience and training, the physicians rated themselves low. In the Nordic countries, there is a limited number of trauma cases per country and per year, which results in limited training opportunities for physicians. According to Grimm and Johnson,26 appropriate courses may provide training in skills needed in the care of trauma patients. Practical skills can be enhanced by simulation in the care of both critically ill and injured patients.[24] Sonesson et al.[21] suggest that the need to develop knowledge and skills in advanced military traumatology can be met by international cooperation with NATO and through e-learning.

In comparison, the nurses rated themselves highly on having sufficient practical skills knowledge. This can be explained by the fact that theoretical and practical action are often combined in nursing care. For the better part of the year, the military nurses who are reserves in SwAF work as specialists in their specific care area at a civilian hospital. Thus, nurses come in somewhat regular contact with the injuries they may face during military service.[10] The nurses' experience-based knowledge and skills, therefore, lead to an autonomous, responsible care

staff.[27] Aitkin et al.[28] also believe that, in addition to experience, health and preventive hospital deaths are reduced through nurses' high level of education (bachelor's degree). According to Daouk-Öyry et al.,[29] the competencies needed in an emergency medicine environment include professionalism and some sort of emotional intelligence. It is a unique situation when medical personnel meet a patient face to face in a critical life or death situation.[30]

Traditionally, military medical education and training consists of short theoretical briefings and practical training sessions for a limited time and often in extreme environments.[21] This may be the reason why all professions rated themselves so low on having sufficient ethical training. It is problematic that they rated low in this category, as caring acts need to be incorporated through head, heart and hand to be accomplished.[31] The care act needs to be included in the patient-caregiver relationship[32] not just as a mechanical act without emotional association.

Limitations

A limitation of this study is that no baseline was used to show improvement by the simulation. Another limitation is that no patients were children. Caring for children affected by traumatic injury requires specific competence.[33] Previous research has shown that both physicians and nurses experience a shortage of theoretical and practical knowledge concerning paediatric emergencies, resulting in perceived negative stress.[34,35] One additional limitation was that personnel were never forced to prioritise among patients, since the patient flow allowed all patients to receive optimal health care, regardless of injury or illness. Another limitation was that – since this is a subjective self-assessment – the participants could only rate specific statements. There might have been other statements that could have provided a better understanding of the situation.

Conclusion

All professions self-rated relatively low on all statements in this study regarding sufficient medical, practical and ethical knowledge, experience and training. The low rating is to be put in relation to a profession that requires medical personnel to have the knowledge and skills to work autonomously in challenging and potentially threatening environments. To regularly let personnel train in countries with a high frequency of battlefield-like injuries could be better than an extended clinical placement in a country with low frequency of battlefield-like injuries. This study's subjective assessment in comparison with an objective assessment has the potential to identify deficiencies in levels of knowledge and skills, which can negatively impact the quality of care.

Corresponding author: Anna Abelsson, anna.abelsson@ju.se
Authors: A Abelsson[1], L Lundberg[2]
Author Affiliations:
1 School of Health Sciences, Jönköping University
2 Swedish Armed Forces, Centre for Defense Medicine

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Disability Reporting Among U.S. Immigrant Veterans: Findings and Implications

Jessica L. Adler, Timothy F. Page

Abstract

Background: This preliminary study offers the first health-related assessment of United States (US) immigrant veterans, who comprise a population of more than 500 000. It builds upon research showing that a number of variables relate to veterans' health experiences, including race, ethnicity and socioeconomic status.

Purpose: To assess levels of disability reporting among foreign-born veterans in comparison with other populations.

Materials and Methods: We analysed 2011–2015 data from the United States Census Bureau 5-Percent Public Use Microdata Sample (PUMS) to compare disability reporting among foreign-born veterans, native-born veterans, foreign-born non-veterans and native-born non-veterans.

Results: Middle-aged foreign-born veterans were less likely to report a disability than native-born veterans and native-born non-veterans, but more likely to report than fellow non-veteran immigrants. When hearing disability—which has been shown to disproportionately impact veterans—was examined independently, foreign-born veterans reported at lower rates than native-born veterans, and at higher rates than native-born and non-veterans immigrants. Native-born veterans consistently reported disabilities at the highest rates.

Conclusion: Foreign-born veterans are distinct from both other veterans and other immigrants in respect to their levels of reported disability. These results could inform research and practice in the US, as well as other countries with diverse and/or foreign-born veteran populations.

Keywords: veteran, immigrant, disability, minority health

Conflict of Interest: None declared.

Introduction

In research on the health of United States (US) veterans, an important group has been overlooked—more than 511 000 immigrants. Foreign-born former service members comprise a growing proportion of the veteran population. Between 1995 and 2016, the total number of veterans in the US fell from 26.1 million to 18.8 million while the number of veterans who were immigrants remained relatively stable. Foreign-born veterans constituted two per cent of all veterans in 1995 and three per cent by 2016[1]. In 2016, 16 per cent of immigrant veterans were from Mexico and 13 per cent were from the Philippines. Six per cent hailed from Germany, and another six per cent from Canada. Haiti, India, the United Kingdom, the Dominican Republic, China and Italy were each the birthplaces of between two and three per cent of living veterans. The remaining 42 per cent were from a variety of countries. In comparison with foreign-born non-veterans, foreign-born veterans were relatively advantaged; they were more likely to have completed college, more likely to hold positions in management—as opposed to service occupations—more likely to have public health insurance coverage and less likely to have limited English language proficiency[1].

This preliminary study is the first, to our knowledge, to provide a health-related assessment of immigrant veterans. Generally, analyses of data from the US Department of Veterans Affairs (VA) focus on a variety of demographic characteristics of the veteran population, including race and ethnicity, but do not separate out birthplace for consideration[2–7]. A 2010 VA report, for example, showed that white

veterans were more likely to report that their health was 'excellent', 'very good' or 'good' than their Black, Asian, Pacific Islander, American Indian/Alaska Native and Hispanic counterparts were[8]. However, the report did not define foreign-born veterans within or apart from larger minority subgroups. Our study intends to determine if immigrant veterans, too, have unique health-related experiences.

Our findings could inform research and practice, not only in the US, but also in other countries where health-related information on minority and foreign-born veteran populations is somewhat limited. Veterans Affairs Canada (VAC) recently reported on the demographics of Canadian military families, including characteristics such as gender, place of residence, age and family composition, but noted that additional demographic data, such as language and ethnicity, could 'inform policies, programs and services'[9]. Reports from the United Kingdom (UK) and Australia suggest that, while the US has relatively large military and veteran populations[10], it is not unique in having diverse ranks. More than five per cent of the UK military population is of non-UK nationality[11] and more than two per cent of the Australian Defence Force in 2015 spoke only a language other than English[12]. Meanwhile, multiple European countries, as well as Canada, are facing challenges recruiting citizens for their armed forces, and commentators suggest that foreign-born populations could serve as willing and able recruits[13,14].

In this broader context, our study offers perspective on how foreign-born veterans from one of the largest militaries in the world fared health-wise in comparison with both native-born veterans, and native-born and immigrant non-veterans. In addition to providing the first detailed analysis of immigrant veterans, an understudied subgroup, it underscores a point governments and researchers must bear in mind when it comes to studying and alleviating the health impacts of military service: veterans' experiences are highly variable. Our finding, that foreign-born former service members are distinct from both the US veteran population and the US immigrant population, in respect to their levels of reported disability, relates to diverse studies on whether former service members are more or less healthy than their non-veteran counterparts, and recent reports from both the Australian Department of Veterans' Affairs and VAC suggesting that a variety of forces—including demographic factors and membership in particular social groups—shape general and health-related post-service experiences[15,16]. It underscores the necessity for researchers and clinicians to conceptualise health studies and systems that pay heed to the potential importance of individuals' social and ethnic backgrounds.

Materials and Methods

The dataset used for this study was the American Community Survey 5-Percent Public Use Microdata Sample (PUMS) covering the years 2011–2015 (US Census Bureau). The PUMS data contain information on five per cent of the non-institutionalised US population. This dataset is the largest nationally representative, publicly available dataset in the US. While other nationally representative datasets exist, such as the Current Population Survey, Panel Study of Income Dynamics or National Health Interview Survey, none is large enough to capture a representative sample of foreign-born veterans, given their limited numbers relative to other population groups.

To retain a focus on individuals eligible to serve in the military, individuals under 17 years of age were dropped from the sample. Individuals in the data were coded as either native-born non-veterans, native-born non-veterans, foreign-born non-veterans or foreign-born veterans. Two measures of disability were used: (1) the reporting of any disability (which included self-care difficulty, hearing difficulty, vision difficulty, independent living difficulty, ambulatory difficulty or cognitive difficulty); and (2) the reporting of a hearing disability, which prior research has shown to disproportionately affect veterans[17].

Demographic characteristics of the four groups were computed. Disability rates were calculated for four age groups: ages 17–35, 36–50, 50–64 and over 65, plotted graphically. To determine what demographic factors were associated with reporting of disabilities, odds ratios were obtained from logistic regressions according to nativity and veteran status. Variables included in the model were measures of nativity (foreign-born=1, native-born=0), age, insurance status (has insurance=1, 0 otherwise), gender (female=1, male=0), veteran status (veteran=1, non-veteran=0), race/ethnicity (Black, Hispanic, Other) and education status (less than high school, high school, some college, college and graduate degree).

To determine the impact of being foreign-born on disability status among veterans while controlling for other variables, logit models, including the variables described above, were estimated and marginal effects were computed at sample means. The marginal effects reported give the percentage point impact of the characteristic on the likelihood of reporting disability. Significance on the 'foreign-born' variable would indicate a differential likelihood of foreign-

Table 1: Demographic characteristics of native-born veterans, foreign-born veterans, native-born non-veterans, and foreign-born non-veterans, United States, 2011–2015

	Native non-veterans	Foreign non-veterans	Native veterans	Foreign veterans
Any disability	0.160	0.114	0.295	0.216
Hearing disability	.042	.030	0.150	0.095
Age	46.6	47.8	63.37	59.84
Has insurance	0.860	0.716	0.952	0.935
Female	0.570	0.535	0.069	0.090
Black	0.115	0.054	0.098	0.073
Other race	0.092	0.449	0.051	0.387
Hispanic	0.113	0.478	0.056	0.286
< High school	0.130	0.314	0.070	0.120
High school	0.272	0.212	0.279	0.205
Some college	0.327	0.210	0.372	0.384
College	0.173	0.160	0.165	0.181
Graduate degree	0.098	0.105	0.117	0.110
N	3,302,080	832,089	400,568	16,891

Notes: The age variable is continuous; all other variables are categorical and the numbers in the table represent proportions

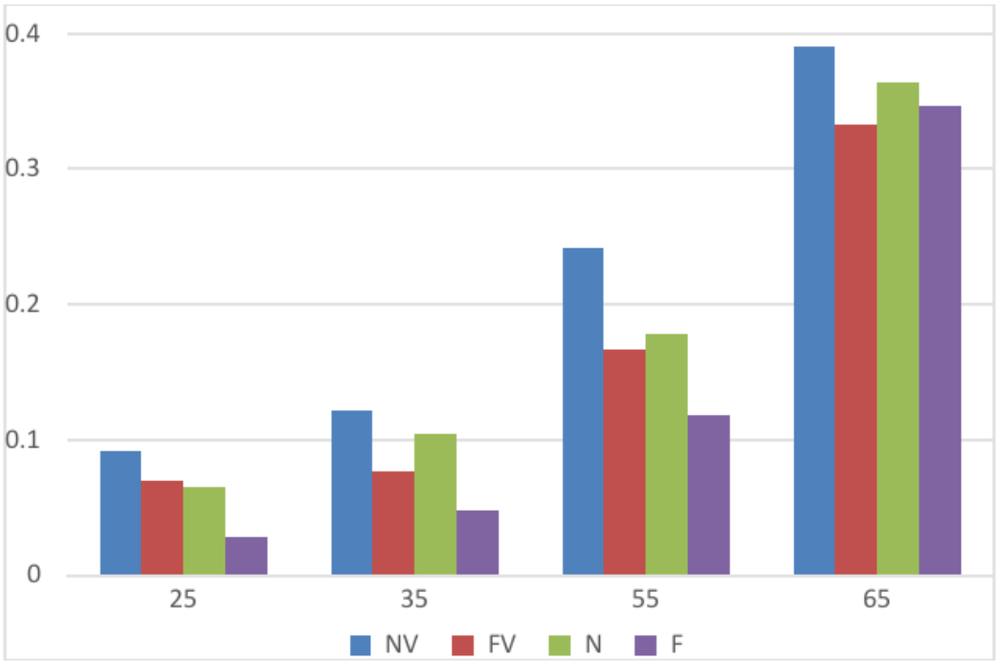
born veterans reporting disabilities relative to native-born veterans. To determine whether significant differences in disability reporting between native and foreign-born veterans are due to differences in sample mean characteristics, the Oaxaca-Blinder method was used to decompose differences into that proportion attributable to sample characteristics and the estimated coefficients[18].

Results

The data contained a total of 4 551 628 individuals over age 17. Of these, 3 302 080 (72.5%) were native-born non-veterans, 832 089 (18.3%) were foreign-born non-veterans, 400 568 (8.9%) were native-born veterans and 16 891 (0.4%) were foreign-born veterans. The 16 891 foreign-born veterans represented approximately four per cent of the total veteran population. Table 1 reports demographic characteristics. Both native- and foreign-born veterans reported higher rates of disability than their non-veteran counterparts did. They were also older and more likely to be insured. Consistent with prior research[1], foreign-born veterans were most likely to have greater than a high school education followed by native veterans, native non-veterans and foreign-born non-veterans.

Figure 1 shows rates of reporting any disability. Overall, native veterans reported the highest rates of disability among the four groups. In middle age (35–65 years old), native non-veterans reported disabilities at the second highest rate, followed by foreign veterans and foreign non-veterans. Reporting of disability increased sharply after age 55. Overall differences across the four groups were smallest for the over age 65 population. While there was a consistent pattern of reporting rates between age 35 and 65, with native veterans reporting the highest rate, native non-veterans the second highest, foreign veterans the third highest, and foreign non-veterans

Figure 1: Any disability by age nativity and veteran status, United States, 2011–2015



Notes: The bar graph shows the proportion of native veterans (NV), foreign veterans (FV), native non-veterans (N) and foreign non-veterans (F) reporting disability.

the fourth highest, after age 65, foreign non-veterans reported slightly higher disability rates than foreign-born veterans. In the under age 35 group, native veterans reported disabilities at the highest rate, with foreign veterans reporting at the second highest rate, followed closely by native non-veterans and foreign non-veterans.

Table 2 reports odds ratios from logistic regressions. For all four groups, age was the strongest predictor of reporting a disability. Insurance status was significant for three of the four groups, with the strongest impact on foreign non-veterans. African Americans were more likely to report disabilities in three of the four groups, while results for the female and Hispanic variables varied in direction, size and significance across the four groups. The education variables had the largest impact on reporting of disability for all groups, with lower rates of education significantly increasing the odds of reporting a disability. The differences exhibited in Figure 1 persist when predicted values at sample means are computed, suggesting the differences are not due to differences in age, race/ethnicity or education level.

Similar results were found when focusing on the reporting of a hearing disability, but differences between the groups were larger and more dependent on veteran status than on nativity (Figure 2). As with the reporting of any disability, the reporting of a hearing disability was highest for native veterans and increased sharply with age for all groups. Foreign-born veterans were the next most likely group to report a hearing disability, unlike the reporting of any disability where native non-veterans were the second most likely to report any disability. While group differences in reporting any disability became smaller after age 65, group differences in the reporting of a hearing disability became larger with age, and rates of reporting of foreign veterans remained higher than foreign non-veterans.

Table 2: Any disability, logistic regression results, native-born veterans, foreign-born veterans, native-born non-veterans, and foreign-born non-veterans, United States, 2011–2015

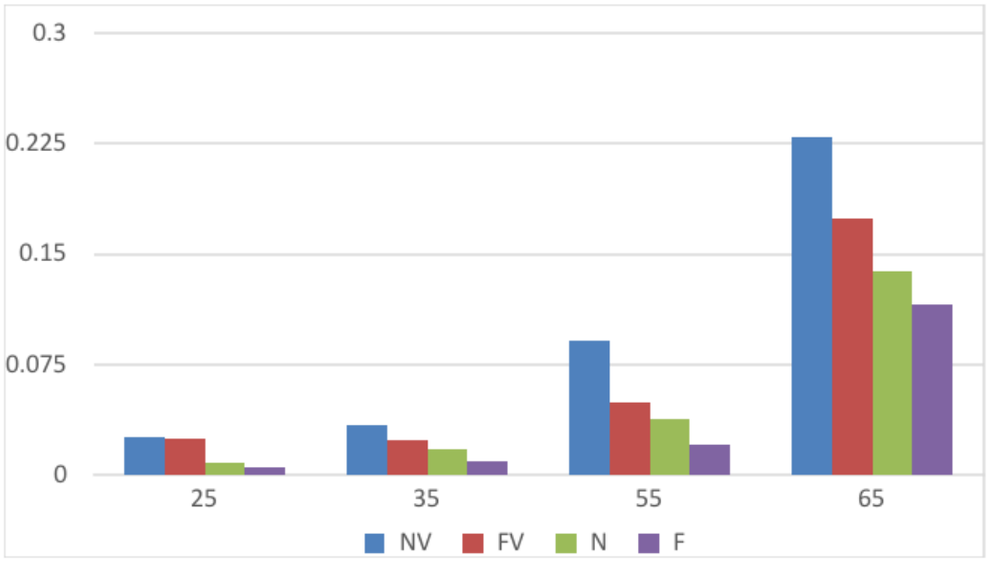
	Native non-veterans	Foreign non-veterans	Native veterans	Foreign veterans
Age	1.05** [1.05, 1.05]	1.07** [1.07, 1.07]	1.05** [1.05, 1.05]	1.06** [1.06, 1.06]
Has insurance	1.10** [1.09, 1.11]	1.42** [1.39, 1.45]	1.08** [1.04, 1.13]	1.11 [0.90. 1.37]
Female	0.955** [0.95, 0.96]	1.10** [1.08, 1.11]	1.18** [1.15, 1.22]	1.12 [0.96, 1.31]
Black	1.49** [1.48, 1.51]	1.21** [1.17, 1.25]	1.23** [1.20, 1.27]	1.11 [0.93, 1.34]
Other race	1.24** [1.22, 1.25]	1.01 [0.99,1.03]	1.36** [1.32, 1.41]	1.10 [1.01, 1.20]
Hispanic	0.93** [0.92, 0.94]	1.16** [1.14, 1.18]	1.03 [1.00, 1.07]	1.06 [0.96, 1.17]
< High school	2.15** [2.13, 2.17]	1.47** [1.44, 1.50]	1.58** [1.54, 1.63]	1.04 [0.91, 1.18]
Some college	0.73** [0.72, 0.74]	0.82** [0.80, 0.84]	0.90** [0.89, 0.92]	0.80*** [0.72, 0.89]
College	0.37** [0.37, 0.37]	0.57** [0.56, 0.59]	0.57** [0.55, 0.58]	0.68** [0.59, 0.77]
Graduate degree	0.31** [0.31, 0.32]	0.44** [0.42, 0.45]	0.50 [0.49, 0.52]	0.53** [0.46, 0.62]
N	3,302,080	832,089	400,568	16,891

*Notes: Results are from logistic regression models. Odds ratios and 95% confidence intervals are reported. * denotes statistical significance at p<0.05 and ** denotes statistical significance at p<0.01*

Odds ratios from logistic regressions are reported in Table 3. As with the reporting of any disability, age and education were the strongest predictors of reporting a hearing disability and showed a similar pattern as the reporting of any disability, with lower levels of education being positively associated with reporting affirmatively. For native non-veterans, having insurance was negatively associated with reporting a hearing disability but was positively associated for foreign non-veterans and native veterans. Unlike the reporting of any disability, being African American was negatively associated with reporting a hearing disability, and the odds ratios for females were less than one and significant for all groups. The differences exhibited in Figure 2 also persist when predicted values at sample means are computed, again suggesting the differences are not due to differences in age, race/ethnicity or education level.

Results from logit models are reported in Table 4 and are consistent with the findings from logistic regression results reported in Tables 2 and 3. For the reporting of any disability, age, insurance status, female, and race/ethnicity were positively associated with reporting disability. Educational attainment and being foreign-born were associated with lower levels of reporting disability. Results suggest that foreign-born veterans were 8.4 per cent less likely to report having a disability than their native-born counterparts were when controlling for other factors. Focusing only on hearing disability found similar results. As in the logistic regression results, results were similar except for female and race/ethnicity now being associated with a lower likelihood of reporting disability. Results suggest that foreign-born veterans are 4.8 percentage points less likely to report having a hearing disability than their native-born counterparts when controlling for other factors.

Figure 2: Hearing disability by age, nativity and veteran status, United Sates, 2011–2015



Notes: The bar graph shows the proportion of native veterans (NV), foreign veterans (FV), native non-veterans (N) and foreign non-veterans (F) reporting disability.

Table 3: Hearing disability, logistic regression results, native-born veterans, foreign-born veterans, native-born non-veterans, and foreign-born non-veterans, United States, 2011–2015

	Native non-veterans	Foreign non-veterans	Native veterans	Foreign veterans
Age	1.07** [1.07, 1.07]	1.09** [1.08, 1.09]	1.06** [1.06, 1.06]	1.07** [1.06, 1.07]
Has insurance	0.89** [0.87, 0.91]	1.17** [1.12, 1.23]	1.23** [1.15, 1.31]	1.02 [0.73, 1.43]
Female	0.56** [0.56, 0.57]	0.71** [0.69, 0.73]	0.63** [0.60, 0.67]	0.73* [0.56, 0.96]
Black	0.70** [0.69, 0.72	0.70** [0.65, 0.75]	0.56** [0.53, 0.58]	0.58** [0.41. 0.83]
Other race	1.28** [1.25, 1.31]	1.00 [0.97, 1.03]	1.26** [2.21, 1.32]	1.08 [0.96, 1.22]
Hispanic	0.86** [0.84, 0.88]	1.03* [1.00, 1.07]	0.96* [0.92, 1.00]	1.08 [0.94, 1.23]
< High school	1.55** [1.53, 1.58]	1.28** [1.23, 1.33]	1.29** [1.25, 1.33]	0.95 [0.80, 1.13]
Some college	0.86** [0.85, 0.88]	0.88** [0.84, 0.92]	0.95** [0.93, 0.98]	0.90 [0.78, 1.04]
College	0.57** [0.55, 0.58]	0.75** [0.71, 0.79]	0.68** [0.66, 0.70]	0.82* [0.69, 0.98]
Graduate degree	0.51** [0.50, 0.53]	0.62** [0.59, 0.66]	0.64** [0.62, 0.66]	0.72** [0.59, 0.88]
N	3,302,080	832,089	400,568	16,891

*Notes: Results are from logistic regression models. Odds ratios and 95% confidence intervals are reported. * denotes statistical significance at p<0.05 and ** denotes statistical significance at p<0.01*

Table 4: Predictors of disability among veterans, United States, 2011–2015

	Any disability	Hearing disability
Age	0.010**	0.006**
Has insurance	0.015**	0.019**
Female	0.032**	-0.044**
Black	0.040**	-0.057**
Other race	0.053**	0.020**
Hispanic	0.007*	-0.003
< High school	0.085**	0.023**
Some college	-0.020**	-0.005**
College	-0.109**	-0.037**
Graduate degree	-0.132**	-0.043**
Foreign-born	-0.084**	-0.048**
N	417,459	417,459

*Notes: Results are from logit models. The table reports marginal effects computed at sample means. * denotes statistical significance at p<0.05 and ** denotes statistical significance at p<0.01*

Discussion

A variety of characteristics impacted overall levels of disability reporting. Education level was the strongest predictor. Higher levels of education were associated with a lower likelihood of disability reporting, confirming previous studies that point to education and social class as important determinants of health[19,20]. Also consistent with other studies, being female or African American was associated with a higher likelihood of reporting a disability other than hearing impairment[21]. Predictably, the reporting of disability increased with age for all groups. Veteran status increased the likelihood of disability reporting, while foreign-born status was found to decrease the likelihood of disability reporting.

