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- Warfare, Ships and Medicine: Prehistoric Origins
- Casualty Evacuation in the Australian Defence Force
- Scaffolded Clinical Skills Development for Clinical Managers in the Royal Australian Navy

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- Publishing and distributing a journal in military medicine
- Promoting research in military medicine

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

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

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Editorial

Before the Next Mission

The delay of this issue reflects the significant change that the world is going through in the grips of the COVID-19 pandemic. The title for this editorial matches the planned theme for the AMMA conference in 2020, where we will turn our gaze forward to the next mission preparing for conflict and disaster. The organising committee placed a focus on disaster relating to the recent bushfire crisis, recent floods and potential mass casualty events, including pandemics. Social distancing is the new normal. Healthcare workers around Australia and the world have become the front-line troops in the battle with Coronavirus. One only needs to reflect on 100 years in the past when the world was dealing with the 'Spanish flu' influenza pandemic from 1918 to 1920 after World War I. This is history repeating itself, but hopefully with a far better outcome to avoid the high death toll of up to 100 million seen a century ago. The military, and particularly those in the field of military medicine, will be called upon to provide care and leadership during the coordinated response to this pandemic. Our Editor-in-Chief, Commodore Andy Robertson, CSC, PSM, RAN, has been working tirelessly to provide clinical leadership in his role as Chief Health Officer and Assistant Director-General in the Public and Aboriginal Health Division of the Department of Health in Western Australia. Many of our readership are equally busy coordinating or supporting the federal, state and local health response to this crisis.

The first issue of 2020 commences with an obituary for a friend and colleague. Many of us knew Lana and it is very appropriate that we begin this year remembering her and celebrating her life.

One original article explores the outcomes of art-based rehabilitation activities for members of the Australian Defence Force. A second reviews the current approach to post-traumatic stress disorder and potential barriers to treatment that may be related to the name of the condition itself. There are a series of articles with a Navy theme, from the prehistoric origins of warfare, ships and medicine, to a modern review of casualty evacuation in the ADF and then to the development of Clinical Managers in the Royal Australian Navy. As always, there is benefit looking at the past and current standards to improve our military deployed healthcare system in the future. We then explore our whole of health community support by reviewing civilian university and military collaborative partnerships. It is indeed timely that the final article relates to infectious diseases in jungle warfare training.

For all of you on the front-line of the COVID-19 crisis, stay safe and take care of yourself.

Dr Ian Young, AM
Captain, RAN
Guest Editorial

SQNLDR (Doctor) Lana Jennifer Lynnelle Davies

28 May 1985 – 6 October 2019

Lana was an exceptional individual, who forged her own awe-inspiring path to her greatest achievements, of being the soul mate to husband Chris and super-Mum to baby Naomi.

She loved to study, with high academic accomplishment through all of her education –

Bachelor of Medicine, Bachelor of Surgery with Honours; Bachelor of Medical Science with Honours; Graduate Certificate of Health Professions Education; Diploma in Child Health; Diploma in Aviation Medicine (UK); Master of Public Health; Master of Health Management; Master of International Public Health.

She was a Fellow of the Royal Australian College of General Practitioners, a Registrar with the Australasian College of Aerospace Medicine, a member of the Australasian Society of Aerospace Medicine, and was recently awarded Associate Fellowship of the Royal Australasian College of Medical Administrators.

She placed service above self, starting her community engagement during her secondary schooling, and continuing her involvement with and commitment to Rotary International in every global location she lived.

She joined the Royal Australian Air Force in 2008, and quickly earned the respect of her superiors, peers, subordinates and aircrew (no mean feat!) through her diligence and devotion to her patients and the blue uniform. She worked at supra-normal pace to make meaningful and tangible change, mentoring and inspiring all who worked with her and for her. Her enthusiasm and dry sense of humour were infectious, enabling many a bleak time to emerge more positive. She strove to be the best Aviation Medical Officer, the best Senior Aviation Medical Officer (SAVMO), the best Chief Instructor at the

Institute of Aviation Medicine, and the best Health Centre Manager East Sale. She excitedly made plans to forge her path as the Regional SAVMO East Sale, which she was to take up in 2020 on promotion to Wing Commander. She was a loyal and proud Air Force Officer and Doctor.

Lana lived life to beyond the fullest extent possible, leaving indelible impressions on the hearts of those she met. Although there is now one less Spice Girls fan in the physical world, 90s music will be playing at high volume, with karaoke and dancing for all, when we next meet.

Farewell dearest Lana, you were extraordinary.

Causes and Duration of Change Resulting from Art-Based Activities for Members of the Australian Defence Force

Tavis Watt, E. James Kehoe

Abstract

Increasingly, military personnel are being exposed to arts-based rehabilitation activities that have been demonstrated as having positive effects in reducing both depressive and anxiety-based symptoms. However, little is known about the specific processes that are engaged by these activities, as well as the duration of positive effects. This study aimed to uncover the underlying contributors to the positive effects as recalled by the military personnel who undertook a four-week program of training leading to visual, written, musical or theatrical creations, in a nonclinical setting.

The respondents reported benefits from the program, including sustained increases in behavioural activation, sense of belonging, flow and therapeutic alliance with the trainers during and following the program. Many respondents recalled that the positive effects of the program were enduring, lasting up to 24 months or longer. All four positive effects clustered strongly on a single factor. Most respondents felt they would have benefited from a follow-up activity after the conclusion of the program. Respondents who had a higher core self-evaluation score reported more benefits from the program than those who did not.

Introduction

In response to recent conflicts in Iraq and Afghanistan, established therapeutic interventions have increasingly been applied to improve veterans' functioning.[1-3] In the context of these therapies, there is increasing interest in the possible added therapeutic benefit of pursuing arts-based activities, including visual, written, musical and theatrical creations among both veterans[4-6] and therapists.[7,8]

These activities have demonstrably reduced PTSD, depressive symptoms and anxiety symptoms.[9-12] Despite these demonstrations, little is known about the processes that may underlie the changes experienced by those undertaking arts-based activities. As described below, proposed contributors have been theorised to include behavioural activation, belonging, flow and therapeutic alliance.

