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The Journal of the Australasian Military Medicine Association

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Front Cover: 'Job's On' – 27 Aug 20 - Dustoff of injured member from HKIA to Bagram Air Base. Patient loaded by members of the Australian contingent.

Photo Credit: Photo by FLTLT Ben James - RAAF Nursing Officer; 2006-current. Posted HOCU - Train the Best.

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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Editorial

DECEPTION IN WAR AND PEACE

Deception of an enemy force in conflict dates back millennia. In the lead up to the second Battle of El Alamein in October 1942, Lieutenant General Montgomery initiated a deception plan, Operation Bertram, to mislead the Axis forces on the time, place and direction of any future attacks.[1] This involved the concealment of ammunition dumps, staging areas, tank concentrations, and troop movements. Critically, the Axis forces were deceived into believing that the attack would be in the south and not before early November 1942. The resulting victory was the beginning of the end of the Western Desert Campaign and revived the morale of the Allied forces. Attempts at misleading others in peace, however, particularly in the medical realm, are concerning. Nguyen et al. have reviewed anti-vaccine discourse on social media. Their data shows that anti-vaccine discourse on social media is 'deeply rooted in anything but scientific knowledge and reasoning'[2], relying on personal opinion and experience rather than facts, and any sources used "are, at best, highly questionable".[2] This highlights the ongoing importance of peer-reviewed scientific journals, such as JMVH, in establishing the evidence-base to guide and enhance high quality healthcare.

Our first issue of 2023 contains a range of articles on diverse topics spanning military training, operational healthcare, military medical history, clinical treatments and veterans' health. We continue to attract a good range of articles, including from overseas, as is demonstrated in this issue with articles from Australia, Greece, Iran, Scotland and the United States. Other military and veterans' health articles, however, are always very welcome, and we would encourage all our readers to consider writing on their areas of military or veterans' health interest. We would particularly welcome papers based on presentations given at our 2022 conference or planned for our 2023 conference, but welcome any articles across the broader spectrum of military health.

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

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Treatment at Point of Injury – A Proposal for an Enhanced Combat First Aider and Health Technician Skillset

C.H.C. Pilgrim, A. P. Chandra, A. Pearson

Abstract

Management of trauma in the future operating environment might be significantly different from the recent experience in the Middle East Region if it were to occur in the context of hostilities between coalition, including Australian forces and a near-peer or peer-level threat. Specifically, reliance on rotary-wing aeromedical evacuation may be compromised if air superiority is degraded or denied.

Two alternative approaches may be considered in the context of constrained evacuation capability. First, enhanced treatment of the injured soldier on the ground at or near the point of injury by first responders may broaden the window during which a patient may survive on the battlefield awaiting evacuation. Alternatively, moving the surgical resources to the casualty may also improve the chances of survival for an injured soldier. However, this comes at the cost of risking higher-level assets. The first of these approaches is considered here with an exploration of what life-saving interventions (LSI) can be delivered by first responder soldiers.

Numerically dropping as a result of tactical combat casualty care principles but persisting as causes of preventable battlefield death, exsanguinating extremity haemorrhage, tension pneumothorax and airway obstruction are areas where future gains may be possible with an expanded skillset deliverable by combat first aiders and health technicians.

Earlier administration of blood products by health technicians to casualties with exsanguinating haemorrhage would align military trauma management principles with the civilian world, where blood products can now be administered en route by trained paramedics. Similarly, there is a shift towards managing tension pneumothorax with finger thoracostomy in preference to needle decompression in the hospital and pre-hospital environment in the civilian sector.

Of much greater complexity, management of non-compressible truncal haemorrhage remains problematic on the battlefield. A highly specialised intervention with significant haemodynamic consequences that nevertheless has been shown to be achievable in both military and civilian contexts is REBOA (resuscitative endovascular balloon occlusion of the aorta). This technique is encumbered with a significant training burden but warrants discussion and is most relevant when evacuation times are expected to fall between 1 and 6 hours.

Expanding the skillset deliverable by combat first aiders and health technicians may offset delays in evacuation and maintain battlefield casualty survival in the future operating environment and may be obtained leveraging existing Defence training programs.

Background

Contemporary treatment of traumatic military injuries in the Middle East Region (MER) has been facilitated by rapid evacuation and transfer of injured soldiers to higher-level care, primarily utilising rotary-wing aeromedical evacuation (RWAME) with relative impunity against an air-inferior enemy. Air transport is a highly efficient way of transporting casualties to medical care. The adoption of expedited helicopter casualty transfers to mobile army surgical hospitals during the Korean War reduced the time from injury to surgical care to 1–2 hours from 10 hours compared to World War II.[1]

Future health planning needs to consider an environment whereby RWAME may be restricted

in movement capability. To that end, exploring alternative approaches to the surgical management of injured soldiers is pertinent.

In short, two alternative approaches may be considered. First, enhanced treatment of the injured soldier on the ground at or near the point of injury with the associated resource, training and logistic implications that carries may broaden the window during which a patient can survive on the battlefield. Alternatively, positioning the surgical resources closer to the patient may also improve the chances of survival for an injured soldier. However, this comes at the cost of risking higher-level assets and considerable force protection and load capacity are required. The first of these approaches is considered here.

Persisting causes of death on the battlefield

Since the introduction of tactical combat casualty care (TCCC), initially developed for the US Special Forces in the mid-1990s,[2] the numbers of fatalities from the three leading causes of battlefield death have decreased significantly in comparison to deaths from these causes in the Vietnam War, Korean War and World War II. Overall, however, exsanguinating extremity (compressible) haemorrhage, tension pneumothorax and airway obstruction remain in the order of 9%, 5% and 1% of preventable deaths on the battlefield.[3]

Even if these three pathologies are eliminated as causes of death in a perfect model of point of care treatment, non-compressible haemorrhage will, by definition, remain a significant cause of potentially preventable death in the absence of surgical intervention. New techniques to address this issue in a minimally-invasive (and non-surgeon dependent) manner exist and have been demonstrated successfully in both the civilian[4] and military trauma settings.[5]

The skill set of a military trauma surgeon

An ADF general surgical clinical skillset for operational readiness has been developed for general surgeons once a casualty arrives at a medical treatment facility (MTF).[6] However, treatment at the point of injury will dictate outcome more so than upskilling deployed surgeons and a consideration of what can be done, by whom, and in the field follows.

Existing trauma management skillset outside a medical treatment facility

All Australian Regular Army (ARA) personnel undergo a four-day Army first aid training course and TCCC training. TCCC training is reiterated as part of force preparation and on deployment during reception, staging and onward movement (RSO) at an intermediary staging base upon deployment. Specific trauma-related procedural skills taught under the auspices of TCCC comprise tourniquet application for uncontrolled extremity haemorrhage, packing of junctional wounds and applying a three-sided occlusive chest seal with a one-way valve (SAM seal/Ferno) for open chest wounds.

Further training provided as a twelve-day course equips non-medical corps ARA members to function as Combat First Aider (CFA) in addition to their primary employment category. Personnel trained to this level are integral roughly within every section and are capable of an expanded skillset of initial diagnosis and treatment. CFA training goes above and beyond standard Army first aid to include advanced intervention and treatment as outlined in the TCCC handbook, including needle thoracocentesis/needle decompression for tension pneumothorax and intravenous cannulation. Given that these personnel function primarily within their own employment category, CFA's (and other non-medical soldiers) will almost always be the first responder on scene at the point of injury, prior to the arrival of an ADF medic (medical/health technician).

In the Army Reserve, employment as Combat Medical Attendant (CMA) exists with the training continuum commencing with Advanced Combat First Aider (ref Health Manual, Volume 8, Chapter 4, annex 4F). The intent is that a CMA is capable of providing basic pre-hospital care as a first responder; however, CMA's are only to deploy on low-level non-warlike operations, and this employment category is not considered further here for that reason. Additionally, these members have no medical background in their civilian roles. On the other hand, combat paramedics are Army Reserve members with a civilian paramedic background and will be integrated into the new employment category ECN368 (see below).

Health technician

The medical technician ECN category within the ADF is in the process of being updated. These personnel will, in the future, be known as health technicians (HLTH TECH, ECN 368). Training of these practitioners takes 14–18 months. At the end of the training continuum, HLTH TECH will possess a TAFE qualification in Nursing and be capable of addressing several life-saving traumatic injuries affecting airway, breathing and circulation. Training for the specific skillset expected of a HLTH TECH will be provided at the Army Logistics and Training

Centre (ALTC) located at Latchford Barracks. The source documents specifically related to trauma management include the Primary Clinical Care Manual (PCCM) 10th edition (2019), produced by the Rural and Remote Clinical Support Unit, Torres and Cape Hospital and Health Service, Cairns and the TCCC handbook.

'Assessment and management' of trauma is specified as a requisite skill in the job task profile document for all employment categories as HLTH TECH (ECN368), from first employment via either Paramedic or Nursing stream. These generic statements are in accordance with the HLTH TECH Scope of Clinical Practice (SoCP) outlined variously in the PCCM, TCCC matrix and the Defence Health Manual. A draft combined document outlining these respective SoCP is presently under consideration at the Directorate of Army Health as a central source document. It is recognised that trauma management is categorised as 'very difficult'; however, it is also considered to be 'critical' to training.

Advanced Medic HLTH TECH (ECN368-34) are expected to lead the resuscitation of a casualty and be capable of providing prolonged field care. Training in higher level of TCCC, in addition to assisting in minor surgical operations, applying and caring for casting/splinting and wound care with skin closure is provided after Initial Employment Training (IET) for this group. Beyond that, sergeant and warrant officer HLTH TECH have extended administrative (but not clinical) skill training requirements.

A small and highly selected group of HLTH TECH equivalents throughout the ADF, such as HLTH TECH Underwater Clinician (HT-UC), are currently trained and expected to perform advanced emergency care clinical procedures, including insertion of an endotracheal airway, surgical cricothyroidotomy, thoracostomy tube insertion, finger thoracostomy, familiarisation of ventilation of patient using closed circuit ventilator and administration of blood and blood products.

General HLTH TECH are familiar with thoracostomy and chest tube insertion with underwater seal drain for pneumothorax and can assist medical staff in completing this procedure (although they are currently not trained to perform it directly). Application of a pelvic binder is also taught as well as general resuscitative measures such as supplemental oxygen delivery, spinal immobilisation and intravenous/intraosseous access.

It is recognised that on warlike operational deployment, conditions of employment may be of long duration in austere conditions in a potentially hazardous threat environment. It is anticipated that there may be limited logistic and technical support such that the HLTH TECH may be required to work as a sole practitioner, far removed from technical support.

Recommended areas of upskilling

Although not medically trained, the CFA is currently able to deliver a targeted set of life-saving interventions (LSI) (in addition to their core employment duties). As the first responder, the CFA has the potential to save a life within minutes of injury in even the highest-risk environment. Of the immediate traumatic threat to life, the use of the combat application tourniquet (CAT) to control exsanguinating extremity haemorrhage has saved countless lives in the MER over the past two decades.[7] This skill is appropriately disseminated widely to all deployed ADF members and is to be commended.

Tension pneumothorax and finger thoracostomy

Tension pneumothorax and airway obstruction are the next two most common causes of preventable death. Appropriately, management of both of these life-threatening conditions is currently likely first attended to by the CFA. It is not anticipated to be practical, feasible or appropriate to consider teaching further surgical or endotracheal approaches to the compromised airway to non-medical staff, and no further upskilling in this area is foreseen.

However, management of tension pneumothorax may be suboptimal due to using only needle thoracocentesis, which may result in technical and clinical failure due to variable thickness of the chest wall, kinking of the catheter or anatomic complications such as puncture of intercostal vessels or other structures. Additionally, the optimal position of a needle to attempt decompression is now recognised as the 5th intercostal space in the mid-axillary line (rather than the 2nd intercostal space in the mid-clavicular line).[8]

The ATLS course (10th edition) recognises these issues and advises that finger thoracostomy is an appropriate alternative to needle decompression. Indeed, the Victorian State Trauma System guidelines for traumatic cardiac arrest in hospital place finger thoracostomy ahead of needle decompression in the management algorithm of suspected tension pneumothorax[9] referenced from the Australian and New Zealand Committee on Resuscitation.[10] Finger thoracostomy must be followed by intercostal catheter

insertion; however, the life-saving intervention is decompression of the pleural space by thoracostomy and chest tube insertion may be delayed if necessary in a tactical military environment. Of note, chest tube insertion was administered by a US resuscitation team in nearly 10% of interventions of 173 casualties reported from the MER published 2017[11] and is therefore not infrequently indicated.

Equally, Ambulance Victoria also recognises the urgent need for finger thoracostomy (and do not mention needle decompression at all) in their clinical practice guideline for managing traumatic chest injury by highly trained air ambulance paramedics.[12] If there is an anticipated delay of pleural decompression, then needle decompression may be considered as a bridging procedure; however, for the aforementioned reasons, this is not ideal.

Finger thoracostomy is currently within the skillset of the HLTH TECH 'Underwater Clinician' category, so the training required is already embedded within Defence training capability. It is recommended that to prepare for treatment at the point of injury in a future contested operating environment (with denied access to early evacuation), consideration must be given to upskilling all HLTH TECH ECN's to deliver this life-saving intervention in preference to needle decompression further forward to minimise preventable loss of life secondary to tension pneumothorax.

Haemorrhage control and blood product transfusion

Junctional haemorrhage continues to represent a significant cause of potentially preventable battlefield death.[3] Haemorrhage in this anatomical region is not amenable to CAT application; however, haemostatic compounds have a role and are applicable on deployment. On the other hand, recommendations for fluid resuscitation have undergone a significant change in civilian practice, with the earlier institution of blood product transfusion now widely established in civilian protocols.

The Ambulance Victoria Clinical Practice Guideline recommends early administration of packed red cell concentrate (PRCC) during resuscitation for hypovolaemic shock, or a priori if hypovolaemic shock is associated with measured anaemia (Haematocrit<30) or in patients with severe anaemia (Hct<21). The usual dose is between 1 and 5 units, preferably delivered via a fluid warming device.[12]

CFA personnel capable of obtaining IV access should be supported by HLTH TECH capable of proceeding to PRCC transfusion in a patient suffering hypovolaemic shock from trauma. The additional load burden of carrying 1–5 units PRCC (plus a lightweight, compact, easy-to-use warming device) should not be arduous or inappropriate for a HLTH TECH and would align with current civilian trauma management practices.

Spinal immobilisation

One area of significant divergence from civilian trauma management guidelines is in regards to spinal immobilisation. This initially arose from a finding that only 1.4% of casualties suffering military traumatic (primarily penetrating) injuries to the neck may have benefited from spinal immobilisation during the Vietnam War.[13] This finding is replicated in UK casualties from Afghanistan where although the mechanism of injury was primarily explosive force in more than ¾ of casualties (anticipated to be associated with a higher probability of cervical spine injury), ultimately only 1 of 56 survivors (1.8%) sustained an unstable cervical spine injury requiring surgical stabilisation (this patient later died due to head injury).[14]

Severe trauma to the neck is invariably associated with severe head injury and high mortality, such that mandatory spinal immobilisation in a high-threat environment is likely to incur more risk to the casualty and responders than any benefit it may provide. As such, spinal immobilisation does not require further undue attention and is rarely indicated in military trauma.

Areas for familiarisation

Rare and extreme LSI in which HTLH TECH should have exposure and familiarisation include resuscitative thoracotomy (RT) for thoracoabdominal trauma and lateral canthotomy for ocular trauma. Familiarisation regarding indication, contraindication and outcome is justified to fully equip the HLTH TECH to function as part of the advanced resuscitation team at higher-level care.

RT should only be performed by adequately trained trauma surgeons or retrievalists in appropriately equipped locations. The pericardial window at RT is associated with a survival opportunity. HTLH TECH should be aware of what is involved in preparing to assist (if required) a trauma surgeon upon delivery of a patient with cardiac tamponade, as this may be performed in a resuscitation bay of an MTF.

Similarly, a lateral canthotomy for ocular trauma and globe at risk may preserve eyesight but should only be performed by an appropriately trained clinician. Assistance at this procedure is reasonably within

the expected skillset of a HLTH TECH and may be performed in a resuscitation bay.

Tailored Trauma Upskill (TTU) training

Rather than recommending training all HLTH TECH to the level of HT-UC, an abbreviated course to specifically target the skills of finger thoracostomy and blood product administration could therefore be designed for advanced HLTH TECH and would expect to be deliverable in as little as a one-week package. All Defence doctors are expected to complete the three-day ATLS/EMST course, which delivers much more than finger thoracostomy training indicating the academic and practical content required can be taught in this time frame to suitably selected candidates with existing trauma management training.

Linking a TTU course with subsequent clinical placement at a civilian trauma hospital would equip HLTH TECH with the skills, knowledge and experience to deliver these LSI on the battlefield. Clinical Placement Deeds between the Department of Defence and the relevant hospital networks are extant at various trauma centres around Australia to facilitate such clinical placements. A minimum two-week block would be expected to provide an opportunity to observe and perform a sufficient number of finger thoracostomies so as to render the candidate proficient in that specific skill.

Considerations for Special Forces

When extraction times and access to Role 2E MTF are anticipated to be between 1 and 6 hours, special consideration should be given to an expanded skillset of more invasive advanced procedures, only applicable or relevant to the special forces, and therefore not encumbering a high-volume training load. Anticipated extraction times beyond 6 hours contraindicate these measures secondary to futility.

REBOA

Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is a haemorrhage-control adjunct that has been used by several Defence Forces (including the US Defence Forces) over the past decade.[15]

Non-compressible haemorrhage remains the leading cause of preventable death in combat.[7,16,17] Non-compressible trauma is categorised into intrathoracic (involves injury to heart, lungs, major vascular structures within the thorax and rib cage) or abdominopelvic (involves injury to solid organs and/or major vascular structures within the abdomen and pelvis).[18,19] REBOA is only appropriate for patients with major abdominopelvic and junctional trauma.

Non-compressible abdominopelvic and junctional trauma in combat casualties are particularly challenging in austere environments because of the inability to control haemorrhage by direct pressure. This progressively leads to hypotension, systemic shock and, ultimately, death. Demise is accelerated by attempts to volume resuscitate or cardiopulmonary resuscitation. Traditionally, the only way to resuscitate these patients would be the surgical application of vascular clamps across the aorta (resuscitative aortic occlusion) by an anterolateral or clam-shell thoracotomy or a laparotomy with supracoeliac control.[20] This allows direct control of the haemorrhage distal to the clamp site, increases cardiac afterload and improves perfusion to the heart and brain. However, these procedures have generally been conducted in an operating theatre by Specialist Medical Officers. There are usually significant delays in transfer time from the point of contact to the point of treatment. The procedures are maximally invasive and have a significant amount of associated morbidity and mortality.

REBOA is a minimally-invasive alternative to Resuscitative Aortic Occlusion in patients with major abdominopelvic injuries.[15] REBOA is a principle rather than a product. The technique involves accessing the common femoral artery by applying a modified-Seldinger technique using an ultrasound. An open cutdown exposing the common femoral artery is also appropriate, and access to the artery can be determined by the clinical state of the patient. A specialised endovascular REBOA balloon is then inserted into the common femoral artery and advanced into the descending thoracic aorta or infrarenal aorta (Figure 1). The final location for the site of inflation depends on the location of the injury, mechanism of injury and pattern of injury. To minimise the potential for incorrect placement, standardisation of field location can be taught by utilising consistent anatomic landmarks such as distance to the umbilicus. Once positioned, the balloon is inflated, thereby applying 'an internal tourniquet' within the aorta to reduce the extent of internal haemorrhage. REBOA allows temporary stabilisation of the haemodynamic state of the casualty using a minimally-invasive intervention, thereby creating a bridge to definitive surgical control of haemorrhage in an operating theatre or hybrid suite.

REBOA had initially been described in the mid-1950s during the Korean War by LTCOL Carl Hughes (US Army),[21] but was not adopted in trauma management

until 2011 by COL Todd Rasmussen (US Air Force).[22] Animal models have demonstrated the effectiveness of REBOA for survival, with balloon (partial) occlusion times of up to 90 minutes.[23,24] REBOA was successfully used with London Helicopter Emergency Medical Service (HEMS) in a pre-hospital setting in 2014,[4] and has been successfully utilised in military austere situations.[5] REBOA has been utilised by the UK and US military but is not being implemented in the ADF yet.

The use of REBOA has traditionally been within the scope of trauma surgeons with considerable vascular surgical experience. However, aeromedical evacuation of combat casualties may not be as easy in future conflicts, and more responsibility for patient stabilisation may be necessary for HLTH TECH. This would warrant consideration of further upskilling for this group of first-line point-of-injury Medics.

Summary

By targeting just the highest value interventions at the immediate point of injury as areas to improve outcomes, upskilling CFA and HLTH TECH may be afforded with minimal training load but maximal impact regarding reducing preventable battlefield death.

Finger thoracostomy in preference to needle decompression of tension pneumothorax to be administered by CFA and HLTH TECH, and earlier administration of blood products by HLTH TECH represent the two highest value targets in this regard.

The training burden required can be minimised by leveraging and modifying existing training courses and supplementing these didactic and theoretical practice sessions with clinical rotations embedded in civilian trauma hospitals utilising existing Defence Deeds and Memoranda of Understanding.

REBOA as a specialty intervention to the highly trained HLTH TECH also represents an opportunity to save a life in the special operations domain when extraction times are anticipated to be between 1 and 6 hours. The introduction of new techniques to address non-compressible truncal haemorrhage such as this are, however, encumbered with a significant training burden but must be considered. Injudicious use may be counterproductive and worsen outcomes if inappropriately deployed. Earlier evacuation may render REBOA redundant if the casualty is moved within an hour and certainly renders this intervention futile if evacuation is not likely until beyond 6 hours.

Disclaimer: The views presented here are those of the authors and do not represent the views of the Directorate of Army Health or the Australian Army.

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Permanent Medical Disqualification of Iranian Air Medical Transportation Pilots

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Abstract

Background: Health is a state of complete physical, mental and social wellbeing. Disability is defined as the effect of a disorder on a person's physical, mental or social activities.

Purpose: Determine the causes and diseases leading to early permanent medical disqualification of Iranian rotary and fixed-wing air medical transportation pilots from 1990 to 2020.

Materials and methods: The study was designed as a descriptive, cross-sectional, retrospective investigation. Data were collected from the medical records and councils and sorted into pre-designed electronic sheets.

Results: Out of 214 permanent disqualifications, 198 were medically disqualified, while the remainder were killed in air accidents. The main reasons for medical disqualification were neurosurgery, psychiatric and cardiovascular causes. Common diseases included discopathy, generalised anxiety disorder and myocardial infarction. The total lost service years were 2239 person-years. The average was 11.3 person-years per individual with a standard deviation of ± 6.04.

Conclusion: The common causes of early permanent medical disqualification of pilots are neurosurgery, cardiovascular and psychiatric. The work environment of rotary-wing pilots is different from fixed-wing pilots. Air medical transportation pilots face higher levels of stress than other pilots due to the transport of patients.

Keywords: Disabilities, Disqualification, Air medical transportation, Pilots, Health

Conflict of interest: None

Introduction

Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity. Health must be a state subject, with the National Health Mission as a reference program of the Ministry of Health. Sufficient attention on health promotion, intersectoral partnership, surveillance, monitoring and evaluation of healthcare delivery should be considered.[1] Healthcare access varies by age group and disability type.[2]

Disability is defined as the effect of a disorder on a person's physical, mental or social activities in which the work environment and family situation are also affected. Disability has been associated with health disparities in behavioural risk factors (e.g., smoking and physical inactivity) and preventive health measures.[3] One-quarter of non-institutionalised US adults (representing an estimated 61.4 million persons) reported some disability. Mobility was the most prevalent disability type (13.7%), followed by cognition (10.8%), independent living issues (6.8%), hearing (5.9%), vision (4.6%) and self-care problems (3.7%). Women reported a higher prevalence of disability (24.4%) than men (19.8%) and higher prevalence of each disability type.[2,4] The prevalence of disability in the unemployed is more than double that of the employed.[4] Prevalence of disability varied by age group and sociodemographic characteristics. Higher prevalences of disability were reported by persons living in poverty.[2] Past studies have shown that adults with disabilities have lower levels of education than non-disabled people.[4]

Selection, training and continuous surveillance of pilots require a lot of material and spiritual costs. Disability or death leads to the loss of expert pilots and increases costs. There is no way except for prevention and continuous surveillance (especially in non-communicable diseases).[1,5,6] The basic principles of health monitoring and disease

prevention include accurate monitoring of workplace conditions, lifestyle, regular periodic examinations and screening tests. The economic, psychological and social problems caused by disabilities have led to many financial and moral burdens.[7]

Disabled persons face greater barriers to healthcare than others. Identifying disparities in access to healthcare highlights disability types, selected demographic groups and possible predisposing factors.[2] Exact demographic data about the prevalence of disability, types of disabilities and their predisposing factors could prevent future disabilities and is essential for public health programming.[2,4]

Safe and successful air medical transportation needs the cooperation of healthy medical and flight crews. They involve medical and operational stressors concomitantly. Therefore, health and medical surveillance are necessary for air medical transportation (AMT) pilots.[8]

The present study aimed to determine the causes and diseases leading to early and permanent medical disqualification (EPMD) of the Iranian AMT pilots based on their service categories from 1990 to 2020. Other objectives included determining the total lost service years (LSY) and the average and exact number of Iranian AMT pilots killed in air accidents according to their service categories. This valuable data helps us to identify and remove existing defects.