We show that hearing impairment disproportionately impacts both native and immigrant veterans while other disabilities disproportionately impact native veterans, but not immigrant veterans. We separated out hearing impairment as a measure because veterans are 30 per cent more likely to experience severe hearing impairment than non-veterans[17]. As with the reporting of any disability, the reporting of a hearing disability was highest for native veterans and increased sharply with age for all groups. Foreign-born veterans, across all age groups, were the next most likely group to report a hearing disability, unlike the reporting of any disability where native non-veterans were the second most likely to report any disability after age 35. While group differences in reporting any disability became smaller after age 65, group differences in the reporting of a hearing disability became larger with age, and rates of reporting of foreign-born veterans remained higher than foreign-born non-veterans. These findings suggest that veteran status impacts disability reporting levels among immigrants, but further research would explain why hearing impairment is disproportionately common among both native and immigrant veterans while other disabilities are disproportionately common among native veterans, but not immigrant veterans.

We found that foreign-born veterans reported lower rates of disability than native veterans or native non-veterans in middle age, but not in the over age 65 group. In the elderly population, foreign-born veterans reported disabilities at the lowest rates of any of the four groups. This could be attributed to a greater health status among foreign-born veterans compared to non-veterans in earlier life due to relatively higher socioeconomic status and access to institutional supports, such as the military and veterans' health systems. The finding correlates with previous research demonstrating that differences in disability rates between veterans and non-veterans decline with age[22].

This study highlights a subcategory of the veteran population that, in middle and old age, reports disabilities at lower rates than both the native veteran and the native non-veteran populations do.

It contrasts with prior work showing that disability reporting is generally higher among US veterans than non-veterans[23]. Wilmoth, et. al. reveal that 30.1 per cent of veteran women and 29.8 per cent of veteran men report some limitation or disability, compared with 23.8 per cent of non-veteran women and 21.7 per cent of non-veteran men.[24].

Our findings build upon prior work regarding the existence of a healthy soldier effect, in the form of decreased risk of mortality among veterans[25], as well as more recent research maintaining that the impact of military service on overall wellbeing is hardly uniform[15,26]. Studies on military service in the life course reveal that long-term physical impacts of serving in the military depend on a variety of factors, including prior health, socioeconomic status and conditions of service—for example, whether or not an individual was stationed in a combat zone or served during a war[27–30]. Previous studies have also shown that minority veterans have distinct experiences receiving diagnoses and accessing health services[2,4–7]. Our study suggests that immigrants, too, have unique post-service experiences, though further research is needed to determine which factors shape key health outcomes, including individual levels of disability reporting.

In addition to relating to research on the health impact of military service in the life course, our findings build upon studies of immigrant health in various countries. Research on the so-called 'healthy immigrant effect' maintains that when individuals first migrate, they report better overall health than native populations in their adopted countries, but that their health advantage decreases over time[31,32]. Researchers note that a variety of characteristics can influence immigrants' health status, including birth country, socioeconomic status and access to social and institutional supports[33–35]. Recent work has indicated the importance of acknowledging 'selective migration'—that new immigrants have characteristics that are distinct from, and relatively favourable in comparison with, overall native-born populations[36,37]. One study, for example, maintains that migrants are generally mobile, so they should be compared not to all natives, but instead to native-born 'movers'[38]. A 2015 systematic review of immigrant health in at least 10 countries, offers a wide-ranging perspective that goes beyond individual socioeconomic factors; underscoring the idea that the health of immigrants—especially undocumented immigrants—is intertwined with public policies, it suggests that there is a direct link between laws intended to restrict immigration and individuals' access to health services[39]. While further research is needed, this previous work suggests that veteran immigrants may be distinct from the larger US foreign-born population in terms of disability reporting, not only due to individual socioeconomic characteristics, but also because they have conditional access to federally sponsored veterans' benefits.

Our work highlights various additional areas for further research. Immigrant veterans' educational, vocational and family status, as well as a wider range of predictor variables, available in the PUMS files, should be examined. Subgroups within foreign-born veteran populations could also be analysed according to factors such as country of origin, age, race/ethnicity, gender and education level. The impact of policy-related variables, such as laws governing access to veterans' health benefits, should be further explored, as should the health care experiences of foreign-born and other minority veterans, especially in public health systems geared towards military and veteran populations. Finally, transnational comparisons of veterans' disability reporting, which consider demographic and socioeconomic characteristics, are also warranted.

This preliminary study had strengths and limitations. Chretien, et al. recently argued that measuring the long-term health impacts of military service is challenging, and asserted that longitudinal studies are necessary[40]. Our work focuses on measures included in the PUMS—one of the few data sets that provides a glimpse of health information about this understudied population and allows relevant comparisons with others. However, the health information in the PUMS file is limited; therefore, the analysis was restricted to the reporting of disability rather than more robust measures of health status that may be available in smaller datasets. Smaller datasets, on the other hand, may not yield adequate samples of foreign-born veterans. As such, we capitalised on a large, nationally representative dataset containing almost 17 000 records of foreign-born veterans to provide an in-depth analysis of demographics and disability reporting.

Conclusion

Our conclusion that immigrant veterans' levels of reported disability are different from both other former service members and other immigrants has important practice, research and policy implications. It signals that health care providers and researchers should consider demographic and social factors when devising studies of, offering care to and designing health systems for former service members. By focusing on a previously invisible subcategory within a veteran population, we verify and call into question aspects of studies regarding

the long-term health impacts of military service and immigration. Our findings underscore the notion that there is no universal rule about whether veterans and/or immigrants are healthier or less healthy than their non-veteran or non-immigrant counterparts are. They also demonstrate that the health status of veterans is shaped by a variety of social circumstances including, but not limited to, their experiences as service members.

Corresponding Author: Jessica Adler, jadler@fiu.edu
Authors: J Adler[1], T Page[1]
Author Affiliations:
1 Florida International University

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Effects of Agility Training on Body Control, Change of Direction Speed and Injury Attrition Rates in Dutch Recruits: A Pilot Study

Iris Dijksma, Sander Perry, Wessel Zimmermann, Cees Lucas, Martijn Stuiver

Abstract

Background: Injury prevention contributes to the improvement of basic military training graduation rates.

Purpose: To obtain an estimated effect of agility training (AT) on body control, change of direction speed (CODS), and attrition due to injuries in Dutch recruits. Methods: Cluster randomised pilot study including 64 recruits undergoing 23 weeks initial military training with the Air Manoeuvre Brigade. Recruits performed the T test and Illinois Agility Test (IAT) pre- and post-intervention (week 6 and week 19) to evaluate body control and CODS. After 23 weeks we evaluated injury attrition rates.

Results: Recruits in the AT group had on average 0.17 seconds faster T test times than recruits in the control groups (CG) (95% CI:-0.48 to 0.13); and on average 0.14 seconds faster IAT-times (95% CI:-0.40 to 0.12), adjusted for baseline scores. Relative risk (RR) of attrition due to injuries in the first six weeks was 1.81 (95% CI 0.32 to 10.11, p=0.65), while that from week 6-23 was 0.32 (95% CI 0.12 to 0.85, p=0.018).

Conclusion: This pilot study provides preliminary evidence that AT may help retain body control and CODS and may reduce attrition due to injuries.

Key Words: Agility training, change of direction speed, armed forces, injury prevention

Introduction

Alertness and manoeuvrability can be a matter of life and death for combat troops. Military service demands a variety of physical abilities, such as carrying heavy loads over long distances and rough terrain, sprinting and employment of military operations in urban environments. The speed at which these activities are performed can affect a soldier's fighting effectiveness and combat survivability. Maximum physical performance in these environments requires, among other things, strength, speed, agility, and aerobic and anaerobic endurance[3,8,12,13,14,23,25].

Approximately 1500 men and women aged 17-27 years, volunteer for service in the Netherlands Armed Forces (NAF) each year. Of these, about 200 undergo training with the 11 Air Manoeuvre Brigade (11 AMB), a rapid response infantry unit that can be deployed anywhere worldwide within 7-20 days. 11 AMC's Basic Military Training (BMT) program lasts 23 weeks, including 11 weeks' basic military training and 12 weeks' advanced airmobile infantry training. The need for a high BMT graduation rate is driven by cost-effectiveness considerations and reduced injury rates. Although reducing the intensity and frequency of training could be a logical strategy, this is at odds with the imperative to deliver highly competent infantry soldiers to the units, who are physically and mentally prepared for combat operations.

The United States (US) Army's Joint Physical Training Injury Prevention Working Group (JPTIPWG) recommends that multiaxial, neuromuscular, proprioceptive and agility exercises be included as a regular component of military physical training programs. Among its other findings, the JPTIPWG

obtained moderate evidence that increasing the proportion of physical training time for exercises that vary musculoskeletal stress in multiple planes, such as agility training (AT), reduces injury risk[2]. Agility is defined as 'a rapid whole body movement with change of velocity or direction in response to a stimulus'[27]. The reactive component includes cognitive functions, such as visual processing, timing, perception and anticipation while the action is an open motor skill, which cannot be pre-planned. Therefore, agility drills teach the brain how to control the body when reacting to a stimulus. By focusing on specific cues, agility drills help improve and correct body position, balance, coordination and explosive movement patterns[5]. It has been suggested that improved agility also includes increased body control during fast movements, increased intramuscular coordination and decreased risk of injury or re-injury[7,19,22]. However, AT is not yet structurally programmed in the current physical training programs in the NAF.

The results of a recent study of 41 subjects at the US Air Force School of Aerospace Medicine suggest that six weeks of AT, compared to running and calisthenics, resulted in significant within-group performance improvements in cardiorespiratory capacity and change of direction speed (CODS), as well as sustained attention, and improved accuracy and speed of working memory. In contrast, six weeks of traditional training did not yield such improvements in the control group16. However, a study of a novel training program for trained male soldiers that incorporated AT did not yield relevant improvements to agility[17]. Likewise, in a study of civilian men undergoing a complex program including AT was not superior to a general program of calisthenics and running for improving performance of five simulated army battlefield activities. Although the volunteers in both study arms improved significantly on all tests, there were no statistical significant differences in training effect between the study arms9. More research is needed to determine how AT should be incorporated in the military training program to achieve the best results. In addition, the feasibility of adapting traditional military training, with its strong focus on military skills training and long distance marches carrying heavy loads, should be assessed.

The primary objective of this pilot study was to obtain an estimated effect of 12 weeks of AT on body control and CODS on 11 AMB recruits compared to the standard 11 AMB physical training program. The secondary objective was to explore the effect of 12 weeks of AT on these recruits, with respect to injury attrition rates.

Methods

This was a cluster randomised controlled pilot study of four BMT classes. On average, 60 recruits start the AMB BMT in each recruiting period, with about of 15 recruits per class. Human Resources divided these before BMT into balanced classes based on age, prior education and future military position after graduation. Classes receive physical training in pairs. Independent from the grouping, we used cluster randomisation to assign the intervention to two of the four classes, which formed the intervention (AT) and control groups (CG). An independent study assistant who drew lots performed randomisation.

The source population consisted of men and women who volunteered to undertake 11 AMB BMT. However, there were no females in this cohort. Eligibility criteria included: age between 17 and 27 years, minimum height 165 cm, minimum weight 65 kg, maximal vision correction of minus 6.0 or plus 6.0, and proof of swimming proficiency. The period of enrolment was January 2015 through July 2015. All BMT candidates were required to pass a pre-participation medical examination and complete a three-day introduction program.

All participants were briefed on the study objectives in week 1 of the BMT by the lead author (ID), both verbally and in writing, and provided written informed consent. The Central Committee of Research of the Netherlands involving human subjects waived the study from formal medical ethical review, noting that the goal of improving (military) physical performance was based on the standard nature of the compared exercise programs.

Procedures

During the first six weeks of the BMT, both groups received the same physical training program, with an emphasis on strength training. In the seventh week, military specific and functional training exercises started for both groups. The physical training time for both groups was 1.5–2 hours per day.

The CG received the standard physical training program, supervised by a designated sports instructor, during the whole BMT. This program included running, calisthenics, obstacle course, strength circuits, military self-defence, and wall and rope climbing.

The AT group underwent the standard physical training program for the first six weeks, 20 minutes of which was substituted with 20 minutes of AT three times a week from the seventh week. The first three weeks of the AT program (week 7-9 of

BMT) consisted primarily of preconditioning basic skills (basic level), such as lateral and backwards movements and direction changing. Exercises during the second three weeks (week 10-12 of BMT) targeted acceleration, deceleration and more complex changes of direction (intermediate level) while the last six weeks (week 13-18 of BMT) contained reactive and explosive agility drills (advanced level)5. Cues varied between sound, timing, visual and physical stimuli, and became increasingly unexpected and more diverse from week four until week 12. See Appendix 1 and Appendix 2 for details of the agility drills. The training sessions of the AT group were also given by designated sports instructors who had undergone training for the study intervention.

Measurements

Anthropometric measurements were taken in the first week of the BMT, pre-intervention (week 6 of the BMT, denoted T0) and post-intervention (week 19 of the BMT, denoted T1).

Body control and CODs were assessed at T0 and T1 using the T test and the Illinois Agility Test (IAT) by independent study assistants who were blinded for group assignment. Outcome assessors were trained to use the measurement tools prior to any study procedures. The tests demonstrated good reliability and validity for this purpose in a military population[22]. Times to complete the tests were measured using the Brower Timing System which is accurate to 1/1000 second[26]. The change from pre- to post-intervention on the CODS and body control tests, measured in 1/100 second, was used as the dependent variable.

Injury attrition rates were evaluated at the end of the 23-week program (denoted as T2). The platoon commander registered dropout-rates and reason for dropout at the moment the recruit was dismissed from the training program

Statistical analyses

Descriptive analysis was used to report anthropometric characteristics of the participants at the start of the BMT, Welch two sample t-tests were used to test for baseline imbalances.

Intention-to-treat analysis of the primary outcome body control and CODS included paired students t-tests to estimate within-group changes, and linear regression analysis with adjustment for the score at T0 to estimate between-group differences. We performed a multilevel analysis to assess the need to account for clustering. This analysis showed no statistically significant intracluster correlation coefficient, and the results were comparable to those of the ordinary least square regression analysis. We therefore present the results of the latter analysis. Results are presented with 95% confidence intervals (CI) and Cohen's d effect sizes (ES). ES of 0.2 is considered a small effect, 0.5 a medium effect and 0.8 a large effect[4].

To explore the effect of AT on attrition due to injuries from week 1 until the end of the BMT, we calculated relative risk (RR) ratios with 95% CI and a corresponding p-value of the Fisher's exact test. We calculated the RR for the first six weeks of the BMT and additionally, the RR from week six until the end of the BMT (T2). We used R version 3.1.3 for statistical analyses[21].

Results

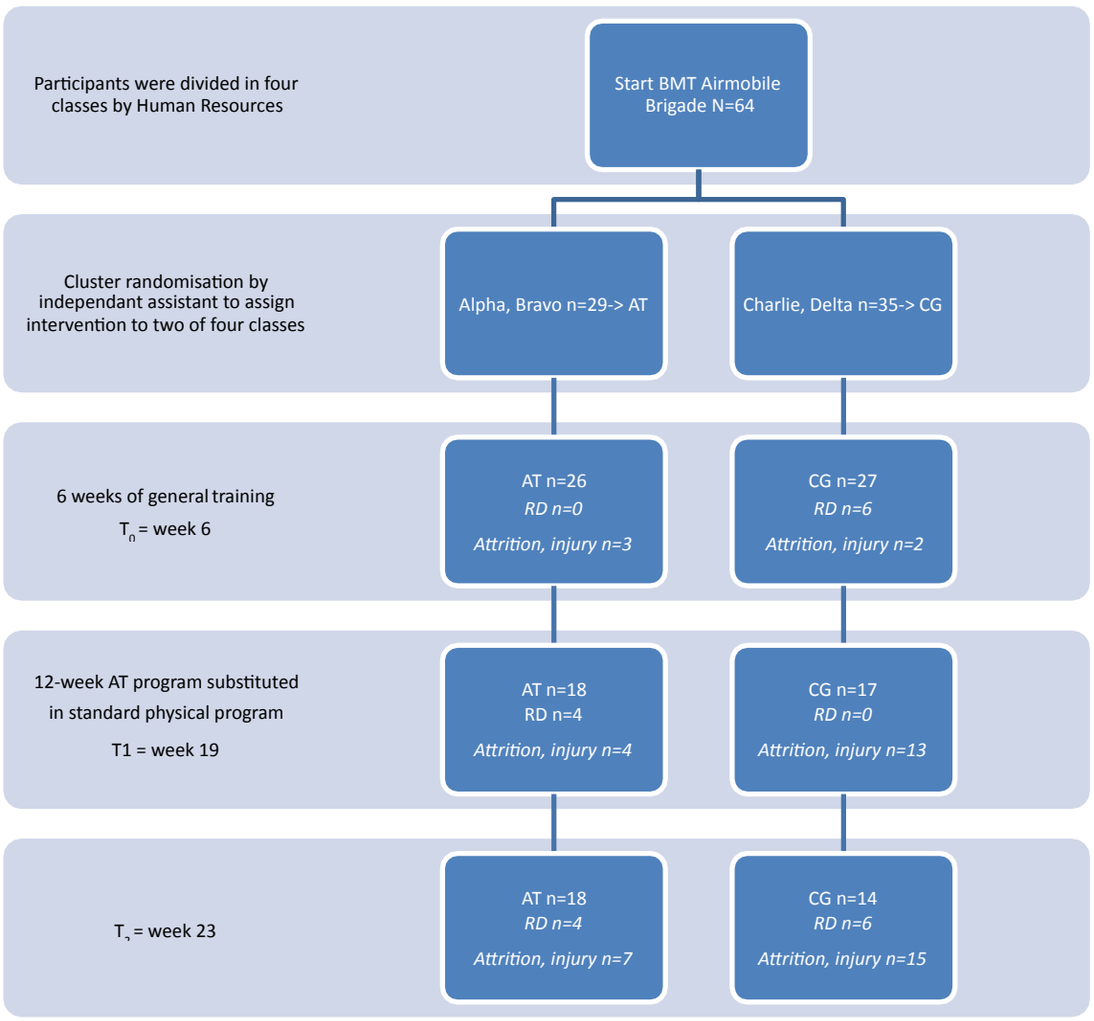
All recruits who started the BMT in October 2015 agreed to be included in the pilot study. Of the 64 recruits who started the BMT in week 1, 53 were still participating at T0 (see Flow chart). The anthropometric characteristics were all comparable at baseline, T0 and T1. The baseline anthropometric characteristics are presented in Table 1. No statistical baseline imbalances were found between the AT and CG. Of the 36 planned AT sessions, 26 (72%) occurred.

Primary outcome:

Recruits in the AT group had on average 0.17 seconds faster T test times than recruits in the CG (95% CI: 0.48 to 0.13, Cohen's d=0.41); and on average, 0.14 seconds faster IAT-times (95% CI: 0.40 to 0.12, Cohen's d=0.26), adjusted for baseline scores (Table 2).

Secondary outcome:

Thirty-two recruits successfully completed the BMT, 18 of whom (28%) were in the AT group, while 14 (22%) were in the CG. Reasons for withdrawal included injuries (AT:7, CG:15) and requested discharge (AT:4, CG:6). For the AT group, RR of attrition due to injuries in the first six weeks was 1.81 (95% CI 0.32 to 10.11, p=0.65), compared to the CG, while RR of attrition due to injuries from week six until the end of the BMT (i.e. during the experimental period) was 0.32 (95%CI 0.12 to 0.85, p=0.018), and thus statistically significant. Injuries varied by body region and onset (acute vs overuse), and included muscle strains in lower back, shoulder, and leg and knee pain. Reasons for requesting discharge from the BMT included altered career ambitions and lack of motivation.



Explanation: BMT= Basic Military Training 11 Air Manoeuvre Brigade, T0= pretesting, T1= post-testing, T2= after 23 weeks of Basic Military Training, AT= Agility Training, CG= Control Group, RD= Requested Discharge

Table 1: Baseline characteristics (week 1 BMT)

	AT (n=29)	CG (n=35)	p-value
	(Mean, sd)	***(Mean, sd)***	
Gender male (%)	100	100	
*Age (**y**)*	21.1(2.4)	21.4(2.6)	0.60
*Height (**m**)*	1.82 (0.05)	1.82(0.06)	0.60
*Weight (**kg**)*	79.4(7.09)	76.0(6.84)	0.25
Body Fat (%)	15.9(3.17)	15.4(3.15)	0.08

Explanation: AT= Agility Training, CG= Control Group, sd= standard deviation, p-value Welch two sample t-test

Table 2: Primary results, body control and CODs

Variables	*AT (n=26) T0 (Mean, sd)*	*AT (n=18) T1 (Mean, sd)*	*AT Change (n=18) T0 -T1 + 95%CI*	*CG (n=27) T0 (Mean, sd)*	*CG (n=17) T1 (Mean, sd)*	*CG Change (n=17) T0 -T1 + 95%CI*	*Adjusted* mean difference + 95%CI*	*Cohen's d*
T Test	11.40(0.59)	11.31(0.61)	-0.12 (-0.33-0.10)	11.42(0.69)	11.43(0.79)	0.07 (-0.16-0.29)	-0.17 (-0.48-0.13) p=0.25	0.41
IAT	16.11(0.61)	16.49(0.52)	0.40 (0.27-0.53)	16.13(0.52)	16.70(0.61)	0.51 (0.24-0.78)	-0.14 (-0.40-0.12) p=0.30	0.26

*Explanation: AT= Agility Training, CG= Control Group, IAT=Illinois Agility test, sd= standard deviation, T0= pretesting, T1= post-testing, *= Mean difference between AT and CG, adjusted for baselines scores, CI= Confidence Interval, Regression Coefficient p<0.05 statistical significant, Cohen's d effect size 0.2 small effect, 0.5 medium effect, 0.8 large effect*

Discussion

The objective of this cluster randomised pilot study was to estimate the effect of 12 weeks AT on body control, CODS and injury attrition rates among recruits of the Dutch 11 AMB. This sample demonstrated a limited effect on body control and CODS after 12 weeks of AT integrated in the BMT, favouring the intervention group. This suggests that AT might limit the loss of body control and CODS during initial military training. More importantly, AT resulted in less withdrawal from initial military training for injury compared to the CG group over the length of the 23-week BMT.

Our findings regarding the primary outcome are in agreement with comparable studies suggesting that, although the training effect on body control and CODS—an intermediate outcome—was small, incorporating AT into military training programs could be useful[9,16,17]. Our study results suggest that even small improvements in these effect–measures, may reduce injury attrition rates among AMB BMT participants. Increased anaerobic endurance and neuromuscular control could have contributed to less muscular fatigue and therefore, lowered the risk of injuries[6]. Another possible explanation could be that substituting a part of the obstacle course and running training sessions with AT reduced training intensity, thereby resulting in less fatigue and better training adaptation[11].