Behavioural activation involves an individual engaging in behaviours that reduce depressive symptoms by developing a sense of purpose, achievement and enjoyment.[13] Depressive symptoms have been found to be particularly prevalent among military populations[14] and, hence, promoting behavioural activation from an arts-based activity may be particularly helpful.[15]

A sense of belonging is strongly encouraged in military training as a means to develop cohesive teams.[16-18] Moreover, a sense of belonging is a protective factor for returned service personnel.[19] Additionally, belonging may be a contributor to the effectiveness of art-based activities in improving an individual's functioning, especially if the activities involve group work or are even conducted individually in the presence of others.[18]

Flow entails being absorbed in a task, with the potential to lose one's sense of space and time.[20] It has been defined as living in the moment, providing a positive distraction thus reducing anxieties and other concerns.[21,22] The concept of flow has been particularly theorised to underpin the effectiveness of art-based interventions.[12,23]

Effective therapeutic relationships between a client and therapist incorporate factors such as trust and confidence in building an alliance.[24] These relationships have been shown to positively influence therapeutic outcomes.[25] Given such

relationship factors are common to most therapies and interventions, their influence in the effectiveness of arts-based interventions using nonclinical arts mentors requires investigation.

Individual differences in response to arts-based activities may include factors such as locus of control, neuroticism, self-esteem and self-efficacy. A higher-order dispositional construct combining the above factors has been identified as core self-evaluations.[26] They have been found to be predictors of individual success and satisfaction in the workplace.[26-28] Similarly, core self-evaluations may be associated with individual differences in their experience with art-based therapy.

As outlined above, military personnel are engaging in arts-based activities to supplement established therapies, and these programs are beginning to yield improvement in the personnel undertaking them.[5,29,30] The present research was conducted as part of the evaluation of a four-week art training program conducted by the Australian Defence Force (ADF). The program is conducted for military personnel in a non-rank environment at a university where nonclinical mentors assist wounded, injured or ill veterans in visual, written, musical or theatrical art. During the program, participants continued to have access to their regular mental health professionals as well as a nearby military hospital.

Identifying which of the above-named factors may be contributing to an enduring improvement in respondents' general mental wellbeing is the focus of the current research. Specifically, the present research addressed the following questions.

1. By participating in an arts-based program, do the respondents report experiencing benefits, in particular, an improved sense of behavioural activation, belonging, flow and/or therapeutic alliance with nonclinical art mentors?
2. If respondents experience benefits from the program, are they enduring and for how long?
3. Given the time since participating, would the respondents have benefited from periodic booster activities following the program, and if so, what would they involve?
4. Do core self-evaluations positively correlate with better mental health outcomes during and following the program?
5. Since completion of the program, what has been the respondents' general wellbeing in relation to the perceived benefits of the program?

Methods

Respondents

The final sample consisted of 31 individuals from a pool of 119 serving members of the ADF who participated in five cohorts of the Arts for Recovery, Resilience and Team Skills (ARRTS) program conducted between 2015 and 2017. Attempts were made to contact all program participants by phone in late 2018 or early 2019. However, many had discharged from the ADF and were no longer contactable. Among the 119 individuals, 61 were successfully contacted and, ultimately, 31 completed the survey. This final sample consisted of 23 males and 8 females, with 29% reporting having served in the Royal Australian Navy, 61% in the Australian Army and 10% in the Royal Australian Air Force. The ages of the respondents ranged from 20 to 50+ years in age. The time between the end of the program for each individual and their completion of the survey varied from 18 to 42 months. Specifically, there were, respectively, 16%, 26%, 10%, 23% and 26% of the respondents who reported completing the program 18, 24, 30, 36 and 42 months prior to the survey.

Materials

The survey included the following questionnaires: (1) demographic variables, including gender, age, duration of service, most recent service type (Navy, Army or Air Force) and cohort of the ARRTS Program; (2) the K10, a measure of current psychological wellbeing/distress;[31] (3) the Core Self-Evaluations Scale (CSES), a validated tool for measuring an individual's aggregate evaluation of their locus of control, neuroticism, self-esteem and self-efficacy;[32,33] (4) a 16-item survey (see Table 1) asked the respondents to retrospectively evaluate the positive effects of the ARRTS Program in terms of their experience of behavioural activation, belonging, flow and therapeutic alliance; (5) finally, there were nine items asking the respondents' opinions about length of the program, the possible benefit of a range of follow-up activities, the non-military environment and its instructors, the development of new relationships, the learning of new skills and the perceived overall benefit of the program.

For each item in the positive effects survey, respondents were given the options of indicating whether the item applied to them before, during and/or after the ARRTS Program. Multiple responses were allowed. For each question, the respondents were also asked, 'How long following the program did the above effect last in months?' The given response options were the effect finished at end of program:

3 months, 6 months, 9 months, 12 months and 24 months or hasn't stopped yet.

Procedure

Prior to being contacted for the survey, the respondents had undertaken a four-week, residential training program in either visual, written, musical or theatrical art, culminating in an exhibition for family, friends and senior military colleagues. The respondents' art mentors in the program were qualified instructors in each area. The respondents completed the survey online using the Qualtrics platform. The study was conducted under the Departments of Defence and Veterans Affairs Human Research Ethics Committee approval Protocol 853-17.

Statistical analyses

Planned statistical contrasts were conducted using O'Brien and Kaiser's[34] multivariate analysis of variance (MANOVA) method. The textual description of the results will report the *F* statistic and its *p* value. For significant effects, the effect size *(d)* is also reported. The *d* statistic represents the median of the 95% confidence interval (CI) for the difference among the contrast-weighted means expressed in standard deviation (SD) units.[35] In line with Cohen's[36] recommendations, effect sizes of 0.20, 0.50 and 0.80 SD units were designated as small, medium and large, respectively. For correlational analyses, correlation coefficients (*r*) of 0.10, 0.30 and 0.50 were designated as small, medium and large, respectively.

Results

Positive effects

Overall, 29 of the 31 respondents reported that the program was beneficial. Table 1 shows the percentage of respondents who reported having experienced the positive effects described in each of the 16 items before, during and after participating in the ARRTS

Table 1. Positive Effects of ARRTS Program

Percentage of participants who experienced:	Before ARRTS Program	During ARRTS Program	After ARRTS Program
Behavioural Activation			
I enjoyed the activities I was involved in	26%	94%	65%
I had a sense of achievement from the activities I undertook	23%	87%	71%
I had a sense of purpose by undertaking the activities	19%	87%	65%
I used the artistic activity to avoid unpleasant feelings	19%	84%	61%
Average Behavioural Activation	22%	88%	65%
Sense of Belonging			
I felt I was accepted by the community I was in	16%	94%	61%
I felt I had close supportive relationships with others	26%	90%	58%
I felt productive	23%	90%	61%
I felt independent	23%	87%	61%
Average Sense of Belonging	22%	90%	60%
Flow			
I felt I could be fully immersed in an activity	6%	87%	45%
I felt I had energised focus	3%	84%	65%
I could lose a sense of space and time when I was absorbed in activity	19%	81%	55%
I did things instinctively and automatically without having to think	32%	65%	42%
Average Flow	15%	79%	52%
Therapeutic Alliance			
I had a good working relationship with the ARRTS staff	32%	94%	74%
The ARRTS staff empathised with me	42%	84%	65%
The ARRTS staff were genuine in relating to me	35%	90%	65%
I feel open to development and change	19%	94%	71%
Average Therapeutic Alliance	32%	90%	69%
Average All Items	**23%**	**87%**	**61%**

Program. Examination of Table 1 reveals that for every item the percentage of respondents reporting the feeling increased during the program and then declined after the program. The average percentage for all items, as shown in the bottom row, increased from 23% to 87%, and then declined from 87% to 61%.