Materials and methods

This is a descriptive, cross-sectional, retrospective study on medical causes and diseases that led to EPMD of Iranian AMT pilots from 1990 to 2020. The study population was selected through the purposive sampling method. We considered the first officers (co-pilots) in the pilot's population. Rotary and fixed-wing AMT pilots with EPMD entered the study based on the inclusion and exclusion criteria. The aim was to determine the medical causes and diseases that led to the EPMD of Iranian AMT pilots according to their service categories. This information can play an important role in preventing disabilities and loss of human resources in the future by early identification and correction of existing deficiencies according to their service categories. The obtained data were presented to the officials of preventive medicine and health planning.

Inclusion and exclusion criteria

The Iranian rotary and fixed-wing AMT pilots with EPMD who had relevant official records from 1990 to 2020 were included in the study. The exclusion criteria included medical disqualification due to physical or mental illness, death in non-occupational accidents, non-medical reasons, personal requests or disciplinary extrusion. In addition, pilots who were killed in air accidents were classified as non-medical permanent disqualification.

Study design

Operators collected data with random identification codes from the medical profiles of the pilot and their air medical council and recorded them in pre-designed sheets based in Excel. These data included date of entry into service, date of retirement, length of service before discharge, major medical cause and disease that led to EPMD based on version 10 of the International Classification of Diseases (ICD-10) and according to their service categories.

According to the International Civil Aviation Organization (ICAO) and European Aviation Safety Agency (EASA) regulations, pilots with no disability can continue to fly up to 65 years of age. However, Iranian official employees can usually retire after 30 years of service. Therefore, the minimum pilots' service duration was considered 30 years.

Statistical analysis

The data were analysed statistically by SPSS software (version 26). Ultimately, we presented the most common medical causes and diseases, the total LSY and their average by tables and graphs according to their service categories.

Ethical considerations

The Ethics Committee of the Aerospace and Sub-Aquatic Medical Faculty at Aja University of Medical Sciences approved this study with the registration number 10167214. The information of each participant was recorded with a random code to prevent the disclosure of the pilot's medical profile. The corresponding author paid all the research costs.

Results

Out of 214 AMT pilots with permanent disqualification, 198 cases were EPMD, while the remainder (n = 16) were killed in air accidents. Rotary-wing pilots had 150 cases of medical disqualifications, while fixed-wing pilots had 48 cases. In all pilots, neurosurgery, psychiatric and cardiovascular disorders were the most common causes of EPMD (Figure 1). Whereas discopathy, generalised anxiety disorder (GAD) and myocardial infarction (MI) were the most frequent diseases (Figure 2).

The total LSY in AMT pilots with EPMD was 2239 person-years. The mean and standard deviation of

LSY for any medical cause, disease and all service categories is presented in Table 4. The mean of total LSY was 11.3 person-years per individual with SD=±6.04. In all pilots, psychiatric, neurosurgery and cardiovascular reasons had the highest means between medical causes of LSY. Post-traumatic stress disorder, GAD and discopathy had the highest means between diseases of LSY. However, in fixed-wing AMT pilots, neurosurgery, psychiatric and cardiovascular reasons had the highest means of LSY. Borderline personality disorder, bipolar mood disorder and discopathy also had the highest means of LSY among diseases in this service category (Table 4).

Table 1: Demographic study data

	Service category		
Cause	**Rotary-wing AMT pilots**	**Fixed-wing AMT pilots**	**Sum**
Early permanent medical disqualification	150	48	198
Killed in air accidents	13	3	16
Sum	161	51	214

Table 2: Medical causes leading to the LSY in AMT pilots with permanent disqualification

	Service category		
Cause	**Rotary-wing AMT pilots**	**Fixed-wing AMT pilots**	**Sum**
Psychiatric	**408**	**115**	**523**
Neurosurgery	**376**	**106**	**482**
Cardiovascular	**255**	**109**	**364**
Other causes	690	180	870
Sum	1729	510	2239

Table 3: Diseases leading to the LSY of AMT pilots with permanent disqualification

	Service category		
Cause	**Rotary-wing AMT pilots**	**Fixed-wing AMT pilots**	**Sum**
Discopathy	240	86	326
Generalised anxiety disorder	203	36	239
Myocardial infarction	86	44	130
Other causes	1200	344	1544
Sum	1729	510	2239

Table 4: Mean and SD of LSY in AMT pilots with permanent disqualification

Service category	Cause	Mean and SD	Diseases	Mean and SD	Mean & SD for each service category	Mean & SD for all service category
Rotary-wing AMT pilots	Psychiatric	Mean=14.57 SD=±6.79	Post-traumatic stress disorder	Mean=17.67 SD=±4.78	Mean=11.53 SD=±6.2	Mean=11.3 SD=±6.04
	Neurosurgery	Mean=11.05 SD=±6.02	Generalised anxiety disorder	Mean=14.5 SD=±6.8		
	Cardiovascular	Mean=10.2 SD=±5.34	Discopathy	Mean=11.43 SD=±3.08		
Fixed-wing AMT pilots	Neurosurgery	Mean=13.25 SD=±3.4	Borderline personality disorder	Mean=19 SD=±1.41	Mean=10.62 SD=±4.86	
	Psychiatric	Mean=11.5 SD=±6.17	Bipolar mood disorder	Mean=17 SD=±0.7		
	Cardiovascular	Mean=9.08 SD=±5.56	Discopathy	Mean=14.33 SD=±3.03		

Discussion

Selection, training and periodic health monitoring of pilot volunteers have a lot of human and material costs. According to global estimates, training a skilled pilot will cost millions of US dollars. Any form of pilot disqualification wastes much material and human capital. The only way to prevent this waste is through effective prevention.[5,6]

The number of fixed-wing AMT pilots is less than rotary-wing in Iran because AMT by aircraft is more expensive and usually used for long-distance transportation of critically-ill patients. The leading causes of EPMD in all pilots in this study were neurosurgery, psychiatric and cardiovascular disorders. According to the literature, the most common causes of EPMD in pilots are cardiovascular, neurological and psychiatric reasons, respectively.[(9)] In Høva's study on loss of license in Norwegian professional pilots between 2006 and 2010, cardiovascular, neurologic and musculoskeletal disorders were the most common reason.[10] Ghazizade et al. reported cardiac, neurologic and gastrointestinal disorders as more frequent medical reasons for EPMD in Islamic Republic of Iran Air Force (IRIAF) pilots between 1992 and 2003.[11] In Whitton's research on US Air Force (USAF) pilots and navigators, common causes were cardiac and neurological disorders. McCrary et al. described cardiac, musculoskeletal and neurologic reasons in a similar population.[12,13] In the Federal Aviation Association (FAA)-assisted Dark study, the most common causes of disqualification of American airline pilots between 1983 and 1984 were cardiac, neurological and psychiatric reasons.[14] Amirabadi Farahani et al. reported otorhinolaryngological, psychiatric and cardiac medical causes for IRIAF cadets between 1986 to 2016.[5] In Pombal's study on permanent medical disqualification in airline cabin crew between 1993 and 2002, otorhinolaryngological, musculoskeletal and psychiatric causes were the most frequent medical conditions reported.[15] Nakanishi et al. reported oncologic, neurologic and psychiatric reasons for 260 Japanese crew members with a permanent disability.[16] In Arva's study, the leading medical causes of EPMD in 257 Norwegian civilian pilots included cardiac, neurologic and psychiatric disorders.[17] Evan and Mitchell reported that heart, neurological and psychiatric reasons were responsible for the sudden disability of British civilian pilots.[18,19]

In the current study, common diseases leading to EPMD in all pilots were GAD and MI. However, in fixed-wing AMT pilots, discopathy, MI and GAD were more frequent. In McCrary's research on EPMD of USAF pilots and navigators between 1995 to 1999, common diseases included ischaemic heart disease, high blood pressure and back pain. While Amirabadi Farahani et al. reported motion sickness, adjustment disorder and epilepsy as the common diseases that resulted in EPMD of IRIAF cadets.[5,13] In February 2014, the FAA published a statement titled *FAA's 15 disqualifying aviation medical conditions for prospective pilots*. The first three diseases on that list were angina pectoris, bipolar disease and cardiac valve replacement.[20] In different studies, similar diseases but with different prevalence and sequences have led to EPMD.

In our research, the total LSY in AMT pilots with EPMD was 2239 person-years. In all pilots, psychiatric, neurosurgery and cardiovascular disorders were the most frequent causes. Whereas discopathy, GAD and MI were the most common diseases.

The mean of total LSY was 11.3 person-years per individual with SD=±6.04. In AMT pilots and rotary-wing AMT pilots, psychiatric, neurosurgery and cardiovascular disorders had the highest means between medical causes of LSY. Post-traumatic stress disorder, GAD and discopathy had the highest means between diseases of LSY. However, in fixed-wing AMT pilots, borderline personality disorder, bipolar mood disorder and discopathy also had the highest means of LSY among diseases. In the Amirabadi Farahani study, the total LSY of IRIAF cadets was 1412 person-years. The most common causes include otorhinolaryngeal, psychiatry and cardiac, while frequent diseases included motion sickness, GAD and epilepsy. The mean of LSY was 25.67 person-years per individual. The common reasons included neurology, psychology and otorhinolaryngeal. While common diseases included high blood pressure, occupational hearing loss and GAD.[5] In Ghazizade's study, the mean of total LSY in IRIAF pilots was 6.14 person-years per individual. Cardiac causes had the highest mean (10 person-years per individual).[11]

Our study had some limitations that include: 1) information lost about 10 per cent due to the lack of a comprehensive electronic system for recording personal medical records, 2) the possibility of misuse in disorders that do not have a specific diagnostic method (and most are diagnosed mentally, such as motion sickness, migraine, irritable bowel syndrome, etc.) and 3) lack of necessary information that affects the health of the AMT pilots (such as aircraft, operational and airbase agents, personal agents and others). Current research also has important advantages, which include: 1) this is the first study on EPMD of AMT pilots; 2) the period of this cross-sectional study was 30 years; 3) presentation the statistics of AMT pilots which killed in air accidents, and 4) presentation the statistics of AMT pilots with EPMD based on their service categories.

The authors believe that AMT pilots are exposed to the stresses of flight, patients, their companions and the air medical crew simultaneously. Rotary-wing AMT pilots have more difficult and almost always urgent operations that produce more stress. As a result, it seems that conducting similar studies in the future can effectively determine the predisposing factors in AMT pilot's disabilities and more effective preventive planning. Moreover, the use of up-to-date comprehensive electronic systems, upgrading on-the-job examinations and sufficient periodic examination in occupational health centres are suggested.

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Ethical approval

The ethical approval of this study was issued by the Ethics Committee of the Aerospace and Sub-aquatic Medical Faculty in Aja University of Medical Sciences, with registration No: 10167214.

Abbreviations

US: United States

EPMD: Early and permanent medical disqualification

AMT: Air medical transportation

LSY: Lost service years

ICD-10: Version 10 of the International Classification of Diseases

ICAO: International Civil Aviation Organization

EASA: European Aviation Safety Agency

GAD: Generalised anxiety disorder

MI: Myocardial infarction

SD: Standard deviation

IRIAF: Islamic Republic of Iran Air Force

USAF: United States Air Force

FAA: Federal Aviation Association

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Toughening Up: Bullying in the British Army during the First World War

S. Walker

Abstract

Hussar Trooper John Flood, Private C. Niblett and Private Jamie Benjafield are three British soldiers who had similar bullying experiences during their service in the British Army. All three men were antagonised by a fellow serviceman, were punished by the institution they served and felt aggrieved at their treatment. The only particular difference between them is that they served separately between a 150-year span from the 1860s through 2017. Bullying is a complicated and contentious issue that is as important today as it was a century ago. Within the military, the act of bullying demands particular attention as coercive and humiliating tactics, common within cases of bullying, have been actively employed by and within the ranks of the British Military for various reasons ranging from training and indoctrination to hazing and targeted abuse. Using the experiences of the three men and many other accounts, this article considers in detail the role of bullying within the experience and transformation of British servicemen during World War I by examining core areas where this behaviour was evident. This research interweaves the commonly identified aspects of bullying behaviour with enthusiastic civilian encouragement for recruitment, overzealous training regimes, enforced military discipline and barrack-room horseplay that were all visible during World War I. This focus remains central to the argument as the article concludes how British men were targeted, abused and humiliated by their officers, their compatriots and the public as part and parcel of the military experience between 1914–1918.

Keywords: soldiers, bullying, World War II, army, social interaction, masculinity, suicide, abuse, indoctrinated behaviour, humiliation.

> *He would scream in your face, saying abusive stuff. He said to me, 'I am going to rape your baby', and he waited a few seconds, and he spat in my face…At the time we thought what they were doing was part of the training. I was expecting it to be tough but nothing like it was.*

Testimony of Former British Army Recruit, Jamie Benjafield, 2017.[1]

On the witness stand in 2018, former British recruit Jamie Benjafield gave the above harrowing recollection of his treatment by an officer during training. This evidence became known as the British Ministry of Defence came under increasing public scrutiny after 28 young recruits aged 17–18 claimed that they had been abused during a training camp. One recruit told the ensuing investigation that an instructor had physically force-fed him animal manure. At the same time, another remembered a colleague being thrown to the ground by instructors in the hangar where they were sleeping. The recruit claimed, 'we got told it was all part of the training and that's what's supposed to happen, and it was just to get us psyched up and ready for it.' Yet, the extent of physical abuse was extensive'.[1] Bullying and military indoctrination share many similarities. In both cases, there is typically a focus on humiliation and physical unpleasantness. In the 21st century, there has been an increasing focus on bringing to account those who are considered to have crossed the line between training and abuse within the British Military. However, during the early 20th century, particularly during World War I, there was a different atmosphere of tolerance and expectation from the men training to fight.

Bullying: Hazing and perception in context

Bullying typically pertains to the physical or social abuse carried out by a person or group of people intended to harass, hurt or influence someone in a less powerful position by physical, verbal, social or psychological means. Wolke and Lereya argue that the resulting impact on the recipient can result in significant behavioural changes and physiological and psychological detriments.[2] Ostvik and Rudmin explain that a commonly theorised criterion of the

bullying process is that the harassment must be extended over time.[3] Stuart and Szeszeran support this definition by adding that as a deliberately repeated act, bullying intentionally creates a state where the target feels coerced, degraded, humiliated, threatened, intimidated or frightened with a significantly evident power imbalance between recipient and perpetrator.[4] However, as many researchers have noted, bullying as a commonly socially-recognised phenomenon lacks a universal definition, particularly within social policy and legality. Dependent on the characteristics of the individuals involved and a variety of external socialising factors, the interpretation of the act between the line of acceptable behaviour and targeted abuse can be subjective.[5] This is problematic in identification and research output as authority-defined categorisations of behaviour do not often match individual perspectives of intolerable behaviour.[6]

This becomes even more complicated within considerations of institutionally based organisations, including the armed forces and law enforcement. As such, indoctrination processes typically depend on a degree of unpleasant experience and conditioning to encourage conformity and obedience. Hazing is a particularly understudied aspect of military existence, with contextual research often unable to find the divide between hazing and bullying inside interpersonal relations within the military.[7] A 2012 US Military report by Lieutenant Commander Leedjia Svec et al. on hazing and bullying begins with the statement:

Hazing in the military began as a celebration of accomplishments and strengthening of unit bonds. However, it has in some cases transformed through time into degrading and demeaning acts with the potential for deadly consequences.[8]

This fine line between the previously accepted conventions of hazing versus a stance against bullying illustrates the problematic process of interpreting behaviours as bullying, hazing or both. Empirically, the difference is often subjective for participants, with the defining characteristic often being one of internalised and interpreted lasting impacts of the event. Though the distinction is problematic, there is no doubt that both bullying and hazing have long associations with military service. Bourke excellently notes that hazing, as a form of 'legitimate bullying' is not only common within modern military life but in many cases, encouraged as comradery and 'toughening them up' as part of a 'masculine, militarist nationalism (that) trumped civilian discourses of human rights'.[9] This rhetoric fits within the considerations of the transformation of civilians into soldiers in World War I as considered in detail by Bourke, Meyer, Walker and Winter.[9,10,11,12] However, it does not detract from the importance of reconsidering the processes of bullying as part of that indoctrination and subsequent experiences as a serviceman within the scope of World War I. As such, this article delves deeper into the experiences of those within World War I whose perception of behaviours towards them illustrate recognition of bullying behaviour. This is not to point fingers or raise moral objections but to identify applicable behaviours and consider the physical and psychological impact of these behaviours on individual recipients within the British Armed Forces during World War I.

Recruitment: Setting them straight from the get-go

Arguably, in the early years of the War, bullying was an effective tool for encouraging men to volunteer for military service. Disabled veteran Corporal Arthur Schuman wrote after the War about how the torment carried out upon men by patriotically zealous women encouraging them to enlist was a persuasive element before conscription. Writing after the War, he mused, 'had I known what was going to happen to me…I might have had second thoughts, even despite the goading of our "worked up" womenfolk. "We don't want to lose you, but we think you ought to go for your King and Country both need you so." '.[13] This method of recruitment is a commonly analysed consideration in the history of World War I as the propagandised questioning of mens' virility and viability for a relationship, made doubly profound by the recruitment of women to internalise and repeat the message. It proved to be a reasonably effective tool for filling the trenches in 1915.[14] Dawson, Meyer and Woollacott have each separately considered the widespread impact of the psychological campaign contextually recognised as the 'White Feather Brigade'.[15,16,17] Gullace explains that at the end of August 1914, Admiral Charles Penrose Fitzgerald had deputised 30 women to distribute white feathers to non-uniformed men. Fitzgerald reportedly instructed them to humiliate 'every young slacker found loafing about'.[18] This is not to state that the entirety of the early enlistment for the War be attributed to such actions. The personal reasons for enlistment in 1914 and 1915 are often complex and multifaceted, driven by a combination of extensive social, economic, cultural and gender factors. Nor does this imply that women in this period occupied a position of overarching power over men in general. Yet, the temporary power they held in establishing labels of bravery or cowardice

within British culture is clear. This demands recognition that despite a plethora of individualised motivations for enlistment, some of these decisions were influenced by the coercive rhetoric espoused through emasculation. A blatant example in practice is a postcard addressed to Railway Porter EA Brooks during World War I from the Scoutmistress at the Bath Girl Scouts offering him a job as a 'washer up' with the justification 'you cannot be a man not to join the army'.[19] Often acting independently, these impassioned women, encouraged by the state and justified by military sanction, sought to 'bully' men into service. Consequently, they were seemingly successful, at least in the early stages of the War.

Coercive bullying behaviour as an aid to recruitment can also be found in the treatment of conscientious objectors. In a parody of the willing recruit, conscientious objectors were often subjected to the same medical assessment, classified under their suitability for service and distributed equipment and a uniform.[20] However, unlike the men who chose this process, many obstinate conscientious objectors rejected the uniform and equipment to confirm their non-military status. This created a complex battle between individuals and the British Military as their resistance to joining the military countered the military's typical methods for forced acquiesce. As a devout Quaker, G Ewan was one such objector who found himself experiencing the parallel enlistment process against his will. Polite to a fault, Ewan recalled how he continually refused to dress in the uniform, leading to a young sergeant advising him, 'I should be forcibly stripped and put in uniform if I objected to putting it on otherwise.'[21] Ewan later had a military cap roughly placed on his head after he refused to touch it. Within the private papers of H Lazenby is a short description of a conscientious objector tribunal during which an objector deflects and defends himself against an onslaught of questions from a panel. Lazenby notes how the topics quickly shift from politics to religion to hypothetical questions about potential inaction during an invasion. Lazenby concludes that the panel is incapable of bullying the man into submission as 'they realise that the flame of conscience humming within a man makes him a very hot person on whom to wage verbal warfare'.[22] As an obviously biased CO himself, it is plausible that Lazenby wished to present the contrasting roles of antagonist and hero lavishly embellished for dramatic effect. Yet, the questions and arguments levied at the unknown CO on trial are to be found in similar tribunals within the period. In 1916, the *No-Conscription Fellowship*, founded in late 1914, published in their journal *Tribunal*, 'The tribunals, however, notwithstanding that Parliament has recognised conscience, seem to take the view that a conscientious objector, whatever his statement of belief, is a person to be rebuked, bullied and condemned'.[23] In May 1916, The Lord Bishop of Oxford repeated similar claims to Parliament lambasting the deplorable treatment of conscientious objectors, citing cases of men being left naked and bullied until they were sick.[24] The Lord Bishop concluded his appeal by reiterating the role of indoctrinated bullying in military transformation but asserting that as COs these men should not be subject to it:

...it is hard to believe how the military authorities could have any escape consistent with the treatment necessary for soldiers in time of war but to inflict this penalty. The kind of bullying to which I have referred, however legitimate, however necessarily involved in military discipline, is, it appears to me, exactly the kind which should not be applied to this particular kind of man.[24]

Bullying was not only an effective tool of recruitment and persuasion but also one considered necessary in establishing and controlling British soldiers. As the analysis shifts from those without uniforms to those serving, the spectrum of bullying and coercion, both official and social, widens dramatically.

As noted by Lord Bishop in 1916, bullying was contextually considered an effective tool in the creation and maintenance of the effective soldier. This remains a common thread within the modern military as individuals are often verbally abused and harangued throughout training. As recent as 2018, a British Army corporal faced disciplinary action after a recording surfaced of his constant verbal tirade against a female soldier during a training exercise that forced her into exhausted tears.[25] A century previous such actions were a common, even expected, part of the training process. For some, this process of deconstruction began even before they were in uniform. Though humiliation was a powerful tool in encouraging enlistment, as the battle for entry began later in 1914, similar bullying practices could be employed by the military officials chosen to separate the soldier from the civilian. In one such case in 1914, the soon-to-be 'Private' Brady suffered a tongue lashing during his first enlistment attempt by a recruitment sergeant who loudly dismissed his physical suitability for service, yelling 'Why don't you two lads bugger off home and tell your mother to change your nappies?'.[26] Brady later gained entry to the British Army. Still, seemingly his introduction to military conditioning and acerbic communication began much before his uniform and rifle acquisition.

Training, indoctrination and resistance: Whatever it takes

Within the history of the British soldier in World War I, one of the most common places to locate bullying behaviour resides within the training and indoctrination phase of men's military experience. Dennis Winter explains that from the very start of the War, the British Military faced a unique issue in that the nature of men's enlistment made traditional military discipline significantly harder to maintain as physically punitive action could actively invite resistance. As a result, the typical bullying techniques alluded to by Lord Bishop, such as verbal admonishment, physical discomfort and public humiliation that were routinely employed to break down a recruit's pride as an encouragement for him to comply, needed to be more carefully applied.[12] This resulted in a polarising response from the training men in relation to deliberate behaviour that some interpreted as bullying over-emphatic preparation for combat. One of the most striking examples remains the case in 1915 where a new regiment made up of volunteer working-class Welsh miners twice refused to fall out and partake in training in protest of the bullying of one of their fellows by an instructor.[26] Said instructor had a reputation for bullying behaviour and sadism towards the men. After repeated occurrences of bullying behaviour, the troop rebelled after another of their number was sentenced to Field Punishment No. 1 for daring to protest their treatment during training. The subsequent strike resulted in a stalemate between the military and their training men. Desperate for a resolution but unable to lose face, the military authorities transferred the hated instructor out of the camp in silent appeasement to the training men.[26] This paints a complex image of the role of bullying as a form of indoctrination. Ultimately, the military was forced to retreat against an entire training corps that took exception to the practices of a senior officer. While it may be argued that this enhanced comradery within the men, it certainly did little for officer-man relationships going forward.