However, there is a great difference between the physiological demands of AT and long distance marches carrying heavy loads with the former improving anaerobic endurance while the latter improves aerobic endurance[11]. Long distance marches are an essential part of the infantry training and a major component of BMT. The marching program includes a total of 280 kilometres spread over the 23 weeks of the BMT, with a final overnight march of 25 kilometres. In general, the BMT is designed to frequently expose the recruits to uncomfortable circumstances. These become more extreme towards the end of the BMT, culminating in a final field test where exhaustion, sleep deprivation, physical discomfort, and (minor) injuries are common. These extreme circumstances are likely to have affected the performance of the recruits during the AT sessions as well as the performance on pre- and post-intervention testing in both groups. The speed of movement and power produced in each agility drill determines the degree of positive adaptations. Subjects should perform all drills with maximum speed and power as anything less decreases the force and power developed, diminishing the training effect[27]. The recruits may have restrained themselves during both the AT sessions as well as during pre- and post-intervention testing out of fear of injuries and subsequent dismissal from the training program.

The JPTIPWG recommends that multiaxial, neuromuscular, proprioceptive and agility exercises should be included as regular components of military physical training programs[2]. Our results support this recommendation, noting the difference in injury attrition rates (43% in the CG to 25% in the AT), which increased the number of recruits who passed the BMT, rather than being dismissed from the training program. Considering that each recruit already costs about €33.817 at the beginning of the BMT, AT may contribute to improve cost-effectiveness of military training[15].

However, this pilot study also revealed some important barriers to implementing AT. Of the 36 planned AT sessions, only 26 of the sessions (72%) were carried out. Cancellation of training sessions occurred mainly in the last three weeks of the program, in both AT and CG, mostly because of scheduling issues. The lack of continuity in training sessions reflects the challenges for implementing AT in the standard physical training program, resulting from time limitations, the large number of goals to be achieved, limited availability of sports instructors and scheduled field weeks.

The strengths of this pilot study are the comparability of the groups concerning demographic characteristics at baseline and performance at the start of the experimental period (T0), and the generalisability resulting from the pragmatic character and protocolled AT training sessions. Furthermore, as we did not want to expose recruits to more physical training than the military training already comprises, the AT group had no extra training time compared to the CG. Finally, the intervention involved reactive drills and starting cues to stimulate anticipation and reaction time to enhance cognitive functions with a view to improving alertness and manoeuvrability. Some weaknesses of the study should also be noted. Although female sex was not an exclusion criterion, the absence of female recruits in this cohort, prevents generalisability of our findings to females. Another limitation of this pilot study is the small sample size, which limited the precision of the effect estimates, especially given the attrition rate before T0. Post-hoc power analysis suggested that the initial sample size was sufficient to show a statistically significant benefit of AT compared to CG of the observed magnitude, on T test times post-intervention. We acknowledge that attrition of BMT as well as the occurrence of musculoskeletal injuries in recruits result from multifactorial processes. A previously proposed multifactorial model of athletic injury aetiology states the interplay between intrinsic factors (e.g. personal factors, previous injury, strength, age), extrinsic factors (e.g. training load, environment) and injury incidence[18]. Additionally, several researchers recognised the nonlinear interplay between those factors and proposed the 'web of determinants', emphasising the complexity of injury risk[1,10,20]. As this was beyond the scope of our study, we did not measure or address personal factors such as grit or ambition level. However, we believe that the random nature of group assignment likely harmonised the groups on these features. Because of this, and because the attrition rate before T0 was not associated with the intervention (since the intervention had not yet started), we believe that observed RR represent a valid estimation of the effect.

Previous research showed that the training methods and qualification of sports instructors are relevant for recruits' fitness development in initial military training[24]. Although, the sports instructors who gave the training sessions to both the AT group as well as the CG were experienced trainers, they had little experience with AT prior to this study. Although provision of the AT program was standardised, technique, intensity, speed, rest and motivational feedback are of great importance to the degree of positive adaptions[27]. Instructors in this pilot study were working their way through their learning curve in providing AT. This may have influenced the quality of the instructions limiting the intervention effects. Even larger effects may therefore be attainable if sports instructors receive additional schooling in skills as AT for military personnel. The Netherlands has several institutions where such courses are available. We hypothesise that the effects of AT are likely to increase CODS and body control in the field, especially with improved compliance to the program and if sports instructors gain more AT experience. We also consider the development of a tactical reactive agility test to be useful for measuring both physical and cognitive effects of renewed training programs in military populations.

In this pilot study we focused solely on exploring the effects of AT to the standard BMT program on body control, CODS and attrition rates. The addition of interventions to optimise personal factors, as well contextual factors, may further improve the outcomes of BMT. We suggest that future studies should investigate the effectiveness of such multidimensional interventions.

Conclusion

Our study shows that there are challenges in implementing AT in initial military training programs. Despite its limitations, this pilot study suggests that AT may have added value as a standard component in initial military training of Airmobile recruits. Larger trials are needed to confirm these findings. Careful consideration should be given to the planning of AT in relation to the remainder of the military training program, to ensure continuity and consistency of AT training sessions.

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Corresponding Author: Iris Dijksma, I.Dijksma.01@mindef.nl
Authors: I Dijksma[1,2,] S Perry[1,] W Zimmerman[3,4,] C Lucas[1,] M Stuiver[1]
Author Affiliations:
1 University of Amsterdam
2 Defence Health Care Organisation
3 Royal Netherlands Army
4 Uniformed Services University of Health Sciences

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Appendix 1: Intervention, Agility Training

	Exercises	Duration
Warming up	Lateral lunge walk Lunge walk with twist Walking high knee pulls Butt kicks High knee runs Quick sprints	6 minutes total warming up 60 seconds per exercise
Basic	2 minutes total work volume 30 seconds rest between drills	
Week 1	Forward and backward line hops One in the hole ladder drills Backpedal cone	4 sets of 10s 5 reps reps
Week 2	Lateral line hops Two-in-the-hole ladder Lateral shuffle cone	4 sets of 10s 4 reps 4 reps
Week 3	Traveling scissors Lateral two in the hole Carioca	4 sets of 10s 4 reps 3 reps
Intermediate	3 minutes total work volume 30 seconds rest between drills	
Week 4	Slaloms 180-degree traveling line hop Power Carioca 90-degree cut	4 reps 4 sets of 8s 4 reps 4 sets of 10s
Week 5	Cherry pickers V drill 90-degree round L drill	4 sets 4 sets of 7s 4 reps 4 reps
Week 6	180s Arrow drill T drill Four corners drill	4 reps 4 reps 4 reps 4 reps

Advanced	4 minutes total work volume 40 seconds rest between drills	
Week 7	T drill M drill Reactive sprint & backpedal drill	5 reps 4 reps 5 reps
Week 8	Lateral bear crawl & backpedal drill Tic tac toe drill Wave drill	3 sets of 15s 5 sets of 8s 3 sets of 10s
Week 9	T drill 360 degree drill Jump squat push up drill	5 reps 4 sets of 8s 4 sets of 10s
Advanced, more reactive	4 minutes total work volume 40 seconds rest between drills	
Week 10	Get up and Go Shadow drill Knee tag	1 set of 12s 3 sets of 12s 4 sets of 30s
Week 11	Reaction ball drill Triangle drill Everybody is it	40s 4 sets of 15s 4 sets of 20s
Week 12	T drill Knee tag Everybody is it	4 reps 4 sets of 30s 4 sets of 20s

Appendix 2: Selection of agility exercises used in the intervention(14)

Warming up

Lateral lunge walk

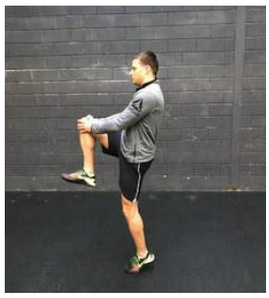
Extend the arms in front of the chest, take a big step to the side and bend the knee of the lead leg once the foot touches the ground.

Keep your arms extended throughout the exercise to assist with balance.

Lateral lunge walk with twist

Extend the arms in front of the chest, take a big step forward and flex the knee of the lead leg to approximately 90 degrees. Then rotate your hips and shoulders towards the lead leg. Return to the starting position by stepping forward with your trial leg. Repeat the exercise with the opposite leg.

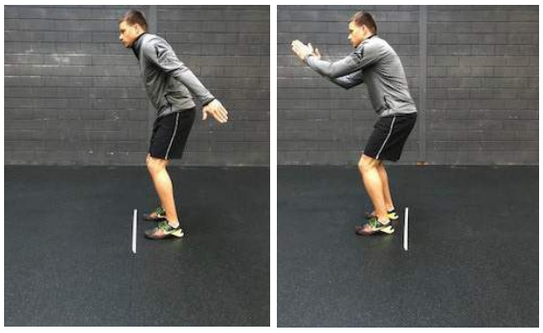
Walking high knee pulls



Start with flexing one hip and lifting your knee on that side as high as possible; grab the leg below the knee and pull your knee to your chest, keeping your back and chest up. Return the raised leg to the ground and repeat while moving forward with the other leg.

Basic

Forward and backward line hops

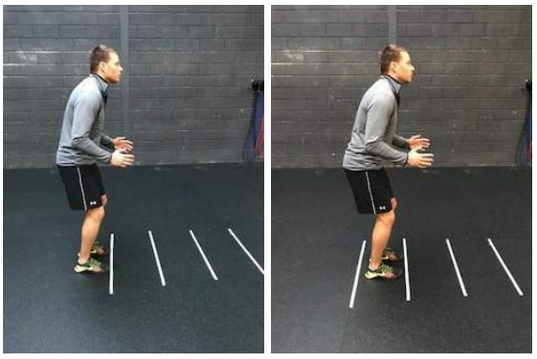


Stand in an athletic position parallel with the line facing forward and hop as fast as possible back and forth over the line with your feet together.

Lateral line hops

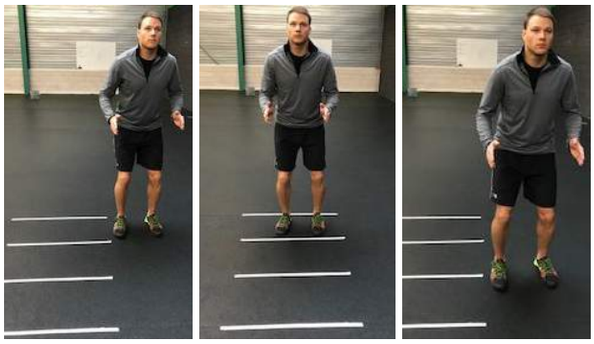
Stand in an athletic position with your shoulders perpendicular to the line and hop as fast as possible sideways over the line with your feet together.

Two-in-the-hole ladder



Stand in an athletic position at the end of the ladder facing forward. Step into the first box with one foot and immediately step into the same box with the other foot. Continue this pattern as fast as possible through the ladder.

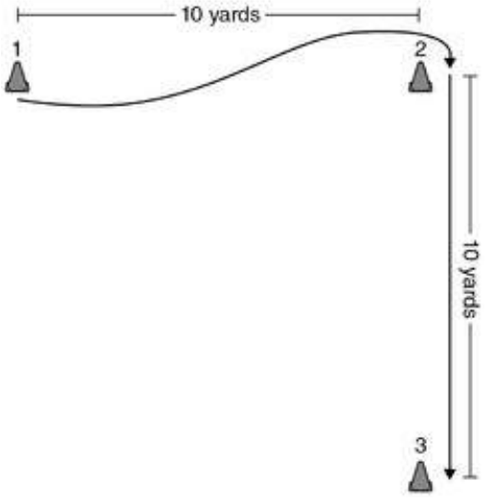
Intermediate Slaloms



Stand in an athletic position to the side of the first box with your hips and shoulders parallel to the ladder. Hop with both feet tighter into the centre of box 1 and immediately hop out of the box to the other side.

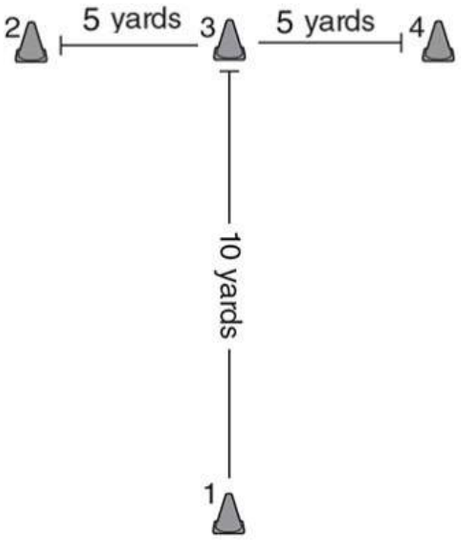
Hop diagonally into the centre of box 2 and immediately hop out of the box diagonally landing at the top of box 2. Continue this zigzag pattern through the ladder.

90-Degree round



Start next to cone 1 with your hips, shoulders and torso parallel to the cone. Sprint on cue towards cone 2; slow down slightly and make a 90- degree turn around cone 2. Then accelerate and sprint past cone 3.

T drill



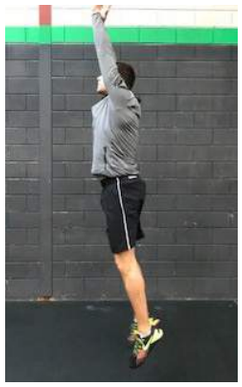
Start in an athletic position at cone 1, sprint to cone 3, cut left and sprint to cone 2. Then, perform a 180-degree turn around cone 2 and sprint to cone 4. Perform a 180-degree turn around cone 4 and sprint back to cone 3, then cut let and sprint back past the starting cone. Use short and choppy steps during the drill.

Advanced

Lateral bear crawl and backpedal drill

Set 4 cones in a square with 5 yards between cones. Start in an athletic position on the outside of cone 1 with your hips, shoulders and torso perpendicular to it. On cue, sprint to cone 2. Then, assume a bear crawl position and move laterally to cone 3. Stand up as fast as possible and backpedal to cone 4. Then, bear crawl laterally back to cone 1.

Jump, squat, push-up drill



Start in an athletic position. The coach calls out jump, squat or push up. Perform the exercise as indicated as fast as possible.

Shadow drill

Two cones are set up 10 yards (9 m) apart from one another. Two athletes stand facing each other in the centre of the cones. One athlete assumes the role of the leader. The other athlete must shadow the leader by mimicking his actions.

Factors Associated with Uptake of U.S. Department of Veterans Affairs Disability Benefits Among U.S. Vietnam War Veterans Who Were VA System Users in 2013

D Fried, M Rajan, C Tseng, D Helmer

Introduction

The US Department of Veterans Affairs (VA) spent US$64.7 billion in FY2016 on disability compensation for US Veterans of all eras with service-connected conditions – 37.5% (US$24.4 billion) was spent just on Vietnam-era Veterans (VNE: January 9, 1962-May 7, 1975).[1] VNE Veterans are the second largest cohort of US living Veterans (6.2 million), of whom 2.7 million were deployed to the Vietnam Theater.[2]

'Service connected' refers to conditions that were caused or aggravated by military service.[3] VA service-connected disability compensation is administered by the Veterans Benefits Administration (VBA) and is based on severity of service-connected disability as well as number of dependents. A combined disability-rating percentage expresses service-connected disability severity on a scale from 0% (not compensable, but related to service) to 100% (most disabling) in increments of 10%. Higher disability ratings result in higher compensation payments and more generous Veterans Health Administration (VHA) access.[1]

Between 1962 and 1971, the US military sprayed almost 20 million gallons of Agent Orange (AO) over the Republic of Vietnam (RVN).[4] AO refers broadly to a class of herbicides that were used to defoliate areas of the jungle and landscape.[5] These herbicides were contaminated with dioxin, a known cause of certain cancers and other adverse health effects.[5] Currently, 14 conditions (Appendix I) presumed to be associated with AO exposure have been designated as presumed (presumptive) service-connected conditions.[6] Type 2 diabetes (DM) and ischaemic heart disease (IHD), both prevalent and costly chronic conditions, were designated as 'presumptive' in 2001 and 2010, respectively. A VNE Veteran seeking to establish service connection for a presumptive condition need only provide evidence of a clinical diagnosis and of having 'stepped foot' in the RVN between January 9, 1962 and May 7, 1975.[5] Once these requirements are met, exposure to AO is presumed because it cannot be documented and presumptive service connection is awarded.

Presumptions, by eliminating the need for Veterans to prove exposure, make it easier for them to receive service connection and thereby access the VA disability system.[7,8] Importantly, Veterans with presumptive conditions must apply for presumptive benefits and the VA service connection application process can be complex and time consuming.[8,9] Despite legislation and VA policies intended to facilitate service connection, little is known about Veterans' uptake of presumptive service-connection benefits. Prior work suggests, however, that not all qualified Veterans with diagnosed presumptive conditions apply for and receive their presumptive service-connection benefits.[10,11] In this study, we refer to the presence of a diagnosed presumptive condition in the VHA electronic medical record in the absence of a presumptive service-connection award for that condition in the VBA compensation database as a 'presumption gap.' We use the term presumption gap to indicate that a Veteran has not received his or her presumptive benefits.

Because the US has a national interest in ensuring that Veterans have access to high-quality VA benefits and services,[9] we examined factors potentially associated with presumption gaps among Vietnam Theater Veterans with diagnosed DM or IHD. As DM and IHD were designated as presumptive at different times (DM in 2001, IHD in 2010), we hypothesised

that IHD presumption gaps would be more prevalent than DM presumption gaps because less time had elapsed for Veterans to apply for and be granted service connection for IHD. We further hypothesised that presumption gap would be associated with poorer health (interfering with Veterans' ability to apply for presumptive benefits) and lower VHA utilisation (representing a higher cost barrier to access).

Materials and methods

The cohort was assembled from the Veterans Service Network Corporate Mini Master File (VETSNET), the primary source of information regarding disability benefits. VETSNET consists of selected fields from the VBA Corporate Database. This database supports the systems used to administer Veterans' benefits including compensation and pension benefits. VETSNET has been cited in prior work.[12,13] In this analysis, we used scrambled Social Security numbers to link VETSNET to VHA data.[13,14] The VETSNET data extract provided cross-sectional information as of April 2013 for 1 186 967 VNE Veterans who were receiving VBA benefits for service-connected disabilities.

Because we were interested in Veterans who were likely to have stepped foot in RVN, we used the Vietnam Theater flag (a binary theater/non-theater indicator available in VETSNET) to initially select 317 545 (26.7%) Vietnam Theater Veterans determined by VBA through manual review of military service documentation to have been deployed to theater. We excluded 869 422 (73.3%) Veterans whose presence in the Vietnam Theater was less certain. We then selected 196 650 (61.9%) with at least one inpatient visit recorded in the VHA Patient Treatment File (PTF) during FY11-FY13 (VHA PTF contains information on each inpatient care episode) or one outpatient visit recorded in the VHA Outpatient Event File (OEF) during FY11-FY13 (VHA OEF contains information on each outpatient encounter). We excluded 120 895 (38.1%) with no VHA use in FY11-FY13.

Among the analytic sample of 196 650 Vietnam Theater Veterans, 125 399 (63.7%) had diagnosed DM and 71 251 (36.3%) had diagnosed IHD recorded in VHA electronic medical records. To determine the presence of diagnosed DM or IHD, we required at least two International Classification of Diseases Ninth Revision (ICD-9) codes within a 24-month period (FY2011–FY2012) to avoid unconfirmed or rule-out diagnoses.[15]

Among those with DM, we considered the presence of a diagnosis for DM in the VHA electronic medical records in the absence of a presumptive service-connection award for DM in the VBA compensation database to be a 'DM presumption gap'. Among those with IHD, we considered presence of a diagnosis for IHD in the VHA electronic medical records in the absence of a presumptive service-connection award for IHD in the VBA compensation database to be an 'IHD presumption gap'.

Dependent variables

Two binary dependent variables were used to examine presumption-gap status in 2013. The first dependent variable was DM presumption-gap status in 2013 (DM presumption gap/no DM presumption gap). The second dependent variable was IHD presumption-gap status in 2013 (IHD presumption gap/no IHD presumption gap).

Independent variables

Variables were extracted from VHA electronic medical records and VBA compensation database records. Veteran characteristics extracted included age, gender, race, marital status, number of chronic comorbidities and presence of diagnosed post-traumatic stress disorder (PTSD). Because Medicare enrolment by older VHA patients may impact their VA system utilisation patterns,[16] continuous variable age (extracted from VHA PTF) was transformed into a dichotomous variable representing subjects who were 66 years of age or older in 2013 (Medicare-enrolment age), or less than 66 years of age (Not Medicare enrolment age). Because some studies have found that blacks are less likely than whites to receive VA service-connection benefits,[17] race/ethnicity (extracted from VHA PTF) was categorised as white, non-white or unknown/missing. Additionally, sex (male/female) and marital status (married, unmarried, unknown/missing) were also extracted as they correlate with service-connection award status and payment amount.[18,19]

To account for differences in comorbidity burden between those with and without presumption gap, we computed Charlson comorbidity index score (Deyo adaptation), which assesses the overall burden of disease and is associated with mortality (higher scores are associated with higher mortality). Charlson scores are based on the medical impact of up to 19 chronic conditions as recorded in the VHA PTF or the VHA OEF in FY2013. Further details on Charlson score can be found elsewhere.[20] The continuous score was transformed into an ordinal variable representing subjects with scores of 0, 1-2 or 3+.

Because PTSD can facilitate or impede service-connection award,[19,20] a dichotomous variable representing presence or absence of PTSD was included as a distinct comorbidity. A Veteran had diagnosed PTSD in FY2013 if he or she had ICD-9 code '309.81' recorded in the VHA PTF or the VHA OEF on at least two separate occasions during a 24-month window (FY2012-FY2013).[21]

To better characterise the sample, additional VHA healthcare utilisation measures (not modelled) from FY2013 are presented: Total number of VHA outpatient healthcare visits, a continuous variable derived by summing clinic stop codes (a Veteran could have more than one ambulatory care visit on any given day) was extracted from VHA OEF; total number of VHA inpatient healthcare visits (extracted from VHA PTF) was dichotomised (at least 1 visit/no visit), as only a relatively small proportion of the sample had been hospitalised in 2013. Given our focus on DM and IHD, VHA specialty endocrine care and VHA specialty cardiac care (both extracted from VHA OEF) were also dichotomised (at least 1 visit/no visit). In addition, length of VHA hospitalisation stay in days, a continuous variable, was extracted from the VHA PTF file.

Veteran characteristics in 2013 extracted from VETSNET included combined disability rating percentage, VBA Individual Unemployability award, VBA Special Monthly Compensation award, VBA Ancillary disability benefit award, branch of service and rank. Because we wanted to capture Veterans whose service-connected disabilities entitled them to maximum benefit levels, combined disability rating percentage (0-100%) was transformed into a three-level variable representing subjects with ratings of 0-40%, 50-90% or 100%.

As measures of disability severity, number of service-connected disabilities, number of non-service-connected disabilities and total number of service and non-service-connected disabilities as of April 2013 were included as continuous measures. Further reflecting disability severity, three dichotomous variables represented presence or absence of the following: (1) VBA Individual Unemployability (IU) provides compensation to Veterans who cannot maintain employment due to service-connected disabilities; (2) VBA Special Monthly Compensation (SMC) provides additional compensation for loss/loss of use of an organ or extremity; (3) VBA Special/Ancillary disability benefits provide additional types of compensation to Veterans with particularly severe service-connected conditions.[22] A Veteran was considered to have a VBA Special/Ancillary disability benefit if they were receiving a clothing allowance, vocational rehabilitation and employment and/or special adaptive equipment or housing grants. Finally, total monthly VBA disability compensation payment accorded by the above benefits was reported in 2013 US dollars.