To analyse this pattern, three scores were computed for each respondent, specifically, (1) the proportion of the 16 positive effects that the respondent reported experiencing before the program; (2) the proportion experienced during the program; and (3) the proportion experienced after the program. In a MANOVA comparing these three scores, there was a large and significant increase from the before scores (M = 23%, SD = 20%) to the during scores (M = 84%, SD = 26%) [$F(1,31) = 111.23$, $p < .01$, $d = 2.413$]. The respondents' after scores were also significantly higher than their before scores (M = 65%, SD = 30%) [$F(1,31) = 13.31$, $p < .01$, $d = 0.773$]. As may be apparent, there was a significant reduction from the during scores to the after scores [$F(1,31) = 51.41$, $p < .01$, $d = 1.640$]. Subsidiary analyses on scores computed for behavioural activation, sense of belonging, flow and therapeutic alliance, yielded a virtually identical pattern of results with similar effect sizes.

Duration of positive effects

Parallel to Table 1, Table 2 outlines the reported duration of each of the positive effects. The positive effects appeared to reduce for some respondents in the three to 24 months period following the program. Nevertheless, for all items the positive effect reported by the majority of respondents (M = 61%) lasted for up to 24 months or longer. For each of the four subscales (behavioural activation, belonging, flow, therapeutic alliance), an average score for

Table 2. Duration of Positive Effects

Duration of the effect experienced by participants:	End of Program	Lasted 3 Months	Lasted 6 Months	Lasted 12 Months	Lasted 24 Months or ongoing
Behavioural Activation					
I enjoyed the activities I was involved in	10%	17%	7%	7%	60%
I had a sense of achievement from the activities I undertook	10%	14%	7%	3%	66%
I had a sense of purpose by undertaking the activities	10%	21%	3%	3%	62%
I used the artistic activity to avoid unpleasant feelings	18%	7%	7%	11%	57%
Average Behavioural Activation	12%	15%	6%	6%	61%
Sense of Belonging					
I felt I was accepted by the community I was in	17%	7%	3%	10%	63%
I felt I had close supportive relationships with others	7%	3%	13%	3%	73%
I felt productive	10%	7%	7%	7%	70%
I felt independent	13%	7%	7%	7%	67%
Average Sense of Belonging	12%	6%	8%	7%	68%
Flow					
I felt I could be fully immersed in an activity	21%	10%	7%	7%	55%
I felt I had energised focus	14%	10%	3%	10%	62%
I could lose a sense of space and time when I was absorbed in activity	29%	7%	4%	7%	54%
I did things instinctively and automatically without having to think	23%	12%	0%	8%	58%
Average Flow	21%	10%	4%	8%	57%
Therapeutic Alliance					
I had a good working relationship with the ARRTS staff	20%	3%	7%	10%	60%
The ARRTS staff empathised with me	21%	7%	4%	18%	50%
The ARRTS staff were genuine in relating to me	23%	10%	0%	17%	50%
I feel open to development and change	7%	14%	7%	3%	69%
Average Therapeutic Alliance	18%	9%	4%	12%	57%
Average all factors	**15%**	**10%**	**5%**	**8%**	**61%**

each respondent was computed. Statistical tests on the distribution of frequencies for the averages revealed that the distributions on three of the four subscales were significantly different from a random distribution. For behavioural activation, belonging and therapeutic alliance, the $\chi 2$ (4) was, respectively, 30.45, 28.19, 24.97, *p*s <.0001. The distribution of flow scores, while still favouring a duration of 24 months or longer in duration appeared less pronounced, $\chi 2$ (4) = 10.77, p <.029.

Principal components analysis of positive effect duration

A principal components analysis was conducted on the duration of the program's positive effects. Overall, the analysis indicated one factor accounted for 96% of the duration of effects experienced by the respondents. No other factor had an eigenvalue over one. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.64, which was above the commonly recommended value of 0.60, and Bartlett's test of sphericity was significant [$\chi 2$ (6) = 21.94, p <.001].

Follow-up actions

Figure 1 shows the percentage of respondents who reported the types of preferred follow-ups. The three most-frequently preferred options were the ability to reconnect with participants of their own program, the ability to remain connected to the benefits of art and undertaking activities that encouraged a sense of purpose. In contrast, the three least preferred follow-up activities were a catch-up with respondents from all programs, an activity which encouraged flow and a phone call from the staff on the program.

Core self-evaluations

There was a positive medium correlation between CSES (M = 37.6 SD = 9.7) and the proportion of the 16 positive effects reported by respondents that occurred during the program (M = 13.5 SD = 4.1), r =.32, p <.05, N = 31. A medium correlation was also found for CSES and the proportion of positive effects experienced after the program (M = 10.3 SD = 4.8), r =.34, p <.05, N = 31.

K10

Responses for the K10 questions were partitioned into three bands aligned with the bands used by the Joint Health Command of the ADF.14 Among the 31 respondents, 12 (39%) were in the band considered likely to be well, with 9 (29%) considered likely to have a moderate disorder, and 10 (32%) considered likely to have a severe disorder. The corresponding percentages from the overall ADF population are