Private Goodson recalled a similar instance of 'forceful encouragement' after a training NCO decided to take a more direct approach to make Goodson's body follow orders:

The cry is from the instructors, 'brace your knees, brace your knees'. Well, you brace your knees as well as you can, but you find that you can't do it like they want it done. So, one of the young assistants, a cocky fella, comes along and whilst I'm doing it just kicks me behind the knee and I go down. I get up and I'm going to bash him…The gym bloke comes after me and says, 'that's enough of that' and I said, 'well that man kicked me behind the knee.' He says, 'if you fancy your chance, you come over here tonight you'll be accommodated.[28]

In Goodson's case, again, the training officer's bullying caused issues in discipline and indoctrination. Goodson's fury at being physically attacked and humiliated led to a physical confrontation between the two men in a boxing ring. As a former boxer and athlete, Goodson's retribution was swift, winning the respect of another CO who appointed him the regimental boxer.[28] However, this does not negate the cause and effect of bullying treatment enacted upon Goodson. Conversely, rough and humiliating treatment of training soldiers was particularly common. Still, instead of rising against the act, many simply regarded the experience as essential to toughen them up to become soldiers in the same way they often viewed the gruelling exercise regime or loss of personal privacy. Within Private Niblett's private papers, he laments and questions his ability to fight in response to his failings in training in 1915.[29] In a letter to his mother, Niblett explained how his furious sergeant had humiliated him in front of the rest of the men by screaming at him during training 'What are you trying to do, tickle that man to death?'[29] Niblett later remarked how his training helped him to become a better soldier. Lieutenant Minnitt recounted a similar experience in his diary of a senior officer balling him out in front of the entire squadron for 'grinning' at him. Promising to 'wipe the b-----y smile off his face' the CSM forced the entire platoon to carry out intense drilling manoeuvres until they were sweating and exhausted. Triumphant, the officer then demanded of Minnitt, 'Now do you feel like grinning at me?'.[32] Although the memory is one of annoyance at the injustice of the treatment by the new CO, Minnitt subsequently writes how the man 'turned out to be a really good fellow to me later on'.[32] For Minnitt, the forced physical exercise and humiliation proved to be a bonding exercise with his comrades, and he held no subsequent ill will. This was not an uncommon attitude with the rigours and gruelling experiences men were put through to prepare them for future battle.

However, while some men may have considered this behaviour as par for the course of military training, others baulked at the treatment. One such example was Private Heavens, who noted acerbically in his diary at the end of November 1915, that his return from convalescing to the Bull Ring for retraining before his return to the front lines entailed 'being shouted at and bullied by men who had seen nothing of the fighting.'[30] The Bull Ring at Etaples served as a training camp and has become infamous for the

conflict between officers and men thanks to Graves' *Goodbye to All That* and the known history of the Etaples Mutiny.[31] In recounting the experiences of New Zealand soldiers during the War, Harper notes several occasions where the training men detested the seemingly sadistic fervour of the camp trainers and officers.[32] Harper described several examples of extensive bullying including the recollections of Ralph Smith in 1915, who noted how his friend Donkin's life was made a 'torment' by two bullies.[32] James expertly sums up the tumultuous climate within Etaples camp by explaining that the combination of the camps 'spiteful military police', 'strenuous battle-training' and the restriction on soldiers seeking diversion through alcohol and brothels ultimately created a toxic environment that devolved into violence and mutiny.[33] Such examples of dissatisfaction descending into insurrection lend support to the assertions of psychologist theorists such as Stanley Milgram, whereby resistance to authority often demands a figurehead or leader.[34] Such was the case with the Etaples 'monocled mutineer' or the Welsh miners in 1915, whose anger against their treatment expanded from one man to the entire platoon.

Another instance in which individual bodies were abused and falls within the scope of bullying is the initial treatments of suspected shellshock cases. As the British Military struggled to recognise the difference between 'treatment' and 'punishment' in cases of psychological trauma, violence towards the mens' bodies was not uncommon to break them from their malaise.[35] Suspected shellshock cases could be slapped, have hot drinks poured on them and be throttled physically in attempts 'treat' their condition and snap them out of their malaise.[36] While this certainly did not occur in every suspected shellshock case, it was not uncommon to find that men suffering from mental trauma were treated with disdain and violence. However, to claim that all this behaviour fell under the category of bullying is problematic. Reid demonstrates that such behaviour is often derived from advised treatments passed down command lines and from the Royal Army Medical Corps.[36] Yet, the memoirs of Sergeant McKay indicate an occasion where the lack of sympathy displayed by a commanding officer towards a suicidal traumatised man tended towards bullying rather than prescribed medical care.[37] McKay remembered how an arrested drunken recruit had been arrested during training and become so distressed at his incarceration that he had threatened to take his own life. Bewildered on how to respond, McKay turned to the ranking officer for advice:

…to my surprise, the staff-sergeant said 'well, we won't stand in his way. Get a rope'. This was got, thrown over a beam and tied around Rutherford's neck. A tug was given to the rope and the victim's face went black, and he was told to go ahead and finish it, as no one would stand in his way. The result was Rutherford went over to a corner and sat down on his bed as quiet as a lamb. This example was one of the best lessons I had learned for a long time, and one which proved invaluable to me later under trench conditions when I had to deal with cases of shellshock.[37]

It is difficult to justify the strangulation of a troubled man to the point that his face changed colour under the guise of medical treatment. While it is possible that McKay exaggerated the account for the narrative of his memoirs, the dismissive attitude and actions of the staff sergeant remain typical of ranking officers' displeasure within this period. Furthermore, McKay, a future member of the RAMC, regarded the bullying of the arrested Rutherford as a formative learning experience on how to deal with shellshock patients later in his career. While there is no mention of McKay acting in this manner again within his memoirs, it is clear from his tone that this instance enabled him to internalise that bullying behaviour had an appropriate place within his experiences as a soldier.

Ultimately, during the training stages of mens' military existence, it was essential to find ways to acclimatise them to the harsh reality of military service during the War. Physical exercise, control over behaviour, diet, clothing, residence and communal living all played a part in this process. However, it seemed bullying and bullying behaviour towards the training men by their superiors also played a role. Such behaviour was accepted by many, but not by all, as responses to such acts could spark insurrection. Beyond training, bullying behaviour continued both between the ranks and among the serving men as they found themselves serving, living and fighting in very close quarters with each other. However, it seems that the most extreme reactions to this behaviour are found in the pivotal moments during which civilians were transformed into soldiers.

Social service—Bullying men on men

It seems almost impossible to find examples of a situation where groups of people are required to live in close contact for set amounts of time without elements of bullying behaviour being noted. This certainly seems to be the case for institutional-type situations such as schools, colleges, the military and prisons.[38] Wertheimer claims that hazing within the modern global militaries has been dramatically

reduced as 'effective authority leads not by fear, but by respect…'.[39] This may be questionable within some modern militaries as cases of suicide and mental health issues reported in the media belie are a continuing undercurrent of the issues related to bullying and rank relationships.[40] This demonstrates the acknowledgement that such practice was commonplace in military history. Indeed, one of the first recorded cases of British Military bullying was the trial of 18th Hussar Trooper John Flood in 1862. Flood was sentenced to death after murdering fellow soldier John O'Dea following years of continual abuse and taunting. On the 1 June 1862, Flood claimed that he 'wished he was dead' after being thoroughly beaten by O'Dea and two others with an army belt under the guise of barrack justice.[41] After brooding over his treatment, Flood got drunk and ended his tormentor's life. He was arrested after shooting O'Dea in the stomach and waiting calmly to be arrested as the man lay dying before him, only becoming agitated and trying to fight off the arresting sergeant when he feared that his tormentor might survive. Flood's case is particularly interesting as his sentence was commuted from death to imprisonment with only hours to spare thanks to Royal Mercy by the Queen under the assertion that 'this unhappy culprit [had been] goaded into an act of continuous and irritating provocation, from which he could not escape.'[41]

While preceding World War I by half a century, Flood's trial illustrates precedence for abhorrent behaviour between serving men transcending World War I. However, it is interesting that in the face of patriotism, bound up with the notions of what was expected of military service and training, recruits after 1914 could compartmentalise their perception of acceptable behaviour between the men to fulfil their duty. Private James Porter Murray recounted within an oral history interview of how physical appearance could inspire negative reactions from other training men. Murray explained that while bullying was not something he saw often, it did happen, typically towards those considered to be 'soft.'[42] However, in many cases what would be considered in modern parlance as 'banter' perhaps overrode clearly defined notions of bullying for the training men. Private Albert Hurst, a middle-class enlistee who joined the 17th Battalion Manchester Regiment in 1915, recalled that as the only teetotaller in a barrack full of northern miners, he received a great deal of 'kidding' from the frequently drunk men.[43] However, Hurst is keen to clarify that this was 'kidding', not bullying, having already mentioned being bullied in private school as a child.[43] While it is possible that this is indeed true, and Hurst was happy to engage with some barrack-room mockery, the point that his refusal of alcohol allowed for derision against his character reiterates the relevance between physical ability and conformity that was so very important during World War I for many men during and beyond their training.

Rank also served as a vehicle for enabling bullying between the serving men. Rowe explains how the 1919 published novel by Charles Morgan, *The Gunroom,* led to raised questions aimed at the Navy by concerned civilians over potential bullying activities on board ship.[44] Morgan depicted a scene within his novel commonly known in the service as 'running torpedoes' in which the chosen 'victim', appointed by the sublieutenant of the gunroom, would be hurtled down a table by six midshipmen at the command of the CO. If the 'human torpedo' managed to strike a match during the process the 'game' would end. If not, it would repeat until he managed.[45] This game was part of a series of 'evolutions' that would be enacted between the senior and junior officers within the covert confines of the gun room on board the ship. Rowe explains that these games meant carrying out the demands of the senior officer and were almost always accompanied by being beaten with sticks.[44] Many regarded this as a rite of passage and responded to any lower ranks who complained about their treatment.

Bullying behaviours such as these were certainly not unique to the Navy. Sheffield explains how the line between 'bully' and 'gentleman' was acceptable within the perception of rank and file. Sheffield quotes Private WV Tilsley, a Derby infantryman within the 55th Division who commented, 'A bad officer, that is, a bully is a -! A good officer, that is, a [sic] considerate, is a 'toff'….' a 'gentleman'.[46] However, unlike training, the battlefield could offer a sinister solution to deal with such men deemed bullies by their subordinates. Within their examination of punishment in World War I, Putkowski and Sykes recount the words of Brig. Gen. Crozier, who described one such case of retribution in the field:

A British N.C.O. had been bullying some of his subordinates. As there appeared to be no way of dealing with the case there, aggrieved men decided to deal with the matter in their own way…A mills bomb has a local but very violent explosive effect. They decided that the Mills bomb should, therefore, be their agent. They caught their victim bending, so to speak. Pulling out the pin from the bomb…one of the, - they had previously drawn lots for the job – pushed the bomb down the back of the N.C.O.'s trousers after which they made off at lighting speed to avoid the explosion…there was no trace whatsoever left of this N.C.O.[47]

This case is an extreme example, as not all disgruntled soldiers would choose to use the cover of warfare to murder their officers. However, it is not an uncommon occurrence. Less than a month after the armistice, members of the British West Indies Regiment (BWIS) decided to act against the discriminatory treatment they had received both from British authorities in terms of pay and allowances and from their British commanding officers, who reportedly treated them very poorly. In retribution, members of the 10th BWIS threw a bomb into the tent of a Regimental Quartermaster-Sergeant and pelted stones at other officers.[49] Putkowski and Sykes also highlight the execution of Lance-Corporal William Price and Private Richard Morgan of 'C' Company, who became intoxicated and shot their Company Sergeant-Major on 20 January 1915. During their court-martial, it was alleged that Price and Morgan had been 'gunning' for their platoon sergeant, who purportedly had been consistently victimising the two men.[47] In these cases, the bully was punished for their misdeeds, albeit from a questionable moral standpoint. However, actions against the will of the British Military could also have severe consequences, namely in the form of corporal punishment and execution.

Dr Petra Boynton argues that the firing squad acted as a form of authoritarian bullying in conveying a 'powerful message' about behaviour and conformity. Boynton stated, 'It was an extremely powerful form of bullying, having to kill your own friends… it sent out the message that you could be next'.[49] The executions of Lance-Corporal Alfred Atkinson and Private Ernest Kirk in March 1915 for desertion provide evidence for Boynton's argument. Labour MP Ernest Thurtle was presented with the following report following the execution:

The two men I selected for the firing party went with the adjutant. [Presumably, these two men formed only part of the firing squad.] When they came back, tough characters though they were supposed to be, they were sick, they screamed in their sleep, they vomited immediately after eating. All they could say was: 'The sight was horrible; made more so by the fact we had shot one of our own men'.[47]

Both Kirk and Atkinson were shot by men from their own battalion, the act of which seemed to have an almost equally devastating impact on the men as the prisoners. Another unnamed man recalled how the men were chosen for the firing squad begged and cajoled him to take their place.[47] An eyewitness to the execution of Rifleman Albert Parker in May the following year recounted how the shooting did not simply affect the members of the firing squad but many of the battalion who bore witness.

He was then marched away to the place where he was to be shot. We were then ordered to about-turn, and the Brigade Transport Officer threatened us that any man who turned round would be put on a crime. So, we stood in silence for what seemed hours, although only minutes. Then the shots rang out and one of the Yorkshires fainted, the strain was that great. [A man from the 6th Battalion King's Own Yorkshire Light Infantry].[47]

Boynton's argument proves to be veracious in the face of these accounts, as the definition of bullying as in to coerce or intimidate someone is directly visible in the reports undertaken by the British Military. Ultimately, many of the men who were executed chose to forgo the blindfold and were considered brave beyond measure for facing death directly. Yet, in these examples, it is the experiences of the men who were forced to participate and those who were not permitted to see but still forced to witness that bear the closest indications of systematic institutional bullying as a form of overarching control.

Different men—Serving and surviving

Until this point in the analysis of bullying in World War I, the discussion has centred on the activity of bullying for indoctrination, control or rank relationships. However, bullying also occurred due to various differences between the men as they entered and served during the War. As noted, due to the demands of the War and the numerous ways men were recruited between 1914–1918, the British Military soon contained an array of individuals who differed in numerous ways. Duncan outlines one of the primary themes within research into bullying, the aspect of 'difference'. He notes that differences allow for discount and conflict, yet further postulates that it is not simply the difference that is the issue, but the meanings ascribed to that difference that inspire hostility.[50] During World War I, there was no shortage of unique differences upon which conflict could be drawn.

World War I poet Isaac Rosenberg noted within his writings and discourse that his military experience was particularly unpleasant because of the level of anti-Semitism that he perceived he received during his service.[51] Moorcroft Wilson raises issues with these feelings as she notes that Rosenberg's perceptions of victimisation do not fit with some of the other historical narratives recorded. One such case was the recollection of Corporal Harry Stansfield, who knew Rosenberg and recalled trying to befriend the 'painfully reserved man'.[51] Stansfield claimed that he tried to convince Rosenberg that religion or background had little to no standing

in the relationships within the trenches stating, 'believe me, we didn't think much about a person's background one way or the other. When you were in the trenchers, all we wanted to know was if you were a reliable comrade or if you weren't. Religion or race had nothing to do with it.'[51] In her exploration of British Jews in World War I, Kitching also alludes to this glossing over of racial and religious heritage in place of a trustworthy colleague on the front lines. Kitching explains that while much the same across Europe at this time, there was an undercurrent of anti-Semitism, Jewish men were not excluded from joining the armed forces in Britain before or during World War I. She notes that members of the Jewish community had joined the British Army at the turn of the century, with one Lieutenant Frank de Pass receiving the highest honour in the form of the Victoria Cross in 1914.[52] She also notes alongside Rosenberg's unhappiness that other men felt the opposite, citing volunteer Marcus Segal who wrote about the number of new friends he made and made no reference to prejudice.[52] The issue here may have been less about religious affiliation and more about perceived worth on the line, as noted by Corporal Stansfield. This was an issue that Army Chaplains often faced. Walker noted how poorly received Chaplain George Birmingham was in his new post at an emergency stretcher-bearers camp in 1915.[53] Birmingham was harshly advised by an officer, '"We don't want no f—ing parsons here", a sentiment that was repeated to him multiple times and reiterated by the sergeant-major (commanding officer) who declared the padre to be an 'inefficient simpleton'.[54] Birmingham notes that he had done nothing to earn this hostility; however, he had also done nothing to dissuade it. Ultimately, he became an integral part of the team through his willingness to support the medical camp. This first meeting is like the reception many chaplains faced upon arrival at their new posting. Questions abounded about the need for such men within a warzone without a weapon or official purpose beyond hymns and prayers.

Race also provided an opportunity for friction and bullying during World War I. In his seminal book *Black Poppies*, Stephen Bourne clarifies that there was no central, single experience for every Black serviceman during World War I. While discrimination was present, Black soldiers were not segregated in the same way they were in the American forces.[55] Bourne continues that while it was unlikely for Black men to achieve commanding roles and therefore have control over White soldiers, it was not impossible; men such as Walter Tull were indeed awarded a command. Unfortunately, there are no surviving individual testimonies of Black soldiers to turn to. However, there are apparent cases of racism against non-white soldiers, such as the case noted previously where West Indies soldiers chose to blow up a commanding officer's tent in retribution for unfair treatment. While not considerably so much more, there has been an enhanced focus on the experiences of Indian soldiers within historiography, not least within the excellent work by Kaushik Roy. Roy explains that the construction of the Indian Army owed much to the martial races' attitude that had permeated British-Indian relations for much the entirety of the nineteenth century.[56] Following in the wake of decades of control, interference and enforced societal class constructions, it is not surprising the inclusion of Indian men was a complicated affair, demanding detailed attention to navigate caste relationships and British-Indian relations, all under the standing British imperial tradition of *divide et impera* (divide and rule).[56] While there are several examples of discrimination of Indian soldiers, both in historiography and fiction, one of the most famous examples of overt bullying on the grounds of race lay within the diary of Indian aristocrat Thakur Amar Singh. Having trained at the Imperial Cadet Corps, Singh served as aide-de-camp to General Brunker. Despite his officer rank, Singh noted that White soldiers refused to salute him, that he was excluded from military tactical briefings and mocked for not eating beef.[57] There is much more to discuss about the inherent racism and treatment of non-whites that was systemic within the British Military during World War I. However, the point of this analysis is less about the overarching elements of discrimination and more about the reality of that differentiation in practice. Non-white serving members of the British forces during World War I were frequently required to endure an ongoing degree of exclusion and harassment that transcended rank and role. While many non-white men were respected and admired by their peers and officers, the fact remained that simply by their different racial heritage, these men were frequently singled out as victims of bullying and hazing as they served.

As always, sex remains a controversial element that must also be considered when focusing on bullying during World War I. One of the primary reasons for bullying asserted in sociological and psychological theory is the identification of behaviour deemed as deviant. To reiterate the work of Duncan, in many cases, bullying behaviour can be attributed to identifying a definable difference within which conflict and malcontent can be extrapolated. Non-heterosexual lifestyles have prompted bullying behaviours for centuries within western culture. During World War I, homosexuality could not only

be rewarded with scorn but also harsh punishments in line with societal perceptions of abnormal sexual behaviour that remained prevalent in context. As such, homosexuality is very difficult to track within any historical investigation into the early 20th century. Weeks and Porter argue that homosexuality in the military in the 19th and early 20th centuries only became visible when it occurred between ranks, and even then, the records are rare and fragmented.[59] According to Robb, 22 British officers and 270 rankers were court-martialled for homosexuality between 1914 and 1922.[60] Harvey adds that there was a significant increase in the prosecution of officers for homosexual and indecent acts in the immediate aftermath of the War. He further notes that of the 17 officers tried for homosexuality during the War, 10 were convicted in the 12 months before 30 September 1916.[61] Harvey explains that this was associated with the sudden lowering of entrance rates and requirements during a period of rapid expansion under the Derby scheme and conscription.[61] While this was not the case for known homosexuals, such as in the case of Captain Alfred C Boyd, whose homosexuality had earned him a two-year sentence of hard labour for eight counts of indecency and a refusal by the British Military to allow him to re-join for the war effort, despite his promise to pursue a heterosexual lifestyle.[61]

However, while accounts of homosexuality are scarce within the testimonies and records from World War I, there remains evidence of the abuse and humiliation men faced because of their sexuality. In one such example, Private Holbrook claimed that homosexuality was not a regular occurrence as men 'wouldn't dare', fearing reprisals from officers and other soldiers.[62] For Holbrook and his fellows, being regarded as homosexual became a part of a bunkhouse game in which any man who failed to retain cork on his person, day or night, was declared deviant, financially fined and publicly ridiculed.[62] According to social theorists such as Ervin Goffman, this internalisation of set behavioural norms, the process of which was at the heart of the military indoctrination experience, would ensure the validation of culturally-acceptable behaviours. In this case, the rejection, humiliation and stigmatisation of homosexuals.[63]

In Weeks and Porter's *Between the Acts*, there are several rare accounts of homosexual men who served as soldiers in the First World War.[59] In one example, a former soldier called 'Fred' described being taunted and humiliated because of his sexual preference. 'Fred' recounted that while billeted midway through the War in crowded Cardiff barracks, his fellow soldiers decided to humiliate him. One night a very drunken soldier openly presented his erect penis to him, demanding 'Fred pleasure him, much to the amusement of the onlooking crowd. Scathingly, 'Fred' turned the tables on the room by demanding that he must be allowed to penetrate the drunken man before he would consent to fellate him. 'Fred' recalled the immediate shift of power in the room as the man lost his erection, much to the audience's amusement: '… his old boy went down just like that. And they all burst out laughing now, making him look like a fool.'[59]

'Fred' and Holbrook's experiences of reactions to homosexuality share similarities in that the individual suspected of being a homosexual is subject to scorn and humiliation. Homosexuality within a military environment is a complicated topic, as situation, opportunity, previous inclination, social pressures and individual perceptions of sexuality all intersect within the consideration. Ward argues that depending on circumstance, many sexual interactions between men are not regarded as homosexual in nature. She considers the history of male heterosexual discourse over the action of homosexual activity within key social groups or situations, noting how homosexual-type actions often appear within bullying behaviours such as 'hazing' rituals in events common to fraternities and sports teams.[64] Nudity, penetration and eating from orifices are common events in such cases, yet Ward explains that these actions are typically exempt from the label of 'homosexual' act.[64] While Ward's argument is centred on men within a modern context, she notes Judith Kegan Gardiner's assertion that the 20th century witnessed a shift from anally-retentive masculinity in the early-to midcentury to an 'explosive anality' towards the beginning of the 21st.[64] Ward also builds on Belkin's work, whose research on American military homosexuality has done much to define the field. Belkin explains that acts of penetration could serve a dual purpose of humiliation and actualisation as '…some military practices construct being penetrated as the ultimate taboo for a warrior. Others construct it as central to what it means to be a real man.[65]

As complicated as this may be, the point remains that sexuality provided an opportunity for men during World War I to take exception to and abuse each other. Yet, bullying on the grounds of sexual activity was not limited to homosexual practice. Bourke discusses male sexual activity and proclivity during their time in military service while noting that being removed from their civilian lives and identities opened up a plethora of educational and physical opportunities for sexual exploration.[9] She presents the testimony of young soldier John William Rowarth

who was mocked for his sexual inexperience: 'One of my mates said to me. Casey have you ever dipped your wick, what do you mean, I ain't got no wick to dip, when the laughter had subsided, they put it more bluntly had I ever made love to a girl, when I said no, oh you must be a bloody virgin then…(sic)'.[9] Rowarth's proceeding sexual adventures proved to be problematic and lacklustre. When he finally managed to lose his virginity, he was underwhelmed by the experience telling his mates that it was the same as 'pulling your thing, but you have someone to talk to'.[9] Bourke adds the testimony of another man, Lieutenant Gareth Smithies Taylor, who also found the practice of pursuing sex distasteful. Taylor noted in his papers that he could not enjoy the experience and only did so because of the peer pressure that expected him to do so.[9] Cherry also argues that men often inflated or exaggerated their sexual activities to save face during barrack-room talk to prevent mockery.[66] Reiterating how sexual proclivity could provide an ample opportunity for bullying and hazing if one's personal activities deviated from the accepted norms of behaviour.