Because Veterans who served in the Army or Marines were more likely than those who served in the Navy or Air Force to experience combat,[22,23,24] and combat is a correlate of service-connection award status, branch of service at discharge was operationalised as a five-level variable (Army, Marines, Navy, Air Force, all other branches). Additionally, because lower rank at discharge (relative to higher rank) is associated with poorer health and lower socioeconomic status,[24,25] both of which are associated with service-connection award status, rank at discharge was operationalised as a three-level categorical variable (Officers, Enlisted or non-commissioned officers, Unknown or missing).

Statistical analysis

The VA-New Jersey Health Care System Institutional Review Board approved this study. All analyses were performed with SAS 9.3 (SAS Corp: Cary, NC), were two-tailed and conducted with α=0.05 significance level.

In analysing descriptive statistics for Veterans with DM or IHD, we compared presumption gap versus no presumption gap for all initial variables. A p value of $\alpha < .05$ denoted a statistically significant difference between these groups. Descriptive statistics are presented as percentages (categorical variables) or medians and interquartile ranges (continuous variables).

In conducting multivariable analyses, we applied a multi-step approach: First, we conducted bivariate analyses to explore associations between candidate predictors and each outcome. Those predictors that had a bivariate association with an outcome at significance level $p<.25$[26] were retained for the multivariable model. Second, binary logistic regression with forward selection[27] was used to model relationships between binary dependent variables and independent variables. Binary logistic regression is a generalised linear model that uses the binomial distribution and a logit link function.[28] Model coefficients are estimated by a maximum-likelihood algorithm and exponentiation of the coefficients provides odds ratios for independent variables.[28] Third, we examined the contribution of each predictor to the multivariable model using a Wald chi-square test with an adjusted significance level. The Bonferroni stepdown method, which was used to derive the adjusted significance level, is

Table 1. Characteristics of Vietnam-Theater Veterans with Diabetes or Ischaemic Heart Disease

	Diabetes (N=125,399)	Ischaemic Heart Disease (N=71,251)
Sociodemographics		
Medicare-Enrolment Age (%)	60.7%	61.6%
Male Sex (%)	99.8%	99.9%
Marital Status (%)		
Married	38.8%	39.9%
Unmarried	46.6%	46.4%
Unknown or Missing	14.5%	14.5%
Race/Ethnicity (%)		
White	6.71%	8.30%
Non-white	3.17%	2.32%
Unknown or Missing	90.1%	89.3%
Military Service		
Branch of Service at Discharge (%)		
Army	66.7%	66.0%
Navy	8.14%	8.23%
Air Force	10.5%	10.3%
Marine Corps	14.4%	15.2%
All Others	0.16%	0.16%
Rank at Discharge (%)		
Enlisted or Non-Commissioned Officer	90.1%	84.2%
Officer	3.17%	4.59%
Missing	6.71%	11.1%
Health and Benefits		
Charlson Comorbidity Score (%)		
0	5.29%	21.0%
1-2	65.7%	50.7%
3+	29.0%	28.2%
Median (IQR) Number of Service-Connected Disabilities	5.0 (3.0-8.0)	5.0 (3.0-7.0)
Median (IQR) Number of Non-Service-Connected Disabilities	3.0 (1.0-5.0)	2.0 (1.0-5.0)
Median (IQR) Number of Total Disabilities	8.0 (5.0-12.0)	8.0 (5.0-12.0)
Posttraumatic Stress Disorder (%)	27.8%	28.8%

Combined Disability Rating Percentage (%)		
0-40 percent	23.2%	16.6%
50-90 percent	51.4%	49.1%
100 percent	25.6%	34.4%
Median (IQR) Monthly VA Disability Compensation Income ($)	$1789 ($888-$3073)	$2816 ($1120-$3073)
VBA Individual Unemployability Award (%)	21.3%	21.4%
VBA Special Monthly Compensation Award (%)	49.0%	40.6%
VBA Ancillary Disability Benefit Award (%)	1.24%	1.23%
Healthcare Utilisation		
At least 1 VHA Outpatient Visit (%)	97.9%	98.0%
Median (IQR) Total VHA Outpatient Visits	22.0 (11.0-41.0)	23.0 (11.0-44.0)
At least 1 VHA Inpatient Visit (%)	11.4%	14.3%
Median (IQR) VHA Inpatient Length of Stay (days)	4.0 (2.0-11.0)	4.0 (2.0-10.0)
VHA Specialty Care Visits (%)		
No Visits	19.7%	21.3%
1-2 Visits	27.4%	24.8%
3-4 Visits	16.9%	16.3%
5 or more Visits	35.8%	37.4%
VHA Primary Care Visits (%)		
No Visits	3.37%	3.15%
1-2 Visits	37.1%	37.6%
3-4 Visits	30.8%	30.5%
5 or more Visits	28.6%	28.6%
At least 1 VHA Cardiac Specialty Care Visit (%)	16.5%	30.1%
At least 1 VHA Endocrine Specialty Care Visit (%)	11.2%	8.68%

Notes: For categorical variables, chi-square used to test for statistically significant differences. For continuous variables, Wilcoxon used to test for statistically significant median differences: For DM, all variables demonstrated statistically significant differences at $\alpha<0.05$ significance level except VHA outpatient visits and VHA emergency care; for IHD, all variables demonstrated statistically significant differences at $\alpha<0.05$ significance level except Medicare-enrolment age, VHA outpatient visits, VHA specialty care and VHA endocrine care.

Table 2: Presumed Service-Connected Award Status in 2013 for Vietnam-Theater Veterans with Diabetes or Ischaemic Heart Disease

	Diabetes Presumption Gap (N=13,715)	No Diabetes Presumption Gap (N=111,684	IHD Presumption Gap (N=28,353)	No IHD Presumption Gap (N=42,898)
Sociodemographics				
Medicare-Enrolment Age (%)	56.1%	61.3%	61.9%	61.5%
Male Sex (%)	99.6%	99.8%	99.8%	99.9%
Marital Status (%)				
Married	36.7%	39.0%	37.4%	39.9%
Unmarried	45.8%	46.7%	46.6%	46.3%
Unknown or Missing	17.4%	14.2%	15.8%	13.7%
Race/Ethnicity (%)				
White	9.55%	6.37%	9.30%	7.63%
Non-white	4.03%	3.06%	2.71%	2.06%
Unknown or Missing	86.4%	90.5%	87.9%	90.3%
Military Service				
Branch of Service at Discharge (%)				
Army	55.2%	68.1%	64.3%	67.1%
Navy	17.2%	7.03%	9.94%	7.10%
Air Force	14.2%	10.1%	10.8%	9.98%
Marine Corps	13.0%	14.5%	14.7%	15.6%
All Others	0.21%	0.15%	0.18%	0.15%
Rank at Discharge (%)				
Enlisted or Non-Commissioned Officer	85.0%	84.8%	83.5%	84.7%
Officer	5.05%	3.95%	5.00%	4.32%
Missing	9.93%	11.2%	11.4%	10.9%
Health and Benefits				
Charlson Comorbidity Score (%)				
0	10.0%	4.72%	20.7%	21.2%
1-2	62.9%	66.0%	50.0%	51.2%
3+	27.1%	29.2%	29.2%	27.5%
Median (IQR) Number of Service-Connected Disabilities	3.0 (2.0-5.0)	5.0 (3.0-8.0)	4.0 (2.0-7.0)	5.0 (3.0-8.0)
Median (IQR) Number of Non-Service-Connected Disabilities	2.0 (1.0-5.0)	3.0 (1.0-5.0)	2.0 (1.0-5.0)	3.0 (1.0-5.0)
Median (IQR) Number of Total Disabilities	6.0 (3.0-10.0)	9.0 (6.0-12.0)	7.0 (4.0-11.0)	8.0 (5.0-12.0)

Posttraumatic Stress Disorder (%)	34.1%	27.1%	30.7%	27.5%
Combined Disability Rating Percentage (%)				
0-40 percent	25.8%	22.8%	19.5%	14.2%
50-90 percent	42.6%	52.1%	46.4%	50.9%
100 percent	31.4%	24.9%	34.0%	34.7%
Median (IQR) Monthly VA Disability Compensation Income ($)	$2816 ($631-$2973)	$1728 ($888-$3073)	$2816 ($1026-$3021)	$2816 ($1220-$3073)
VBA Individual Unemployability Award (%)	22.8%	21.1%	23.5%	20.0%
VBA Special Monthly Compensation Award (%)	18.6%	52.7%	36.2%	43.4%
VBA Ancillary Disability Benefit Award (%)	2.24%	1.09%	1.68%	0.96%
Healthcare Utilisation				
At least 1 VHA Outpatient Visit (%)	97.7%	97.9%	98.1%	98.0%
Median (IQR) Total VHA Outpatient Visits	23.0 (12.0-42.0)	22.0 (11.0-41.0)	24.0 (12.0-45.0)	23.0 (11.0-43.0)
At least 1 VHA Inpatient Visit (%)	13.0%	11.2%	15.5%	13.6%
Median (IQR) VHA Inpatient Length of Stay (days)	5.0 (2.0-12.0)	4.0 (2.0-11.0)	4.0 (2.0-11.0)	4.0 (2.0-10.0)
VHA Specialty Care Visits (%)				
No Visits	21.6%	19.4%	20.9%	21.6%
1-2 Visits	27.0%	27.5%	24.2%	25.3%
3-4 Visits	16.8%	17.0%	16.2%	16.3%
5 or more Visits	34.4%	35.9%	38.5%	36.7%
VHA Primary Care Visits (%)				
No Visits	4.45%	3.24%	3.43%	2.97%
1-2 Visits	37.3%	37.3%	36.9%	38.0%
3-4 Visits	30.1%	30.1%	30.2%	30.7%
5 or more Visits	28.1%	28.7%	29.3%	28.2%
At least 1 VHA Cardiac Specialty Care Visit (%)	15.9%	16.6%	29.7%	30.3%
At least 1 VHA Endocrine Specialty Care Visit (%)	8.42%	11.5%	8.73%	8.65%

Notes: For categorical variables, chi-square used to test for statistically significant differences. For continuous variables, Wilcoxon used to test for statistically significant median differences: For DM, all variables demonstrated statistically significant differences at $\alpha<0.05$ significance level except VHA outpatient visits and VHA emergency care; for IHD, all variables demonstrated statistically significant differences at $\alpha<0.05$ significance level except Medicare-enrolment age, VHA outpatient visits, VHA specialty care and VHA endocrine care.

Table 3: Multivariable binary logistic regression modelling of factors associated with diabetes presumption gap (vs no diabetes presumption gap) or ischaemic heart disease presumption gap (vs no ischaemic heart disease presumption gap)

	Model 1 [N=122,517] Diabetes Presumption Gap Adjusted Odds Ratio (95% CI)	**Model 2 [N=69,734] Ischaemic Heart Disease Presumption Gap Adjusted Odds Ratio (95% CI)**
Sociodemographics		
Medicare-Enrolment Age (Yes vs No)	0.82 (0.78-0.87)	1.03 (0.98-1.08)
Marital Status		
Unmarried (vs married)	1.01 (0.94-1.07)	1.06 (1.01-1.11)
Unknown/missing (vs married)	1.14 (1.05-1.24)	1.18 (1.10-1.27)
Military Service		
Branch of Service at Discharge		
Navy (vs Army)	3.32 (3.06-3.60)	1.45 (1.33-1.57)
Air Force (vs Army)	2.07 (1.91-2.26)	1.17 (1.09-1.27)
Marine Corps (vs Army)	1.06 (0.97-1.15)	0.98 (0.92-1.05)
All Others (vs Army)	1.86 (1.02-3.42)	1.27 (0.73-2.20)
Rank at discharge		
Enlisted/Non-commissioned officer (vs Officer)	0.67 (0.58-0.76)	0.79 (0.71-0.88)
Unknown/missing (vs Officer)	0.56 (0.48-0.66)	0.83 (0.73-0.94)
Health and Benefits		
Charlson Comorbidity Score		
1-2 (vs 0)	0.41 (0.37-0.45)	1.13 (1.07-1.20)
3+ (vs 0)	0.45 (0.41-0.51)	1.30 (1.22-1.39)
Total Number of Disabilities	0.93 (0.92-0.93)	0.98 (0.97-0.98)
Post-traumatic Stress Disorder (Yes vs No)	1.57 (1.47-1.67)	1.26 (1.20-1.33)
Combined Disability Rating Percentage		
50-90 percent (vs 0-40 percent)	0.94 (0.87-1.02)	0.59 (0.55-0.63)
100 percent (vs 0-40 percent)	2.96 (2.72-3.22)	0.81 (0.75-0.87)
VBA Individual Unemployability Award (Yes vs No)	1.89 (1.74-2.04)	1.55 (1.46-1.65)
VBA Special Monthly Compensation Award (Yes vs No)	0.18 (0.16-0.19)	0.73 (0.69-0.77)

Notes: 95% CI=95% confidence interval, VBA=Veterans Benefits Administration; Model 1: AIC [Full model=72874 vs Intercept only model=84826], overall Wald χ2 [Diabetes model: χ2(17) = 9587, p<.0001]. Model 2 AIC [Full model=920176 vs Intercept only model=93763] and the overall Wald χ2 [χ2(17) = 1667, p<.0001].

appropriate when several statistical tests are being performed simultaneously on a single dataset.[30]

In assessing goodness of model fit, since the Hosmer-Lemeshow goodness of fit test performs poorly for large samples[30], goodness of fit was instead assessed with the following: Akaike Information Criterion (AIC) fit statistic was used to compare the full model to the intercept only model (the model with the smallest AIC is considered best).[31] Additionally, the Wald $\chi 2$ goodness of fit test was used to evaluate overall model fit (p values of $\alpha<0.05$ significance level indicate satisfactory fit).[26] To assess overdispersion, the deviance statistic was divided by its degrees of freedom (the result should be approximately equal to 1 when no lack of fit or overdispersion exists).[31,32] As a final indicator of fit, to assess multicollinearity, we generated Variance Inflation Factors (VIF) (VIFs of approximately 1.0 indicate little/no multicollinearity).[33]

In multivariable modelling, race/ethnicity (83.8% unknown or missing) was excluded due to excessive unknown or missing observations. For all other variables, missing observations were deleted through an automated process of listwise deletion.

Results

Among 196 650 Vietnam Theater Veterans (mostly male) who were VBA and VHA users, 125 399 (43%) had DM and 71 251 (25%) had IHD, in 2013. Among those with diagnosed DM, 13 715 (10.9%) had a DM presumption gap, and 111 864 (89.1%) did not have a DM presumption gap in 2013. Among those with diagnosed IHD, 28 353 (39.7%) had an IHD presumption gap and 43 898 (61.3%) did not have an IHD presumption gap, in 2013 (Table 1).

Unadjusted analysis (Table 2) of Veterans with DM revealed that those with a DM presumption gap (relative to no DM presumption gap) had higher rates of PTSD (DM gap=34.1% vs no DM gap=27.1%), 100% combined disability rating (DM gap=31.4% vs no DM gap=24.9%), and VBA IU award (DM gap=22.8% vs no DM gap=21.1%) and received higher median VBA disability compensation payment (DM gap=US$2 816 vs no DM gap=US$1 728). In contrast, those with a DM presumption gap (relative to no DM presumption gap) were less frequently of Medicare-enrolment age (DM gap=56.1% vs no DM gap=61.3%), had 3+ comorbidities (DM gap=27.1% vs no DM gap=29.2%) and VBA SMC award (DM gap=18.6% vs no DM gap=52.7%). With the exception of endocrine care (DM gap=8.42% vs no DM gap=11.5%), those with and without a DM presumption gap had similar VHA utilisation patterns in FY2013.

The final DM presumption gap multivariable model (Table 3) included Medicare-enrolment age, Charlson comorbidity index score, branch of service, PTSD, combined degree per cent, SMC, IU, marital status, rank and total number of disabilities. After adjusting for covariates (Table 3), DM presumption gap continued to be associated with greater likelihoods of PTSD (OR=1.57, 95% CI: 1.47-1.67), 100% combined disability rating (OR=2.96, 95% CI: 2.72-3.22), VBA IU award (OR=1.89, 95% CI: 1.74-2.04), lower likelihoods of Medicare-enrolment age (OR=0.82, 95% CI: 0.78-0.87), 3+ comorbidities (OR=0.45, 95% CI: 0.41-0.51) and VBA SMC award (OR=0.18, 95% CI: 0.16-0.19).

In terms of fit for the DM presumption-gap model, the AIC [Full model=72874 vs Intercept only model=84826] and the overall Wald $\chi 2$ [$\chi 2(17) = 9587$, $p<.0001$] indicated adequate fit (Table 3). As further indication of adequate fit, we found no evidence of overdispersion [Deviance/DF=1.02, p=0.0021] or multicollinearity [VIF $\approx$ 1.0].

Unadjusted analysis (Table 2) of Veterans with IHD revealed that those with an IHD presumption gap (relative to no IHD presumption gap) more frequently had PTSD (IHD gap=30.7% vs no IHD gap=27.5%), 3+ comorbidities (IHD gap=29.2% vs no IHD gap=27.5%) and VBA IU award (IHD gap=23.5% vs no IHD gap=20.0%). Those with an IHD presumption gap (relative to no IHD presumption gap) less frequently had 100% combined disability rating (IHD gap=34% vs no IHD gap=34.7%) and VBA SMC award (IHD gap=36.2% vs no IHD gap=43.4%). With the exception of inpatient care (IHD gap=15.5% vs no IHD gap=13.6%), those with and without an IHD presumption gap had similar VHA utilisation patterns in FY2013.

The final IHD presumption gap multivariable model (Table 3) included Medicare-enrolment age, Charlson comorbidity index score, branch of service, PTSD, combined degree percent, SMC, IU, marital status, rank and total number of disabilities. After adjusting for covariates (Table 3), similar to DM gap experience, IHD gap was associated with greater likelihoods of PTSD (OR=1.26, 95% CI: 1.20-1.33) and VBA IU award (OR=1.55, 95% CI: 1.46-1.65) and lower likelihoods of VBA SMC award (OR=0.73, 95% CI: 0.69-0.77). In contrast to the DM gap experience, IHD gap was associated with increased likelihood of having 3+ comorbidities (OR=1.30, 95% CI: 1.22-1.39) and lower likelihood of having 100% combined disability rating (OR=0.81, 95% CI: 0.75-0.87).

In terms of fit for the IHD presumption-gap model, the AIC [Full model=92176 vs Intercept only

model=93763] and the overall Wald $\chi 2$ [$\chi 2(17) = 1667$, $p<.0001$] indicated adequate fit (Table 3). As further indication of adequate fit, we found no evidence of overdispersion [Deviance/DF=1.34, p=0.0021] or multicollinearity [VIF ≈ 1.0].

Discussion

This study found, as hypothesised, a larger presumption gap for IHD (39.7%) than for DM (10.9%) in 2013. This suggests that it may take time for Veterans to become aware of, apply for and be awarded service connection, even for their diagnosed conditions that are presumed related to military service. In 2013, DM had been a designated presumptive condition for 12 years and IHD for only 3 years. This difference in presumption gap size for these two conditions with markedly different time since the policy change (i.e., presumptive designation) is critical in understanding the differences between factors associated with IHD and DM presumption gaps.

Our findings suggest that for some Veterans, chronic comorbid conditions may delay or impede filing of a presumed service-connection claim because impairments may make it difficult to complete the lengthy application, or attend all required evaluations.[10] Veterans busy managing multiple chronic health conditions may have less time and opportunity to become aware of, or act on more recent changes in presumptive policy. Among Veterans with IHD, those with an IHD presumption gap had higher comorbidity burden and were much more likely to have diagnosed PTSD, compared to those without an IHD gap, during the study period. While a DM presumption gap was associated with greater prevalence of PTSD, the presence of 3+ comorbidities was associated with a lower likelihood of a presumption gap (in marked contrast to Veterans with IHD). These findings, in suggesting that PTSD may be a common impediment to uptake of presumed service connection in both condition cohorts, are consistent with studies suggesting that mental health conditions may impede receipt of disability benefits, particularly among those with severe mental illness.[34,35] While this study did not examine different levels of PTSD severity, subsequent studies might wish to evaluate the role of mental health condition severity level in uptake of presumptive benefits. The difference in the relationship between presumption gap and burden of comorbid conditions most likely reflects the difference in time since the presumptive service-connection policy inception for these two conditions.

Another interesting finding of the study is that the DM presumption gap appeared to be associated with attainment of maximum allowable benefits. Among our sample, those with a DM gap were more likely than those without this gap to have a 100% combined disability rating and to receive VBA IU benefits. Both of these benefit statuses result in monthly disability compensation at the 100% rate. It is worth noting that Veterans with a 100% disability rating receive highest priority VHA care for all service and non-service-connected conditions at no cost; for these Veterans, addition of a presumptive service-connection award for their DM would not alter their access to VHA healthcare services, compensation payment, priority group assignment or co-payments. These Veterans would have little incentive to file a presumptive claim, resulting in a persistent DM presumption gap, as more maximally-rated Veterans develop this age-related chronic condition.

Overall, such extensive use of the VA system is consistent with our contention that while reduced uptake may reflect the inability to acquire benefits for some with very poor health, it may also reflect limited interest in acquiring additional service-connection awards for others who have 'maxed out' on their VA benefits. We suspect that a sample of Vietnam Theater Veterans less engaged with the VA benefits system would demonstrate different characteristics in relation to presumption gaps.

Limitations

In this cross-sectional study there is some possibility of misclassification of Vietnam-Theater status, a key characteristic of our population of interest. However, because the theater flag we used from VETSNET is only applied when there is documented evidence of in-theater service verified by the VBA, misclassification is likely to be minimal. Also, presumptive service connection has been incrementally expanded to include Veterans deployed to the waters near Vietnam (brown-water Vietnam Veterans), some Veterans deployed to the Republic of Korea, and is currently being considered for US Navy Veterans on ships which transported AO (blue-water Vietnam Veterans). Therefore, our results may not be generalised to these groups. In addition, findings from our own prior studies[36,37] lead us to believe that other factors (such as social support, education, literacy and financial means) are likely also associated with the presumption gap for these conditions; our data, however, were inadequate in this study to explore these associations. In addition, since we were only able to examine the presumption-gap status of Veterans with DM or IHD due to VETSNET data limitations, it is possible that factors associated with these disease presumption gaps differ from

factors associated with presumption gaps for other presumptive conditions (e.g., prostate cancer). As an additional limitation, this analysis was restricted to VA system users. Given that a majority of Veterans in any given year do not use the VHA, inclusion in our sample of Veterans who were not VA system users might have led to different results. Finally, because this analysis was restricted to living Veterans with DM or IHD, results may be subject to survivor bias.

Conclusion

Service connection is a multibillion dollar annual federal expenditure to the benefit of Veterans. Presumptive service connection is a critical special accommodation to address the challenges of documenting military-related exposures with latent negative health effects. Our findings provide essential, new information about presumed service connection for IHD and DM for Vietnam Veterans and elucidate the relationships among Veteran characteristics, presumed service connection and VA system utilisation.

It appears that it may take several years from presumptive designation to widespread uptake of the benefits. VA may want to consider more aggressive outreach of such policies, especially targeting those with covered conditions diagnosed in VHA. Additionally, because PTSD and the heavy burden of chronic conditions may be a barrier to benefit uptake for some Veterans, VA may consider enhancing outreach and assistance programs focused on this group to increase awareness of service-connected benefits. On the other hand, many Veterans who have already maxed out their VA benefits appear aware that there is limited incentive for seeking additional benefits.

For Veterans and Veteran advocates, our findings offer clues to why presumptive benefits were 'left on the table' among Vietnam Veterans who did not file for presumed service connection despite their diagnosis of IHD and DM. For VA policymakers and Veterans Service Organisations, our findings can help shape the resources and approaches needed to accelerate the uptake of disability and healthcare benefits by eligible Veterans.