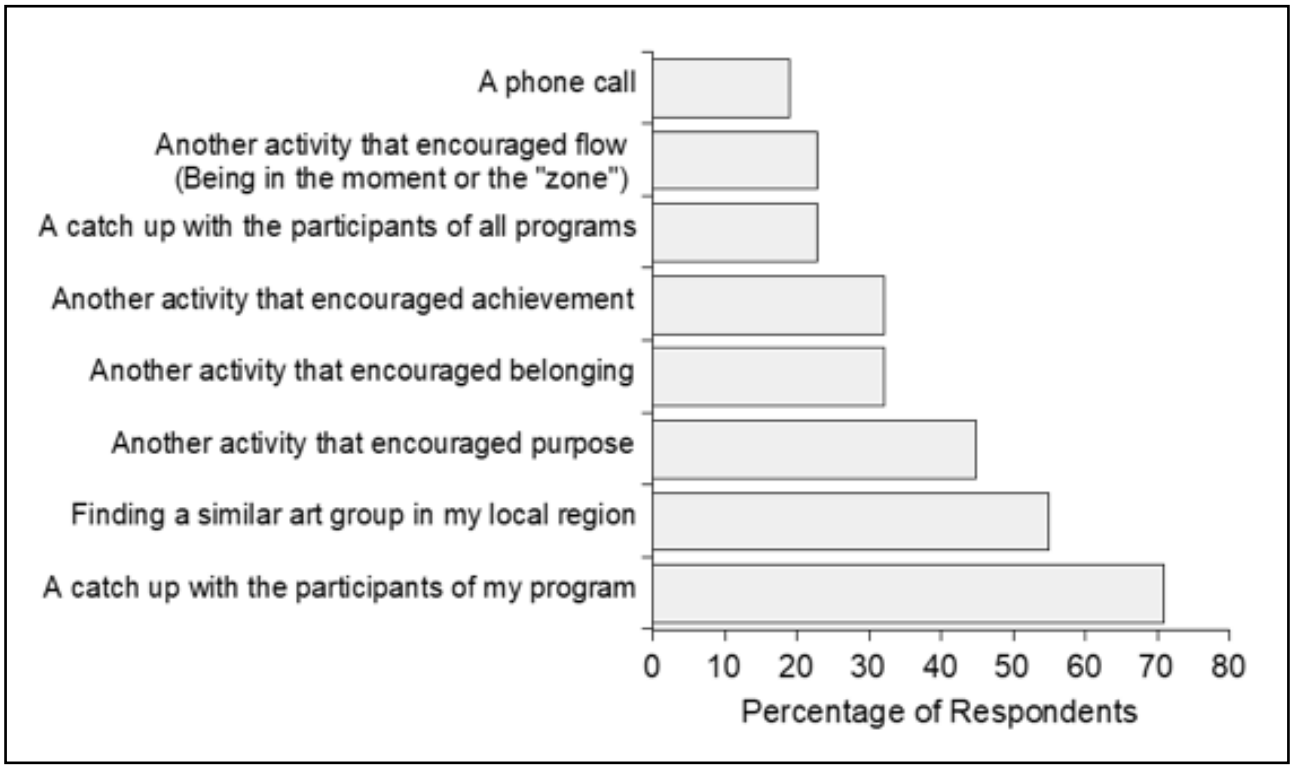

Figure 1: Percentage of respondents who indicated which follow-up activity they would have wished to have available after the ARRTS program was finished

65%, 22% and 13%.14 Thus, a majority of the respondents (61%) were significantly more likely to be experiencing some degree of continuing psychological distress as compared to 35% in the overall ADF population, $\chi 2$ (2) = 12.84, p <.002.

Discussion

The aim of the current study was to examine the self-reported impact of an art-based training program on current serving veterans with respect to six research questions.

Question 1 queried what benefits respondents gained. The respondents reported having experienced multiple benefits, including gains in their sense of behavioural activation, belonging, flow and therapeutic alliance with their arts mentors. On an individual basis, the magnitude of the gains was highly correlated; principal components analysis revealed that the ratings for 16 positive effects all loaded on to a single factor that explained 96% of the variance.

Question 2 sought the duration of the self-reported benefits. A solid majority of respondents (61%) reported that the program's benefits endured at least 24 months, while only 15% reported that the benefits did not outlast the program.

Question 3 asked whether a follow-up would be desirable. The bulk of respondents (81%) reported that they would like to have had an opportunity for a follow-up activity, especially an art activity that involved elements of belonging and behavioural activation.

Question 4 examined each respondent's core self-evaluations and its relation to their experience in the program. Respondents who had a higher CSES score reported more benefits from the program than those who did not.

Question 5 asked about the respondents' general sense wellbeing (K-10) in relation to the perceived benefits of the program. The respondents' current general wellbeing was significantly lower than the general ADF population; 61% were likely to have some degree of disorder in comparison to 35% in the general ADF population. The perceived benefits appear to have been relatively constant across levels of wellbeing or lack thereof.

In this research, respondents reported multiple, enduring benefits from their participation in the ARRTS. Given concerns raised about sustained effectiveness of established therapies,[37,38] the long duration of change reported by respondents is strongly encouraging for the participation of military personnel in arts-based programs. Although 61% of the respondents experienced enduring benefits from the arts program in addition to their previous treatment, the respondents' overall wellbeing was lower than the general ADF population. Given the lower level of wellbeing, the respondents' desire for follow-up art activities that promoted belonging and a sense of purpose is consistent with findings that sustaining the retention and maintenance of training is bolstered by brief refresher training.[39-41]

Limitations and future directions

The current research has framed the ARRTS Program as an arts-based activity adjunct to established forms of psychological therapy administered within the ADF, which is typically cognitive behavioural therapy. Behavioural activation, belonging, flow and therapeutic alliance have been previously suggested as contributors to therapeutic change. The current research confirmed that all four elements were positive outcomes of the arts-based program. What had not been expected was that all four elements appeared to cluster as one factor that contributes to the art-based effect. Yet, the underlying constructs seem to be at least partially distinct. In particular, belonging and therapeutic alliance concern interpersonal relationships, while behavioural activation and flow seem more related to the individual's personal positive experience with an activity. Further research with a greater number of participants to understand the commonality and/or divergence between these constructs would seem worthwhile. Increasing the sample size would potentially allow for the separation of the effects from each of the art-based activities used in the ARRTS Program.

The higher-order construct of core self-evaluations has been proposed as being predictive of future positive engagement and satisfaction.27,28 The CSES scores were positively correlated with the benefits experienced by respondents both during and following the program. Further research into how core self-evaluations may mediate and/or moderate this outcome may also be worthwhile. In contrast, there was no discernible correlation of CSES scores with the respondents' reports of their before scores for behavioural activation, belonging, flow and therapeutic alliance. In this connection, the design of the current study involved significant recall from the respondents. The recall of experiences in the ARRTS Program could be considered both semantic and episodic in nature and, given the theorised differences in degradation of such memories,42 it would be beneficial to understand how the program

influences the encoding of those memories at the time of experience. An opportunity for further investigation that is less reliant on recall could clarify the present findings, for example, periodic face-to-face mental wellbeing assessments both before and following the program.