Ultimately, these separate aspects of life during service in World War I demonstrate how cases of bullying and hazing were not. These examples are often driven by a lack of tolerance for a-typical behaviour. Some men laughed off the abuse and others responded in the extreme. Yet, the story remains the same: as the War progressed, those who found themselves outside the expected norm were often faced with humiliation, intimidation and discrimination.

A continuing issue

Bullying and hazing remain contentious subjects within the modern British Military, so much so that agreements on the line between the two remain inconsistent and blurred. Such treatment of individuals within the service has become a widespread moral panic, with sensationalist headlines decrying incidents of degradation and humiliation, often forcing comment from the Ministry of Defence. This was the case in 2019 when the public was made aware of the consistent bullying of serviceman Mark Holder. His treatment included having his picture used for target practice.[67] Holder subsequently claimed that the harassment he received forced him out of the armed forces. This episode is similar to the investigations into several suicides at Deepcut barracks in Surrey between 1995 and 2002, which again all inferred the involvement of bullying and abuse.[68] Evidently, despite the length of time that this has been a concern for militaries worldwide, a solution has yet to be found.

Conclusion

Bullying within the British Armed Forces is not a new phenomenon. During World War I, far from being the subject of sensational headlines, bullying was highlighted in parliamentary debate as part of the course for creating successful soldiers. As men transformed and served their country, they encountered several opportunities to endure and enact bullying behaviour, as men's close-quarter living, range of diverse backgrounds and unique individual perspectives clashed against the backdrop of brutal training, muddy battlegrounds and a uniform cramped existence between 1914–18. Still, as noted, men often experienced innovative bullying even before they received their uniforms (or refused it in the case of conscientious objectors), as the behaviour was repurposed and targeted to bring men into the military to fight for their country.

The examples in this article are varied and far-reaching. The men who bullied and experienced bullying often have very different accounts. It is important to recognise the limitations of this historical analysis in that the evidence is often one-sided and subjective, with no opportunity for rebuttal. It is also not possible within the confines of an article to consider the nuances of every case and explore each bullying motivation from all perspectives. Yet, this should not reduce the importance of the argument that bullying was very much part of World War I experience for many British men who served. Be it that they experienced it, perpetrated it, witnessed it, heard about it or some combination thereof, bullying, as classified in the opening of this article as the 'overbearing mistreatment and domination of others', can not only be located in the various histories of World War I but is surprisingly visible once those sources are collated. Bullying in the War was a form of enlistment, training and indoctrination, interrelational engagement and a recreational, social pastime. Bullying pushed men to take their own and other men's lives, leaving a lasting impact that remains striking within individual testimonies a century after the event. Post centenary, the heroic glorification of World War I has begun to wane again. It is painfully obvious that many of the issues men faced during the chaos of those four years in the beginning of the 20th century remain today, as questions continue to be levied about the nature of bullying and hazing within the makeup of the modern military.

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Changing the Way We Treat Tinnitus

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Abstract

Tinnitus is among the top three most frequently accepted service-related conditions for Australian veterans. Veterans have described the effects of tinnitus as causing physical, emotional and social problems. In addition, many veterans with tinnitus, especially those with troublesome tinnitus, have other health conditions, such as hearing loss, insomnia, anxiety and depression.

Research suggests tinnitus develops due to maladaptive neural changes in auditory and non-auditory pathways. This is thought to be due to actual or potential physical or psychological trauma. Hence, treatments focusing on physical and psychological factors, including emotional, attentional, behavioural and social aspects, obtain the best outcomes in reducing tinnitus-related distress. The most promising therapy to address these factors is cognitive behavioural therapy, particularly in a multidisciplinary setting, for which robust evidence exists.

Keywords: tinnitus, cognitive behavioural therapy, hearing loss

Introduction

Tinnitus is complex, multifactorial and not fully understood.[1,2] It is the perception of sound that has no external source, commonly described as ringing, buzzing, hissing, clicking or humming perceived in one or both ears and as coming from within or outside the head.[3,4] Research suggests that it most often develops as a result of maladaptive neural changes in auditory pathways and in attentional, memory, cognitive and emotional areas of the brain. This usually happens after an actual or potential physical or psychological injury, much the same way that cognitive-affective processes play a key role in the experience and maintenance of chronic pain.[2,5-8]

Military personnel are often exposed to hazardous occupational noise, including noise from gunfire and machinery during service are at high risk of tinnitus.[9] In addition, they may be exposed to somatosensory system disturbances and emotional stress during service.[2] Traumatic brain injury (especially blast-induced), concussion, hearing loss and post-traumatic stress disorder experienced by military personnel can lead to or exacerbate tinnitus.[10,11] Veterans are vulnerable to 'acoustic shock' an involuntary trauma response to a sudden, brief and unexpected loud sound, for example, blasts and weapon fire. This can lead to tinnitus, startle reactions and hyperacusis (an increased sensitivity to sound in which the person may find sounds painful or distressing). This sensitivity can lead to anger, anxiety and depression, significantly impacting quality of life. Unfortunately, it is not well understood, diagnosed or treated.

In the United States, tinnitus is the most prevalent service-related disability of veterans registered with the Veterans Benefits Administration.[12] In 2020, tinnitus was among the top three conditions accepted as service related for Australian veterans, with 39 500 having an accepted tinnitus condition. Of these, almost 9000 served in East Timor, Solomon Islands, Afghanistan and Iraq (contemporary veterans), and 11 500 were Vietnam Veterans.[13]

Veterans with tinnitus may be reluctant to talk about their tinnitus or its full impact on their lives, even with their family and friends, and 'soldier on' without seeking help.[9] There may be several active military personnel and veterans in Australia who have tinnitus but have not shared that information with family members or sought treatment.

This review describes the impact tinnitus can have on veterans' lives and emphasises the benefits of a multidisciplinary approach, including cognitive behavioural therapy (CBT), to reduce the perceived severity of tinnitus.

The impact of tinnitus on veterans' lives

Veterans and active military personnel have described the effects of tinnitus as causing physical, emotional and social problems, which have a detrimental effect on concentration, work performance, communication and interactions with other people.[9] Many veterans

report that they cannot relax or sleep well, which stops them from enjoying a full social life.[9,12] For active service personnel, the effects of tinnitus may influence their ability to carry out assigned tasks, especially in combat situations.[12]

Not all veterans with tinnitus are troubled by it. Many can adapt to the noise over time.[1] Some report it as being of a moderate problem, but still requiring intervention.[9,12] For others, their emotional wellbeing is substantially affected by their tinnitus.[6,12] Many of these veterans have other health conditions in addition to their tinnitus, such as hearing loss, sleeping problems, traumatic brain injury, substance misuse disorders and mental health issues, including anxiety and depression.[6,9,12,14] Some veterans with troublesome tinnitus may also experience social phobias and adjustment disorders.[15,16] Others report feeling angry and frustrated, overwhelmed, exhausted, hopeless or even suicidal.[6] Some veterans with tinnitus have multiple comorbid mental health conditions and complex needs that require careful planning of their treatment.[14,17]

Tinnitus is often a chronic condition for which no medical or pharmacological treatment is currently available.[12] A multidisciplinary approach that addresses cognitive, behavioural, attentional, emotional and social aspects can help to reduce the perceived severity of tinnitus and improve veterans' quality of life.[1,6]

Early referral of veterans to a psychologist or audiologist

The most promising therapy to address cognitive, behavioural and emotional factors associated with tinnitus is CBT, for which there is robust evidence.[1,3,18-20] CBT, delivered by trained psychologists or audiologists, primarily focuses on identifying negative or unwanted thoughts about tinnitus that results in distress, and challenging, modifying and replacing those thoughts and emotions with more helpful and realist beliefs (see Figure 1).[3,18]

An audiologist can help patients understand how neurological pathways work to process potentially threatening sounds and why tinnitus can be triggered and propagated. In addition, acknowledging the trauma of what may have caused the tinnitus can help prepare the foundation for CBT.

CBT aims to reduce tinnitus-related distress and improve quality of life. It may not reduce the noise of the tinnitus or eliminate its occurrence.[3,7] CBT is strongly recommended, especially if tinnitus is troublesome and distressing.[1,3]

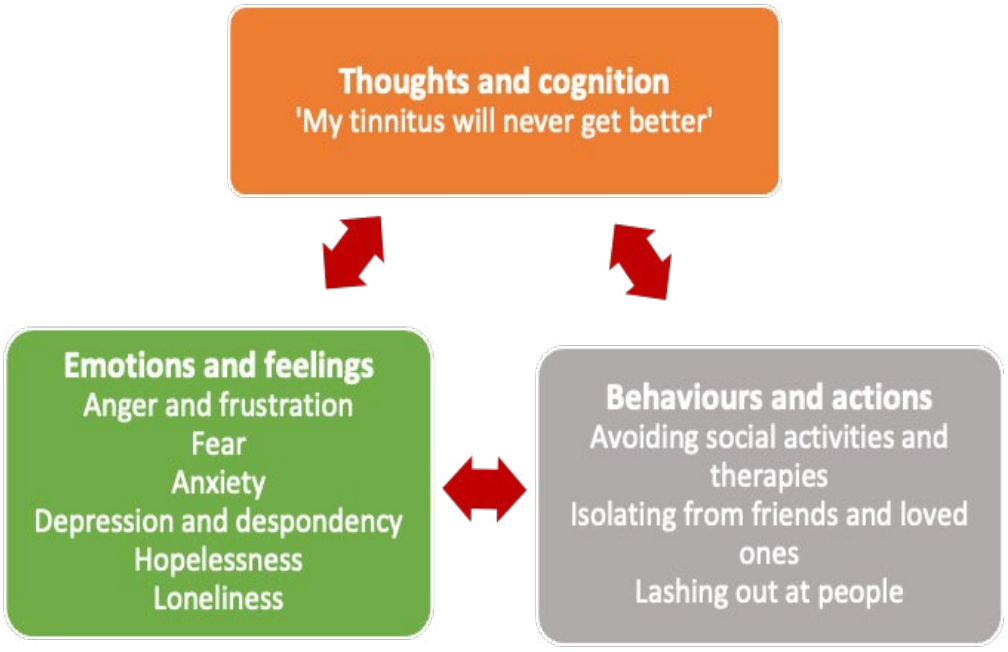

Figure 1. The negative and irrational thoughts, emotions and behaviours about tinnitus that are challenged and restructured by the psychologist during CBT[3]

CBT for tinnitus includes learning relaxation techniques and sleep hygiene.[3] Internet or smartphone-based tinnitus treatments that include CBT have been shown to be helpful.[19-21] For veterans with chronic pain and tinnitus, psychological treatments, such as CBT that addresses psychosomatic symptoms, negative coping attitudes and emotional tension, can reduce both tinnitus and pain-related distress.[8]

CBT can also help address depression, anxiety and poor sleep, and is strongly recommended as first-line therapy before any prescription of an antidepressant, anti-anxiety or hypnotic medicine.[22]

Research in the United States suggests CBT for tinnitus is not commonly discussed as a treatment option for veterans with tinnitus.[23] Analysis of Australian Government Department of Veterans' Affairs (DVA) health claims data indicates that only 8% of White and Gold Card holders with tinnitus have made a claim for a psychologist's visit.[24]

Through non-liability health care, DVA funds evidence-based mental health treatment provided by mental health professionals for mental health conditions for veterans without needing the condition to be accepted as related to service. For further information, go to: www.dva.gov.au/health-and-treatment/injury-or-health-treatments/mental-health-care/free-mental-health-care-veterans

Box 1: Resources for health professions to treat veterans with tinnitus

- Comprehensive tinnitus information for the public as well as information and training for clinicians at: www.tinnitusaustralia.org.au
- An audiologist at: www.audiology.asn.au
- A psychologist (Australian Psychological Society) at: www.psychology.org.au/Find-a-Psychologist
- A psychiatrist (Royal Australian and New Zealand College of Psychiatrists) at: www.yourhealthinmind.org/find-a-psychiatrist
- Other health services, including social workers and occupational therapists (Healthdirect) at: www.healthdirect.gov.au/australian-health-services
- The 2020 Royal Australian and New Zealand College of Psychiatrists clinical practice guidelines for mood disorders at: www.ranzcp.org/practice-education/guidelines-and-resources-for-practice/mood-disorders-cpg-and-associated-resources
- Open Arms – Veterans & Families Counselling
  - For mental health and wellbeing support for DVA clients, Open Arms – Veterans & Families Counselling is available 24/7 by phoning 1800 011 046
  - For assessing and treating veterans with anxiety, PTSD, depression, insomnia, alcohol and substance misuse, problematic anger or complicated grief, go to: www.openarms.gov.au/health-professionals/assessment-and-treatment
  - To help your veteran patient access a suite of self-help SMART (Self-Management And Resilience Training model) tools designed specifically for them to enhance their stress management skills and build resilience by addressing physical responses, thoughts, emotions and behaviours, go to: www.openarms.gov.au/get-support/self-help-tools#!/home
  - To help your veteran patient access a suite of short videos (1–20 minutes) to learn to relax and gain control using controlled breathing, muscle relaxation and meditative strategies, go to: www.openarms.gov.au/get-support/self-help-tools/show-all-tools

Referring veterans to an audiologist for assessment, review or treatment, including devices

Noise-induced hearing loss, often associated with tinnitus, can exacerbate the distress experienced by veterans with troublesome tinnitus. Sensorineural hearing loss is the second most common condition accepted as service related among Australian Vietnam and contemporary veterans.[13] Thirteen per cent of the known 39 500 Australian veterans with tinnitus have claimed a hearing device.[24] Some veterans with tinnitus may not be aware they have hearing loss. Trouble communicating and the resultant frustration and distress might have more to do with undiagnosed hearing loss than with their tinnitus.[25]

Untreated hearing loss is associated with an increased risk of cognitive decline and dementia, social isolation,[26-28] depression and irritability.[29,30] Treating hearing loss can lessen the intrusiveness of tinnitus.[1] The additional benefits of treating hearing loss include improving concentration, communication, cognition and quality of life.[3,30,31]

Offer to refer veterans who report hearing difficulties or have tinnitus that is troublesome, and who have not seen an audiologist recently to an audiologist for an assessment or review, or to discuss devices to help with tinnitus.[3,4,32] An audiologist can conduct impedance audiometry and tympanometry to assess hearing deficits and middle ear and eardrum function, provide tinnitus rehabilitation and counselling, and fit hearing aids and assistive listening devices as needed.[32]

Audiology Australia can help find an audiologist at: https://audiology.asn.au/Home The list can be filtered to find an audiologist who specialises in treating people with tinnitus.

Under the Repatriation Transport Scheme, DVA funds transport assistance for eligible Veteran Card holders to travel to approved treatment locations. If your patient requires assistance with transport to approved tinnitus appointments, go to: https://www.dva.gov.au/about-us/overview/overview-dva-benefits-and-services

Referral to an ear, nose and throat specialist

Consider referral to an ear, nose and throat (ENT) specialist for further investigations and treatment if the tinnitus is:

- pulsatile or unilateral[32]
- rapidly progressive
- associated with sudden, asymmetric or fluctuating hearing loss
- associated with a feeling of fullness or pressure in one or both ears
- associated with vertigo or balance problems.[1,33]

To find an ENT specialist, go to Healthdirect, at: www.healthdirect.gov.au/australian-health-services

Box 2: DVA-funded hearing services and tinnitus treatments for eligible Veteran Card holders

- Audiology consultations and investigations to assess hearing and tinnitus can help determine whether tinnitus and hearing loss are service related.
- Hearing devices and support through the Australian Department of Health Hearing Services Program on 1800 500 726 or at: www.hearingservices.gov.au.
- Assistive listening devices through the Rehabilitation Appliances Program (RAP), including:
  - induction loops (a cable that picks up and transmits sound to a hearing aid allowing better hearing in a designated induction loop area)
  - headsets for watching television
  - microphones and frequency modulation (FM) listening systems (a handheld microphone that transmits sound directly to the hearing aid)
  - doorbells and smoke alarms with lights
  - streamers that transmit sound from a mobile phone, tablet or television to a hearing aid.
- Cochlear implants and treatment through the Hearing Services Program. Phone 1800 500 726.
- Tinnitus treatment for eligible veterans with severe tinnitus that cannot be managed through the Hearing Services and RAP programs. Only an audiologist or ENT specialist can refer a patient for the DVA-funded tinnitus treatment. Treatment may include:
  - a clinical assessment and treatment by a specialist audiologist
  - specialised counselling by a specialist audiologist, for example, tinnitus retraining therapy and use of sound enrichment devices
  - hearing aids with tinnitus settings and devices to assist with sleeping.

For further information about eligibility, programs, services or hearing devices, contact DVA on 1800 550 457 or go to: www.dva.gov.au/providers/health-programs-and-services-our-clients/hearing-service-information-providers.

Education, support and self-care can empower veterans

Many veterans in a United Kingdom study expressed a need for a better understanding of tinnitus and access to support groups.[9] Research indicates a possible way to reduce severe symptoms can be found for many people when they are able to understand their tinnitus better. In particular, how the brain evaluates and filters sounds subconsciously via auditory and non-auditory pathways, and how the somatosensory system and negative thoughts and beliefs can influence tinnitus severity.[34]

Information and support can be empowering; encourage veterans with tinnitus to access Tinnitus Australia at: www.tinnitusaustralia.org.au and to read through DVA's *The Veterans' guide to better hearing* to gain an understanding of tinnitus and hearing loss, available at: www.dva.gov.au/sites/default/files/files/p04129-guide-to-better-hearing.pdf

Talk to veterans with tinnitus

Explain to veterans that:

- tinnitus is a symptom rather than a disease, and many strategies can help reduce its perceived severity[3]
- while medical investigations may be needed initially to rule out possible causes, tinnitus rarely indicates a serious illness[1]
- no single treatment works for everyone. A coordinated multidisciplinary approach that involves a range of strategies, including CBT and Acceptance and Commitment Therapy, self-care, education, mindfulness and relaxation, communication and auditory therapies, and devices such as hearing aids and assistive listening devices, as well as sound therapy, can be helpful.[3,4,35] These therapies focus on helping the person to adapt and better manage their emotional reaction to their tinnitus[6]
- tinnitus can be a bit like an 'emotional barometer'; emotional stress, anxiety, poor general health, pain, lack of sleep or exposure to loud noises can heighten the noise along with anxiety and distress.[1, 3] Likewise, doing enjoyable things each day can help make the noise seem less noticeable and lessen anxiety and distress.[1]

There are no proven medicines to improve tinnitus

Although numerous medicines, herbal extracts, dietary supplements and vitamins have been tried in the treatment of tinnitus (for example, antidepressants, anxiolytics, antiepileptics, betahistine, *Ginkgo biloba*, melatonin and zinc), there is little to no evidence that these therapies are of benefit to people with tinnitus.[1,4,16,36-39] In addition, these medicines and supplements could also have adverse effects and interact with other medicines.[36-38]

Some veterans may think that the medicines they take for tinnitus, such as anxiolytics or antidepressants, help their tinnitus. Explain to veterans the importance of stopping ineffective therapies and emphasise the benefits of seeing a psychologist to help them adapt to their tinnitus and reduce their distress.[18] While some medicines may not be able to be changed or stopped, it may be appropriate to taper or cease many.

For information on how to:

- taper or cease antidepressants, go to: www.veteransmates.net.au/topic-49-therapeutic-brief
- manage benzodiazepine dependence, go to: www.nps.org.au/news/managing-benzodiazepine-dependence-in-primary-care.

To help veterans better understand the risks associated with taking sedative-hypnotic medicines, direct them to: www.criugm.qc.ca/fichier/pdf/BENZOeng.pdf, or for further resources about medicines and falls or memory loss, go to: www.deprescribingnetwork.ca/patients-and-public.

Medicines rarely cause tinnitus

There are many anecdotal reports of medicines causing tinnitus, but there is acceptable evidence for a small number, and in these cases, tinnitus as a side effect occurs only rarely.[40] The risk of ototoxic effects from medicine use is higher with older age, long-term use, renal or liver impairment and when ototoxic medicines are combined. Most ototoxic effects are temporary and dose-dependent. In most cases, normal doses do not cause tinnitus.[36, 41]

Medicines associated with ototoxic effects include:

- Antimalarial medicines, including quinine-based agents; tinnitus can occur with prolonged daily doses greater than 200–300 mg, but is usually reversible[36, 42-44]
- Non-steroidal anti-inflammatory drugs (NSAIDs), including aspirin, with doses higher than 4 grams per day. Tinnitus is almost always reversible within a few days of discontinuation of the aspirin.[44] Tinnitus occurs in less than 0.1% of patients with other NSAID use[36, 44]

- Loop diuretics, including furosemide, produce a dose-related, usually reversible ototoxicity, primarily affecting patients with renal impairment[36, 44]
- Tinnitus can occur with furosemide when a total daily intravenous dose is greater than 240 mg,[44] or oral administration of 160–800 mg per day in patients with renal impairment[44]
- Antibiotics, including aminoglycosides (gentamicin and streptomycin), glycopeptides (vancomycin) and macrolides (erythromycin and azithromycin)[36]
- Chemotherapies, including methotrexate, cisplatin, carboplatin and vincristine. Effects may be temporary or permanent.[36]

Conclusion

Tinnitus is a common service-related disability associated with psychological distress and poorer functioning and health among veterans and military personnel. Better recognition, assessment and management of tinnitus in both military personnel and veterans may reduce suffering and improve quality of life.

While there is currently no pharmacological or medical treatment for tinnitus, several effective management strategies can help veterans to improve the quality of their everyday lives. CBT seems to be the most promising therapy; however, many other things can help, including audiologist referral, educating patients about their condition, talking and sound therapies, relaxation and mindfulness-based therapies, and group support. These are best implemented using a coordinated multidisciplinary framework.

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English Medieval Ships, Warfare and Medicine

N. Westphalen

Introduction

Previous articles describe the development from prehistory to the end of the Viking period, of a cycle whereby increasing trade necessitated larger and more efficient ships to transport merchandise and better weapons to defend or attack them, both of which facilitated more trading opportunities.[1,2,3,4] However, it was not until the mid-18th century that Western medicine had sufficiently developed for its role as an operational enabler of this cycle to be recognised, which, among other things, made possible the European settlement of Australia.[5]

While the technical developments in ships, weapons and medicine driven by this cycle often developed independently in multiple regions worldwide, they remained closely linked throughout Western history. This article updates a previous paper that describes some of the technical and other developments in ships, warfare and medicine during the English medieval period between 1200 and 1500.[6]

Medieval ships

By the end of the Viking period, Northern European ships mostly comprised 'knorrs' (also 'knarrs'). These were essentially large open boats, with overlapping-edge or 'clinker-built' hulls that were shorter, rounder and progressively less amenable to being rowed compared to their Viking longship predecessors, and a single mast with a single square sail.[7] Lacking permanent cabins, any crew and passenger shelter was made of canvas, while hot food would have been prepared—if and when the need arose—over a wood fire on an open deck.[8] Although their seaworthiness, combined with the European introduction of the navigation compass sometime before 1190, would have allowed them to undertake limited voyages offshore, their susceptibility to being swamped and sunk meant knorrs routinely undertook brief coastal passages only during the northern summer months.[9]

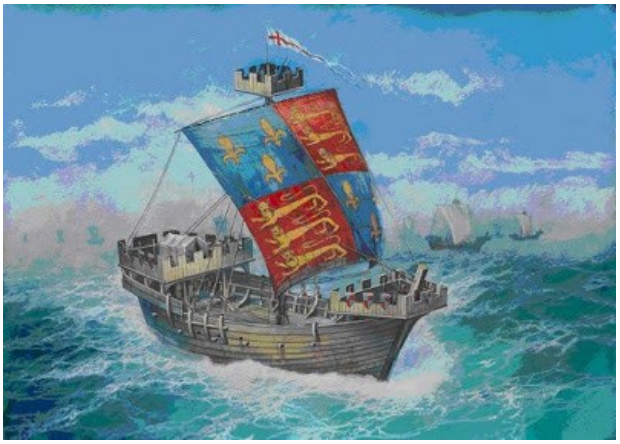
However, increasing trade required larger ships, which led to knorrs becoming 'cogs'. These had centre-line rudders instead of steering oars, which improved their manoeuvrability and allowed them to come alongside on the 'steerboard' side of the ship as well as the 'port'. Cogs also had hulls deep enough to need weather decks to work the ship, which, besides reducing their risk of being swamped, created space below for crew and passenger accommodation and cargo. Besides making living conditions slightly less arduous, these developments made cogs safer and more profitable in peacetime while also allowing them to carry more troops and supplies in war.[10,11] Even so, their small size continued to limit their winter operations. At the same time, the absence of efficient bilge pumps not only still made for wet living conditions below but also increased the hygiene hazards posed by stagnant seawater, decomposing food waste and spilled perishable cargo, rats and their droppings, and sewage from passengers or troops relieving themselves below rather than on deck in bad weather. Although a prohibition on undressing at sea further exacerbated these hazards,[12] they were partly mitigated by the cog's endurance remaining limited to, at most, a few days.