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Corresponding Author: Dennis Fried, Dennis.Fried@va.gov
Authors: D Fried[1,2], M Rajan[3], C Tseng[1], D Helmer[1]
Author Affiliations:
1 US Department of Veteran Affairs
2 War Related Injury and Illness Study Centre
3 Weill Cornell Medicine

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Appendix I. Presumptive conditions (ICD-9 codes) and VHA healthcare categories (clinic stop codes)

PRESUMPTIVE CONDITIONS (NON-CANCERS)	ICD-9 CODES
Chloracne or other acneform disease similar to chloracne*	706.1
Ischaemic heart disease†	410.xx, 411.0, 411.1, 411.8, 411.81, 411.89, 412.0, 413.0, 413.1, 413.9, 414.0, 414.01, 414.02, 414.03, 414.04, 414.05, 414.10, 414.11, 414.19, 414.80, 414.90
Parkinson's disease†	332.0, 332.1
Peripheral neuropathy*	356.4, 356.8, 356.9
Porphyria cutanea tarda*	277.1
Type 2 diabetes†	250.xx
PRESUMPTIVE CANCERS	
Chronic b-cell leukemias†	204.1
Hodgkin's disease†	201.xx
Multiple myeloma†	203.0, 203.1, 238.6
Non-Hodgkin's lymphoma†	202.80-202.88
Prostate cancer†	185.00
Respiratory cancers (lung, bronchus, larynx, trachea)†	161.8, 161.9, 162.0, 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 231.0, 231.1, 231.2
Soft-tissue sarcoma†	171.00
VHA HEALTHCARE CATEGORIES	CLINIC STOP CODES
VHA Primary Care	170, 171, 301, 318, 319, 322, 323, 350, 531
VHA Specialty Care	201, 210, 211, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 320, 401, 402, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 418, 419, 420, 422, 426, 457
VHA Diabetes/Endocrine Specialty Care	305, 306
VHA Cardiac Specialty Care	303, 402

*Notes:†Presumptive any time after discharge; *Presumptive within 1-year of discharge*

Evaluation of the Online, Peer Delivered 'Post War: Survive to Thrive Program' for Veterans with Symptoms of Posttraumatic Stress Disorder

Madeline Romaniuk, Justine Evans, Chloe Kidd

Abstract

Background: Veterans frequently report barriers to accessing and adhering to first-line treatments for posttraumatic stress disorder (PTSD). Online delivery of an evidence-based intervention by a peer-developed program may aid in overcoming these barriers.

Purpose: This study evaluated the 'Post War: Survive to Thrive Program', an online, peer developed and delivered program, designed to assist with the management of commonly occurring mental health symptoms among veterans.

Material and Methods: Former Australian Defence Force (ADF) members (n = 29) completed the program and were assessed at pre-intervention, three months post-commencement of the program (post-intervention) and six months post-commencement (follow-up). Changes in mental health symptoms were assessed using the DASS-21 and PTSD Checklist for DSM-5, and changes in overall levels of happiness were assessed using the Oxford Happiness Questionnaire.

Results: Repeated measures ANOVAs indicated significant main effects across time for all constructs measured. Post-hoc comparisons indicated depression, anxiety, stress and posttraumatic stress symptoms were significantly lower at post-intervention and follow-up compared to pre- intervention. Happiness scores were significantly higher at post-intervention and follow-up compared to pre-intervention. There were no significant differences between post-intervention and follow-up, indicating maintenance of treatment gains.

Conclusions: To the authors' knowledge, this is the first study to report an evaluation of an online therapy program utilising a peer developed and facilitated psychological intervention with a veteran population. Findings demonstrated a positive trend, indicating the Post War: Survive to Thrive Online Program may be beneficial for veterans; however, a controlled trial with a larger sample is required to determine effectiveness of the program.

Keywords: posttraumatic stress disorder, online, military personnel, treatment, veteran mental health

Conflicts of interest: The authors declare no conflicts of interest.

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Evaluation of the online, peer delivered 'Post War: Survive to Thrive Program' for Veterans with symptoms of posttraumatic stress disorder

Following exposure to a traumatic event, posttraumatic stress disorder (PTSD) is characterised by intrusive memories and nightmares, avoidance of stimuli reminiscent of the trauma, negative changes in mood, and heightened physiological arousal and reactivity[1]. Previous research has demonstrated prevalence rates of PTSD are greater in current serving and service veterans compared to community based populations; 5.49% to 20.9%2-6 compared to 1.3 to 12.2% respectively[7]. PTSD is also associated with comorbid psychiatric conditions, including generalised anxiety and depressive disorders[8], as well as physical health problems[9].

Current first-line evidence-based treatments for PTSD include Trauma Focused-Cognitive Behavioural Therapy (TF-CBT), Prolonged Exposure Therapy (PET), and Eye Movement Desensitisation and Reprocessing Therapy (EMDR)[10]. While such interventions are utilised within the veteran population, there are particular barriers to engaging in face-to-face treatments relevant to this population. Barriers reported by this population include access difficulties, treatment beliefs, as well as stigma and concerns about potential social consequences[8,11]. Given the elevated prevalence rates of PTSD and other mental health conditions in veteran populations, it is imperative to develop tailored interventions that overcome these barriers.

Online interventions for Veterans with PTSD

To address potential barriers to treatment access, innovations in technology have seen the integration of digital-mediated platforms into the screening and treatment of PTSD[12-14]. Notable preliminary evidence from recent review studies has demonstrated the efficacy of internet-based interventions in the treatment of PTSD[15,16] and symptoms of depression and anxiety[17]. In terms of veteran specific interventions for PTSD, a number of online programs have been recently evaluated[12-14].

In particular, an online resource developed specifically for serving members and veterans, the 'Posttraumatic Stress Workshop'[12], was assessed with promising findings[13,18].

Initially, a multiple-baseline single-case design (n = 11) provided preliminary support for the workshop, with statistically significant reductions in PTSD symptoms for 4 participants, and significant overall reductions in PTSD symptoms between enrolment and post-intervention for 5 participants[18]. Qualitative feedback found that while participants were satisfied with the module content, they desired the inclusion of a peer-support component.[18]

An additional study assessed the feasibility and effectiveness of the online workshop, recruiting veterans without access to traditional treatments for PTSD (n = 24)[13]. Weekly telephone contact with clinic staff was included to assess symptoms and promote adherence. Similar findings to the previous study were noted, with 40% of participants reporting a reliable decrease in PTSD symptoms; however, the study had high dropout rates and failed to include a follow-up assessment[13].

Hobfoll et al.[14] conducted a randomised controlled trial (n = 303) evaluating the efficacy of an interactive seven-module, online CBT intervention, targeting treatment of mild to moderate PTSD and comorbid depression among veterans. The intervention also included optional engagements in an online peer chat (with trained military veterans who provided supportive guidance only) and a community message board. The study found that participants in the treatment condition (n = 209) reported a significant reduction in PTSD and depressive symptoms at 12 weeks follow-up, compared with veterans in the treatment as usual condition (n = 94), with moderate effect sizes for both PTSD and depression[14]. The study authors were unable to ascertain if accessing peer support through online peer chat or message boards had an impact on these outcomes. However, the authors note that the retention rate in this study was higher than other web-based intervention studies that do not include peer support, and concluded that the addition of this support may have reduced participant attrition[14].

Peer support

Peer support is typically defined as 'a peer with a history of mental illness who, having experienced significant improvement in their condition, offers services and support to a peer considered to be not as far along in their own recovery process'[19]. Previous research has noted standard internet-based interventions often report low completion rates and the addition of peer support may help reduce the likelihood of attrition[20]. Jain et al.[19] conducted a qualitative study to examine the mechanisms through which peer support may be helpful to veterans with PTSD. The themes identified were: (1) peer support contributes to feelings of positive social connectedness; (2) role modelling by the peer-support provider can instil hope that recovery from PTSD is possible; (3) peer support can destigmatise

the decision to seek mental health treatment and increase engagement with treatment; and (4) peer support can assist with orienting and navigating the veteran to mental health treatment[19].

In addition, a pilot study examined the feasibility of utilising a peer-support model to increase engagement and completion of an eight module online CBT intervention for veterans with a diagnosed depressive disorder[21]. The peer-support model involved pairing program participants with a veteran who had completed the program, who provided weekly phone contact to offer support and guidance. Assessment of depression was conducted at pre-intervention, and at 4- and 8-week follow-up. The results indicated that at 8 weeks, symptom reduction and completion rates were comparable to results of brief individual, group CBT and staff assisted CBT interventions[21]. This study provides evidence of the role peer support may play in improving engagement and successful completion of online programs. This study used an established model of peer support where the peer is utilised as an ancillary source of guidance and support with the goal of increasing engagement with the intervention.

The Survive to Thrive Program

The preceding review demonstrates evidence of effectiveness of online psychological interventions for the treatment of PTSD and commonly occurring comorbid conditions[15-17]. However, there have been limited studies using veteran populations[13,14,18]. The use of peer support has also demonstrated additional benefits[14,19-21]; however, it appears that no studies to date have evaluated peer developed and delivered interventions within a veteran population. Given the high prevalence of PTSD in military veteran populations, barriers to treatment identified, as well as the potential benefits of peer support, further research determining the effectiveness of online mental health interventions for the treatment of PTSD and common comorbid conditions in this population is important. The willingness to utilise peers with diagnosed mental health conditions, in development and implementation roles, may represent an innovative approach to overcoming barriers to treatment in veteran populations.

The Post War: Survive to Thrive Program is unique to previously evaluated online psychological treatments as it was developed and delivered by a non-mental health trained peer facilitator, who previously served in the military and has experienced PTSD, depression and anxiety symptoms. The program is comprised of nine modules of online psychoeducation, motivational speaking and coaching, CBT skills training and mindfulness skills training. A former infantry soldier of the Australian Army developed the program, with technical support from an online training provider. It was developed following first-hand military experience and incidence of PTSD, depression and anxiety, as well as prior clinical mental health treatment. The program was designed for current serving personnel and service veterans with the aim of assisting participants to understand common mental health conditions arising from military service and training, and how they may impact behaviour. The objective and aim of the program (as stated by the program developer/facilitator) is to 'teach current and ex-service personnel to accept responsibility for the role they can have in their own self-development, growth, recovery, and transitional success back to civilian life' and 'prepare participants and their family for common stressors and scenarios while dealing with PTSD, depression and anxiety, and adversities arising from military service'. While this program is currently being offered to the veteran community, the effectiveness of the intervention has not been evaluated.

Aim of the current study

The aim of the current study was to evaluate the psychological outcomes of participants of the Post War: Survive to Thrive Program across the domains of depression, anxiety, stress, posttraumatic stress, and happiness and wellbeing. These domains were assessed with the Depression Anxiety Stress Scale-21 (DASS-21), PTSD Checklist for DSM-5 (PCL-5) and Oxford Happiness Questionnaire (OHQ). In addition, this study aims to assess the retention rates of this peer developed and delivered program. To the authors' knowledge, this is the first evaluation of an online therapy program with a peer as the content creator and facilitator with a veteran population; therefore, no hypotheses were proposed.

Method

Study design

The study was a non-controlled, within-subject, longitudinal open trial, with psychometric assessment at three time points: pre-intervention, three months following commencement of the program (post-intervention), and six months following commencement of the program (follow-up). Given the lack of prior evidence regarding effectiveness of this novel intervention (which was not developed by the authors), a small, non-controlled open trial was deemed the most suitable approach in assessing utility, retention and potential treatment gains.

Intervention content

The program is separated into 9 modules that focus on (1) 'Surviving Methods' (Modules 1–5) and (2) 'Thriving Methods' (Modules 6–9). Table 1 provides an overview of specific module content. Participants utilising the program progress through the nine modules at their own pace and complete each module individually. There is no specified lag time between modules and the program is expected to take no longer than three months to complete. Various educational mediums are utilised in the delivery of the content including videos, slides and printable resources. The modules are pre-recorded and include video content accompanied by written tasks. The peer component includes viewing videos of a veteran (the program developer and facilitator) discussing his own experiences with mental health and describing what strategies have aided his recovery. The only additional contact made between the peer and the participants was organisational (i.e. providing program logins, reminders to complete measures and reminders to login).

Recruitment of participants

Ethics approval was obtained from The Department of Veterans' Affairs (DVA) Human Research Ethics Committee (EO16/006). Potential participants were recruited from two ex-service organisations. Both signed and electronic consent was gained prior to commencement of the program. The inclusion criteria for eligibility to participate in the study were: (1) Prior service in the military; and (2) Over 18 years of age. The exclusion criterion included: (1) Current hospitalisation for treatment of a mental health condition. Participants did not receive payment for completion of the modules or participation in this study.

Study measures

Demographic characteristics

Participants were asked to report their age, gender, marital status and employment status. Service information was also requested including length and branch of service and if they were medically discharged. Additionally, participants were asked to report if they had been diagnosed with a psychological condition and had ever received psychological treatment for this condition.

Psychological outcome measures

Depression, anxiety and stress levels were measured with the DASS-21. The DASS-21 is a 21-item self-report questionnaire with 3 subscales measuring depression, anxiety and stress[22]. Test takers rate each item on a 4-point Likert scale according to how much they were affected by the symptom over the past week. Higher scores on subscales indicate greater depression, anxiety and stress levels. The scale has demonstrated strong psychometric properties in previous research[22,23] and excellent internal consistency in this study ($\alpha = 0.96$).

Presence and severity of PTSD symptoms were measured with the PCL-5. The PCL-5 is a 20-item self-report measure that assesses DSM-5 symptoms of PTSD[24]. Test takers are asked to rate each item on a 5-point Likert scale according to how much they were affected by the symptom over the past month. Higher scores indicate greater symptom severity. The PCL-5 has demonstrated strong psychometric properties and is used regularly for research purposes including monitoring symptom change during and after treatment, screening individuals for PTSD and making a provisional PTSD diagnosis[24-26]. The measure demonstrated excellent internal consistency in this study ($\alpha = 0.95$).

Participants' subjective happiness and wellbeing was measured with the 29-item self-report OHQ[27]. Test takers are presented with statements and asked to rate each item along a 6-point Likert scale with higher scores indicating greater levels of happiness. Previous research has reported this measure has good psychometric properties[27,28] and it demonstrated excellent internal consistency in this study ($\alpha = 0.94$).

Data collection

Outcome measures were developed using online software. Following informed consent, a link to the online questionnaires was sent to participants to complete at each assessment point (pre-intervention, post-intervention and follow-up). The program developer and online training provider managed all program aspects and logistics over this time.

Statistical analysis

Statistical analysis was conducted using the IBM Statistical Package for the Social Sciences (SPSS) version 24. Descriptive analysis was carried out through examination of means and standard deviations, and a series of one-way repeated measures ANOVAs were used to examine if significant changes occurred between each assessment time point (pre-intervention, post-intervention, follow-up) on the DASS-21 subscales, PCL-5 and OHQ.

Significant main effects were further explored post-hoc with paired-samples t-tests. To account

Table 1: Module Content of Post War: Survive to Thrive Program

Module	Content/Objective	Therapeutic Strategies	Resources
1. Welcome to the Program	Session provides introduction to program modules and personal background of facilitator. The key aims and objectives of the program are introduced. The six key areas of goal setting and personal development are introduced: 1) Spiritual; 2) Psychological/Emotional; 3) Physical; 4) Within relationships; 5) Environments and communities; and 6) Financially. At the completion of the module, there is a suicide prevention video, which educates participants around managing and decreasing risk related to suicidal thoughts, plans and intent.	Psychoeducation Suicide Risk Management	Contact information for support and emergency services.
2. Managing the New You	Session introduces cognitive behavioural therapy concepts and strategies including link between thoughts, behaviours and emotions. Rational thought record exercise and resource is provided. Psychoeducation on mental health stigma and the relationship between stress and mental health. Tips are provided for overcoming and challenging stigma. Psychoeducation on external and self-discipline and the role they play in motivation and goal achievement. Participants are taught about the importance of self-discipline, personal responsibility and dedication in mental health recovery. The role of building support networks is covered with psychoeducation on the importance of clinical and non-clinical relationships on our mental states. This is paired with a workshop handout for completion. At the completion of the module, a video expands on the six key areas of happiness and a goal-setting task is provided to set specific goals in each of these individual areas.	Cognitive Behavioural Therapy Psychoeducation	PTSD Rational Thought Record (blank and example form) Six Key Areas of Happiness: A Goal-Setting Workshop Building a Support Network Workshop
3. Acceptance and Mindfulness	Session introduces two key concepts of acceptance and mindfulness. Psychoeducation on the link between lack of acceptance and anger. Includes reflection exercise on areas in person's life which require acceptance. Psychoeducation video on stages of acceptance. Acceptance workshop includes activities on forgiveness and expectations of self and others. Gratefulness workshop provides an activity on focusing on three things each day that the participant is grateful for. Psychoeducation on mindfulness and introduction to mindfulness practices.	Mindfulness Psychoeducation	Gratefulness Workshop Acceptance Workshop Guided Meditation Video links (x3)
4. Education (Part One)	Session focuses on education around the psychological transition from military to civilian life. This includes information on: involving partner in the education process; forming and changing habits; actively seeking sources of inspiration and motivation; the impact of military training on anger and aggression and how the indoctrination processes changes emotional and physical responses; the impact of stress on the body and the difference between military and civilian stressors. The session concludes with information on both clinical and non-clinical methods for stress management.	Psychoeducation	No additional resources

Module	Content/Objective	Therapeutic Strategies	Resources
5. Education (Part Two)	Session focuses on importance of understanding triggers through education and self-awareness, including realistic targets for change. Psychoeducation is provided on mental health conditions including depression, anxiety and PTSD. Videos provide examples of thought challenging for anxious and depressive thoughts. Video provides brief summary and strategies on communication and conflict resolution skills. The session concludes with research on the impact of exercise on PTSD.	Cognitive Behaviour Therapy Psychoeducation	PTSD Rational Thought Record – Depressed Thoughts (blank and example form) PTSD Rational Thought Record – Anxious Thoughts
			(blank and example form) 3. Education material: Brief Snapshot of Mental Illness in Australia
6. Inspiration	Session introduces key concept of sense of purpose and visualisation. Psychoeducation on the role inspiration can play in developing vision and purpose including different potential sources of inspiration. Inspiration is defined as a process, a motivating feeling that can drive use towards our goals and find purpose. Workshop on creating an inspiration strategy and incorporating inspiration sources into daily life.	Visualisation Psychoeducation	List of Personal Development Coaches, Motivational Speakers and Spiritual Guidance gurus Six Key Areas of Happiness Workshop: What inspires you?
7. Motivation	Module introduces motivation as a crucial element in setting and attaining goals, overcoming adversity and achieving challenges. The module serves as a platform for understanding the important role of structure in achieving behavioural goals and building motivation. The module uses a series of videos (nutrition, exercise, relationship goals, financial goals and community reintegration) and activities to look at specific goal setting areas. The module challenges participants to set and achieve goals (i.e. they may be emotionally based, nutritional targets, exercise focused or community oriented). The module links goal setting to an increased sense of wellbeing, confidence and self-esteem.	Goal Setting Psychoeducation	Post War: Survive to Thrive Personal Development Journal Education: Nourish your Brain with a Healthy Diet Education: Food for Brain Health Education: Changing Diets, Changing Minds: How Food affects Mental Wellbeing and Behaviour
8. Dedication	Module defines dedication as the willingness to give a lot of time and energy to something that is highly valued. It discusses the important role of willingness in mental health recovery and resilience. Provides education on recognising relapse and step-by-step guidance on actions to take when they encounter setbacks in movement towards goals.	Psychoeducation	No additional resources
9. Leaving the Military	Module discusses the challenges that occur when an individual transitions from the military. The module focuses on finding personal purpose after the military, including how to use skills and positive attributes in civilian life. The module concludes with 10 tips for successful transition by a career transition coach.	Psychoeducation	No additional resources

for multiple testing, a Bonferroni correction was applied and the significance level was set at $p < .017$. Effect sizes were examined and interpreted utilising Cohen's[29] d guidelines; r = 0.2 (small effect), r = 0.5 (medium effect), r = 0.8 (large effect). Due to a computer error, scores on Item 7 of the PCL-5 were not recorded at pre-intervention or post-intervention. Therefore, analyses involving the PCL-5 included summed scores with this item excluded. Inspection of descriptive frequencies, histograms, as well as skewness and kurtosis statistics for the total scale scores revealed adequate normality. The assumption of homogeneity of sphericity was upheld for all analyses except the DASS-21 Depression subscale. For this variable, Greenhouse-Geisser correction was used to account for this violation.

Results

Study sample and retention rates

A total of 29 participants completed the program, and all were former ADF personnel. Zero participants dropped out of the program. Participant demographic information is presented in Table 2. The mean age of participants was 42[28] (SD = 9.67) and the majority of participants were in the 31–50 year age group (72.41%). There were high rates of participants who reported they had been diagnosed with a psychological condition (75.9%) and had previously received treatment for that condition (89.7%). Pre-intervention scores on the PCL-5 ranged from 14–71 and all participants had experienced at least 3 clinical level symptoms of PTSD in the month prior to study participation (i.e. a score of 2 or above). In addition, 20 participants (68.97%) scored or exceeded the clinical cut-point score (> 33) on the PCL-5 at pre-intervention. Additionally, pre-intervention mean scores on the DASS-21 indicated participants were in the 'Severe' range on the depression and stress subscales and in the 'Extremely severe' range on the anxiety subscale. While program developers reported all 29 participants completed the program (100% intervention retention rate), three participants did not complete all outcome measures at post-intervention, one participant completed all outcome measures except the PCL-5 at post-intervention, and two participants did not complete outcome measures at follow-up (89.66%, 86.21% and 93.10% study retention rates respectively).

One-way repeated measures ANOVAs

A series of one-way repeated measures ANOVAs were conducted to compare scores on the psychological outcome measures across three assessment points: pre-intervention, post-intervention and follow-up.

Table 2: Participant demographic characteristics (N=29)

Variable	n (%)	Mean ± SD
Age (years)		42.28 ± 9.67
25-30	3 (10.34%)	
31-40	9 (31.03%)	
41-50	12 (41.38%)	
51-60	3 (10.34%)	
> 61	2 (6.90%)	
Gender		
Male	22 (75.9%)	
Female	7 (24.1%)	
Marital status		
Married	14 (48.28%)	
De facto	4 (13.79%)	
Single	11 (37.9%)	
Employment status		
Full-time	13 (44.8%)	
Part-time	1 (3.4%)	
Casual	3 (10.3%)	
Medical pension	5 (17.2%)	
Retired	2 (6.9%)	
Volunteer	3 (10.3%)	
Did not respond	2 (6.90%)	
Type of Service		
Air Force	1 (3.4%)	
Army	23 (79.3%)	
Navy	5 (17.2%)	
Length of Service (years)		13.10 ± 8.06
Medically discharged		
Yes	11 (37.9%)	
No	18 (62.1%)	
Diagnosed with psychological condition		
Yes	22 (75.9%)	
No	1 (3.4%)	
Unsure	3 (10.3%)	
Did not respond	3 (10.34%)	
Received psychological treatment for above conditions		
Yes	26 (89.7%)	
No	3 (10.3%)	

The results of these analyses are presented in Table 3 and indicate a significant main effect for each measure. Due to significant main effects, post-hoc comparisons were conducted. Means and standard deviations and the results of post-hoc comparisons between each assessment time point with effect sizes, are presented in Table 4.