Art-based activities fall on a continuum of usage in society ranging self-entertainment through self-development and into their therapeutic usage.43 The framework of established, conventional therapy has been argued by some to be counterproductive for the free forms of expression that art can offer. However, integrated programs such as CBT-ART44 are currently being developed. Evaluation of art-based activities' contribution to wellbeing must consider the full range of experiences and delivery methods such activities can provide.

Conclusion

The current study extended the existing knowledge on how to engage military personnel with art as a potential adjunct to their previous and ongoing clinical treatment. Based on the respondents' recall, the ARRTS Program provided aggregate benefits in several ways. The results indicated that the art-based program had a positive effect on apparently disparate elements of the respondents' functioning. In fact, four seemingly unrelated elements of behavioural activation, sense of belonging, flow and therapeutic alliance might be considered one overarching factor, at least in this context.

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Corresponding Author: Tavis Watt
tavis.watt@student.unsw.edu.au
Authors: T Watt[1,2], E Kehoe[1]
Author Affiliations:
1 University of NSW
2 Australian Army

Authors Biographical Note

Tavis Watt

Mr Tavis Watt has a BSc (Hons), Master of Business Administration, and a Master of Psychology (Clinical). He has held various roles within Human Resources in international oil companies and Director level appointments within the university sector. He joined the Australian Army Psychology Corps in 1999, in which he is a Major. He has deployed on operations to the Solomon Islands, Timor L'Este, the Middle East and Afghanistan. In addition, he has supported disaster recovery during the 2009 Australian Bushfires. More recently, he has supported the Australian Defence Force—Art for Resilience Recovery and Teamwork Skills (ARRTS) program and the 2018 Invictus Games team.

In civilian life, he is a Clinical Psychologist in private practice, the club psychologist for the AFL team, the Geelong Cats and a PhD candidate at the University of New South Wales (UNSW).

E. James Kehoe

Professor E. James Kehoe has earned a BA (cum laude), MA and PhD in Psychology. He came to Australia in 1977, after completing his PhD at the University of Iowa, to take up a lectureship at the UNSW. He is now Professor and past Director of Organisational Psychology in the School of Psychology. He has served in the Australian Army Psychology Corps since 2008 in the active reserve as a senior project officer, with the rank of Lieutenant Colonel.

Prof. Kehoe has conducted 45 years of research in psychology and published over 100 articles in peer-reviewed scientific journals. He has taught professional and research ethics. He chaired the UNSW Animal Care and Ethics Committee (1995–2000) and continues to be the co-chair of a low-impact ethics panel for human research at UNSW (2001–2017).

Professor Kehoe is a Fellow of the Royal Society of New South Wales, the Association for Psychological Science (USA) and the Psychonomic Society. He is registered and endorsed organisational psychologist and a member of the Australian Psychology Society College of Organisational Psychologists.

Disclosure statement

Tavis Watt is currently a reservist officer in the Australian Army and receives normal wages for his current duties in the ADF ARRTS Program.

Prof. Kehoe receives reimbursement for his travel expenses related to this project from the University of New South Wales

Neither author has any further declarations concerning conflicts of interest associated with the writing of this manuscript.

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Warfare, Ships and Medicine: Prehistoric Origins

Commander Neil Westphalen

Introduction

Compared to other species, *Homo sapiens* have some major limitations. Examples abound of animals with better vision, hearing and olfaction; greater strength or agility, that can run, climb or swim faster; and have anatomical weapons such as claws, teeth and venom, with greater lethality.

Our non-technological achievements such as the arts and literature have clearly materially contributed to making us who and what we are. Nevertheless, it is our mastery of technology over the last 300 000 years[1] that have made us the current dominant species on this planet.

These accomplishments are symbiotic: arts, such as sculpture, have had centuries of technological development, while technical achievements such as ships and weapons often have their own aesthetic qualities, even without additional adornments that do not contribute to their functionality.

Likewise, medicine has both technological and non-technological qualities. Comparatively recent anatomical, physiological, biochemical and other scientific discoveries have led to major technical advances in clinical care that can significantly enhance our quality of life. Yet good clinical practice remains utterly dependent on the emotional, social, spiritual and other non-technical interactions between patients and their caregivers.[2]

This article describes the beginnings of three of what are arguably, for better and for worse, the greatest accomplishments in human history: weapons, ships and medicine. The timeframe covers the Palaeolithic (3 300 000–12 000 BCE) and Neolithic (12 000–4500 BCE) Periods, followed by the Copper (6500–1000 BCE) Bronze (3500–300 BCE), and Iron (1500 BCE–800 CE) Ages.

While acknowledging the contributions to these among other technologies from Africa, Asia and the Americas, this and subsequent articles are focused mostly on those from Europe, given their eventual relevance to Australian military maritime medicine.[3]

Prehistoric weapons

A broad generalisation of nomadic hunter-gatherers is that, to a certain extent, everyone has more or less the same skills to essentially make the same items, such as the clothing and tools needed to survive.[4] The lack of unique possessions between and within clans during the Palaeolithic and Neolithic Periods, combined with the dispersed population distribution[5] and itinerant existence inherent to hunting and foraging, suggests they had limited opportunities or need for trade. It also seems likely that their daily struggle to simply stay alive left little spare capacity for fighting other clans.

These considerations suggest that inter-clan conflicts during this time only occurred as a result of life-threatening water and/or food shortages, and that any 'fighting' was mostly ritualistic, with few combat casualties.[6]

These inferences are supported by the fact that the oldest archaeological evidence of weapons being used on other people rather than animals is only dated to about 11 000 BCE.[7] This is despite hominids first using weapons up to five million years ago,[8] while the oldest weapons to be identified as such (a collection of wooden spears) are dated from 300 000 to 400 000 BCE.[9] The earliest evidence of bows and arrows is from 71 000 BCE,[10] followed by weapons such as clubs,[11] axes,[12] and slingshots.[13]

Wooden spear, found Schöningen Germany, dated c400 000 BCE[14]

Neanderthal spearheads, found southern Sahara, Morocco, dated 100 000–33 000 BCE[15]

Flint arrowhead, Western Desert Egypt, dated 90 000–5000 BCE[16]

Jebel Sahaba cemetery, northern Sudan, dated c11 000 BCE.[17,18] *The pencils indicate stone arrowhead marks on the bones, which suggest that the victims were killed by archers.*

Cave art, Cueva del Roure, Morella la Vella, Castellón, Valencia in Spain, dated c8000 BCE.[19] *Note the three archers on the right under attack by another four archers on the left… or perhaps vice versa.*

The development of animal domestication from 10 000 BCE led to pastoral societies that migrated seasonally depending on the availability of feed and water for their herds.[20] Although raiding each other's animals would have increased the potential for conflict, the ongoing lack of differentiated possessions suggests such events still only occurred when their stock ran short.