By 1285, cogs had also acquired temporary wartime fore-and-aft 'castles', which gave soldiers a height advantage to either grapple and board or defend against such attacks. These castles were permanently integrated into the cog's structure from about 1350, allowing their crews to use them to defend against (or partake in) peacetime piracy. The space below the castle decks came to be used for crew accommodation (sailors forward, officers aft), freeing the hold below the weather deck for additional passengers and cargo or troops and stores.[13,14]

As the northern powers extended their trade into the Mediterranean, their crews were exposed to local shipbuilding traditions that greatly influenced their own. By 1400, larger cogs had acquired two or more masts, thereby becoming 'carracks'. [15,16] Over the next century, the single large square sail on each mast was displaced by two or more easier-to-handle sails, with additional fore-and-aft 'lateen' sails at the ship's rear to balance the sail plan, and assist heading upwind. As carracks themselves increased in size, the limitations of clinker-built hulls led to their carvel (edge-to-edge) construction. This resulted in ships large enough to acquire a second 'lower' deck below the weather or 'upper' deck, thereby freeing the hold for cargo except for the galley or 'cookroom' amid the aforementioned effluvia that remained despite the first effective bilge pumps.

Hence by 1450, northern European carracks could remain at sea in most weathers over weeks or months, with enough passenger and cargo-carrying capacity to make longer voyages profitable. These capabilities initiated an era of exploration over the next three centuries to pursue opportunities for worldwide trading (and later colonisation). However, although they had sufficient clientele to justify seagoing surgeons—especially when carrying troops—and (just) enough room for them to work on board, the concomitant advances in personal and shipboard hygiene, food and water preservation, clothing, ventilation and other attributes necessary to prevent disease—not only as an end unto itself but to also facilitate trade opportunities—were not achieved until after the 1740s.

Knorr, c.1200. Note the clinker-built hull, steering oar, open deck without shelter and small crew size.[17]



Representation of Edward III's flagship Cog Thomas, *which fought the Battle of Winchelsea on 29 August 1350. Note the clinker-built hull with central rudder, weather deck enclosing the hull, and non-integral fore-and-aft fighting castles. Her troops are omitted.*[18]

Carrack, c.1400. Note the carvel-built hull with integral fore and after castles, the additional stern fighting castle, two masts with an aft lateen sail, and greater crew size.[19]

Replica carrack c.1500, Vila do Conde, Portugal. Note the carvel-built hull, three masts with yards for one or more sails, and integral bow and stern castles.[20]

English medieval naval warfare

During the five centuries following the 1066 Norman conquest, the term 'navy' referred to all the ships that enabled English maritime power, whether owned by the monarch (if he had any) or his merchant subjects and was mostly limited to the Channel and the North Sea. Besides trading with continental Europe, they were used to transport armies and their stores to and from France, countering piracy and defending against invasion. Moreover, the monarch would hire his ships out to the merchants for trade and 'arrest' their ships and crews for his own purposes when required. In addition, the harbours at Dover,

Hastings, Hythe, Romney and Sandwich (which remained the Cinque Ports despite the addition of Rye, Winchelsea and other towns from the 1190s) furnished the monarch with 1140 men and 57 ships for 15 days per year in exchange for certain tax privileges.[21] Furthermore, English ships were built in ad hoc locations rather than dedicated shipyards until the early 15th century. While a Clerk of the King's Ships provided administrative support for all royal and 'arrested' ships from 1344, this typically entailed only managing the finances.[22]

Hence, medieval English mariners performed their duties interchangeably between their monarch and private employers under the *Laws* (also Rules or Rolls) *of Oléron*. 'Olroms' originated as the *Maritime Assizes of the Kingdom of Jerusalem*, which were based on the ancient *Lex Rhodia* that had governed Mediterranean commerce for centuries prior to the Christian era. They were introduced to England by Henry II's wife, Eleanor of Aquitaine, who brought the assizes from the Second Crusade and set up a maritime court on the Ile of Oléron to administer them sometime after 1160. On their incorporation into English law in 1190, they covered numerous matters, including the responsibilities of masters with respect to hiring their crew, profit shares, discipline and welfare.[23]

As 'Olroms' applied to all English ships, irrespective of who owned them, shipboard 'command' was held by the same 'master' in both peace and war. These began their professional life as apprentices when the absence of charts or pilot guides meant their navigation skills, in particular, were dependent on memory.[24] As ships became larger and more complex, they required increasingly specialised crewmembers such as the boatswain, carpenter and cook, who were joined in the royal ships by the gunner, purser and, from 1510, the surgeon. Apart from the cook—whose job existed to keep disabled seamen employed and hence did not require any culinary expertise—their professional development was likewise based on long apprenticeships. The master's role as a 'first among equals' per 'Olroms' meant there was no formal seagoing 'officer class' until the mathematically-based navigation methods introduced in the mid-16th century required better literacy skills.

Although the prevalence of piracy meant that sailors often had to defend themselves even in peacetime (unless engaging in it themselves), soldiers were carried on the rare occasions that entailed serious battles.[25] These included an action off Dover in 1217 at the end of the First Baron's War, and the battles of Sluys (modern Sluis) in 1340 and Les Espagnols-Sur-Mer in 1350 during the Hundred Years War. These entailed the sailors getting their ships close enough for the embarked soldiers to attack with bows and lances until they could grapple and board, and then either holding alongside or breaking free of their opponent, depending on how the battle fared. Boarding led to melee hand-to-hand fighting with swords and axes while the opposition threw rocks and lumps of metal from the masthead tops. Neither side gave quarter, and the losers went over the side whether or not they were wounded.[26]

These soldiers came under a military commander, who, in accordance with their feudal obligations to their monarch, came from the English aristocracy on the same terms as ashore. This usually also gave them command over the master and his crew, which they continued to exercise even after their soldiers were rendered redundant by large-calibre below-deck guns after 1500.[27] Hence, by the mid-16th century, English royal ships had evolved two types of officer: 'gentlemen' who were 'commissioned' to exercise command on the monarch's behalf, and 'tarpaulins', who received 'warrants' from the Navy Board introduced by Henry VIII in 1546. The latter included naval surgeons, who did not have commissioned status until 1843.[28]

The first English ship known to carry guns was the *Christopher of the Tower* in 1338. She had three iron guns and a handgun, which were mounted on the fore and after castles as anti-personnel rather than anti-ship weapons.[29] It was not until after 1410 that Henry IV began mounting large numbers of such guns aboard his ships, while his son, Henry V, built larger and stronger ships (including the world's first three-masted carrack *Grace Dieu*) with multi-storied fighting castles and more tumblehome to accommodate them.[30,31] However, Henry V's ships were sold after his death in 1422, leaving England to rely again on merchant ships for its naval defence. It was Henry VIII who founded the current Royal Navy in 1509, as a force of dedicated state-owned warships with their own dockyards and other shore-based infrastructure.

Battle of Dover (also called the Battle of Sandwich), 24 August 1217, showing the capture of the French flagship,[32] Note the knarr-type hull without castles, grappling hook, axe and swords… and the men going over the side.

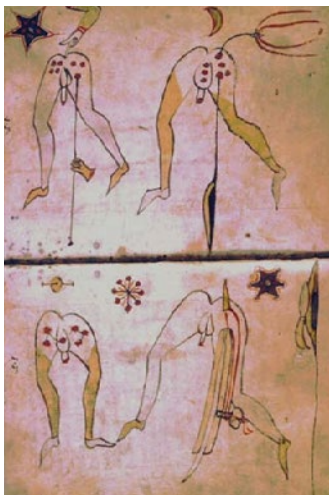
Battle of Sluys, 24 June 1340.[33] Note the cog hulls with castles, fighting tops… and more men going over the side.

English medieval naval medicine

English medicine before 1150 had generally relied on folk traditions of leeches, charms and medicinal herbs, many being introduced by Viking, Anglo-Saxon and other post-Roman invaders.[34,35,36] These traditions were gradually subsumed by clerical scribes such as Roger Bacon (c.1214–1292), a philosopher-friar whose writings advocated the study of nature through empirical observation.[37] In referring to sources such as the Salerno medical school established after c.900 AD, these scribes led to English medicine becoming aligned with the Galenic model used by the rest of western Europe, in which the Church had become the key repository of medical knowledge.[38,39] The folk-medicine herbalists and drug-sellers developed into apothecaries, who became part of the Guild of Pepperers in 1180, followed by the Worshipful Company of Grocers in 1373. Although the Royal College of Physicians London was not established until 1518, the relationship between English university-educated physicians and apprenticeship-trained apothecaries had long entailed a small select group of the former catering to the nobility who could afford them, while supervising the latter selling their wares to the masses.[40]

English medical developments during this time were also facilitated by Richard I's Third Crusade (1189–1192), which found that many Middle Eastern powers had highly organised military medical organisations derived from the old Roman Empire, whose physicians often proved more efficient than their own.[41] An exception was Gilbertus Anglicus, an English cleric-physician whose *Compendium Medicinae* (probably written between 1230 and 1250) included the first medical advice for sailors. It advised seafarers to keep clean, protect their heads from the sun, eat a moderate diet with plenty of fruit (anticipating the prevention of scurvy) and exercise. Gilbertus also anticipated a 19th century Admiralty regulation for airing clothing and bedding to rid them of fleas and lice, and even indicated that drinking water could be distilled from seawater.[42]

The best-known medieval English cleric-surgeon was John of Arderne (1307–c.1377), who wrote over 50 manuscripts with more than 250 illustrations, the most famous being his treatise on anal fistulas.[43] He is believed to have served as a military surgeon at the Battle of Crecy in 1346, Antwerp in 1338 and Algeciras in Spain in 1343, where gunpowder was used in battle for the first time.[44]



Extract from John Arderne's Fistula in Ano. *The bottom-left illustration shows a probe inserted into a fistula to be met by the finger in the anus. Top left shows a ligature passed through the fistula using the probe. In the bottom right, the ligature is through all the fistulae, and the top right uses the ligatures to guide laying them open.[45]*

However, from 1139, the clergy were progressively discouraged from teaching or practising medicine outside their monasteries for financial gain.[46] Despite encouraging 'houses of pity', Pope Innocent III prohibited priests from performing surgery involving cautery or incision in 1215, while Henry III prohibited all English clergy from practising any medicine the following year.[47,48,49] Hence, the clergy began training the barbers who shaved their tonsures in minor procedures such as bleeding, cupping, dental extractions and lancing abscesses, which led to the founding of several barber-surgeon's guilds throughout England, including the London Barber-Surgeons Company in 1308. In 1376, the London barber-surgeons were separated from the barbers within the same company, who, despite having soon dropped the 'barber' prefix, did not form their own company until 1745. Meanwhile, a 1462 Royal Charter required the London Barber-Surgeons Company to provide surgeons for the army and London and the navy after 1510. Hence, as many barber-surgeons would have begun their careers at the 'houses of pity', it would have been these young itinerants who first treated mariners ashore, which were eventually compelled or 'impressed' by the London Barber-Surgeons Company on behalf of the monarch to go to sea.[50]

A Fellowship of Surgeons was founded in 1363, comprising a small pool of university-trained surgeons to serve the nobility and supervise the barber-surgeons' guilds on similar terms as the physicians and apothecaries. Having established regulations for examining the London barber-surgeons in 1435, agreement with the company they ostensibly supervised was not reached until 1493. After a somewhat precarious existence, the Fellowship was subsumed into the latter in 1540. At that point, the new London Barber-Surgeons Company's charter also allowed for the provision of four executed criminals per year for teaching purposes and specified that, although surgeons were not to cut hair nor barbers to perform surgery, both could continue to extract teeth.[51,52]

Although an attempt was made in 1421 to combine English physicians and surgeons into one college, this failed three years later, resulting in a split within the medical profession that endured for the next 400 years. This had two crucial effects on British naval medicine: the physicians' higher social status meant they rarely, if ever, went to sea, while 'sea surgeons' lacked the legal authority and expertise to treat the medical cases that came to comprise most of their workload. Putting surgeons rather than physicians on ships also reflected the assumption that they were only needed for treating battle casualties among the soldiers: sailors were not expected to be wounded because they had no direct fighting role.[53]

As previously described, the care provided by physicians to their lord as part of their retinue meant their soldiers generally did without. It was not until 1415 that Henry V indentured his personal surgeon and physician to serve in France for 12 months during the Agincourt campaign. Although both were required to provide archers, the surgeon also had to find 12 junior colleagues who were paid the same rate as the archers hired by their master.[54] While their treatment of wounds caused by edged, thrown, torsion and bludgeon-type weapons would have followed the previous 1000 years of Galenic practice, the new firearms created a new type of wound characterised by greater amounts of devitalised tissue. The increased morbidity and mortality from the ensuing local and systemic infections, up to 600 years before the need to debride such wounds were recognised, led to a belief that they were poisoned by gunpowder until the French surgeon Ambroise Paré explained otherwise over a century later.[55]

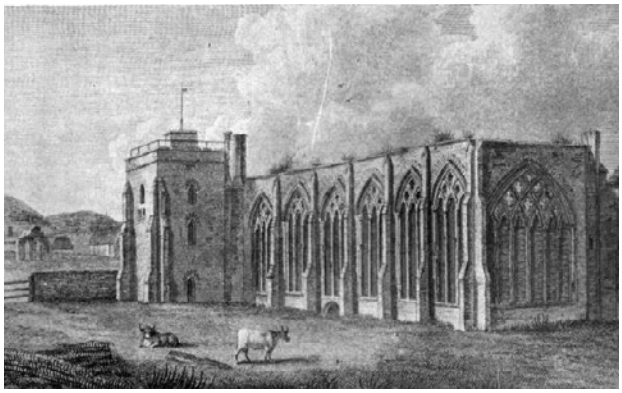
On the other hand, 'Olroms' included the following medical provisions for English sailors:

> *'If by chance any mariner be taken in sickness in the ship doing service he belongs thereto, the master ought to set him out of the ship, and seek lodging for him, and ought for to find him light, as tallow or candle, and to give him a lad of the ship for to look after him, or hire a woman to keep him, and obtain the same food as is used in the ship, that is to weight and as much as he took when he was in health, but no more, but as the master will.*
>
> *And if he wants any other food, the master is not bound to get him any, but to be at his cost.*
>
> *And if the ship be ready to depart, it ought not to wait for him, and if he recovers, to receive his hire in paying and rebating that the master laid out for him.*
>
> *And if he dies, his wife or next of kin or friend ought to have it for him.*
>
> *This is the judgement.'*[56]

Although this meant English masters had to pay for lodging their sick and injured ashore, a key omission over the next 450 years was a lack of actual accommodation, despite King John allowing 'houses of pity' to hold fairs in exchange for admitting disabled soldiers and mariners. Furthermore, while the lack of distinction between royal and merchant ships

meant these provisions applied to all sailors, those wounded in the King's service were often treated as soldiers, whom their lord frequently abandoned on their return home. As a result, even sick or wounded seamen from the Cinque Ports could only expect temporary accommodation unless they could enter a 'house of pity'.[57]

This pattern of care for naval casualties began after the 1217 Dover battle. The few surviving wounded were landed at several places ashore, including the Maison Dieu Hospital, a Dover almshouse. As the number of permanently disabled mariners slowly increased, they established their own 'masyndews' via their craft guilds; the first at Kingston-on-Hull in 1457, followed soon after by the Cinque Ports and other south coast English harbours. However, other seamen's guilds either relied on private citizens or contributed to other charities in exchange for access for their members. Even so, many of these 'masyndews' had less than 10 beds, while their standard of care varied considerably. [58]



The Maison Dieu, Dover (now the oldest section of the Dover Town Hall), c.1830.[59]

Conclusion

No provision had been made for sick and injured English mariners until Eleanor recognised the need in both peace and war. Besides the absence of personalised attention for anyone other than the nobility, the slow pace of medical progress and a split medical profession, their standard care ashore reflected the contemporary ideas of Christian suffering as a part of life, which only began to change with the Church's gradual withdrawal from being the sole repository of medical knowledge.

Despite increasing crew sizes and passenger/troop numbers throughout the medieval period, it seems likely that the voyages they undertook were too short to develop epidemic-level infectious diseases such as typhus and dysentery, or deficiency disorders such as scurvy until they began venturing beyond the Mediterranean and coastal Europe from the mid-15th century. Meanwhile, medieval English sea battles were rare and generally fought similarly to that ashore. While they typically still employed many weapons since prehistory, these had begun to be displaced by the first firearms, creating new types of wounds of greater morbidity and mortality.

The first English seagoing health services were based on the assumption that it only required surgeons to treat wounded soldiers rather than sailors. Although this may have been so provided voyages were short, naval engagements few and casualties rare, the next three centuries saw more naval campaigns and expeditions fail through disease than losses in battle. Yet, Gilbertus had identified several shipboard hygiene and other preventive health measures as early as 1250, which, had they been adopted at that time, would have saved lives and made their success more likely.

Disclaimer

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

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30 Tumblehome: opposite of 'flare'. The convex lines of a ships hull, where the upper sides are brought towards the centreline after reaching the maximum beam (typically at the waterline).

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The Impact of Military Combat Uniform on Injury Rate During Basic Military Training in Greek Naval Cadets

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Introduction

Musculoskeletal injuries are a common occurrence during the period of basic military training (BMT). During the BMT period, it is estimated that 25% of male and 50% of female trainees experience injuries.[1,2] In a review of Army basic training, injury risk-factor studies showed that increased age, smoking history and prior sedentary lifestyle among male recruits were associated with increased injury risk.[1]

Low physical conditioning is strongly associated with an increased risk of training-related musculoskeletal injuries in military trainees.[3–6] In particular, poor performance on timed run tests with a fixed distance is a predictor for injuries.[7] In a study performed in the British Army, 58% of 1810 recruits sustained at least one injury during initial military training. Overuse musculoskeletal injuries were more common than acute injuries, representing 65% and 35% of injuries, respectively.[4]

Studies for musculoskeletal injuries among Greek Army Officer cadets during combat BMT revealed that 32% presented with injuries (muscle, tendon, bone, joint and ligament)[8] and 28.3% suffered from some form of injury, with 51.3% appearing during the first two weeks of BMT.[9]

The purpose of the present study was to focus on the effects of military combat uniforms compared to athletic clothing on injury rates during BMT in Greek naval cadets.

Methods

Subjects

Forty-five healthy male Greek Naval cadets volunteered to participate in this study. Their mean values ± standard deviation (SD) was for age 18.2 ± 0.5 years, body mass 75.9 ± 3.8 kg and body height 177.7 ± 4.6 cm. The cadets were randomly separated into two groups, both of which exercised with the same training protocol but different clothing. Group1, which included athletic clothing (AT), exercised with sports shorts, a t-shirt and sports shoes (n=21, age 18.2 ± 0.5 years, body mass 76.1 ± 3.8 kg and body height 178.6 ± 5.7 cm). Group2 trained with military clothing (MT) and boots (n= 24, age 18.3 ± 0.6 years, body mass 75.6 ± 3.3 kg, and body height 176.8 ± 2.3 cm) as shown in Table 1.

The study's results involved only the Naval cadets who completed BMT and who abstained from exercise owing to injuries for up to three days. All the Greek Naval cadets were healthy, non-smokers and had no injuries the two years prior to the BMT.

Table 1. Anthropometric measurements and body composition

Group	AT (n=21)	MT (n=24)	Total (n=45)
Age (years)	18.2 ± 0.5	18.3 ± 0.6	18.2 ± 0.5
Height (cm)	178.6 ± 5.7	176.8 ± 2.3	177.9 ± 4.6
BM (kg)	76.1 ± 3.8	75.6 ± 3.3	75.9 ± 3.8
BMI ($kg \times m^2$)	23.9 ± 1.6	24.2 ± 1.1	24.0 ± 1.4
BF (%)	11.2 ± 3.8	10.5 ± 2.8	11.1 ± 3.4

BM = Body Mass; BMI = Body Mass Index; %BF = percentage of Body Fat; cm = centimetres; kg = kilogram

Training protocol

The BMT period lasted five weeks. The training program was applied six times a week from Monday to Saturday, four days included physical fitness and two swim training sessions. In the first week, three days were used for the following measurements:

anthropometric (height, body mass, body mass index calculated as weight in kilograms divided by height in metres squared and % fat) and physical fitness tests (push-ups in one minute, sit-ups in one minute and 12 minutes run test).

The Naval cadets that participated in the BMT performed 27 training sessions in the morning and 27 in the afternoon. The morning training sessions lasted 70 minutes and included 3 x 12 min running with a five min interval, followed by 24 minutes of agility exercises, gymnastics, sit-ups, push-ups, rope climbing, obstacle course training and stretching. The swimming training sessions lasted 50 mins. The groups ran at a standard pace of 6:30 min/km for weeks 1–2, 6:00 min/km for weeks 3–4 and 5:30min/km for week 5 (Table 2).

Furthermore, in the afternoon from 17:00–18:00, all cadets participated in marching-military activity sessions for 60 minutes.

Statistical analysis

Data are presented as mean (± SD). A two-proportion z-test was used to test for the statistically significant difference between the two population proportions on injuries. Significance was accepted at $P < 0.05$.

Registration of injuries

An injury was registered when cadets felt pain or complained of pain during BMT and visited a military physician. Musculoskeletal injuries recorded were muscle pain, tendon, stress fracture and joint or ligament injury (knee pain, ankle pain). Additionally, every injury requiring a cadet to consult a physician (unit medical officers and conscripted physicians) was registered and documented.

Results

The data was recorded for 22 Naval cadets from the MT group, because two cadets dropped out in week 2 of the BMT. From the results, there was a significant difference in the proportion of injuries between the two groups ($z = -2.3044$, $P = 0.021$, $P < 0.05$). The injuries occurred in six (28.6%) Naval cadets from the AT group and 14 (63.6%) Naval cadets from the MT group, totalling 20 injured cadets. During the five weeks of BMT, 36 injuries were recorded, for AT six (16.7%) injuries and MT 30 (83.3%) injuries. Both groups recorded 18 (50.0%) joint/ligament injuries, six (16.7%) stress fractures, eight (22.2%) tendon and four (11.1%) muscle injuries. Specifically, the AT group recorded six injuries, of which four (66.6%) were joint/ligament injuries, one (16.7%) a stress fracture and one (16.7%) a tendon injury. In addition, the MT group recorded 14 (46.7%) joint/ligament injuries, five (16.7%) stress fractures, seven (23.3%) tendon and four (13.3%) muscle injuries. The injury ratio (injuries per trainee) was 0.3 injuries per trainee in the AT team and 1.4 injuries per trainee in the MT team (Table 3). The incidence of injuries in each week of BMT was seven in week 1, 12 in week 2, 13 in week 3, four in week 4 and none in week 5 (Table 4, Figure 1).