Results revealed that scores on the DASS-21

Table 3: Repeated Measures ANOVAs Comparing Scores on Measures Across Assessment Time Points

Measure	F	df	2 ηp
DASS-21			
Depression	13.07***	1.61, 38.73	.35
Anxiety	9.54***	2, 48	.29
Stress	7.35**	2, 48	.24
PCL-5	12.87***	2, 46	.36
OHQ	11.61***	2, 48	.33

Note. DASS-21 = Depression Anxiety Stress Scale – 21 items. PCL-5 = PTSD Checklist for DSM-5. OHQ = Oxford Happiness Questionnaire.

***p < .01. ***p < .001.*

Table 4: Means, Standard Deviations and Post-Hoc Comparisons Between Time Points for each Outcome Measure

	Pre-Intervention		Post-Intervention		Follow-Up		Pre-Intervention – Post-Intervention			Pre-Intervention – Follow-Up			Post-Intervention – Follow-Up		
Measure	n	M ± SD	n	M ± SD	n	M ± SD	t	df	d	t	df	d	t	df	d
DASS-21															
Depression	29	12.55 ± 5.42	26	8.31 ± 5.73	27	7.93 ± 6.10	3.59*	25	0.70	5.07*	26	0.98	1.19	24	0.24
Anxiety	29	9.55 ± 4.73	26	6.35 ± 4.52	27	6.07 ± 4.31	3.20*	25	0.63	4.58*	26	0.88	0.53	24	0.11
Stress	29	13.07 ± 4.16	26	10.46 ± 5.31	27	9.63 ± 4.98	2.75*	25	0.54	3.71*	26	0.71	1.44	24	0.29
PCL-5	29	42.79 ± 16.28	25	30.40 ± 17.75	27	29.07 ± 17.65	3.84*	24	0.86	4.48*	26	0.85	1.59	23	0.32
OHQ	29	2.63 ± 0.85	26	3.35 ± 0.86	27	3.27 ± 0.97	-4.50*	25	-0.88	-4.20*	26	-0.81	0.42	24	-0.08

Note. DASS-21 = Depression Anxiety Stress Scale – 21 items. PCL-5 = PTSD Checklist for DSM-5. OHQ = Oxford Happiness Questionnaire.

**Significant at Bonferroni-corrected alpha level (p < .017).*

subscales and PCL-5 were significantly lower at post-intervention compared to pre-intervention, and significantly lower at follow-up compared to pre-intervention. There were no significant differences in scores between post-intervention and follow-up, indicating reductions in psychological symptoms were maintained at six months.

All DASS-21 subscale means at post-intervention dropped to the 'Moderate' range and remained in this range six months later. Furthermore, from pre-intervention to post-intervention, the mean score on the PCL-5 reduced by greater than 10 points. According to author guidelines of the PCL for DSM-IV, this indicates a 'clinically significant' change. While change scores for PCL-5 are currently being determined, it is expected that reliable and clinically meaningful change will be in a similar range[24].

Finally, results revealed scores on the OHQ were significantly higher at post-intervention compared to pre-intervention, and significantly higher at follow-up compared to pre-intervention. There was no significant difference in OHQ scores between post-intervention and follow-up, indicating the increase in happiness and wellbeing was maintained at six months. For all significant differences, effect sizes were medium to large.

Discussion

This study aimed to evaluate the outcomes of participants of the Post War: Survive to Thrive Program across the psychological domains of depression, anxiety, stress, posttraumatic stress, and happiness and wellbeing. To the authors' knowledge, this is the first study to report an evaluation of an online therapy program utilising a peer developed and facilitated psychological intervention with a veteran population. The sample had predominantly served in the army, been reportedly diagnosed with a psychological condition and had previously received treatment for that condition.

Overall, the results of the evaluation demonstrated a positive trend, indicating the Post War: Survive to Thrive Program may be beneficial for veteran participants. The self-reported psychological symptoms of depression, anxiety, stress and PTSD significantly reduced between pre- and post-intervention, with this change remaining stable six months following program commencement. Self-reported happiness and wellbeing also significantly improved between pre- and post-intervention and was maintained at follow-up. Effect sizes were large for symptoms of depression, anxiety, PTSD, and happiness and wellbeing, while the effect size for stress symptoms was moderate. Self-reported PTSD symptoms, on average, reduced by greater than 10 points, indicating a clinically significant change[24].

These findings share consistencies with prior research that have demonstrated significant reductions in PTSD symptoms among veteran populations using online psychological interventions[13,14,18]. With regards to the effect on PTSD symptoms within non-veteran samples, e-mental health interventions have evidenced similar positive outcomes[15,16].

The results are also in line with the broader literature examining the efficacy of mental health e-interventions for the treatment of depression and anxiety[17,30]. The moderate to large effect sizes found for the mental health outcomes in the current study are in line with previous research[14, 17]. Retention rates in the current program were also strong, echoing previous findings demonstrating inclusion of peers in mental health interventions reduces attrition to online programs[14, 20].

Limitations

Despite the strengths of the current research, it is important to consider the limitations associated with the research design and interpretation of outcomes. First, as this was a preliminary open trial, the study design was not blinded and did not include a control group. This means it cannot be concluded that the program was the mechanism of change that led to reductions in depression, anxiety, stress, and PTSD symptoms, and an increase in happiness and wellbeing. Outcomes may be attributed to other non-controlled factors, such as the high rate of participation in previous therapeutic activities. Second, although comparable to similar pilot study research, the sample size for quantitative data analysis was small, limiting generalisability. Third, self-report measures are potentially biased with the risk of under or over reporting of symptom severity. It is also important to view the results in the context of the sample under discussion; approximately 90% of participants had reportedly engaged in psychological treatment prior to commencing the program. As such, it is unclear if a more clinically severe population, who have not received previous psychological treatment, would benefit from the lower intensity intervention offered by the Post War: Survive to Thrive Program. However, the high retention rate is positive and suggests strong engagement with the peer presenter and peer-developed content.

Future directions

Future research could proceed in a number of ways. Conducting a waitlist controlled trial and increasing the sample size would allow for greater certainty in identifying efficacy and mechanisms of change in the intervention. Additionally, the integration of mental health trained co-facilitators as well as providing therapist and/or peer feedback and assistance throughout the self-paced modules may be beneficial. Prior research has indicated that larger effect sizes are evidenced where therapist support is available (i.e. via email, skype etc.) [30] as well as positive outcomes with 'live' peer support[14,18].

Conclusion

This study adds to the published literature examining effectiveness of online psychological therapy interventions for veterans with mental health complaints. It indicates the use of a non-mental health trained peer facilitator (with lived experience of PTSD, anxiety and depression), utilising CBT and coaching principles, may be associated with beneficial outcomes for participants, including the reduction of PTSD symptoms. It also provides further support for the use of a peer in improving retention for online mental health programs. This is particularly relevant in the delivery of mental health treatment to the veteran population in which there are often barriers preventing help-seeking, including geographical limitations and fear of stigma. A waitlist controlled trial with a larger sample size would help determine, with greater certainty, if the Post War: Survive to Thrive Program is an effective intervention for PTSD and associated mental health symptoms.

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Corresponding Author: Madeline Romaniuk, romaniukm@ramsayhealth.com.au
Authors: M Romaniuk[1,2,3] J Evans[1,] C Kidd[1]
Author Affiliations:
1 Gallipoli Medical Research Institute
2 University of Queensland
3 University of Southern Queensland

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A History of Australian Navy Health Officer Uniforms and Ranks (Part One)

Commander Neil Westphalen, Royal Australian Navy

Purpose

More than a century after its establishment, many Royal Australian Navy (RAN) uniforms and ranks still reflect those used by the (British) Royal Navy (RN). Previous articles have described the history of Navy sailor uniforms or 'rigs' since 1509,[1] the development of male and female health sailor uniforms since 1879,[2] and the evolution of their rank and rate badges since 1827.[3]

The purpose of this two-part article is to describe the development of Australian Navy health officer uniforms. This part describes the overall development of male and female RN, Australian colonial and RAN uniforms and ranks since the 11th century. The second will focus on RN and RAN medical, dental, medical administration and nursing officer uniforms.

Background

A previous article described how English maritime power during the five centuries after the 1066 Norman conquest was mostly limited to the North Sea and English Channel. During this time, the monarch hired his ships out to the merchants for trade, and could 'arrest' their ships and crews for his own purposes when required. The same ships were therefore used for both warlike and peacetime purposes.

During this time, mariners performed their duties in accordance with the *Laws* (also Rules or Rolls) *of Oléron*[4] and the *Black Book of the Admiralty*,[5] which applied to all English ships irrespective of who owned them. Consequently, English mariners were employed interchangeably between private merchants and their monarch until the 1850s.[6]

The same 'master' likewise held shipboard 'command' in both peace and war. Masters began their seagoing life as apprentices, when the absence of manuals or charts meant that their navigation and seamanship skills were totally dependent on memory.[7] Furthermore, the *Laws of Oléron*, and the common social background of masters and their crews, meant that their leadership style had to be one of 'first among equals'; for example, masters were required to seek agreement from their crews as to when their ship was ready to sail.[8]

As ships became larger, they were able to keep the sea longer, and to voyage further. This required increasingly specialised crewmembers such as the boatswain, carpenter and cook. In the King's ships, these specialists were later joined by the gunner, purser and, eventually, the surgeon. Apart from the cook—whose job, in fact, did *not* require any culinary expertise—like the master, the professional development for these specialists were all based on long apprenticeships.

Hence, there was no formal seagoing 'officer class' as understood today, until mathematically-based navigation methods from the mid-16th century required masters to have greater literacy skills, as likewise did their subordinates regarding their own functions and roles.

During the medieval period, fighting at sea entailed grappling and boarding, followed by hand-to-hand combat. Although the prevalence of piracy meant that, sailors often had to defend themselves even in peacetime, soldiers were carried on the rare occasions that entailed wartime sea fighting.[9] As military command ashore was the prerogative of the English aristocracy (per their feudal obligations to their monarch), the lower standing of what became known as 'tarpaulin' officers usually, but not always, made them subordinate to the 'gentlemen' officers who commanded the soldiers when embarked.

These 'gentlemen' officers continued to exercise command, even after specialised warships with below-deck large-calibre gun firing through gunports eventually eliminated their soldiers from the early 16th century.[10] Over time, their literacy skills enabled them to acquire comparable navigation and seamanship skills—if not necessarily the same experience—as 'tarpaulin' masters. While the term 'master' technically remains extant for merchant ship

captains, the introduction of a formal seamanship examination of 'gentlemen' officers for promotion to lieutenant from 1678,[11] eventually made masters obsolete within Navy by the end of the 19th century.[12]

Hence, Navy had two types of officer at the beginning of the 16th century: 'gentlemen' officers received 'commissions' from the monarch to exercise command on his or her behalf, while 'tarpaulin' officers received 'warrants' from the relevant Navy Board.[13]

The first commissioned ranks were lieutenant, captain and admiral. The title 'Admiral' was first used by the English to describe a fleet commander in 1297.[14] Full Admirals usually led their fleet from the centre, while Vice Admirals were seconds-in-command who led the van or front, and Rear Admirals were thirds-in-command who led the rear. The first Admiral of the Fleet, ranked above all of these admirals, was appointed in 1688.[15]

The title 'Commodore' has existed since 1690, but was not formalised until the 1980s. It initially referred to senior captains appointed to command fleets or squadrons, where an admiral was not required or was unavailable.[16]

The title 'Captain' was first used for the ship's commanding officer above the master in 1380,[17] while 'Master and Commander' ('Commander' from 1794), did likewise for smaller ships from the 1690s. 'Lieutenant' has been used since Elizabethan times for 'gentlemen' officers who exercised command over the master on the captain's behalf. 'Sub Lieutenants' were introduced in 1861, while 'Midshipman' has referred to prospective commissioned officers since the 17th century.[18]

Meanwhile, Navy warrant officers themselves came in two forms. The 'standing' warrant officers—boatswains, gunners, carpenters, pursers and cooks—stood by their ships even when they were not in service, while masters, chaplains and surgeons were only appointed for ships in service as required.[19]

Some warrant officers eventually achieved commissioned status (surgeons from 1843),[20] while the remainder were abolished in 1949.[21] Commissioned and warrant officers were both divided between 'military' and 'civil' branches—with health officers included with the latter—until 1957.[22]

Hence, the current Warrant Officer title used for the RAN's senior sailor rank above Chief Petty Officer since 1971, is completely unrelated to its original use for over 400 years from the early 16th century, for highly experienced and skilled yet patently subordinate non-sailor officers, who were often employed interchangeably between the King's ships and civilian merchantmen.

Male RN officer uniforms

Although the French and Spanish navies introduced officer uniforms in the early 18th century, the RN did not do so until 1748. The lack of uniform was felt to reduce social, military and/or diplomatic standing with foreigners, while creating difficulty proving one's rank if captured. The main issue however, was the inability to clearly indicate status within Navy, which for example meant that the captain of a first rate had little to distinguish him from that of a sloop (especially if the latter was well heeled).[23]

The first uniforms were for commissioned officers and midshipmen. Unlike today, where rank is indicated by adornments to a single standard uniform, each rank had its own unique attire. Midshipmen excepted, these included a 'dress' uniform for formal occasions, and an 'undress' uniform for daily wear. Anecdotally, the blue and white colours were chosen by King George II, based on a horse riding habit worn by the Duchess of Bedford.[24] Officer uniform styles have since generally followed contemporary civilian fashion.

The use of sleeve stripes to identify rank did not occur until 1856. Lieutenants initially had one stripe, commanders two, and captains three, until the introduction of the Sub Lieutenant rank in 1861 resulted in each gaining an extra stripe. Lieutenants with over eight years' seniority wore a half-stripe from 1877, which became the formal Lieutenant Commander rank from 1914.[25]

The 'executive curl' on the proximal stripe was initially only worn by 'military' executive seamen branch officers, in order to distinguish them from non-executive 'military' and 'civil' branch officers. 'Distinction cloths', per Table 1, were added between the stripes for the latter officers from 1863 until their abolition in 1956, except for medical, dental and wardmaster (later medical administration) officers.

A tropical uniform was introduced in 1883, consisting of a white single-breasted tunic with stand-up collar and shoulder rank boards, white trousers and shoes and pith helmet.[26] This became the current summer undress uniform or 'ice-cream suit'.

In 1889, a blue double-breasted 'monkey' jacket was introduced for everyday wear.[27] This became the current winter undress 'fives' jacket, after frock coats and cocked hats were abandoned in 1939—but not formally abolished until 1950, essentially because they had become unaffordable.[28]

In 1915, Engineer Commanders and above received the same oak leaf 'brass hat' motifs on their cap peaks that had previously only been worn by seaman officers.[29] This was extended to all other officers (including surgeons), in 1918, along with the 'executive curl'.

Table 1: RN and RAN Non-Executive Officer Distinction Cloth Colours[25]

Branch		Distinction Cloth Colour		
Masters	1863-1867	 Light blue		
Engineers	1863-1956	 Purple		
Supply	1863-1956	 White (hence 'White Mafia')		
Medical	1863 - current	 Red		
Instructors	1879-1956	 Light blue		
Shipwrights	1884-1956	 Silver grey		
(RAN) Wardmasters	1911-1979	 Red 1911-1918	 Maroon 1918-1951	 Salmon Pink 1951-79
Ordnance	1918–1950	 Dark blue		
Electrical	1918-1956	 Mid-green 1918-1951	 Light green 1951-1956 (hence 'Greenies')	
Dental	1918-	 Orange		
(RAN) Nursing	1942-1948 1964-	 Maroon 1942-1948	 1964-1972	 Maroon 1972-

Officer Clothing, c1700

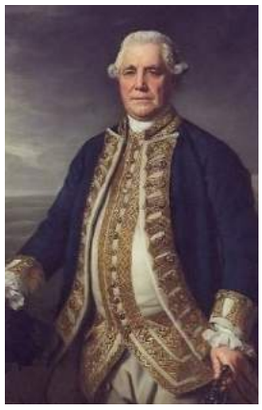

Left: Captain George Byng, 1st Viscount Torrington, c1701[30]
Right: Admiral Sir Stafford Fairborne, c1708[31]
Note that besides the big hair, Fairborne outranked Byng with respect to Navy rank; however, vice versa applied regarding their civilian titles.

Officer Uniforms, 1748




Top Left: Admiral's uniform, 1755.[32]
Top Right: Captain's uniform, 1749.[33]
Bottom Left: Lieutenant's uniform coat, 1748.[34]
Bottom Right: Midshipman's uniform coat, 1748.[35]

Officer Uniforms, 1767




Left: Admiral's uniform, 1780.[36]
Right: Captain's uniform, 1774.[37]

Midshipman's uniform, 1780.[38] *Note the white-collar patches worn since to this day.*

Officer Uniforms, 1783


Left: Admiral's uniform, 1794.[39] *This was the first to differentiate between rear, vice and full admirals.*[40]
Right: Lieutenant's uniform, c1783.[41]

Officer Uniforms, 1795

Left: Vice Admiral Lord Nelson's uniform coat, 1805.[42] Note the bullet hole in the left epaulet.

Right: Captain's coat, c1798[43]

These were the first Navy uniforms with epaulets.[44]

Officer Uniforms, 1812

Left: Rear Admiral's uniform coat, 1822.[45]

Right: Commander's uniform coat, c1812.[46]

Both uniforms lack the epaulets normally also worn.

Officer Uniform, 1827

Left: Captain's uniform coat, 1827 pattern.[47] The original white collars and cuffs were replaced by red at the behest of King William IV from 1833. It lacks epaulets.

Right: Captain's uniform as worn. Note the red collar and cuffs and epaulets.[48]

Officer Uniforms, 1843

Top Left: Admiral's uniform coat, 1843.[49]

Top Right: Commander's uniform coat, 1843.[50]

Bottom Left, Lieutenant's uniform coat, 1843.[51]

Bottom Right: Midshipman's uniform coat, 1843.[52] Note the single row of buttons and white-collar patches.

Note the abandonment of the red collar and cuffs, and the gradual move to rank being indicated by adornments to a single standard uniform. These coats all lack epaulets.

Officer Uniforms, 1856

Left: Admiral's uniform coat.[53]

Right: Commander's (not Lieutenant's) uniform coat.[54]

Note the curled stripe for executive branch officers. Both coats lack the epaulets also worn. Commanders acquired a third stripe with the introduction of Sub-Lieutenants in 1861.

The St Edward's crown worn on all Navy uniforms during the Victorian era was displaced by the Tudor crown in 1901, on the accession of Edward VII. The accession of Elizabeth II in 1953 resulted in a return to the St Edward's crown used today.

Top: replica 1856–1901 officer's cap badge.[55] *Note the St Edward's crown.*

Centre: replica 1901–1953 officer's cap badge.[56] *Note the Tudor crown.*

Bottom: post-1953 officer's cap badge.[57] *Note the updated St Edward's crown.*

Top Left: RN officer's button, 1860–1901.[58] *Note the Victorian era St Edward's crown.*

Top Right: RN officer's button, 1901–1953.[59] *Note the Tudor crown.*

Bottom: Post 1953 RN officer's button.[60] *Note the updated St Edward's crown.*

Male Reserve RN officer uniforms

The occupational mobility of sailors and 'tarpaulin' officers between private merchantmen and the King's ships largely negated the need for a 'reserve' as understood today until the 1850s. Technological advances, and a recruiting shortfall at the outbreak of the Crimean War in 1853, led to the establishment of the Royal Naval Reserve (RNR) in 1859.[61] Initially intended for sailors only, the RNR was extended to officers from 1862. All RNR members were recruited from the merchant service and underwent brief periods of gunnery and other Navy-specific training.[62]

However, the further expansion of the RN prior to World War I resulted in the establishment of the Royal Naval Volunteer Reserve (RNVR) in 1903. RNVR personnel had no professional seagoing background, but underwent limited shore training before brief periods at sea.[63] It was widely said during the war that RN officers were gentlemen trying to be sailors, RNR officers were sailors trying to be gentlemen, while RNVR officers were neither trying to be both. By the end of World War II, 88% of all RN officers (50 000) were RNVR.[64]

RNR and RNVR officers were distinguished from their RN counterparts by their stripes: RNR officers had an intertwined chain pattern, while RNVR stripes had a 'Wavy Navy' pattern. In 1951, RNR and RNVR officers received the same stripes as RN officers, with an 'R' in the executive curl. Both Reserves were amalgamated into a single RNR in 1958, with the same uniform as RN officers being worn after the 'R' was abolished in 2007.[65]

Reserve Officer Uniforms

Left: Captain RNR jacket, 1941.[66] Note the 'chain' stripes.

Centre: Lieutenant RNVR jacket, 1941.[67] Note the 'Wavy Navy' stripes.

Right: Lieutenant Commander RNVR (later RNR) jacket, 1951.[68] Note the 'R' in the executive curl.

Male RAN uniforms

Except for Tasmania and Western Australia, each of the Australian colonies had their own volunteer naval forces from 1853 until Federation in 1901. A key consideration for the colonial naval officers was not being mistaken for being RN, especially in Sydney where the Australian Squadron were based.

RAN Officer Uniforms

Left: Captain Francis Hixson, NSW Naval Brigade c1860s, HMAS Kuttabul Combined Mess. (Author) Note the silver rather than gold stripes, which presumably would have led to a major tarnishing problem at sea!

Right: Captain Hixson and family, c1900.[69] Note the RNR-type stripes.

Left: Captain John Cotterell Walcot, South Australian Naval Forces (SANF), c1895.[70] Note the crossed anchor motif in lieu of the 'executive curl'.

Centre: Victorian Naval Forces Lieutenant in full dress.[71] Note the diamond-shaped 'executive curl'.

Right: Captain William Rooke Creswell, Queensland Naval Forces, c1904.[72] Note the triangular 'executive curl'.

The establishment of the RAN in 1911 led to the adoption of RN uniforms, apart from RAN-specific buttons.[73] These used an oblique 'lazy anchor' pattern until 1927, when they were replaced by the current vertical pattern. The Tudor crown was replaced by the St Edward's crown in 1953. In 1965, 'Australia' flashes were added to all RAN uniforms, apart from some flag officer items.[74]

Top Left: RAN officer's 'lazy anchor' button, 1913-1927.[75] Note the Tudor crown.

Top Right: RAN officer's button, 1927-1953.[76] Note the Tudor crown.

Bottom: RAN officer's button, post-1953.[77] Note the St Edward's crown.

When RAN personnel were posted to the US from 1963 to pick up the guided missile destroyers *Perth* (DDG 38) *Hobart* (DDG 39) and *Brisbane* (DDG 41), permission was granted for them to wear khaki uniforms.[78] In 1966, permission was also granted for officers to wear Royal Canadian Navy (RCN) shirt collar rank insignia.[79] Khaki uniforms continued to be worn by DDG officers for Vietnam deployments until they ceased in 1971, while other officers deploying to Southeast Asia with the Far East Strategic Reserve continued to wear non-khaki uniforms. The collar rank insignia were replaced in the mid-1970s by the current shoulder rank slides, worn on winter shirts and 'woolly pullies' with shoulder tabs.[80]

RAN khaki uniform worn by CAPT KW Shand RAN, Commanding Officer HMAS Hobart, June 1968.[81] Note the RCN collar rank insignia—and the non-khaki cap in lieu of the one he should have been wearing.

Ward master (later Medical Administration Officer) SBLT and LEUT collar rank insignia. (courtesy Phil Davies) Note the salmon pink distinction colour.