While gold, silver and iron are found naturally in their metallic form (albeit the latter only as meteorites), the discovery that heating certain ores liberated other metals such as mercury, tin, lead and copper was made independently in modern Syria and central America, in the former case in c6500 BCE.[21] Producing these metals required people to settle where the ores were located, and additional capacity by those producing the food to feed those who mined and processed them. The latter requirement had already been met by the advent of sustainable agriculture from 12 000 BCE.[22] These advances increased differentiation as to who possessed what, thereby creating the first trading opportunities within and between settlements, while also increasing the scope for conflict.

By 3500 BCE, it had been discovered that a 90:10 per cent alloy of copper and tin made bronze, which is harder and less brittle than either metal alone. This led to the gradual replacement of wooden and stone weapons with ones made of copper and later bronze. It also facilitated the development of new edged weapons from c2000 BCE, such as swords and daggers.[23]

Wooden club, found Thames River, Chelsea UK, dated 3530–3340 BCE.[24,25]

Top to bottom: axe with yew handle and copper head, incomplete bow stave and flint knife. All found Ötztal Alps, Italy, dated 3400–3100 BCE.[26,27,28]

Early Bronze Age cast copper alloy arrowhead, find location unknown, dated 2100–1500 BCE.[29]

Middle Bronze Age spear head, found Nine Elms Vauxhall UK, dated 1400–1275 BCE[30]

Late Bronze Age sword, found Thames River, Richmond UK, dated 900–800 BCE.[31]

Flint arrowhead imbedded in a humeral head, Tollense River, Germany, c1200 BCE.[32]

Intracranial penetration by bronze arrowhead, Tollense River, Germany, c1200 BCE.[33]

Skull with blunt-force trauma, Tollense River, Germany, c1200 BCE.[34]

Throughout the Neolithic Period and the Copper / Bronze Ages, the scarcity and hardness of meteoric iron limited its use to mostly ornamental purposes,[35] while the inability to generate the high temperatures required to produce metallic iron from ore precluded its large-scale production.[36] The technology that overcame the latter developed independently in multiple locations worldwide, beginning c1500 BCE in the Middle East. It entailed using charcoal to heat the ore and produce carbon monoxide, the combination of which chemically reduced the iron to a metallic 'bloom' form, which was then repeatedly heated and hammered to remove impurities.[37]

However, the resulting 'wrought' iron is actually softer than bronze. It was not until c900 BCE that it was found that reheating iron with additional charcoal transfers carbon to its surface. If it is then rapidly cooled in water or oil, the result is a tempered hard steel surface over a flexible iron interior. This discovery led to iron displacing bronze, in particular for edged weapons that could be made longer and kept sharper.[38] Their effectiveness for hand-to-hand combat in particular went unchallenged until the first handheld firearms were developed in China in the 13th century CE.[39]

Iron Age sword, found Kirkburn UK, dated c200 BCE[40]

Iron Age Celtic spear head, find location unknown, dated 100–300 BCE[41]

Iron Age dagger, found Southwark UK, dated 100 BCE–50 CE[42]

Prehistoric ships

The development of trade between the first farms, hamlets and villages was initially limited by the carrying capacity of individual people (no more than 40–50kg each), which would only have been suitable for small, lightweight and/or valuable merchandise.[43] It was not until 4000 BCE that oxen were first harnessed to pull sledges, while ponies and donkeys were not domesticated until 1000 years later.[44] Even with the first wheeled carts from c3150 BCE,[45] transporting large amounts of bulky and/or weighty commodities overland remained inefficient and expensive until the development of the first railways.[46]

Hence, the technological developments that led to the first vessel to achieve sustainable and controlled

waterborne travel with a person (and later cargo) aboard, arguably rank with those that resulted in the 1903 Wright Flyer[47] and the Vostok and Mercury spacecraft.[48] These developments were most likely driven by the fact that even now, besides their effectiveness for fishing, ships[49] remain the most efficient means of transporting large and heavy commodities over long distances.[50]

Like weapons, watercraft technology developed independently in multiple locations worldwide, based on the local materials available. As examples, prior to 8000 BCE hunters in Scandinavia made boats from reindeer skin on antler frames,[51] while Egyptian boat builders used papyrus reeds.[52]

Nevertheless, subsequent advances entailed some elements of parallel evolution, such as dugout boats from hollowed-out logs. Using northern Europe as an example, the oldest known dugout is dated c8000 BCE.[53] By c3000 BCE, European dugouts had developed a 'spoon' bow and a separate transom piece bevelled and tied in place to made the stern watertight. The limitations inherent to the width of the parent log first led to planks being lashed in place above the gunwale to increase freeboard, and later to the parent log being split in half and planks added between to increase beam.[54]

These vessels were all propelled with poles or paddles until the development of oars and rowlocks, at times ranging from 6000 BCE in Korea,[55] to c200 BCE in Scandinavia.[56]

Notwithstanding their greater carrying capacity compared to people, pack animals or carts, the small size and general lack of seaworthiness of these watercrafts would have restricted their operations to local rivers, lakes and estuaries. Even so, the earliest evidence of Mediterranean seafaring (dated to 10 000–3000 BCE), are flakes of obsidian found in mainland Greece that are unique to the island of Melos, which is 50 nautical miles offshore.[57]

Diagrammatic representation of a northern European dugout, c8000 BCE.[58] Note the quality of the workmanship would have reflected the stone tools used at the time and was therefore far less neat. (Author)

Diagrammatic representation of a northern European dugout, c3000 BCE.[59] Note the spoon bow and transom stern. (Author)

Diagrammatic representation of a northern European dugout, c2700 BCE.[60] Note the spoon bow, transom stern and planks added to increase freeboard and beam. (Author)

Diagrammatic representation of a northern European dugout, c1300 BCE.[61] The cutaway shows how the parent log has been split in half, with a plank inserted between to increase beam and transverse ribs to hold them together. Also note the lack of a keel. (Author)

Prehistoric medicine

While bones from the Palaeolithic and Neolithic Periods indicate human lifespans of only 30 to 40 years, the paucity of any other archaeological evidence means that the knowledge of prehistoric medicine is rather speculative.[62] Even so, it is known that human life expectancy at birth was limited by high peri- and neonatal mortality rates, as this remained the case until comparatively modern times.[63] Survivors would then have been subject to the health risks inherent to hunter-gatherer and pastoral nomadic societies, in particular communicable disease and trauma.