Table 2. Program Characteristics

Exercises per week						
week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	Test day 1	Test day 2	Test day 3	Physical fitness	Physical fitness	Swimming
2–5	Physical fitness	Physical fitness	Swimming	Physical fitness	Physical fitness	Swimming
Training sessions						
	Exercise					Total
Morning 6:00–7:10	(3x12 min running /5 min interval /common pace 6:30 min/km for weeks 1–2, 6:00 min/km for weeks 3–4 and 5:30min/km week 5) + (24 minutes exercises/ agility, gymnastics, sit ups, push-ups, rope climbing & stretching) Swimming training sessions lasted 50 min					27
Afternoon 17:00–18:00	60 min/marching-military activity					27

Discussion

This study aimed to investigate the effects of training with sports clothing and military combat uniform and boots on the occurrence of injuries during five weeks of BMT. The training with military combat uniform and boots caused injuries to 20 Naval cadets, corresponding to 46.5% of those who completed the BMT. In the AT group, six cadets (28.6%) were recorded with injuries, and in the MT group 14 cadets (63.6%) recorded injuries. Research in BMT in the Greek Army cadets reported injuries in 32.0%[8] and 28.3%[9] of the trainees, which is a close percentage compared to the AT team, which presented 28.6%. However, in the MT group's current recording, 63.3% of injured cadets is double that of the above studies in the Greek Army.[8,9]

The results showed that during the BMT period, both groups showed a total of 36 injuries, of which 30 (83.3%) occurred in the MT group and six (16.7%) occurred in the AT group.

Fifty per cent of the injuries in both groups occurred in the joints and ligaments, four of which were in the AT group and constituted 66.6% and 14 in the MT group 46.7%, respectively. The other injuries presented in the AT group were one stress fracture and one tendon corresponding to 16.7% each with no muscle injury. Respectively, in the MT group, there were five cases of stress fracture (16.7%), seven cases of tendon injury (23.3%) and four of muscle injury (13.3%). The injury ratio was 0.3 injuries per trainee in the AT team and 1.4 injuries per trainee in the MT team. Injuries reported during BMT are consistent with research on the BMT period and report the occurrence of injuries.[1,2,4,8,9]

Table 3. Results

Group	AT (n=21)	MT (n=22)	Total (n=43)
	Injured cadets/group		
	6 (28.6%)	14 (63.7%)	
	Injuries/group		
	6 (16.7%)	30 (83.3%)	36 (100.0%)
	% Injuries		
joint/ligament	4 (66.6%)	14 (46.7%)	18 (50.0%)
stress fracture	1 (16.7%)	5 (16.7%)	6 (16.7%)
tendon	1 (16.7%)	7 (23.3%)	8 (22.2%)
muscle	0 (00.0%)	4 (13.3%)	4 (11.1%)
Total	6 (100.0%)	30 (100.0%)	36 (100.0%)
	Injured cadets		
	6 (30.0%)	14 (70.0%)	20 (100.0%)
	Injury ratio		
	0.3	1.4	

Injure ratio = number of injuries per trainee; % injuries = percentage of injuries

Table 4. Injuries per week

Injuries	Week 1	Week 2	Week 3	Week 4	Week 5	Total
joint/ligament	3	6	7	2	0	18
stress fractures	1	2	2	1	0	6
tendon	3	2	3	0	0	8
muscle	0	2	1	1	0	4
Total	7 (19.5%)	12 (33.3%)	13 (36.1%)	4 (11.1%)	0 (0.0%)	36 (100%)

An interesting observation in the present study is that injuries progressively increased in the first three weeks and decreased in the fourth and fifth weeks (Figure 1). Specifically, in week 1, seven injuries affected 19.5% of the total. In week 2, there were 12 that affected 33.3% of the total, and in week 3, 13 injuries affected 36.1%. In week 4, there was a decrease; four injuries (11.1%), and in week 5, there were no injuries. A similar occurrence of injuries in the first two weeks was presented in a study of Greek Army cadets.[9] Although injuries decreased in the last two weeks, it was observed that the cadets had pain and discomfort, mainly in the legs, although they did not visit a doctor as they stated that the BMT was coming to an end.

During the program's implementation, no allergies or skin conditions were caused by the clothing, even though the military uniform was heavier than the sportswear. Wearing the combat uniform caused more sweat retention because the body breathes less than when in sportswear. In addition, an expected effect of the MT group's clothing was increased body temperature and heart rate.[10] However, there was no incident of injury or reduced participation in exercise that was solely due to clothing.

Injuries appeared on the lower part of the body, and the leading cause of these injuries appears to be footwear. More specifically, the boots worn by the MT group weighed 1.5 ± 0.25 kg, while the sports shoes worn by the AT group weighed 0.45 ± 0.05 kg. The use of heavy footwear is associated with load carriage[11], and previous studies have shown that the average increment in energy cost was 1.0% per 100 gm increase in weight per pair of footwear.[12]

The use of military boots in our study seems to be the factor associated with the increased risk of injury. Although combat boots are designed to protect the foot[13], heavy boots may have caused a change in kinematic or mechanical parameters and were related to muscle activation patterns during running[14], especially at the initial stage of BMT. It seems that the use of military boots in our study compared to sports shoes functioned as a large external load and increased the risk of injury on the lower body. In addition, military boots do not seem to absorb the ground reaction forces during training.[15]

Owing to the small sample size of the present study, compared to other studies[4], we cannot claim that the difference in the injuries of the two groups is due to the military combat uniform and boots. A possibility arises that the MT group is exposed to high forces or high loading rates during running with a specific type of boot that is associated with the occurrence of injuries.[16,17] Then, an intervention that could reduce the risk of injury would be to increase the cushioning in footwear or the design of the training program.

The main purpose of BMT is to help the cadets to develop their physical condition and mental/psychosomatic condition. When these two factors are involved, we should carefully decide what we have to improve first and what needs gradual improvement. We know that extrinsic factors, such as total mileage and training intensity[18,19] have also contributed to injury risk. In addition, training programs with adequate training loads are proposed to reduce the risk of injury and produce high fitness.[20] Moreover, if we expect that this period, especially the first five weeks, is sufficient to achieve a relative improvement in aerobic capacity then high intensity interval training (HIIT) programs are suggested to cause metabolic adjustments in just six sessions over two weeks.[21,22]

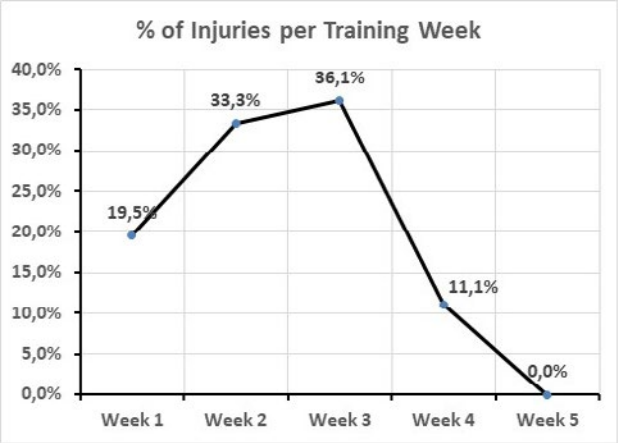

Figure 1. Percentage of injuries per training week

We must agree that BMT, is an initial step in the entire process of training civilian recruits to become effective military personnel[23], and completing BMT is mandatory for all recruits to progress their career within the military.[24] The results agree that the recruits enter the military with widely varying fitness levels, even within one platoon[25] and confirm that overuse injuries are the most common sustained by military recruits.[26] Injuries, specifically overuse injuries in military recruits during BMT, place a huge logistical and financial burden on military organizations[24,27], while large increases in training load may precede injury.[24,28]

Previous research has identified multiple risk factors for training-related injury. For example, the physical fitness components, such as aerobic endurance, muscular endurance, muscular strength, body

composition, flexibility, mobility, dynamic balance[29,30] and asymmetries, appear to increase injury risk.[31]

The increased injury rates lead us to the conclusion that the initial level of fitness of cadets should be assessed and intense activities with military clothing should be avoided to decrease burden. It may be necessary to redefine the exercise program and take more time to adjust the cadets by mainly focusing on their initial fitness level prior to BMT.

When developing training for the Greek Naval cadets, we must create intelligent programs to reduce injuries. As coaches, we must be convinced that the officer we have to prepare for military training, especially during this period, must be treated as an athlete starting their initial training. Subsequently, we need every recruit to be in the training field, not recuperating in a medical office.

The BMT period should generally be treated as an initial stage of training and not as a period in which we monitor the expected problems arising from injuries. Each military unit undertaking the BMT must improve and avoid repeated mistakes that reduce training time and waste money on medical interventions. So we have not made an enormous discovery in BMT; we are just reluctant to change and afraid to improve. We should probably allow for more time to adapt to the desired level set by the requirements of each army. If fitness training is synchronised with military exercises during the BMT period, fewer injuries are likely to occur.

There should be a combination of various activities in BMT, such as running, callisthenics, obstacle course, resistance training, military self-defence, rope climbing and loaded marches. Participating in all these activities elicits large fluctuations in training loads instead of a single activity with a constant moderate training load.

It is important to delimit the exercise and training that needs to be done in the BMT period and to realise that during this period, there are two different types of training, namely sports and military. Sports training aimed at improving fitness should follow the training principles and be separate from the burden of exercise with military clothing. This is probably the key point because it shows that training with military clothing, especially in the first stage of BMT, puts an additional strain on the body. Therefore, the principles of progressive resistance and the gradual increase in volume and intensity must be applied to sports and military training.

Sports athletes and military recruits share similarities since both populations strive to achieve high-performance levels. Therefore, a successful military trainer can design a short-term training program to optimise training adaptations and reduce training load error, injuries and attrition.[32] A consistent moderate training load level can be established through routine monitoring and is suggested to be protective against injury.[33] Consequently, individualisation and differentiation in training programs are presumably needed to improve the fitness of all recruits to align with military training.[32]

From the specific recording of injuries in the BMT period, it was noted that when the exercise is performed in military combat uniform and boots, there is an increase in injuries. The injuries caused are not only due to the burden of the exercise but also to the added load of clothing with military combat uniform and boots. Those who intend to participate in BMT may need a preparation program to improve their physical condition. BMT can be more functional if the military combat uniform and boots are used as long as the programs are carefully designed so as not to cause unnecessary injuries.

More specifically, the ways to reduce the risk of overreaching or overtraining and provide solutions to optimise training adaptations and reduce injuries in BMT are likely to be (a) the gradual increase of physical fitness without large increases in training load, (b) the prior physical activity levels can be established, and cadets can be categorised into groups according to initial physical fitness, (c) training with groups based on risk factors, (d) carefully planned training load, monitoring load and (e) meticulous choice of clothing and especially footwear.

Conclusion

This study aimed to record injuries following the same kind of exercise with and without military combat uniform during five weeks of BMT in Greek naval cadets. The results showed that the burden of exercise during BMT, which is carried out in military combat uniform and boots, caused several injuries compared to sportswear. Ways to avoid injury can include a carefully designed exercise program according to the principles of coaching, the gradual increase of intensity and total volume, as well as a gradual and staggered introduction to military clothing and footwear. In addition, the initial level of fitness of the Naval cadets in the entry stage of the BMT should also be considered, and the exercise programs should be as carefully designed as possible.

Future studies on the duration of BMT and training programs would provide further information on how to avoid injuries.

Limitations

The findings of this study have the following limitations. Firstly, it concerns Greek Naval cadets accepted into the Hellenic Naval Academy after passing the PanHellenic National University Exams. Secondly, the study did not consider and assess the initial physical condition of the cadets, and the program was not designed accordingly. Thirdly, specific injuries during assessment, for example, those of joints and ligaments, were assessed as one.

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U.S. Blue Water Navy Veterans of the Vietnam War: Comparisons from the Vietnam Era Health Retrospective Observational Study (VE-HEROeS)

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Abstract

Background: US Vietnam War Blue Water Navy veterans (BWN) conducted military operations on Vietnam's offshore waters and likely experienced various war-related exposures. The overall health of the BWN has never been systematically studied.

Purpose: Describe and compare BWN's health with other servicemembers and non-veterans of the Vietnam era.

Materials and methods: Survey of 45 067 randomly selected US Vietnam War theatre and non-theatre veterans and 6885 non-veterans.

Results: For 22 646 male respondents, self-reported health was contrasted by veteran status defined as BWN (n=985), theatre veterans (n=6717), non-theatre veterans (n=10 698) and non-veterans (n=4246). Exposure was service in the Vietnam War theatre. Collected were demographics, military service characteristics, lifestyle factors and health conditions. Adjusted odds ratios (aOR) were calculated using multivariable logistic regression. Controlling for cigarette smoking and other covariates, respiratory cancer risk was highest in BWN vs other veterans (theatre: aOR 1.65; 95% CI 1.09, 2.50; non-theatre: aOR 1.77; 1.13, 2.77) and to non-veterans (aOR 1.78; 1.15, 2.74). Other findings showed BWN's health risks between theatre and non-theatre veterans.

Conclusion: There was a higher risk for respiratory cancers in BWN. Other risks were less than theatre veterans but greater than non-theatre or non-veterans, indicating a potential role of military exposures in BWN's health.

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Keywords: Vietnam War, Blue Water Navy, veterans, military, exposure

Conflict of interest: The authors report no conflicts of interest.

Introduction

The Blue Water Navy (BWN) of the Vietnam War served on ships on the offshore waters of former South and North Vietnam, not on inland rivers, estuaries or the land.[1,2] BWN were engaged in combat, surveillance and interdiction, transport and supply, rescue and humanitarian operations.[3] Little evidence documents their health after military service in BWN.[1,2] Although BWN did not have 'boots on the ground' during the war like their theatre veteran counterparts who were exposed to and had effects from the stresses and physical hazards of wartime military operations, we hypothesise that exposure risks experienced by BWN were similarly hazardous[3-7].

Harmful exposures during the Vietnam War cannot be precisely quantified;[1,8] the primary exposure studied here is veteran status in the Vietnam War theatre of operations. BWN report that in addition to

recognised shipboard hazards (e.g., fuels, solvents, second-hand tobacco smoke, asbestos)[1,9,10] and combat service,[3] they came into direct contact with chemically contaminated seawater that was used for bathing and drinking after desalinisation and plumes of sprayed chemicals drifting from land-based applications.[1,11] One potential exposure was to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), which contaminated the tactical herbicide known as Agent Orange. TCDD has varying evidence of association with human harm, including teratogenicity,[1,8] carcinogenicity,[1,8,12] immunologic effects,[8] possible endocrine disruption[13-15] and hypothesised epigenetic effects.[8, 16]

The Vietnam-era soldiers and sailors who were exposed to herbicides and suffered health consequences are based on limited scientific evidence with sometimes conflicting conclusions.[1,8,17] In a laboratory experiment, Australian Government scientists distilled water containing chemical components of Vietnam War tactical herbicides, including dioxins. This Australian Government study concluded that evaporative distillation was a potential route of exposure. However, actual exposures to BWN could not be quantified.[11] In 2011, the National Academy of Science's Institute of Medicine (IOM) reviewed the available evidence on the likelihood of BWN's exposures.[1] IOM formed an independent committee to assess 'whether the Vietnam veterans in the Blue Water Navy experienced exposures to herbicides and their contaminants comparable with the Brown Water Navy Vietnam Veterans (who served on inland rivers and estuaries) and those on the ground in Vietnam'.[1] The IOM committee concluded that there was possible but unquantifiable exposure by inhalation from aerial spray drift, ingestion of or dermal exposure to drifted spray and contaminated sea water, and ingestion, inhalation and dermal exposure to distilled shipboard water.[1]

The overall health of the Vietnam War BWN has never been systematically studied. A case-control study of selected cancers among Vietnam Veterans by the CDC included a BWN-like cohort (those who served on 'ocean-going vessels') among those who served in four land-based regions (corps) in Vietnam (odds ratio (OR) BWN vs land-based corps 2.17 (99% CI, 1.22-3.86; p=0.11).[18,19] They found the BWN veterans had the second-highest risk of non-Hodgkin's lymphoma. I corps (troops active in northern South Vietnam) demonstrated higher odds of NHL (OR 2.25, 95% CI 1.21, 4.28; p=0.59).[18] The OR for Hodgkin's lymphoma was similarly elevated: highest for I corps than BWN.[20] These regression analyses adjusted for NHL risk factors.

An exploratory aim of this study was to describe BWN's health. We hypothesised that their health would lie between theatre veterans (who generally had the highest exposure to war conditions and, therefore, the poorest health measures) and non-theatre veterans who served entirely outside the war theatre during the Vietnam era. Age- and sex-matched civilians who had never served in the military were included. These non-veterans, we thought, would report the best health. Assuming better health in non-veterans contradicts the premise of the 'healthy soldier effect' where servicemembers selected for military service based on physical and mental health frequently perform better than non-veterans on measurements of these factors.[21] However, findings from several previous studies indicate that the 'healthy soldier effect' may diminish and disappear over time, possibly due to the lingering effects of exposures incurred in military service.[22,23] We further hypothesised that BWN veterans would report poorer health than Navy veterans who served outside the war theatre. This paper is a comparative analysis of BWN's health by Vietnam War-era veteran status.

Materials and methods

Study design

This cross-sectional study was a mail survey of a stratified random sample of 45 067 living veterans who served in the US Military from 28 February 1961 to 7 May 1975, the Congressionally defined Vietnam War era.[24] The sampling frame was 9.9 million records of Vietnam-era service members in the US Veterans Eligibility Trends and Statistics (USVETS).[25] A control group of 6885 non-veterans born before 1958 was selected from a two-stage random sample of 300 000 US households and matched by age and sex with the Vietnam Veterans; Figure 1 presents the study flow. The survey for veterans was a 24-page, 91-item instrument of newly developed questions and previously validated items, including the SF-8[26] and questions from the 2010 National Survey of Veterans.[27,28] The length of the survey was dictated by the need for a comprehensive survey of physical and mental health, demographics and life course information balanced by the risk of overburdening potential respondents because of survey length. We consulted with Vietnam-era veterans on survey questions and length. The survey was qualitatively tested for comprehension and feasibility—including length—and revised accordingly.[29] We fielded the survey from November 2016 through March 2017. The non-veteran survey was identical, except that military service questions were eliminated. The veteran and non-veteran surveys are available from the authors.

Study populations

BWN were the primary population of interest for these analyses. Definitive computerized records of where individual veterans served during the Vietnam war era are unavailable.[30-31] There is no roster of BWN to our knowledge; the study intent to describe BWN was exploratory as we had little information on population size, characteristics and response likelihood. From a Congressional Research Service report[32] and an estimate provided by the Blue Water Navy Vietnam Veterans Association[33] we projected there were 80 000 BWN at the time of study development. Based on a goal of 12 000 veteran responses (6000 Vietnam theatre, 6000 non-theatre including BWN) we projected 200 BWN responses. BWN were considered non-theatre veterans for sample size estimation but were distinguished by a survey question: 'Are you a Blue Water Navy Veteran? In other words, was your Vietnam service limited to the offshore waters of Vietnam?'.[2] Other veteran status was defined from survey questions as: 1) Vietnam or 'theatre' veterans who served in Vietnam, Cambodia, and/or Laos; 2) non-theatre; 3) non-theatre Navy veterans. Non-theatre Navy veterans reported service outside of the war theatre and/or its offshore waters and were included to compare BWN to general Navy veterans; 4) Non-veterans were born before 1958 and never served in the US Military. Non-veterans were included to assess differences between those with military service and those without; such a comparison helps separate health effects of ageing from the long-term effects of military service.

Exposure measures

The main exposure studied was veteran status relative to service in the Vietnam theatre of operations. In addition, exposures to fuels, lead, solvents, pesticides and herbicides were collected from a question newly developed and tested for the study: 'Have you ever been heavily exposed to any of the following … because of your military service? By heavily, we mean long-term, daily or extreme exposure.'

Demographics, health conditions and lifestyle factors

Sociodemographic data, including age, marital status and education level were collected, as were military service variables (e.g., age at entry, duration of service). Lifestyle factors including cigarette smoking patterns and pack-years, alcohol use as quantified by the AUDIT-C,[34] body mass index (BMI) in kg/m,[2] psychologic distress (Kessler-6)[35] and past/current recreational drug use were collected. Post-traumatic stress disorder (PTSD), used here as a covariate that strongly influences overall health,[36-37] was a composite measure of an 'ever' doctor or health professional diagnosis and/or three or more positive responses on the Primary Care PTSD screen for DSM-5 (PC-PTSD-5).[38]

SF-8™ scores measured general physical and mental health. Physical and mental component summary scores were derived from eight survey questions using norm-based scoring methods, with lower scores indicating poorer health. A score of 50 reflects the average of the 1998 general US population.[26]

Physician-diagnosed health conditions were based on questions obtained from the 2013–2014 National Health and Nutrition Examination Survey that asked, 'Have you ever been told by a doctor or health professional that you had…?'.[39] 'Any cancer' indicated a positive response to a cancer diagnosis of those asked on the survey.

The study was approved by the US Department of Veterans Affairs Central Institutional Review Board (#15-12), which allowed information enclosed with the study mailing and a returned survey in lieu of written informed consent.

Statistical analyses

Survey data were weighted to adjust for differences in selection probability and non-response to provide representative estimates of the US Vietnam-era veteran population by sex, age and period of Vietnam War service (1961–64 or 1965–75). In addition to weighting the data, we further adjusted for the complex study design by using jack-knife replications to calculate the standard errors of the estimates. We performed hot deck imputation[40] for missing values of 16 key survey items that were pre-designated to define a complete survey and imputed if a survey had any missing data for a key item after data cleaning. Hot deck imputation replaces missing data with imputed values from others' survey responses that were similar. Eliminating missing data by imputation allows for consistent analysis from one user to the next, avoids large biases in estimates of totals, can reduce nonresponse bias in other types of estimates and allows the use of multiple key items when conducting multivariate analyses when the alternative is to drop all such cases. The hot deck imputation plan is available from the authors.

Descriptive results included unweighted counts and weighted percentages of health conditions and military service-related exposures by veteran status. We conducted univariable analyses to test

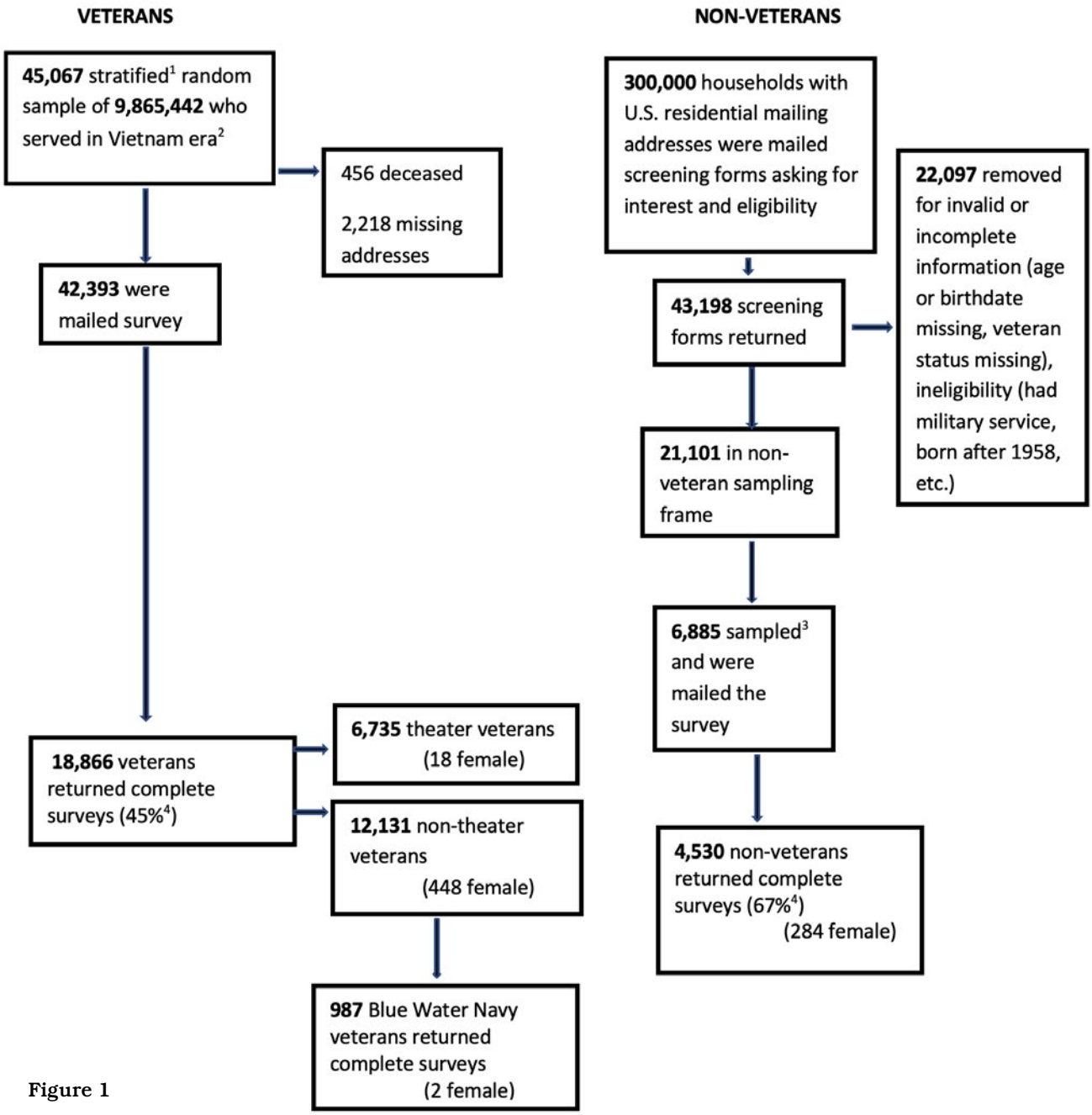
VETERANS
45,067 stratified[1] random sample of 9,865,442 who served in Vietnam era[2]
456 deceased
2,218 missing addresses
42,393 were mailed survey
18,866 veterans returned complete surveys (45%[4])
6,735 theater veterans (18 female)
12,131 non-theater veterans (448 female)
987 Blue Water Navy veterans returned complete surveys (2 female)
NON-VETERANS
300,000 households with U.S. residential mailing addresses were mailed screening forms asking for interest and eligibility
43,198 screening forms returned
22,097 removed for invalid or incomplete information (age or birthdate missing, veteran status missing), ineligibility (had military service, born after 1958, etc.)
21,101 in non-veteran sampling frame
6,885 sampled[3] and were mailed the survey
4,530 non-veterans returned complete surveys (67%[4]) (284 female)

Figure 1

the existence of associations (cross-tabs, simple regression), and investigated correlations and multicollinearity among variables. We also used a 0.05 level of significance as an inclusion criterion, as well as adequate cell size. In the multivariable models, we included variables that satisfied these criteria and were considered important risk factors based on published literature and subject matter expertise.