Australian Naval Reserve Officers

Multiple name changes notwithstanding, the reserve Australian naval forces differed from the RN in generally having three rather than two components. The RAN Reserve (RANR) was established in 1911, for officers and sailors with a regular (and at various times compulsory) shore training obligation, while the RAN Reserve (Seagoing) or RANR(S) was established in 1913 for professional seafaring officers. The RAN Volunteer Reserve (RANVR) was formed in 1921 for officers and sailors who were available for call-up but did not undertake regular training.[82]

RANR(S) officers wore the same stripes as the RNR, while RANR and RANVR officers had the same stripes as the RNVR. All three reserve forces had standard RAN buttons.[83]

In 1973, all three reserve forces were amalgamated into a single RANR, with their officer stripes changing to the PN pattern with the same 'R' within the executive curl as the RNR. The 'R' was abolished in 1986, leaving RANR officers with the same uniform as PN officers.[84]

Lieutenant Marsden Carr Hordern RANVR, and Lieutenant Cyril Morris 'Bill' Boas RANR(S), 1946.[85] Note their stripes are identical to the RNVR and RNR respectively.

British and Australian Women's Naval Services

The RN first introduced the Women's Royal Naval Service (WRNS) or 'Wrens' during WWI. After an interwar hiatus, the WRNS was re-introduced in 1939 and continued until its integration into the RN in 1993. The wartime Women's Royal Australian Naval Service (WRANS) was instigated in 1942 and was abolished in 1948. It was reconstituted in 1951 and was incorporated into the RAN on 7 June 1985.[86]

The wartime WRNS and WRANS officer uniforms consisted of a double-breasted jacket with gilt buttons, matching skirt, and blue rank stripes and titles based on the merchant service. WRNS officers wore a tricorne cap (the WWII version remaining in use to this day) with a blue cap badge, while wartime WRANS officers wore a broad-brimmed felt hat with the standard male gold cap badge.

The postwar WRANS officer uniform was essentially identical to that for the WRNS. Following their integration into the RAN, the blue half-stripe on the top of the cap band for female commanders and above were replaced by gold, which was in turn replaced from 2013 by the same oak leaf 'brass hat' motifs on the front of the cap brim as for male officers.[87]

Table 2: WRNS and WRANS Rank and Insignia

1917-1919 (WRNS only)	**1939-1993 (WRNS)** **1942-1948; 1951-1984 (WRANS – in Bold)**	**Uniform Stripes**	**Male Equivalent**
Assistant Principal	**Third Officer**		SBLT
Deputy Principal	**Second Officer**		LEUT
Principal	**First Officer**		LCDR
Deputy Divisional Director	**Chief Officer**		CMDR
Divisional Director	**Superintendent**		CAPT
Deputy Assistant Director	Director (until 1951) Commandant (from 1951)		RADM (until 1946) CDRE (from 1946)
Assistant Director	Commandant (until 1951) Chief Commandant (from 1951)		RADM (from 1946)




Top Left: WRNS uniform, WWI.[88] Note the rather extravagant tricorne hat.

Top Right: WRNS uniform, WWII.[89] Note the tricorne cap (which had a blue winter and white summer top, until it was standardised on the latter from 1953).

Bottom Left: First Officer Sheila McClemans, Director WRANS, 1943.[90] Note the wide-brimmed felt hat and the same gold cap badge as for male officers.

Bottom Right: WRANS officers, c1953.[91] Their uniforms are the same as the WRNS, apart from RAN buttons.



Left: WRNS officer cap badge, 1917–1919. [92] Note the Tudor crown, and the WRNS initials above the anchor.

Middle: WRNS officer cap badge, 1939–1953, WRANS officer cap badge, 1951-1953. [93] Note the Tudor crown.

Right: replica WRNS officer cap badge 1953–1993, WRANS officer cap badge 1953-1985. [94] Note the St Edward's crown.


Left: CAPT Wendy Malcolm RAN, 2015.[95] Note the gold half-stripe on the top of the cap band.

Right: tricorne 'brass hat' with oak leaf motif on the front of the brim. (Author)

RAN warfare badges

British Royal Naval Air Service aircrew wore a gilt eagle on their left sleeve from 1914 until 1918, when they were taken over by the Royal Air Force. On returning to the RN in 1939, they reverted to embroidered 'wings' on their sleeves. The RAN followed suit for its aircrew from 1947 until 1966, when they received gilt 'wings' worn on the left breast.[96] The RAN also became the first Commonwealth Navy to award 'dolphin' badges to its submariners at that time.[97]

Principal Warfare Officers or PWOs (now known as Maritime Warfare Officers or MWOs), have worn gilt chest badges since 1990. Having lost their distinction cloths in 1956, charge-qualified Supply (now Maritime Logistics) and Engineer Officers received their own badges in 1999, along with qualified Hydrographic (now Maritime Geospatial), Mine Warfare and Mine Clearance Diver Officers.[98]

Sea Readiness Badges (SRBs)

SRBs have been issued since 2000, to indicate the member's current deployability and accumulated sea time. The latter is indicated by four SRB grades at four-year intervals.[99]

Summary

Throughout Navy history, there has been a struggle for status, firstly between (and within) the commissioned and warrant officers, and later between (and within) the 'civil' and 'military' branch officers. It can be argued that since their introduction for commissioned officers in 1748, and for warrant officers in 1787, uniforms have been a weapon, and an expression, of these battles. It can also be argued that women RN and RAN officers fought the same battle for status throughout the 20th century, noting that for much of this time they were only considered 'of' rather than 'in' the Navy.

Unlike Navy sailor uniforms, which not only identified sailors as such but were also intended for functional wear at sea, Navy officer uniform styles have tended to reflect contemporary civilian fashion. This article has shown how this has led to a steady (if at times delayed) simplification of clothing styles over the last 270 years. In addition, the replacement of different uniforms for each rank by a standard uniform with rank embellishments from the 1840s limited uniform costs, particularly for junior officers who lacked a second income. Both factors especially came to the fore during and after World War II, which resulted in Navy officer uniforms that largely remain extant today.

Author

Dr Neil Westphalen graduated from Adelaide University in 1985 and joined the RAN in 1987. He is a RAN Staff Course graduate and a Fellow of the Royal Australian College of General Practitioners, the Australasian Faculty of Occupational and Environmental Medicine, and the Australasian College of Aerospace Medicine. He also holds a Diploma of Aviation Medicine and a Master of Public Health.

His seagoing service includes HMA Ships *Swan*, *Stalwart*, *Success*, *Sydney*, *Perth* and *Choules*. Deployments include DAMASK VII, RIMPAC 96, TANAGER, RELEX II, GEMSBOK, TALISMAN SABRE 07, RENDERSAFE 14, SEA RAIDER 15, KAKADU 16 and SEA HORIZON 17. His service ashore includes clinical roles at *Cerberus*, *Penguin*, *Kuttabul*, *Albatross* and *Stirling*, and staff positions as J07 (Director Health) at the then HQAST, Director Navy Occupational and Environmental Health, Director of Navy Health, Joint Health Command SO1 MEC Advisory and Review Services, and Fleet Medical Officer (2013–2016).

Commander Westphalen transferred to the Active Reserve in July 2016.

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Disclaimer

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

Corresponding Author: Neil Westphalen, neil.westphalen@bigpond.com
Authors: N Westphalen [1]
Author Affiliations:
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An Overview of the Key Elements Required for Haemostasis Following Military Trauma from the Point of Injury to Definitive care

LTCOL Charles H.C. Pilgrim

Abstract

Haemorrhage control for traumatised soldiers takes place at many levels, from the point of injury through resuscitation and reception into surgical facilities, and postoperatively to intensive care units where normalisation of physiology and ultimate recovery following definitive surgery may be achieved.

Differences in priorities and availability of interventions at each level of care provide unique opportunities for improvement and all contribute towards the ultimate goal of the saving of life with restoration of function and the return of a fit fighting force.

Priorities and challenges at each level are described in this review and are pertinent to the soldier and combat medic on the battlefield, the medical evacuation team providing transport, and the receiving surgical, anaesthetic and intensive care treatment teams stationed at medical facilities in theatres of operation.

Keywords: Haemostasis, trauma

Introduction

Exsanguinating haemorrhage continues to be the leading cause of otherwise potentially survivable acute mortality in current military conflicts[1]. Two-thirds of lethal haemorrhage is truncal, whereas junctional and peripheral-extremity haemorrhage accounts for roughly 20% and 15% respectively[1].

Truncal haemorrhage can only be arrested in adequately equipped medical facilities, but lifesaving techniques can be utilised to control extremity and junctional haemorrhage on the battlefield. Lives can therefore be saved at many points along the continuum of a wounded soldier's journey from point of injury, through transport to a medical facility and then through the operating theatre and postoperatively to the intensive care unit (ICU) (see Figure 1).

This review considers haemostasis in a military context from the time of wounding on the battlefield until definitive haemorrhage control and stabilisation in the ICU. It highlights current advances in haemostatic mechanisms available to soldier and combat medic through to surgeon and intensivist in a theatre of operation.

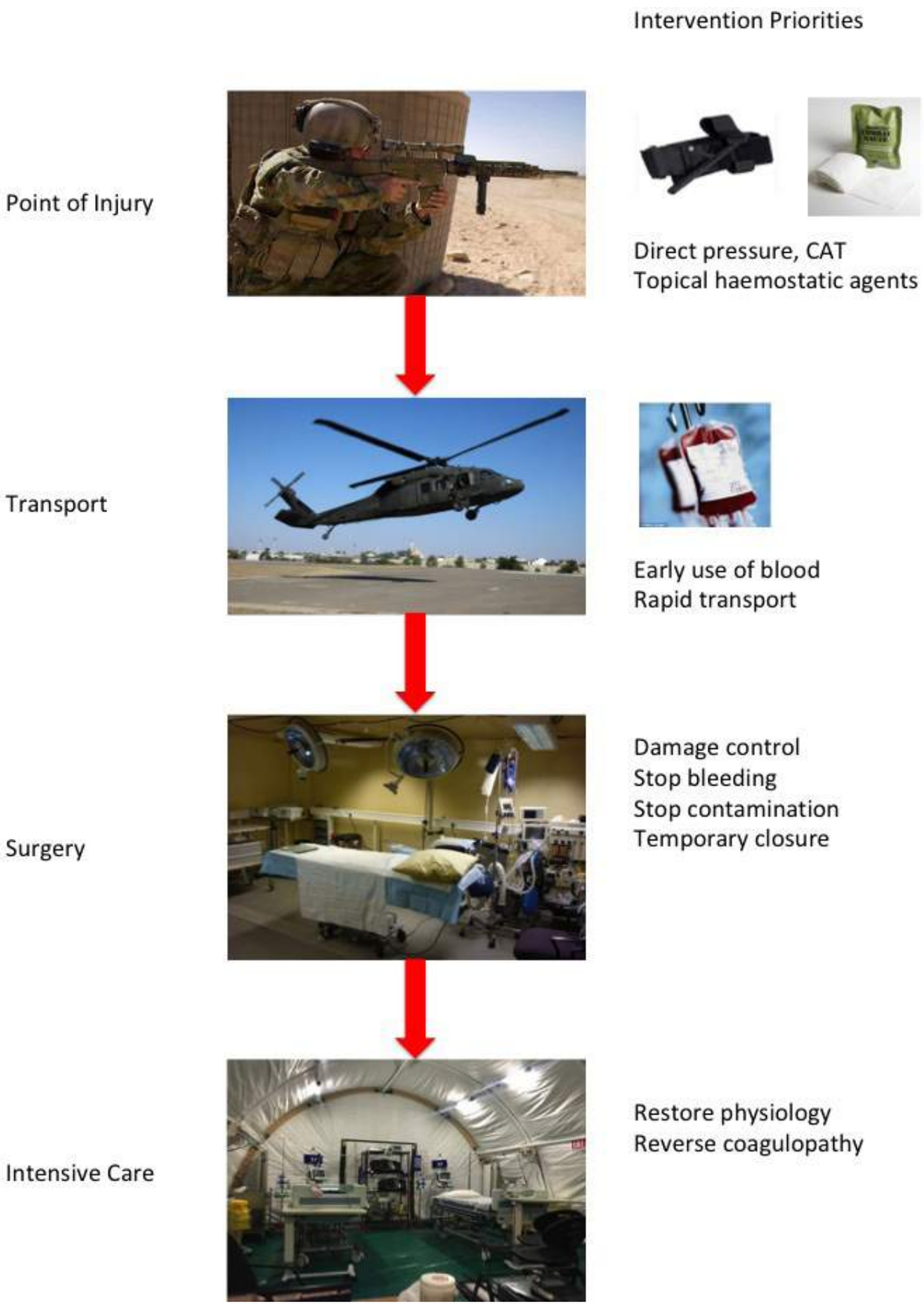
The patient journey from point of wounding and delivery of tactical combat casualty care (TCCC) provided by the individual soldier or combat medic; issues of relevance for transport of bleeding patients; surgical and resuscitative considerations; and, principles of transfusion management and coagulation adjuncts in the ICU will be discussed.

Battlefield haemostasis

Of over 4500 battlefield fatalities prospectively collected by the United States (US) military in the conflicts between 2001 and 2011, the vast majority of deaths occurred on the battlefield. More than one-third of all deaths were categorised as instantaneous (35.2%) and a further 52% occurred within minutes or hours of injury in the pre-medical facility environment. Only 12.5% of deaths occurred once wounded military personnel reached a medical facility[1].

Of those deaths occurring prior to arrival at a medical facility, almost 25% were considered potentially survivable; meaning that immediate treatment at

Figure 1: Haemostasis priorities along the continuum of care from point of injury to the intensive care unit



the site of wounding is a critical area where effective haemostasis may be lifesaving[1]. Other studies have shown that up to 20% of haemorrhagic deaths are from compressible bleeding[2].

On the battlefield, medical treatment is however, not the only priority. Battlefield casualty care is a combination of good medicine and good small unit tactics. In a broader interpretation of DRABC, danger in the military context often needs to be neutralised by winning the ground battle before efforts at ABC can be employed. Rounds down range often take priority over medical intervention. Whereas in the emergency department, the patient is the mission, on the battlefield, casualty care is only part of the mission. The principles of TCCC have developed and been widely adopted over the last two decades of conflict and direct care at the point of injury on the battlefield[3]. Simple measures such as direct pressure on arterial bleeding and the early application of the combat application tourniquet (CAT) have the ability to save lives and can be applied by all soldiers in theatre. Advanced wound dressings available to the combat medic also provide additional haemorrhage control at the point of injury. However, extremity haemorrhage still remains the largest preventable cause of death in combat[4].

Extremity and junctional haemorrhage

An expert committee formed by the American College of Surgeons Committee on Trauma (ACS-CoT) released guidelines on the prehospital management of severe extremity trauma in 2014 and many of these guidelines have direct military applications or indeed were derived from military experiences[5].

Non-truncal haemorrhage can be divided into true extremity haemorrhage and junctional haemorrhage to reflect the different principles of haemorrhage control at these anatomical locations. Junctional haemorrhage was defined as: groin haemorrhage proximal to the inguinal ligament; haemorrhage from buttocks, gluteal and pelvic areas; perineal haemorrhage; axillary and shoulder girdle haemorrhage; and haemorrhage from the base of neck. Extremity haemorrhage reflects bleeding distal to these sites. Major truncal haemorrhage from the chest and abdomen is not covered by these guidelines, the control of which remains in the operating room.

Direct pressure and tourniquets

Direct pressure remains the mainstay of acute extremity or junctional haemorrhage where possible. Tourniquet use is recommended in the prehospital setting where control of significant extremity haemorrhage is 'ineffective or impractical' with direct pressure[5].

Direct pressure may be impractical under austere conditions with limited resources or multiple casualties. Similarly, in unsecure scenes or where complex extrication or extraction is required, direct pressure may be impractical. In a military context, many of these conditions manifest, and clearly direct pressure under fire fulfils the definition of impracticality[4].

Direct pressure can be ineffective in the presence of major (deep) arterial injury, although in wounds associated with significant tissue loss and exposed arterial structures, direct pressure and control remains the gold standard of surgical management. For soldiers and combat medics, a low threshold for activating a CAT has saved lives on the battlefield and the continued use of the CAT is well supported by the available evidence regarding its safety in a military environment.

Before the introduction of tourniquets, the death rate for US forces from peripheral-extremity haemorrhage was 23.3 deaths per year. This was reduced to 3.5 deaths per year after the full implementation of CAT application, representing an 85% decrease in mortality[1]. Thirty-one per cent of potentially survivable haemorrhagic deaths were from extremity haemorrhage in previous cohorts (reported from previous wars) compared to 13.5% in the current conflicts[1] reflecting the impact this simple device has had upon battlefield casualties. Fewer patients are now dying of extremity haemorrhage than seen in previous conflicts and this single advance has revolutionised battlefield haemorrhage control.

Battlefield extrication times have reduced with dedicated airframes for evacuation and in fact, time from wounding to arrival at a level 2 facility can be, in many cases, faster than what can be achieved in a civilian context. As such, concerns about prolonged tourniquet time may be overstated, and the ACS-CoT guidelines recommend not releasing any tourniquet until the patient reaches definitive care[5]. Exceptions include where transport time is expected to be prolonged, in which case liaison with the appropriate clinical lead is necessary.

Topical haemostatic dressings

Management of junctional haemorrhage on the battlefield is more complex and potentially less effective. The anatomical restrictions of gaining adequate direct pressure are compounded by a similar inability to place a tourniquet proximally.

Topical haemostatic dressings should be used in combination with direct pressure for bleeding from these locations[5]. The ACS-CoT guidelines recommend using agents delivered in a gauze format that supports wound packing and which can be easily removed surgically (rather than crystalline or powder formulations which are surgically more challenging to disengage). It is important to appreciate that direct pressure remains an essential component of haemostasis when using these products.

The three primary products available for use in a military context are QuikClot® combat gauze, Celox™ gauze and the HemCon™ bandage[6]. QuikClot was originally produced as a granular form of zeolite powder that absorbed water from the wound, thereby concentrating clotting factors locally. It was best suited for low-pressure bleeding from an unidentifiable source[7]. In addition to its pure granular form, it came prepared in a gauze-bagged form more suited to removal than the original granules. Initial experience was in the military context, but a report of 46 patients treated in a rural civilian setting with QuikClot also describes effective control of bleeding in 89% of treated patients[8]. The civilian evidence remains low and of poor quality, and although the results appear promising, an evidence based review from 2013 concluded that further large-scale trials were required[9]. Additional concerns about the exothermic nature of the original zeolite formulation and secondary thermal burns have led to the current form of QuikClot using kaolin as the active clotting agent impregnated into the gauze dressing rather than zeolite.

HemCon uses chitosan as the active ingredient manufactured from crushed shellfish and promotes haemostasis by the ionic attraction of red blood cells into the dressing causing bonding with the injured tissue surface[10]. It has been tested in the civilian setting and reported in small series, the largest of which demonstrated it as a safe and effective adjunct in the prehospital treatment of massive external traumatic haemorrhage in 66 patients in the Netherlands[11]. Complete cessation of haemorrhage was seen in 70% of these patients, with only 6% of cases where correct usage failed to control haemorrhage at all. Celox is similarly a chitosan-impregnated gauze with comparable properties to the HemCon bandage.

All three products are valuable additions to a combat medic's armamentarium but have training implications for correct usage, as all require proper wound packing and pressure application techniques for optimal effectiveness.

Transport considerations

Following immediate life saving measures to control exsanguinating haemorrhage on the battlefield, the wounded soldier needs to be rapidly and safely transported to higher levels of care where blood replacement and definitive management of bleeding can be instituted. The rotary wing platform provides rapid access and egress forward and is tactical but has some inherent issues of relevance to bleeding cessation, and while en route, the resuscitation efforts must not worsen the patient's physiology. The acronym GHOSTBaN will be familiar to those trained in rotary wing evacuation and of most relevance to haemostasis are the O, S and T components (Oxygen, the Shakes and Temperature). The fundamental activity of haemoglobin is oxygen carriage and moving to any aeromedical sphere inherently begins to diminish atmospheric oxygen. Similarly with altitude, temperature drops and resuscitative measures are fundamentally undermined by the triad of acidosis, coagulopathy and hypothermia. Keeping bleeding patients warm is a critical element of transport and retrieval that has major flow on effects in terms of resuscitative efforts at higher-level care. Finally, the vibrations associated with the rotary wing platform has the potential to cause clot disruption, particularly in the immediate phase post-injury where fibrin cross-linking to stabilise platelet-based clotting has not yet come into full effect.

Damage control resuscitation

Similar concepts of clot preservation underlie the first principle of damage control resuscitation, that is, of permissive hypotension aiming to maintain a systolic blood pressure of 90mmHg but not higher[12]. This is aimed at preventing renewed bleeding from recently clotted vessels[12]. The second principle is of volume restoration with what was lost – i.e. a move towards earlier and more aggressive use of fresh frozen plasma (FFP) as the primary resuscitation fluid in addition to packed red blood cell (PRBC) transfusion[12]. This is manifest in high ratios of plasma and also platelets to PRBC with an aim of 1:1:1 transfusion. Crystalloid is limited to keeping intravenous (IV) lines open between units of blood. The end result is a move away from simply running in huge quantities of crystalloid without thought or endpoint. Rather, it is a considered and measured approach that is much more a balancing act requiring finesse and constant clinical reappraisal to ensure perfusion of vital organs by maintaining sufficient pressure while preserving clot and the body's own haemostatic mechanisms. The take home message is to minimise crystalloid infusion, accept lower

systolic blood pressure and to transport the patient to definitive care for haemorrhage control while minimising periods and extent of hypothermia and without diluting natural coagulation factors.

Surgical techniques

Damage control surgery was first coined in 1993[13] but the concepts had been published a year earlier[14] where 200 patients had been treated over the preceding 7 years with, at the time, 'unorthodox techniques' such as the ligation of enteric injuries in 34 patients, retained vascular clamps in 13, temporary intravascular shunts in 4, packing of diffusely bleeding surfaces in 171, and the use of multiple towel clips to close only the skin of the abdominal wall in 178. Since then, the concept has been recognised as the standard of care for the severely injured unstable patient in both civilian and military contexts.

The principles can be summarised as: stop the bleeding; stop the contamination; avoid abdominal compartment syndrome; and prepare for definitive surgery once physiology is restored, (generally somewhere between 48 and 72 hours after initial surgery). There is a shift in emphasis from the operating room to the ICU for stabilisation, with the realisation that prolonged and complex surgery is not safe in patients who are haemodynamically challenged. The minimal activity required to halt further gross anatomical deterioration (i.e. uncontrolled surgical haemorrhage, ongoing enteric soiling from gastrointestinal compromise) is all that is required in theatre, with further attention to restoration of cardiovascular, haematologic, acid–base, thermoregulatory and respiratory parameters taking place in intensive care.

The major threat to life in the immediate instance is uncontrolled haemorrhage. Abdominal bleeding can be categorised as venous, arterial or parenchymal and control of haemorrhage varies slightly in each circumstance. Immediate control of abdominal venous bleeding is most quickly afforded with four quadrant packing, and indeed this may be all that is required in the damage control setting for even substantial venous bleeding. Major venous bleeding from structures such as the vena cava frequently require definitive vascular control much the same as major arterial structures. Smaller arterial structures can generally be ligated, whereas larger structures require repair, bypass or shunt, depending upon the organ supplied. Ultimate proximal vascular control of the abdominal arterial structures can be afforded in desperation via a left lateral thoracotomy and cross-clamping of the descending thoracic aorta, primarily a procedure rarely performed in the emergency department prior to laparotomy. At laparotomy, control of the abdominal aorta in the supracoeliac location as it enters between the diaphragmatic crura has the same effect. In both instances, more localised control at the site of injury must then be attended to in order to minimise secondary injury from occlusion of structures such as the renal arteries and superior mesenteric artery.