From a modern occupational and public health perspective, a communicable disease outbreak within a clan could have been devastating, not only because of the morbidity and mortality associated with the outbreak itself, but because of the second- and third-order effects regarding the clan's ability to move, forage and hunt.[64] Even so, any pandemic threat to the worldwide human population was limited by the scattered nature of its constituent clan groups and the sparse contacts between them.[65]

While the agglomeration of people into the first hamlets, villages and towns would have eliminated these indirect consequences, their closer contacts in greater numbers would have increased their communicable disease risk.[66] The role of watercraft as a communicable disease vector therefore probably came early in human history and, in combination with aircraft, remains extant today.[67,68]

The apparent absence of a clearly discernible cause for disease outbreaks otherwise probably made them generally inexplicable, except as an adverse spiritual intervention. This highlights the importance of the spiritual interactions between medical patients and their caregivers, in addition to their emotional and social support.

From a modern clinical perspective, actively treating infectious diseases and other medical conditions was limited by the inability to accurately diagnose. Even when this could be achieved (such as during an epidemic), caregivers still needed to be able to identify the right therapeutic agent(s)—where these existed—and then ascertain the right dose.

Notwithstanding thousands of years of empiric trial and error, this process would have been complicated by the plethora of candidate plants in particular, their high toxicity in some cases, and the quantities required to achieve therapeutic effects beyond simply inducing vomiting and/or diarrhoea in most others. Achieving success was also problematic until there were sufficient living grandparents from 30 000 BCE, to maintain a living knowledge base within each clan, as to which agents were effective for which conditions in what dose.[69]

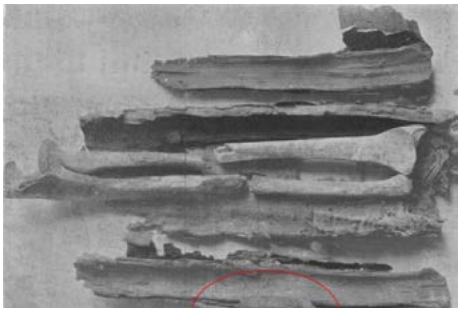
Therefore, it seems reasonable that a key reason for today's limited knowledge of prehistoric therapeutic agents relates to their efficacy: in short, only the ones that definitely worked for readily diagnosable medical conditions remained in use long enough to be documented in written form.[70] While many of the remaining agents failed with respect to being actively therapeutic, their relative *non*-toxicity also meant they were unlikely to do much harm. It therefore seems likely that these agents became the basis of folklore-based treatments until comparatively modern times. This arguably remains the case regarding at least some complementary medicines.[71]

As previously indicated, the size and speed of many animals would have made them highly dangerous to hunt with the weapons available.[72,73,74,75] Plant foraging undoubtedly posed its own hazards with respect to competing with larger/faster animals and/or being stalked by ambush or pack predators.[76,77] To these hazards can be added ample scope for slips, trips, falls and crush injuries, especially in rough terrain.[78]

The risks to each clan posed by individuals with injuries that rendered them unable to travel were probably similar, albeit perhaps less dire, than those posed by communicable disease. The greater threat to the clan would have come from the accumulation of members with chronic impairments and injuries, who were rendered temporarily or permanently unable to hunt or forage.

To this end, the overt connection between cause and effect, particularly regarding uncomplicated cuts, abrasions, limb fractures and perhaps even dental conditions, is likely to have facilitated identifying some effective surgical treatments via the aforementioned empiric methods.[79,80] Even so, head, spinal, chest and abdominal injuries in particular remained almost universally fatal until modern times. Likewise, wound complications such as infections (especially from retained foreign bodies), gas gangrene and tetanus would have had very high morbidity and mortality rates. Exceptions to the contrary from this time are therefore highly remarkable.

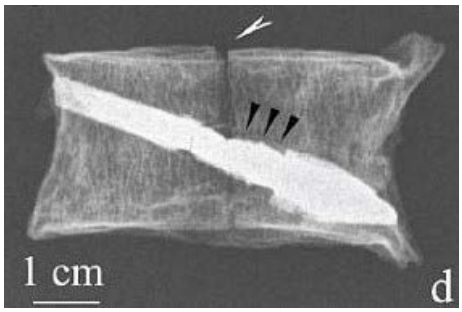
Highly worn upper central incisors with possible bitumen fillings, c11 000 BCE[81]



Bark splints applied to a left midshaft radial / ulnar fracture of a 14-year-old girl, Fifth Egyptian Dynasty (2498–2345 BCE).[82] *The circled area is blood clot adhering to the linen over the splint, implying these fractures were compound.*

Left (A): Posterior view, healed proximal fracture left humerus with displacement, Nubian Egypt, c1539–1075 BCE[83]

Trepanned skull, Omdurman Sudan, 4000–5000 BCE.[84] *Note the new bone formation around the edge of the hole in the cranium, suggesting the patient survived. Although numerous such cases have been found, the reason(s) for this procedure on apparently healthy individuals remains unknown.*



Bronze arrowhead imbedded in an otherwise healed vertebral body, Central Kazakhstan, 500–600 BCE.[85]

Conclusion

The relationship between weapons, ships and medicine have been closely linked since late prehistory. A key theme to their development pertains to their independent development in multiple regions worldwide. This most likely represents the extent to which the watercraft that became the *only* means of communication between them for hundreds of years, were initially only suitable for local rivers, lakes and estuaries.

While the first weapons up to five million years ago allowed hominids to progress from scavenging to hunting, current archaeological evidence indicates that inter-human conflict only began about 11 000 years ago. This suggests the extent to which the struggle to survive was hard enough without fighting each other (except in dire environmental circumstances), as well as the likelihood that no-one had anything worth trading or fighting for that they could not make themselves.

People with illnesses or injuries that limited or prevented them from participating in the hunting and/or foraging activities necessary to survive, would have had significant second- and third-order adverse effects on the rest of their clan. From a modern occupational and public health perspective, the breadth and depth of these effects appear to lack prominence, at least in the current non-specialist palaeontological literature. Even so, it seems the benefits to each clan as a whole with respect to actively caring for their disabled members outweighed any of the somewhat more Darwinian alternatives: were this not so, the latter would probably have a far greater place in modern society.[86]

The empiric methods available to identify effective surgical treatments for uncomplicated cuts, abrasions and limb fractures were probably relatively straightforward, especially after there were sufficient living grandparents to maintain an ongoing knowledge base. Even so, head, spinal, chest and

abdominal injuries remained almost universally fatal until modern times, along with very high morbidity and mortality rates from wound complications.