We used multivariable regression models to estimate adjusted odds ratios (aOR) and associated 95% confidence intervals (CI). The associations between health conditions and veteran status were estimated, controlling for demographics and health-related independent variables; results are presented from two final regression models. The first model compared BWN to theatre, non-theatre and non-veterans. The second model compared BWN to non-theatre Navy and assessed the associations of BWN service to Navy service outside the war theatre or its coastal waters. We started with the same covariates in both models: age in years at the time of the survey, BMI (≤ 25 kg/m^2 or > 25 kg/m^2), PTSD (yes/no), pack-years of cigarette smoking (0, >0< 15, 15–30, >30) and education (high school or less, some college, undergraduate degree, graduate degree). In the first model, we also adjusted for race/ethnicity (White, African American, other race, Hispanic) and marital status (married/de facto, divorced/separated, widowed, never married). The second model did not include race/ethnicity and marital status since small cell counts for these covariates did not allow models to converge.[41]

Age was a covariate because of its relationship with health,[42] the heterogeneity in ages of Vietnam-era service members due to the war's long duration and conscription of younger individuals during the peak war years (1965–70).[43] Race/ethnicity,[44] BMI,[45] cigarette smoking,[44] marital status and education[42] were covariates because of their association with health outcomes in veterans. PTSD was included because of its prevalence in military veterans and its association with cardiovascular disease,[36-37,46-49] other health conditions,[50-54] and mortality.[55] Covariates considered and excluded based on adjusted analyses were alcohol dependence, military service branch, age at entry to the military and duration of military service because they did not satisfy the inclusion criteria. Military service-related exposures to fuels, lead, solvents, pesticides and herbicides were not included in the final model because their prevalence closely paralleled veteran status and self-reported exposures were thought to be less precise than the self-reported veteran status of having served in the war theatre or non-theatre.

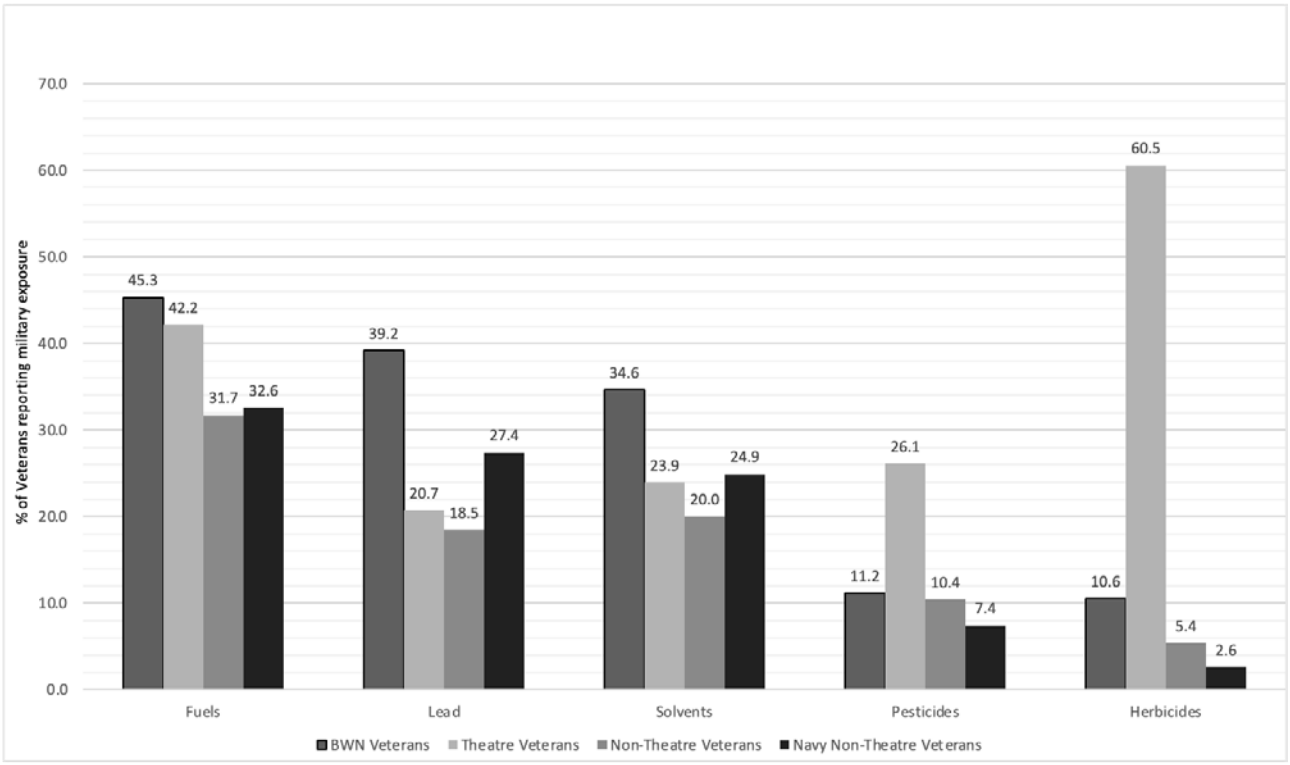

Figure 2. Selected self-reported military service-related exposures by veteran status

Table 1: Sociodemographic, health risks and military service characteristics of male respondents by veteran status[a]

		All	Blue Water Navy (BWN)	Theatre Veterans	Non-Theatre Veterans (excludes BWN)	Non-Veterans
		(n=22 646)	(n=985)	(n=6717)	(n=10 698)	(n=4246)
			(Unweighted counts and weighted percentages) n (%)			
Sociodemographic and health risks[b]						
Age range (years)	58-65	6423 (46.0)	278 (34.8)	448 (8.2)	3447 (39.3)	2250 (53.9)
	66–70	9110 (28.6)	399 (38.5)	3758 (58.7)	3982 (34.5)	971 (22.1)
	71–75	4616 (14.6)	212 (19.5)	1716 (23.7)	2141 (17.5)	547 (12.4)
	76–80	1701 (6.4)	62 (4.1)	467 (4.4)	866 (6.3)	306 (6.8)
	80+	796 (4.3)	34 (3.1)	328 (4.9)	262 (2.4)	172 (4.8)
Age, years mean[c] SE		67.3 (0.1)	68.0 (0.2)	70.09 (0.0)	67.7 (0.0)	66.72 (0.1)
BMI, mean[3] SE		28.6 (0.1)	29.2 (0.2)	29.0 (0.1)	29.0 (0.1)	28.43 (0.1)
Race/Ethnicity						
	White, non-Hispanic	18993 (84.9)	857 (87.5)	5621 (83.8)	8887 (82.7)	3628 (85.7)
	African American	1634 (6.4)	51 (5.7)	485 (7.1)	875 (8.6)	223 (5.6)
	Other race, non-Hispanic	844 (4.7)	34 (3.9)	246 (3.9)	360 (3.6)	204 (5.1)
	Hispanic	942 (4.0)	28 (2.9)	294 (5.2)	4476 (5.1)	144 (3.5)
Education						
	High school or less	5800 (24.5)	266 (28.11)	1782 (27.47)	2778 (26.81)	974 (23.4)
	Associate degree or some college	8906 (32.4)	448 (46.8)	2828 (43.8)	4475 (43.6)	1155 (27.3)
	Bachelor's degree	4080 (22.2)	144 (14.5)	1081 (16.2)	1806 (16.9)	1049 (24.8)
	Master, Professional, PhD	3466 (20.8)	112 (10.6)	884 (12.6)	1436 (12.7)	1034 (24.5)
Marital status						
	Married/ De facto	17430 (77.8)	773 (79.7)	5255 (79.2)	8113 (76.4)	3289 (78.0)
	Divorced/ Separated	2830 (12.9)	97 (10.7)	779 (12.2)	1474 (14.6)	480 (11.9)
	Widowed	1200 (4.5)	60 (6.2)	410 (5.9)	570 (5.3)	160 (4.0)
	Never married	844 (5.3)	31 (3.5)	170 (2.7)	395 (3.8)	248 (6.2)
Cigarette smoking						
	Non-smoker	7699 (43.4)	294 (30.0)	1900 (28.5)	3431 (32.1)	2074 (39.1)
	Current smoker	3278 (12.8)	147 (16.3)	981 (15.4)	1693 (17.2)	457 (11.1)
	Former smoker	11314 (43.8)	522 (53.8)	3693 (56.1)	5416 (50.7)	1683 (39.8)
Cigarette pack-years						
	0	7699 (46.3)	294 (31.9)	1900 (31.4)	3431 (35.0)	2074 (51.8)
	>0 <15	4482 (21.0)	190 (21.1)	1346 (22.7)	2136 (22.1)	810 (20.4)
	>15 <= 30	2973 (12.3)	147 (16.5)	903 (15.4)	1486 (15.3)	437 (10.9)
	>30 <= 45	2145 (8.4)	101 (11.2)	696 (11.7)	1064 (11.3)	284 (7.1)
	>=45 <60	1681 (6.2)	85 (9.6)	606 (10.1)	795 (8.4)	195 (4.9)
	>= 60	1565 (5.9)	84 (9.7)	524 (8.7)	764 (8.0)	193 (4.9)

Military service characteristics[2]					
Military Branch					
	Army	8700 (47.3)	21 (2.3)	3662 (54.4)	5017 (47.4)
	Navy	3970 (21.6)	924 (94.2)	1193 (18.0)	1853 (17.1)
	Air Force	3861 (20.7)	9 (0.7)	994 (14.3)	2858 (26.1)
	Marine Corps	1614 (9.4)	25 (2.7)	826 (13.0)	763 (7.9)
	Coast Guard	183 (1.0)	1 (0.1)	18 (0.3)	164 (1.5)
Age at entry to Military (years)					
	<= 20	12246 (71.6)	757 (81.0)	4565 (70.5)	6924 (71.3)
	21–25	5234 (27.0)	189 (17.8)	2000 (28.7)	3045 (30.0)
	>= 26	297 (1.4)	13 (1.16)	74 (0.86)	210 (1.7)
Length of Military Duty (years)					
	<5	12551 (71.8)	587 (63.1)	4446 (69.7)	7518 (73.9)
	≥5 <10	1798 (10.3)	135 (14.0)	589 (8.9)	1074 (10.8)
	≥10 <20	651 (3.6)	44 (4.4)	260 (3.5)	347 (3.5)
	>20	2808 (14.3)	193 (18.5)	1356 (18.0)	1259 (11.8)

[a] *Blue Water Navy (BWN) served in waters offshore North or South Vietnam during the 1961–1975 Vietnam War; non-theatre Navy served in the 1961–1975 Vietnam era but not in BWN or the Vietnam War theatre. Males only.*

[b] *Chi square tests of proportions were significant for all sociodemographic, health risks and military variables across the veteran status groups.*

[c] *weighted mean*

Physician-diagnosed health conditions of 10 or fewer responses are not reported due to privacy concerns. Statistical significance was defined as $p \leq 0.05$, two-tailed. Analyses employed SAS procedures for complex survey designs (SAS Enterprise Guide Version 7.15; Cary, North Carolina).

Results

There were 6735 Vietnam theatre, 12 131 non-theatre veteran respondents (including BWN) and 4530 non-veteran respondents (overall veteran response, 45%; non-veteran response, 67%, using the American Association of Public Opinion Research response rate 4.0 calculator.[56] (Figure 1). Contrary to our projected 200 BWN respondents, there were 987 (985 men, 2 women) who attested to serving only on Blue Water ships in the Vietnam War (Figure 1). These analyses included only males because of the few BWN female respondents.

Table 1 shows the characteristics of the male respondents (unweighted counts and weighted percentages). BWN respondents averaged two years younger than their Vietnam theatre counterparts at the time of the survey (68.0 vs 70.1 years, respectively). They were similar in age to non-theatre veterans (67.7 years). Respondents were predominantly white, with BWN comprising the highest percentage at 87.5%, Vietnam theatre 83.8%, non-theatre veterans 82.7% and non-veterans 85.7%. BWN had the highest proportion entering military service at 20 years old or younger (81%) and the highest proportion with greater than 20 years of military service (18.5%).

BWN were frequent current smokers (16.3%) and had the highest percentage of 60 or more pack-year smokers (9.7%). A higher percentage of BWN reported fuel (45.3% BWN vs 42.2% theatre or 31.7% non-theatre), lead (39.2% BWN vs 20.7% theatre or 18.5% non-theatre), and/or solvent exposures (34.6% BWN vs 24.3% theatre or 21.1% non-theatre) than the other veterans. In comparison, theatre veterans reported a higher percentage of exposure to herbicides (60.5% theatre vs 10.6% BWN vs 5.4% non-theatre), as well as higher exposures to pesticides (26.1% theatre vs 11.2% BWN vs 10.4% non-theatre. Figure 2).

Measuring overall physical health, 62.6% of BWN reported an SF-8™ physical component summary score <50 (indicating poor health) compared to 74.6% of theatre veterans (aOR 0.77, 95% CI 0.65, 0.91. Tables 2 and 3).

Table 2. Proportion of male respondents who reported health conditions by veteran status[a,b]

	All	Blue Water Navy Veterans (BWN)	Theatre Veterans	Non-theatre Veterans (excludes BWN)	Non-Veterans
Health conditions, n (%)	(n=22 646)	(n=985)	(n=6717)	(n=10 698)	(n=4246)
Poor physical health past 4 weeks, SF-8, score <50	13796(53.14)	591(62.61)	4788(74.61)	6459(63.54)	1958(46.93)
Hypertension	14868(60.77)	666(67.54)	4750(70.95)	6999(65.35)	2453(57.79)
Ischaemic heart disease	4328(15.38)	182(18.13)	1648(24.41)	1926(17.54)	572(13.33)
Stroke	1620(5.99)	77(8.11)	565(8.41)	757(6.92)	221(5.31)
Diabetes Mellitus Type 2	5592(19.99)	241(23.83)	1977(29.43)	2641(24.63)	733(17.18)
Hypothyroidism	2116(8.56)	90(8.87)	752(11.1)	929(8.71)	345(8.13)
Autoimmune disease	766(3.46)	38(3.76)	242(3.58)	336(3.19)	150(3.52)
Chronic obstructive pulmonary disease	2975(9.71)	152(14.92)	1173(17.45)	1330(12.66)	320(7.58)
Obstructive sleep apnoea	5504(19.85)	243(24.53)	2073(31.33)	2455(23.06)	733(17.1)
Peripheral Neuropathy	2828(9.85)	109(10.92)	1244(18.53)	1116(10.36)	359(8.36)
Parkinson's disease	322(1.15)	14(1.44)	143(2.13)	123(1.11)	42(1.0)
Dementia/Alzheimer's	495(1.7)	25(2.29)	230(3.28)	181(1.61)	59(1.47)
Brain injury/Concussion	2612(12.06)	111(11.74)	866(13.1)	1116(10.92)	519(12.23)
Cirrhosis	453(1.57)	19(1.98)	175(2.78)	206(2.08)	53(1.23)
Any cancer[c]	4214(15.5)	174(17.25)	1557(22.68)	1881(16.88)	602(13.98)
Brain cancer	143(0.38)	≤10	60(0.91)	71(0.65)	10(0.23)
Colon cancer	486(1.59)	16(1.63)	186(2.67)	228(2.07)	56(1.30)
Hodgkin's lymphoma	85(0.37)	≤10	32(0.48)	33(0.31)	16(0.37)
Non-Hodgkin's lymphoma	263(0.83)	≤10	105(1.60)	123(1.1)	28(0.63)
Liver Cancer	111(0.34)	≤10	40(0.61)	56(0.54)	10(0.23)
Pancreatic cancer	85(0.32)	≤10	36(0.53)	33(0.32)	12(0.29)
Prostate cancer	2149(8.22)	88(8.51)	768(11.01)	960(8.36)	333(7.75)
Respiratory cancers	536(1.81)	33(3.38)	210(3.19)	229(2.13)	64(1.48)
Soft tissue sarcoma	736(2.58)	26(2.64)	339(4.90)	274(2.48)	97(2.25)
Testicular cancer	100(0.44)	≤10	36(0.52)	40(0.40)	20(0.44)
Thyroid cancer	146(0.44)	≤10	56(0.87)	5(0.28)	15(0.35)
Urinary bladder cancer	434(1.51)	25(2.54)	156(2.26)	197(1.82)	56(1.28)
Poor mental health past 4 weeks, SF-8, score <50	8077(30.07)	311(34.78)	3115(49.24)	3601(36.23)	1050(25.46)
PTSD past or current	4129(10.55)	124(13.79)	2488(39.6)	1305(13.76)	212(5.2)
Depression	5626(19.95)	202(21.62)	2378(36.4)	2347(22.94)	699(16.57)
High psychological distress past 30 days (K-6 score >10)	2202(6.63)	80(8.91)	1015(15.97)	924(9.38)	183(4.39)
Alcohol dependence ever	2340(7.1)	106(11.3)	1016(15.73)	1017(10.24)	201(4.81)
Drug dependence ever	950(3.1)	46(5.29)	365(5.87)	453(4.83)	86(2.15)

[a] *Weighted for non-response and probability of selection.*

[b] *Veteran status: Blue Water Navy (BWN)=aboard ship on offshore waters of Vietnam; Vietnam theatre=Vietnam, Cambodia, Laos; non-theatre veterans=military service in other locations; non-veteran=never served in military and born before 1958.*

[c] *of the cancers on the survey (brain, colon, Hodgkin's lymphoma, non-Hodgkin's lymphoma, liver, pancreatic, prostate, respiratory, soft tissue sarcoma, testicular, thyroid, urinary bladder).*

Table 3. Adjusted[a] odds ratios of health conditions of BWN vs other veteran status groups[b]

Characteristic/Condition	Veteran Status Comparisons		
	Blue Water Navy (BWN) to Theatre Veterans	BWN to Non-Theatre Veterans (excludes BWN)	BWN to Non-Veterans
Poor physical health past 4 weeks, SF-8, score <50	**0.77(0.65,0.91)**	0.92(0.80,1.07)	**1.25(1.06,1.46)**
Hypertension/High blood pressure	0.96(0.79,1.17)	1.03(0.87,1.22)	1.19(0.99,1.43)
Ischaemic heart disease	0.91(0.74,1.11)	0.97(0.80,1.17)	1.02(0.83,1.26)
Stroke	**1.53(1.11,2.10)**	1.24(0.92,1.68)	1.33(0.95,1.84)
Diabetes mellitus	0.89(0.73,1.08)	0.93(0.77,1.12)	1.20(0.97,1.48)
Hypothyroidism	1.16(0.92,1.47)	1.15(0.89,1.48)	1.19(0.89,1.59)
Autoimmune disorder	1.42(0.92,2.20)	1.28(0.88,1.84)	1.18(0.78,1.78)
Chronic obstructive pulmonary disease (COPD)	1.12(0.88,1.42)	1.18(0.93,1.48)	**1.33(1.03,1.71)**
Obstructive sleep apnoea (OSA)	0.90(0.71,1.13)	1.03(0.84,1.26)	1.23(1.00,1.52)
Peripheral neuropathy	**0.76(0.60,0.95)**	1.03(0.82,1.31)	1.02(0.79,1.31)
Parkinson's	1.48(0.78,2.80)	1.53(0.81,2.92)	1.69(0.84,3.43)
Dementia/Alzheimer	1.35(0.80,2.29)	1.49(0.89,2.50)	1.36(0.82,2.26)
Brain Injury/Concussion	1.30(0.99,1.69)	1.09(0.85,1.41)	0.80(0.61,1.05)
Cirrhosis	1.20(0.75,1.92)	1.15(0.67,1.96)	1.34(0.76,2.36)
Depression	0.89(0.71,1.11)	0.98(0.79,1.20)	1.06(0.85,1.31)
Alcohol dependence	1.01(0.75,1.37)	1.24(0.93,1.65)	**1.91(1.38,2.64)**
Drug dependence	1.58(1.00,2.51)	1.24(0.80,1.92)	**1.71(1.04,2.81)**
Hepatitis C	1.27(0.88,1.83)	1.11(0.78,1.58)	1.38(0.95,2.01)
Brain cancer[c]			
Colon cancer	0.73(0.35,1.50)	0.73(0.36,1.48)	1.01(0.48,2.15)
Hodgkin's lymphoma[c]			
Non-Hodgkin's lymphoma[c]			
Liver cancer[c]			
Prostate cancer	0.93(0.70,1.23)	1.06(0.80,1.39)	1.15(0.86,1.53)
Respiratory cancers	**1.65(1.09,2.50)**	**1.77(1.13,2.77)**	**1.78(1.15,2.74)**
Soft tissue sarcoma	**0.55(0.36,0.85)**	0.90(0.56,1.43)	1.00(0.64,1.56)
Testicular cancer[c]			
Thyroid cancer[c]			
Urinary bladder	1.55(0.83,2.87)	1.27(0.70,2.32)	1.66(0.87,3.16)
Any cancer[d]	0.88(0.72,1.07)	1.01(0.83,1.22)	1.18(0.96,1.45)

In ***bold****: statistically significant; 95% CI do not cross 1.0*

a The associations between BWN, Vietnam theatre, non-theatre veteran or non-veteran and health outcomes were adjusted for age, Body mass index (BMI), Post-traumatic stress disorder (PTSD), education, cigarette pack-years, race/ethnicity and marital status

b Veteran status: Blue Water Navy (BWN)=aboard ship on offshore waters of Vietnam; Vietnam theatre=Vietnam, Cambodia, Laos; non-theatre veterans=military service in other locations; non-veteran=never served in military and born before 1958.

c Count not reported and outcome not modelled, cell size ≤10

d of the cancers on the survey (brain, colon, Hodgkin's lymphoma, non-Hodgkin's lymphoma, liver, pancreatic, prostate, respiratory, soft tissue sarcoma, testicular, thyroid, urinary bladder).