Resuscitative endovascular balloon occlusion of the aorta (REBOA) has recently been introduced as an emergency department endovascular intervention to control major abdominal or pelvic arterial bleeding in penetrating and blunt trauma[15]. Balloon inflation achieves the same goal as proximal aortic control during resuscitative thoracotomy with aortic cross-clamping without the morbidity and is currently in use in a number of civilian high volume shock trauma centres. Overall, in a study of 285 patients presenting in extremis, almost 10% of patients undergoing REBOA compared with 2.5% of resuscitative thoracotomy patients survived to discharge[15]. This technique appears to be quite promising and worthy of further study. Improvements in design are now allowing consideration of military field deployability; however, barriers remain in the skillset of front-line providers to achieve arterial access required for REBOA use[16].

Management of parenchymal bleeding depends on the organ affected, which may either be resected, repaired or packed as a general principle. For example, although splenic preservation techniques such as buttress suture repair or encasement in vicryl mesh bags went through a phase of popularity at the end of the 1990s and early 2000s, in haemodynamically unstable trauma patients requiring laparotomy and found to have injured spleens, there is now a low threshold for splenectomy. Embolisation in the interventional radiology department for patients with higher grades of splenic injury but who are presently haemodynamically stable is appropriate in many cases not requiring laparotomy and may avoid the need for subsequent surgery.

Parenchymal bleeding from injured livers is mostly effectively managed by packing to approximate anatomical normality and restoration of physiology and coagulation factors in the ICU, but occasionally requires more advanced approaches such as direct suture ligation, or even ligation of major portal inflow structures for control of bleeding. The right or left hepatic artery alone is more likely to require ligation than either the portal vein or the whole portal triad, and this usually means it is not necessary to proceed to emergency hepatectomy at first look laparotomy.

It is likely a combination of packing and selective arterial ligation will be sufficient to achieve adequate haemostasis for transfer of the patient to ICU and upon relook laparotomy and removal of packs, if the liver is sufficiently healthy, nothing further may need to be done (relying solely on portal venous inflow for oxygenation thereafter).

Major bleeding from the limbs is either controlled with simple ligation of smaller vessels or may require arterial repair, shunt or bypass. In severely injured limbs, amputation may be indicated. Damage control orthopaedics follows similar principles to damage control laparotomy in that attention is focused on perfusion and bony stability rather than definitive repair of fractures, and a low threshold for fasciotomy to prevent compartment syndrome and further physiological insult is recommended.

Restoration of physiology and correction of coagulopathy

Following initial surgery for trauma, unstable patients require a period of physiological normalisation in the ICU. Damage control resuscitation principles still apply here and, in particular, high-ratio transfusion of FFP and other products to red cells is appropriate. The use of adjunctive agents has been studied in detail and while some agents are no longer indicated, others appear more promising.

Trauma induced coagulopathy

The traditional view of coagulopathy following trauma has simply viewed consumption of clotting factors and dilution from intravenous fluids and administration of mostly packed red cells as the driving factors, exacerbated by environmental factors, primarily hypothermia and subsequent reduced clotting factor activity.

Our new understanding of trauma induced coagulopathy (TIC) recognises the traumatised patient as being in a hypoperfused state[17], with metabolic acidosis, hypocalcaemia and inappropriate breakdown of formed clots by physical manipulation resulting from tissue injury.

Similar to our understanding of the systemic inflammatory response syndrome (SIRS) seen in other critically ill patients, TIC is seen as an overwhelming activation of systems that are usually localised with resultant systemic activation producing whole-body effects, rather than the intended beneficial local actions that usually result from the dual process of clot generation and lysis.

Central to the coagulopathic state is systemic hyperfibrinolysis resulting from massive release of tissue plasminogen activator (tPA) from the endothelium combined with protein C activation and inhibition of the extrinsic pathway of coagulation.

TIC is a highly mortal condition. Of the 135 patients with TIC (defined by INR > 1.2, APTT > 50 sec.) in a cohort of 435 patients undergoing emergency surgery post-injury in whom a massive transfusion was required (>10 units of FFP or PBRC), 53 died (mortality of those with TIC 39.5%)[17]. Transfusion intervention with a higher ratio of FFP to PRBC was seen to improve mortality in this cohort whereby those patients receiving 1:1 ratio of FFP:PRBC vs those with 1:4 ratio of FFP:PRBC had improved mortality of 28% vs 51% ($p<0.03$)[17].

TIC is a common condition. In another cohort of 106 patients, overall 43% of patients were coagulopathic, with the highest rate in those transfused the most (68%)[18].

Appropriate activation of a massive transfusion protocol in these patients is recommended, but there is insufficient evidence to support or refute the use of specific ratios of PRBC to other blood components[19].

Adjuncts to coagulation

Despite their use being widespread, the evidence on the use of various blood components in traumatised patients has been poorly studied. When considered individually, there is limited quality evidence on the use of FFP, no studies on the use of platelets or prothrombin complex concentrate or cryoprecipitate. Fibrinogen concentrate has been studied in more detail, primarily in the elective setting, which does not reflect the physiological state of the traumatised emergency patient classically presenting with hypothermia, hypotension and acidosis [19].

On the other hand, low fibrinogen has been definitively associated with higher mortality in trauma patients. Despite this, there are no randomised controlled trials on supplementation, type of product (cryoprecipitate, fibrinogen concentrate) or optimal dose[19].

There are several products that have been investigated as adjuncts to restoration of normal coagulation in trauma patients.

Prothrombin complex concentrate (PCC) has been used extensively in the reversal of warfarin in the elective surgery setting where its use is established and indicated. Its use in trauma is more controversial and it is not currently indicated as first-line therapy

in trauma. It may have a role in refractory bleeding but it is likely inferior or at least not superior to FFP[20].

PCC does not contain fibrinogen and although it has the theoretical benefit of not requiring thawing (as FFP does). This can be overcome by having pre-thawed FFP available at trauma centres.

Recombinant Factor VIIa (rFVIIa) initially showed promise as an agent to promote coagulation in extremis and was originally included in part of damage control resuscitation[10]. However, the available evidence now confirms that the off-label use of rFVIIa in critical bleeding or trauma confers no benefit to mortality outcomes[19]. In fact, there is a trend towards an increased risk of thromboembolic events and a significantly increased risk of arterial thromboembolic events associated with the use of rFVIIa.

rFVIIa relies on endogenous factor X, II and platelets for efficacy, whereas PCC contains these factors (except platelets) and outperforms rFVIIa in studies that have compared them (which were however, mostly animal studies)[20].

It is interesting to note that we appear to have come full circle in our transfusion practices. The first transfusions replaced whole blood, but with further work we came to understand the various components of blood, and separated and transfused these products individually. We now appreciate that traumatic bleeding is not only injurious by lack of the oxygen carrying capacity of red cells, but that the coagulopathy associated with the loss of plasma products leads to further ongoing blood loss and other threats to life. Ironically, trauma patients are also at higher risk of thromboembolus post-injury due to loss of antithrombin (and other factors) reflecting the complex interplay of all components of blood. Administration of higher ratios of FFP and platelets to PRBC reflects our appreciation that all elements of blood are critical to normal human life and, in fact, the plasma products may be more lifesaving than simply replacing the red cells that are lost.

The most promising adjunct of recent years is the reintroduction of an old and cheap agent, tranexamic acid (TxA). The important CRASH-2 trial studied 20 211 adult trauma patients with significant bleeding in 274 hospitals across 40 countries[21]. Patients were randomly assigned (<8 hr post-injury) to either TxA or placebo. All-cause mortality was significantly reduced from 16.0% to 14.5% (1463 deaths in 10 096 administered TxA vs 1613 deaths in 10 115 placebo arm)[21]. Similarly, the risk of death due to bleeding was also significantly reduced from 5.7% to 4·9%[21].

Although this benefit may seem marginal, considering the worldwide impact of trauma, it has been estimated that administering TxA within 3 hours of injury could save over 100 000 lives yearly[22].

Highlighting yet again the complexity of trauma coagulopathy and the dynamic physiological changes occurring, TxA administered beyond 3 hours was actually associated with an increased risk of death due to bleeding (4.4% vs 3.1%)[23]. Nevertheless, this agent and its application in the military setting where first responders are able to reach and treat traumatised soldiers well within the 3 hour timeframe holds promise for the future of battlefield care.

Conclusion

Haemostasis in military trauma should be considered at all points during the continuum of treatment of the traumatised soldier.

On the battlefield, direct pressure, the use of CAT tourniquets for extremity injury and advances in dressings for truncal and cavitating wounds has saved lives. The administration of TxA holds future promise.

During transportation, key factors such as rapid evacuation to higher levels of care, active attention to keeping the patient warm while maintaining an appropriate blood pressure (not simply the highest blood pressure possible) and the early administration of blood, with limitation of clear fluid volume replacement, remain priorities.

In surgery, damage control principles focusing on stopping the bleeding and contamination, while avoiding extended resections and reconstruction are critical.

Postoperatively in the ICU, physiology should be restored and normalised by replacing what is lost prior to definitive return to theatre for completion of surgery intervention.

By optimising each step in the continuum of care, we can expect to reduce soldier mortality from exsanguinating haemorrhage, which remains the leading cause of survivable battlefield mortality.

Conflict of interest

The author states that he has no conflicts of interest.

Corresponding author: Charles Pilgrim, charlespilgrim@hotmail.com
Authors: C Pilgrim[1,2,3,4,5]
Author Affiliations:
1 The Alfred Hospital
2 Cabrini Hospital
3 Peninsula Health - Frankston Hospital
4 Peninsula Private
5 6HSC, 3HSB

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The Camino de Santiago An Ancient Way – A Way Back for Veterans?

Sanjiva Wijesinha,

Keywords: camino de santiago, mental health, pilgrimage, veterans' health

Preface

This article is based on the Sir Edward 'Weary' Dunlop Award winning presentation delivered at the annual conference of the Australasian Military Medical Association, Brisbane October 2017.

Introduction

Transitioning from service in the military back to civilian life can be an extremely challenging period for many ex-service personnel. This stressful period in a veteran's life can precipitate the onset or exacerbation of mental health problems.

A pilgrimage—a journey of spiritual healing—undertaken in the company of like-minded companions is one way of helping veterans through this particularly vulnerable transition period.

In the summary report of the Department of Defence and Department of Veterans' Affairs Mental Health and Wellbeing Transition Study, published in 2018, it was noted that the period of transition from military to civilian life is quickly becoming recognised as one of the most significant and stressful transitions in the life course of military members worldwide, owing to the potential changes in identity, community and residence, social networks and status, family roles, occupation, finances, routines, fresh responsibilities, supports and culture.[1] Changes brought about by the transition process can lead to the development and/or exacerbation of existing service related mental and physical symptoms resulting in psychosocial adjustment issues.

The results of this study showed that Australian Defence Force (ADF) members transitioning from full-time military service represented a group at particular risk for mental disorders and would benefit from proactive strategies that aim to lessen the burden of mental illness. It was estimated that no less than 46% of ADF members who transitioned from full-time service within the past five years met the 12-month diagnostic criteria for a mental health disorder.

A year previously, the Australian Institute of Health and Welfare released its report Incidence of suicide among serving and ex-serving Australian Defence Force personnel 2001–2015[2]. One of the reassuring conclusions from this report, which drew on data collected over the previous 15 years, was that serving members of the ADF are far less likely to commit suicide compared to the general population. Men serving full-time or in the reserve had age-adjusted suicide rates of 53% and 49% lower than all Australian men did.

The not so good news from this report, however, was that the suicide rate of ex-serving men (there was virtually no data for ex-serving women) was more than TWICE as high as serving men and 14% higher than men in the general population.[2]

This is certainly a cause for concern. Suicide is indeed a complex issue encompassing philosophical, ethical, legal and practical dilemmas. It cannot be assumed that ALL suicides are due to abnormal mental health,[3] but it is not unreasonable to speculate that such a high rate of suicide in Australian veterans after they discharge from the ADF indicates a high rate of mental illness in this population.

Why are so many soldiers—not just in the ADF but in armies all over the world—lost when they leave the military and start transitioning to civilian life? From my own observations as an army doctor and a family physician who has looked after many veterans, as well as from the discussions I have had with health professional colleagues who have served in the defence forces of other countries, some of the reasons that could explain this are:

- soldiers discharging from the military lose the self-respect, the stability and the support system that goes with the uniform and belonging to an organisation that is respected by society

- they hold no rank or status in the civilian community—from being somebodies they virtually become nobodies
- they have to start anew on discharging, and they have to start alone.

There is already much research to indicate that veterans often experience a sense of vulnerability and social isolation, which can be attributed to their having been separated from systems and people they relied upon for years.[4]

In his book A Soldier to Santiago, US Navy Veteran Senior Chief Petty Officer Brad Genereux wrote:

> *'For over 22 years and with pride I represented my country by wearing the uniform of my nation. And when my service was all over? Life had passed me by and I found that I fit in – Nowhere.'*[5]

Genereux is the founder of Veterans on the Camino, a project designed to help suffering military veterans achieve healing by undertaking a journey along the Camino de Santiago ('The Way')—an ancient 800-kilometre trail to the shrine of Santiago de Compostela in northern Spain that is walked by over two hundred thousand pilgrims each year.

If one were to ask 'What is a pilgrimage?' the obvious definition would be 'a journey to a place in the belief that a duty will be fulfilled, a wish will be granted or sins will be forgiven'. Pilgrimages such as these are undertaken, for example, by Jews and Christians to Jerusalem, Catholics to Lourdes, Muslims to Mecca, Hindus to the source of the Ganges and Japanese Buddhists to the various historic temples on the island of Shikoku. But one could also look on a pilgrimage as a journey away from home in search of spiritual wellbeing—to seek inner peace through physical journeying.

Unfortunately, although scholars within the disciplines of anthropology, archaeology, sociology and religious studies have explored the topic of pilgrimage, there has been very little research done to ascertain the psychological and emotional implications of pilgrimage on individuals.[6]

A strong motivation for many pilgrims is the desire for healing. The healing process that occurs on pilgrimage is not one that cures physical ailments but rather addresses the human experience of loss and suffering.[7]

As Notermans has observed, pilgrimage also provides a communal structure of similar individuals who move through rituals together.[8] Therefore, the healing dynamics of a pilgrimage include not simply a physical journey with physical, social and symbolic effects, but also an act of personal empowerment and a sense of solidarity with a community of fellow pilgrims. It is this inner peace that a pilgrimage along the Camino can help someone suffering from the mental battle scars of war to achieve. Some of the ways undertaking a pilgrimage along the Camino can help veterans are as follows.

Identity transformation

The shock of leaving behind one's military identity can be profound. Wearing a military uniform allows one to 'walk tall', but when a soldier discharges from the military and gives up his uniform, he becomes just another civilian struggling to make his way in an unfamiliar world. Inherent in the pilgrimage journey are the adoption of a new identity, 'Pilgrim', and the sharing of the journey's hardship with other pilgrims.

Tradition

While walking this ancient trail, which pilgrims have traversed for over one thousand years, one becomes aware of all those who have moved along this ancient space. Just as in the military, one wears a uniform, a beret or a slouch hat, which are badges of honour that acknowledge and respect those who have gone before.

Action

Soldiers are all familiar with the 'Situation, Mission, Execution' type of action that goes with being in the military. The pilgrim journey provides a shared direction of movement towards a common end state, while the side by side progress along 'The Way', reminiscent of soldiers doing PT, drill, weapon cleaning etc. together, engenders sharing and support as they move together to achieve the envisaged goal.

Community

Walking in the company of others who are on a similar quest and so becoming part of a community ('We are all in this together!'), brings about a sense of mutual RESPECT. There is a readiness along The Way to 'help a mate' through illness and injury, and there is always the opportunity, over a glass of beer or a copa de vino at the end of a hard day's walk, to share stories and experiences.

A pilgrimage along the Camino can bring back the joy and camaraderie of old times, the respect and sense of purpose that was treasured and the self-

esteem that was lost. Walking along this ancient trail, one experiences views of snow-capped mountains, groves of majestic leafy trees or tranquil lakes. The world and its travails seem a thousand miles away. One feels so very small, and yet one feels a part of humanity and a part of the universe.[9]

A pilgrimage to Santiago, admittedly, is not for everyone and is not the only way to help veterans suffering from loss, mental scars, PTSD and grief. The therapeutic value of a pilgrimage, however, has been well known over the ages and throughout many different societies.

Walking the Camino de Santiago is, I believe, a journey that will help veterans who are struggling to find themselves to achieve not only spiritual healing but also mental peace.

Author

Major Sanjiva Wijesinha MBBS (Ceylon), MSc (Oxford), FRCS, FRACGP served as a medical officer in the Sri Lanka Army Medical Corps for 11 years and subsequently in the Royal Australian Army Medical Corps for 16 years. Currently an associate professor at the Faculty of Medicine, Monash University, Melbourne, Australia, he is the author of Strangers on the Camino and Not Our War.

Address for correspondence:
sanjiva.wijesinha@monash.edu.

Corresponding Author: Sanjiva Wijesinha, sanjiva.wijesinha@monash.edu
Authors: S.S.Wijesinha [1,2]
Author Affiliations:
1 RAAMC
2 Monash University

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Notes

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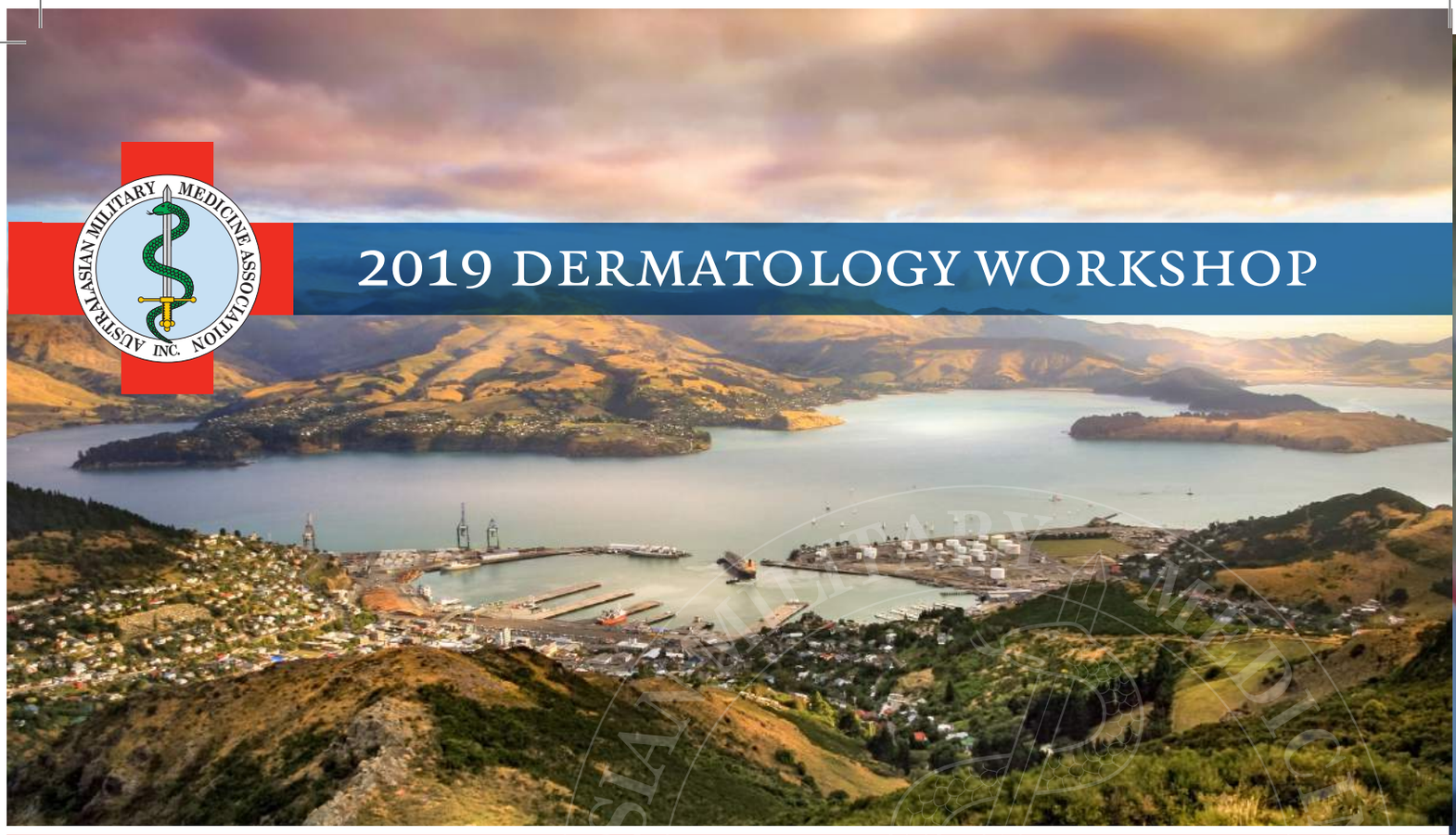

2019 DERMATOLOGY WORKSHOP

Location: Air Force Museum of New Zealand, Christchurch

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Time: 0900-1700

Cost: $325 AMMA Members | $375 Non-Members

Contact: Jodi to register - jodi@laevents.com.au

WORKSOP PROGRAM

TIME	SESSION	DURATION
0900-0915	Arrival Tea & Coffee	15 min
0915-0930	Welcome and Introduction	15 min
0930-1030	Recognition and management of benign and malignant skin lesions	60 min
	Morning Refreshments	
1045-1145	Introduction to dermoscopy: How to avoid unnecessary excisions of benign lesions	60 min
1145-1245	E-referrals and dermatological imaging: Use your smartphone effectively	60 min
	Lunch	
1330-1430	Diagnosis and management of eczema and psoriasis	60 min
1430-1530	Diagnosis and management of common bacterial, fungal and viral skin infections	60 min
	Afternoon Refreshments	
1545-1645	Acute rashes: When to refer to hospital	60 min
1645	Q&A | Close	15 min

* Program subject to change without notice

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Period of membership:

Join date – 30/06/2020

Jodi Stevens
AMMA Secretariat
secretariat@amma.asn.au

Other great Membership benefits:

Receive a discount to the 2019 AMMA Conference, held in Adelaide Convention Centre, Adelaide, SA

Receive discounts for all AMMA workshops – approximately 4 times a year.

Interact with peers, community and the fellowship. As a reservist you will stay connected with the Australian and New Zealand Army, Navy and Air Force.

You will qualify to apply for AMMA grants and Scholarships:

- $5,000 & $10,000 Research Grants
- Conference Scholarships consist of one full registration and return economy airfares to applicants nearest Australian capital city.

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JMVH call to authors

The Journal of Military and Veteran's Health is a peer reviewed quarterly publication published by the Australasian Military Medicine Association. The JMVH Editorial Board has identified the following themes and deadlines for future editions:

ISSUE DATES AND DEADLINES

Volume	No	Issue Date	Submission Deadline	Advertising Deadline
July 2019 – 100 Years On – Rehabilitation				
27	3	July 2019	1 April 2019	1 June 2019
October 2019 – Conference Abstracts				
27	4	October 2019	As per AMMA Conference Submission Process	1 September 2019

The Editor would be delighted to receive articles for consideration on these themes. However, please note that although these are the suggested themes, we encourage authors to continue to submit articles on a range of topics on military medicine and veterans' health including operational articles.

Categories for the above include: Original Research/Original Articles, Short Communication, Review Articles, Reprinted Articles, Case Studies, Abstracts from the Literature, Biographies, History, Book Reviews, Commentary and View from the Front.

Please submit via the JMVH website www.jmvh.org just click the 'Submit your article' button on the home page. Ensure you read the 'Instructions to Authors' that can also be found on the JMVH website by clicking on the 'AUTHORS' tab.

Should you have any queries in relation to submitting to JMVH, please do not hesitate to contact JMVH Editorial Office on +61 3 6234 7844 or editorial@jmvh.org

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