Table 4. Blue Water Navy compared to non-theatre Navy[a]—Sociodemographic, exposures and health conditions, males

	Blue Water Navy (BWN) (n=985) n (%)	Non-Theatre Navy (n=1853) n (%)
	(Unweighted counts, weighted percentages)	
Sociodemographic and health risks		
Age range (years)		
58–65	278(34.77)	572(38.57)
66–70	399(38.47)	722(36.1)
71–75	212(19.54)	381(18.12)
76–80	62(4.13)	144(5.66)
80+	34(3.09)	34(1.55)
Overweight or obese BMI (> 25/m2)	756(81.06)	1413(78.61)
Race/Ethnicity		
White, non-Hispanic	857(87.53)	1661(89.76)
African American	51(5.69)	66(4.01)
Other race, non-Hispanic	34(3.9)	56(3.15)
Hispanic	28(2.87)	51(3.09)
Education		
High school or less	266(28.11)	456(25.84)
Associate degree or some college	448(46.75)	803(44.71)
Bachelor's degree	144(14.51)	297(16.07)
Master, Professional, PhD	112(10.64)	263(13.38)
Marital Status		
Married/De facto	773(79.65)	1426(77.23)
Divorced/Separated	97(10.67)	240(13.76)
Widowed	60(6.16)	96(5.05)
Never married	31(3.52)	68(3.96)
Cigarette smoking		
Non-smoker	294(29.97)	574(30.78)
Current smoker	147(16.27)	280(16.74)
Former smoker	522(53.76)	978(52.48)
Cigarette pack-years		
0	294(31.86)	574(33.63)
>0 <15	190(21.09)	377(22.37)
>15 <= 30	147(16.5)	257(15.63)
>30 <= 45	101(11.23)	206(12.61)
>=45 <60	85(9.57)	145(8.76)
>= 60	84(9.74)	117(7.01)
PTSD, past or current	124(13.79)	187(11.31)
Military Service		
Branch		
Army	21(2.33)	0
Navy	924(94.2)	1853 (100.0)
Air Force	<10	0
Marine Corps	25(2.67)	0
Coast Guard	<10	0

Age at Entry to Military, years n (%)			
<= 20	757(81)	1341(78.01)	
21–25	189(17.84)	405(20.42)	
>= 26	13(1.16)	37(1.57)	
Exposures			
Herbicides	105(10.56)	48(2.62)	
Fuel	425(45.31)	576(32.59)	
Solvents	327(34.62)	432(24.92)	
Lead	371(39.2)	485(27.39)	
Pesticides	105(11.17)	132(7.41)	
Health conditions			**Adjusted odds ratio[2] (95%CI)**
Poor physical health past 4 weeks, SF-8, score <50	591(62.61)	1064(59.86)	1.07 (0.90,1.28)
Hypertension	666(67.54)	1165(62.25)	1.11 (0.93,1.33)
Ischaemic Heart Disease	182(18.13)	318(16.24)	1.05 (0.85,1.31)
Stroke	77(8.11)	118(6.13)	1.24 (0.90, 1.71)
Diabetes mellitus type 2	241(23.83)	432(22.64)	1.02 (0.82, 1.27)
Hypothyroidism	90(8.87)	167(9.16)	1.00 (0.74, 1.35)
Autoimmune disorder	38(3.76)	74(3.9)	1.00 (0.63, 1.59)
Chronic obstructive pulmonary disease (COPD)	152(14.92)	227(12.45)	1.24 (0.94, 1.63)
OSA (obstructive sleep apnoea)	243(24.53)	442(23.8)	0.98 (0.78, 1.23)
Peripheral neuropathy	109(10.92)	190(10.04)	1.11 (0.85,1.45)
Parkinson's disease	14(1.44)	26(1.43)	1.02 (0.46, 2.25)
Dementia/Alzheimer's disease	25(2.29)	34(1.87)	1.16 (0.60,2.24)
Brain Injury/Concussion	111(11.74)	168(9.47)	1.29 (0.94,1.76)
Cirrhosis	19(1.98)	25(1.55)	1.58 (0.76,3.28)
Depression	202(21.62)	385(21.6)	0.98 (0.78, 1.23)
Alcohol dependence	106(11.3)	170(9.8)	1.22 (0.90, 1.66)
Drug dependence	46(5.29)	74(4.65)	1.04 (0.62, 1.74)
Hepatitis C	66(7.28)	96(5.71)	1.33 (0.88, 2.00)
HIV[b]	≤ 10	≤10	
Brain cancer[b]	≤ 10	14(0.77)	
Colon cancer	16(1.63)	43(2.21)	0.58 (0.29, 1.15)
Hodgkin's lymphoma[b]	≤ 10	≤ 10	
Non-Hodgkin's lymphoma[b]	≤ 10	26(1.26)	
Liver cancer[b]	≤ 10	≤ 10	
Pancreatic cancer[b]	≤ 10	≤ 10	
Prostate cancer	88(8.51)	167(8.23)	1.04 (0.77, 1.39)
Respiratory cancer	33(3.38)	33(1.85)	**1.99 (1.11, 3.56)**
Soft tissue sarcoma	26(2.64)	40(2.01)	1.19 (0.63, 2.22)
Testicular cancer[c]	≤ 10	≤ 10	
Thyroid cancer[c]	≤ 10	≤ 10	
Urinary bladder cancer	25(2.54)	26(1.42)	1.58 (0.81, 3.09)
Any cancer[c]	174(17.25)	312(15.92)	1.06 (0.86, 1.32)

In ***bold****: statistically significant; 95% CI do not cross 1.0*

a Blue Water Navy (BWN) served in waters offshore North or South Vietnam during the 1961–1975 Vietnam War; non-theatre Navy served in the 1961–1975 Vietnam era but not in BWN or in the Vietnam War theatre. Males only.

b Not modelled, cell size ≤10

c of the cancers on the survey (brain, colon, Hodgkin's lymphoma, non-Hodgkin's lymphoma, liver, pancreatic, prostate, respiratory, soft tissue sarcoma, testicular, thyroid, urinary bladder).

Table 2 reports counts and weighted percentages for health conditions by veteran status. The proportion of BWN reporting health conditions was between that of theatre and non-theatre veterans for most conditions. These were hypertension, ischaemic heart disease, stroke, hypothyroidism, chronic obstructive pulmonary disease (COPD), obstructive sleep apnoea, peripheral neuropathy, Parkinson's disease, dementia/Alzheimer's, brain injury/concussion, any cancer, prostate cancer, soft tissue sarcoma, testicular cancer, PTSD and alcohol or drug dependence. A lower proportion of BWN reported colon cancer, diabetes mellitus type 2, cirrhosis, SF-8™ mental component summary score <50, depression or high psychologic distress than theatre or non-theatre veterans. The proportion of respondents reporting autoimmune disease and respiratory and urinary bladder cancers was highest in BWN.

Table 3 shows the adjusted odds of health outcomes for BWN relative to the other veteran status groups. With adjustment for cigarette smoking and other variables, the odds of respiratory cancers among BWN were significantly greater than each of the other veteran status groups (BWN vs theatre aOR 1.65, 95% CI 1.09, 2.50; BWN vs non-theatre aOR 1.77, 95% CI 1.13, 2.77; BWN vs non-veterans 1.78 95% CI 1.15, 2.74). These results were consistent for the model comparing BWN with non-theatre Navy (aOR 1.99, 95% CI 1.11, 3.56. Table 4). Odds for stroke among BWN were also statistically greater than for theatre veterans (aOR 1.53, 95% CI 1.11, 2.10). In addition, BWN had greater odds of COPD (aOR 1.33 95% CI 1.03, 1.71) and alcohol and drug dependence than non-veterans (alcohol aOR 1.91, 95% CI 1.38, 2.64; drug aOR 1.71, 95% CI 1.04, 2.81) but were not significantly different from theatre or non-theatre veterans on this outcome (Table 3).

Discussion

Supporting our hypothesis, the weighted, unadjusted results demonstrate that the proportion of BWN reporting physician or healthcare provider diagnosed conditions was between that of Vietnam theatre and non-theatre veterans and were almost always greater than in non-veterans. Additionally, after adjustment for demographics, cigarette smoking, BMI and PTSD, a few conditions remained statistically significantly more common in BWN than one or more of the comparison groups. These were stroke, COPD, respiratory cancers, and alcohol and drug dependence.

This is the first report on the overall health of the BWN veterans of the Vietnam War, to our knowledge. Except for the 1990 CDC study of selected cancers,[18,57] other Vietnam War veterans' health studies do not evaluate the BWN as a specific population.[1]

We compared health conditions with prior evidence of an association with exposure to the Vietnam War theatre or those conceptually associated with Vietnam War exposure,[8] between the BWN, Vietnam theatre veterans, non-theatre veterans, non-theatre Navy veterans and age- and sex-matched non-veterans. Past studies report poorer health in Vietnam theatre veterans as measured by symptom reports,[58] objective measures (diagnoses of hypertension, heart disease, diabetes mellitus, thyroid abnormalities, cancers including prostate and melanoma, chronic respiratory conditions), healthcare utilisation, laboratory studies (hearing loss, hepatitis B infection, sperm abnormalities), behavioural risks (smoking, alcohol and drug use)[58-71] and early excess mortality compared to non-theatre veterans and/or the general public.[72-78] Others have found mixed differences in mortality outcomes.[73,76,79-84]

Although the main exposure studied here was veteran status, the frequencies of environmental and other exposures reported by BWN and Vietnam theatre veterans differed. BWN reported high fuels, solvents and lead exposures. Recognised Navy shipboard exposures include contact with fuels, machinery, paints, passive tobacco smoke, asbestos and cleaning products,[1,3,9-10] while Vietnam theatre veterans reported heavy herbicide and pesticide exposures. Common wartime and post-war health risks and behaviours, including elevated BMI,[66] smoking,[85] alcohol and drug use[62,72,85] may potentiate effects of wartime exposures that occurred in both BWN and Vietnam theatre veterans.[8] Differences in or combinations of exposures that could not be measured in this study may relate to health outcomes of BWN, including their statistically significantly higher risk of respiratory cancers compared to other veterans and non-veterans after adjustment for risk factors, including smoking, for which they reported the highest levels of pack-years.

A comparison of BWN to non-theatre Navy was done to assess whether outcomes seen in BWN might be associated with Navy service rather than Vietnam War service. The comparison revealed that a higher proportion of BWN reported recognised health risks: BMI in the overweight/obese range at the time of the survey, less formal education, entry into the military at 20 years or younger, more pack-years of smoking and significantly higher reported exposures to military service-related exposures queried in the survey. After adjustment, the only statistically significant health difference was the higher odds of

respiratory cancers, suggesting the possibility of an association with combined exposures unique to the Vietnam War and the BWN's shipboard exposures off coastal Vietnam.

Study strengths include the response rate—BWN responses were nearly five times the 200 estimated and the 18 866 total responding veterans exceeded our goal of 12 000. The study was designed and implemented with advice from BWN, Vietnam theatre and non-theatre veterans; this may have contributed to the response rates. Other strengths were the stratified random sample from a frame of all Vietnam-era veterans and the non-veteran comparison group sampled from 300 000 randomly selected US households. We considered and adjusted for a range of potential confounders that are associated with long-term health outcomes, including smoking history, diagnosis of PTSD and elevated BMI.

Weaknesses include limited statistical power to detect a difference, especially for rare conditions including many cancers. A sample size of 6000 Vietnam theatre veterans, 6000 non-theatre veterans (which included BWN) and 4500 non-veterans was calculated to detect, with 80% power, a 20% difference between groups for diseases with a prevalence of 9%, and a 50% difference for those with a prevalence of 2% at a 2-sided level of significance of 0.05. Although this self-reported survey was an efficient way to study large numbers of a pre-defined population, responses here lack independent validation. However, agreement between self-reported conditions and medical records or physical examination is high in older adults and veteran populations.[86-87] Self-report is a well-regarded means to determine population characteristics.[88] There is potential for several types of bias: recall bias for events that happened 40–50 years ago and social desirability bias where respondents report what they believe are socially acceptable or responsible responses. Selection bias could have been introduced by the proportionately large number of BWN respondents. While we solicited advice from reliable sources on the size of the BWN population, lacking a complete roster, we cannot evaluate the response rate by BWN to the study invitation. BWN may have been motivated to participate because they sought inclusion on par with Vietnam theatre veterans for VA benefits related to their military service at the time of the study (VA benefits have since been granted[89]). Systematic error or information bias could have been introduced by Vietnam theatre veteran respondents, who may be more aware of and vigilant about their health than the other groups because of long-time and well-publicised concerns regarding hazardous Vietnam War exposures.

Finally, as many as one-third of Vietnam-era veterans are deceased. Differential post-Vietnam War-related mortality may be related to outcomes reported here. For example, we did not ask about a history of mesothelioma or exposure to asbestos in our survey, an exposure common on Navy ships into the Vietnam War era that might be related to the prevalence of respiratory cancers seen here. Some participants might have reported a current diagnosis of pleural mesothelioma as 'respiratory cancer'. However, since all forms of mesothelioma cause death rapidly, this cancer is probably best explored in mortality studies. This study team has a Vietnam-era veteran mortality study under way to assess further the association of causes of death with veteran status.

We assessed current differences in the health of BWN veterans who served in the Vietnam War, comparing BWN to theatre, non-theatre and sex and age-matched non-veterans, controlling for variables that affect risks of health outcomes. The key findings were that for most health conditions examined here, including those with a conceptual or documented association with wartime Vietnam service, there was a clear gradient that showed theatre veterans report the poorest health and highest prevalence of physician-diagnosed conditions, followed by BWN, then non-theatre veterans, with non-veterans reporting the best health, indicating that BWN may have exposures and outcomes associated with their Vietnam wartime experience. Second, BWN reported military service-related exposures that are unique to them. Last, in comparing BWN to the other veteran groups, including Navy veterans of the era who did not serve in theatre or on the coastal waters of Vietnam, we found that respiratory cancers remained significantly higher in BWN after adjustment for covariates. Given the results here, better enumeration of the Vietnam War BWN and monitoring of their health is warranted. Recent and future veterans will benefit from new efforts to document, measure and communicate hazardous military exposures. These efforts include a computerised longitudinal military exposure record that should provide information for healthcare, research and benefits[90] and a common electronic medical record for military servicemembers and veterans.[91]

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War-Related Dysentery Epidemics in the Australian Army

G. D. Shanks

Abstract

Dysentery (blood and pus in faeces) has been an epidemic disease in armies throughout history. The Australian Imperial Force (AIF) encountered epidemic dysentery in both Gallipoli in 1915 and Palestine in 1918. During World War II, dysentery epidemics were a military problem in Queensland and Northern Territory. A massive dysentery epidemic involving AIF soldiers, Japanese soldiers and civilians was prominent in Papua New Guinea during 1943, killing thousands in the highlands. Prisoners of War (POW) in Asia, particularly along the Burma–Thailand Railway, died at high rates from chronic dysentery. Where available, as in Australia, successful treatment with early antibiotics such as sulphaguanidine limited mortality. Dysentery during field exercises was seen in Australia during the 1960s and remains a modern risk, especially in developing countries and in refugee camps, complex emergencies and natural disasters when sanitation measures fail.

Dysentery is defined as blood and pus in diarrheal stools. It has cast a shadow over military operations for centuries and the Australian Defence Force since its beginning. Traditionally separated into bacillary (usually caused by *Shigella sp*) and parasitic (usually caused by *Entamoeba histolytica*) forms, both are highly infectious by faecal–oral spread. Although potentially lethal, dysentery's great military impact is from its ability to make many men suddenly ill during sieges or invasions. Epidemic dysentery occurs when soldiers are crowded into unhygienic situations, as happened on the Gallipoli Peninsula in 1915. Particular risk factors during the Gallipoli campaign were the rocky soil preventing normal latrine construction (see Figure 1), extreme limitation of water supplies for washing, and a tactical situation that left men crowded into trenches for days with nowhere else to defecate. The *Official History* states that '"Dysenteric diarrhea" had become almost universal', meaning that Gallipoli for the ANZACs of 1915 was like a siege in the pre-antibiotic era.[1] Fifty Australian soldiers are listed as having died of dysentery with an approximate case fatality rate of 5%. However, it was the primary cause of medical evacuations, which peaked at >10% of the force in a single week.[1] Temporising control measures to screen food and burn animal manure to reduce flies were insufficient to impact the spread of dysentery and only decreased as cold weather developed. Dysentery was one of many factors that led to the debilitation of soldiers on Gallipoli and the eventual abandonment of the position as untenable.

Figure 1: Pioneers of the 1st BN AIF on the Gallipoli Peninsula in August 1915. They are making wooden latrines ('thunderboxes') during the height of the dysentery epidemic.[1] AWM photo C01921, now in the public domain.

Dysentery also had a significant role in the Palestine campaign of 1918 when the ANZAC Corps consisted largely of mounted infantry in the extremely hot Jordan Valley during the summer.[1] Holding such inhospitable territory against the Turkish Army was difficult, and dysentery/diarrhea was a constant factor, as seen in Figure 2. Blackburn described the clinical picture with a predominance of bacillary cases for which there was no treatment, although amoeba could be treated with emetine.[2] Twenty per cent of autopsies performed by Fairley at No 3 Australia General Hospital in Egypt showed amoeba. Therefore, most deaths were either acute infections

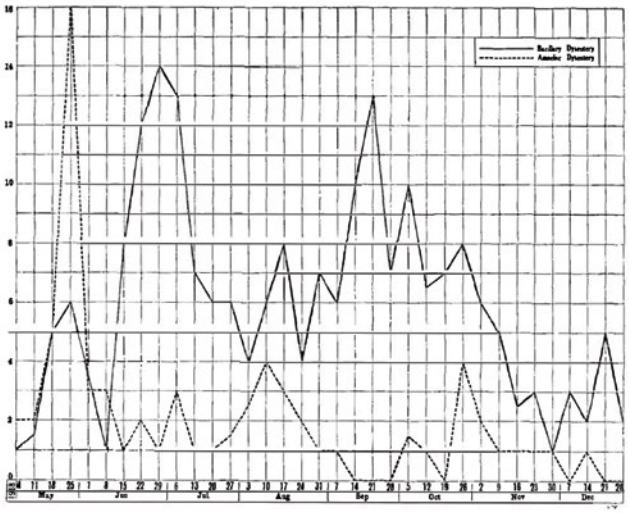

Figure 2: Weekly dysentery cases/1000 men in the Desert Mounted Corps of the Egyptian Expeditionary Force in Palestine during 1918. Graph 13 from summer in the Jordan Valley in the Official History of the War.[1]

Figure 3: Australia and New Guinea Administrative Unit (ANGAU) officer exchanging rice for fruit on Karkar Island, 4 Jun 1944, where it was estimated that a high proportion of inhabitants had developed dysentery and malnutrition during the Japanese occupation. AWM photo 073824, now in the public domain.[10]

driven by the Shiga bacterial toxin or chronic infections resulting in malnutrition and debilitation.[3]

Later the desert campaigns in the Middle East from 1940 were familiar territory to the Australian Army of World War II in Egypt, where dysentery continued to be a pervasive medical problem. The principal advance in therapeutics was the earliest sulpha drugs, as the poorly absorbed sulphaguanidine performed well against *Shigella* in the pre-resistance era of antibiotics.[4] During the war, hundreds of thousands of tablets of sulphaguanidine were used to get sick soldiers back into action and likely inadvertently helped enteric organisms evolve drug resistance factors.

During the mobilisation of troops in Australia, especially after the bombing of Darwin in 1942, dysentery was a problem in rural areas where the military infrastructure to defend the country was being established. The Northern Territory was a hub for such activities, and a General Hospital there recorded 114 cases in which 6 days of treatment with sulphaguanidine was usually sufficient to return soldiers to duty.[5] In central Queensland, an unfamiliar species of *Shigella* was encountered in 42 soldiers, which was eventually described as *Shigella boydii*.[6] The common risk factor for Shigellosis was not geography as much as poor sanitary infrastructure leading to epidemics.

By 1943 when the Australian Army had primarily moved to New Guinea, it was thought that dysentery was becoming a manageable medical problem, at least within the military. This did not account for the highly toxic form of the disease caused by *Shigella dysenteriae,* the introduction of which was blamed on the Japanese invaders. A case series of 503 soldiers from a military hospital in New Guinea showed that 13% of the more than 1000 dysenteric organisms isolated were due to this remarkably pathogenic organism with a potent toxin.[7] Worse was to come as *Shigella dysenteriae* began journeying through the highly populated but socially isolated highland areas where civilians became collateral damage during the fighting.[8] Although the severity and lethality of dysentery in otherwise healthy New Guinea men was known from the mining camp epidemics affecting contract labourers, its impact on entire communities was greatly magnified in 1944 by its ability to disrupt village food supplies that were already tenuous due to wartime logistical disruptions. See Figure 3. A staggering number of patients were admitted to an increasing number of emergency hospitals during 1944.[8] Dysentery progressively moved across the New Guinea highlands in a fitful manner, even reaching isolated tribal groups uninvolved in the conflict as the pathogen was carried by people travelling across the rugged mountain paths.[8] No one knows how many thousands of civilians died in Papua New Guinea during the wartime dysentery epidemics. However, post-war surveys of village populations suggest that 5% of populations died in some groups, and many took over a generation to recover their previous numbers.[9]

Figure 4: Allied POWs of 'F Force' suffering from dysentery relieving themselves while on a break from the train ride into Thailand to work on the Burma–Thailand Railway 1943. AWM photo P02569.184 now in the public domain by PTE George Aspinall

Prisoners of War (POWs) were particularly affected during World War II, where dysentery was one of the leading causes of death in Australian soldiers captured by the Imperial Japanese Army. Rarely was this a single event, as dysentery usually worked with a variety of factors to wear down a prisoner's resistance until he succumbed; 'Dysentery did kill large numbers of British, Australian and Allied men in Japanese prisons and working camps, not so much through lack of therapeutic agents, but through concomitant malnutrition, exhaustion and disease.'[10] Those working on the Burma–Thailand Railway were particularly at risk, with entire wards of the camp hospitals dedicated to dysentery patients (see Figure 4). In the absence of even basic medications in POW camps, other interventions were tried in an attempt to halt the mortality from chronic dysentery, such as diverting colostomies and whole blood transfusions.[11] Given the extreme circumstances, it is a wonder that the mortality rates were not greater than that observed, with roughly one-fifth dying in the camps overall, with particularly unfortunate groups experiencing overall mortality rates up to 40%.[10] High mortality rates were not confined to western soldiers as many Chinese and Korean POWs died of dysentery during the Korean War.[12]

Dysentery was primarily a problem of small-scale outbreaks in particular units during the Australian Army's participation in the Vietnam War during the 1960s.[13] A 1969 twelve-soldier outbreak of *Shigella flexneri* in a signals unit caused the entire unit to be quarantined to prevent a larger epidemic in the entire brigade at Vung Tau. The small infectious dose of *Shigella* meant that any breakdown in field sanitation, sometimes occurring during unit parties, could be followed by an epidemic of dysentery. Not all outbreaks occurred overseas; one epidemic was observed in military reservists on exercise in South Australia in 1964.[14] Advances in antibiotics meant dysentery was not a lethal event during the Vietnam War but certainly was a major infectious disease threat with the more generic diarrhoeas. Since the Vietnam War, the Australian Army has been deployed into many complex emergency and post-disaster missions where a breakdown in water and sanitation systems, poor food safety and displaced populations raise the possibility of dysentery epidemics. The Goma refugee camps in Zaire (now the Democratic Republic of Congo) were a spillover effect of the Rwandan war and genocide. Despite the emphasis on cholera in refugee and internally displaced persons camps, more deaths may have been due to drug-resistant *Shigella dysenteriae*, as enteric contamination rarely involves a single pathogen.[15] In 2013, a large outbreak of Shigellosis commenced in an internally displaced persons camp in Papua New Guinea, resulting in around 1200 cases.[16] The Cox's Bazar region of Bangladesh hosts the highest density of refugees anywhere in the world. In 2017, outbreaks of bloody diarrhoea were reported to have a significantly higher case fatality rate than outbreaks of acute watery diarrhoea among the refugees in Cox's Bazar, who had fled violence in Myanmar. As seen in New Guinea in 1944, epidemics of dysentery spread outwards from the main conflict zones to involve civilian populations otherwise uninvolved in the complex public health emergency. Globally, dysentery remains an important disease, especially in developing countries and in countries affected by humanitarian emergencies. In 2016, *Shigella* was the second only to rotavirus as a cause of diarrhoea mortality.[17] War and extreme disruptions of civil communities by other disasters in the future will continue to carry the risk of dysentery epidemics; it is well we learn from our corporate history to avoid the worst outcomes when pathogens and disasters interact to the detriment of stressed populations.

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