The first farming communities in 12 000 BCE, followed 2 000 years later by the first domesticated animals, allowed Bronze Age people to settle where they could mine and process metal ores from 6500 BCE. Although this would have eliminated some of the medical hazards inherent to hunter-gathering, it is likely to have exacerbated others such as communicable disease, the aetiology of which remained generally inexplicable until quite recently. The inability to accurately diagnose, or to match diagnosis to treatment, would have generally limited the latter to non-technical emotional, social and spiritual support.

The first settlements would also have led to differences as to who possessed what, resulting in commodities being traded within and between them. It seems likely this provided the impetus for developing the first watercraft, not only for fishing but also to transport trade goods in greater quantities than could be achieved otherwise. It probably also led to people with nothing to trade seeking to take what they needed or wanted by force, while their prospective victims sought to defend themselves and their commodities from such attacks.

These developments initiated a cycle: increasing trade drove the need for larger and more efficient ships to transport commodities and for better weapons for defence or attack, which in turn enabled further trading opportunities. Thousands of years later, this cycle continues to remain relevant to the economic wellbeing of many nations, including Australia.[87]

Future articles will describe how the expansion of this cycle worldwide from Europe from the end of the 15th century frequently led to the near or total annihilation of the participating ship's crews. It was not until the 18th century that medicine's role as an operational enabler for this cycle was first recognised. Besides facilitating the European settlement of Australia, this recognition proved crucial to British naval dominance during the 19th century,[88] as well as Allied military success in two world wars among other 20th century conflicts.[89,90]

Author

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

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

Commander Westphalen transferred to the Active Reserve in 2016.

Disclaimer

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

Corresponding Author: Neil Westphalen
neil.westphalen@bigpond.com
Authors: N Westphalen [1,2]
Author Affiliations:
1 Royal Australian Navy Reserve
2 Navy Health Service, C/O Director Navy Health

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Lead:	327°C
Silver:	961°C
Gold:	1064 C
Copper:	1084°C
Iron:	1538°C

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Casualty Evacuation in the Australian Defence Force

Commander Neil Westphalen

Introduction

This article is the latest of a series regarding the role of occupational and environmental medicine in the ADF.[1,2,3,4,5,6]

These articles, as well as a recent Productivity Commission inquiry,[7] indicate that high workplace illness and injury rates confirm the need to improve the management of hazards associated with ADF workplaces, with better emphasis on prevention. To this end, a submission by the Royal Australasian College of Physicians to the aforementioned inquiry advocated this would best be achieved by basing the ADF's health services on a systems-based occupational health strategic model.[8]

Doing so would have to entail reassessing the fundamental inputs to capability[9] for both Joint Health Command and Defence's Work Health and Safety Branch. The current state of the ADF's occupational and environmental health services, and the small number of specialist practitioners within the Australasian Faculty of Occupational and Environmental Medicine, suggests that a mature model would take 10–15 years' sustained effort.[10]

This article expands on these papers, with respect to the application of a strategic-level systems-based occupational health model to the ADF's casualty evacuation capabilities.

Definitional clarifications

The term 'casualty evacuation' (casevac) can be differentiated from 'medical evacuation' (medevac), in that unlike the former, medevacs use dedicated vehicles (whether road, sea or air),[11] and are protected by the Geneva Protocols.[12]

In addition, for the purpose of this article, the term 'dedicated' refers to purpose-built and -operated medevac platforms, while 'designated' refers to platforms with multimission capabilities that can include conducting casevacs when required.

ADF overseas operations and other deployments requiring ADF casevac support

Table 1 describes the ADF's current overseas operations as of 10 May 2019.

However, Table 1 does not include short-term recurrent operations such as GATEWAY (Australia's contribution to the preservation of regional security and stability in the northern Indian Ocean and South China Sea), SOLANIA (Australia's contribution to maritime surveillance within the Pacific Region), or RENDERSAFE (disposal of World War II-era explosive remnants from South Pacific island nations).[13] It also does not include 'one-off' overseas operations in response to specific incidents, such as assisting

Table 1: Current ADF global operations as of 10 May 2019[1]

Operation	Location	Personnel	Government Mandate
ACCORDION	Middle East Region	500	Ongoing
ASLAN	Sudan	25	Reviewed annually
MANITOU	Middle East Region	240	Ongoing
MAZURKA	Egypt	27	Ongoing
OKRA	Middle East Region and Iraq	600	Ongoing
PALADIN	Israel/Lebanon	12	Reviewed Annually
RESOLUTE	Australian Maritime Interests	600	Ongoing
HIGHROAD	Afghanistan	300	Ongoing
AUGURY - PHILIPPINES	Philippines	100	Reviewed annually
	Total	2404	

the response to the Fukushima nuclear accident in 2011,[14] the Indian Ocean search for MH370 in 2014,[15] or Operation FIJI ASSIST following Typhoon Winston in 2016.[16]

Table 1 also excludes ADF members who undertake overseas deployments without being force-assigned to any of these operations. For example, approximately one-third of Navy's 14 000 personnel are posted to ships at any one time for up to two years, of whom about a third (up to 1600 personnel), are at sea or visiting overseas ports. Only about 500 of these seagoing Navy personnel are force-assigned to the operations per Table 1.[17] It is likely that Army and Air Force have significant numbers of their own personnel in similar circumstances.

It is therefore estimated that at present, strategic casevac support is routinely required for at least 3500 ADF personnel. However, even this figure does not include up to 1300 additional ADF members aboard each of Navy's two Landing Helicopter Dock (LHD) ships, which would increase the number of personnel requiring strategic casevac support to over 6000, or well over double that per Table 1.[18]

While there are no numbers available regarding forward or tactical casevacs, there were approximately 70 ADF casevacs back to Australia in 2017, 20 per cent of which were perhaps from *non*-Table 1 operations and other deployments.[19] It is therefore estimated that the ADF currently conducts about 20 strategic AMEs per thousand deployed members per year.

In addition to its own personnel, the ADF has also deployed overseas to evacuate civilian casualties, notably the 2002[20] and 2005[21] Bali bombings.

ADF operations and exercises within Australia requiring ADF casevac support

ADF personnel often undertake exercises and other activities within Australia that may require casevac support. For example, Exercise TALISMAN SABRE 2015[22] resulted in 48 strategic casevacs, while Exercise HAMEL 2016[23] had 54.[24] While these casevacs were for routine conditions, the 1996 midair collision between two Army Blackhawks during a routine training exercise at the High Range Training Area near Townsville, led to 18 fatalities and 12 casevacs.[25] In addition, a main machinery space fire aboard HMAS *Westralia* in 1998, at the beginning of an otherwise routine non-exercise deployment from HMAS *Stirling*, resulted in four deaths and five casevacs ashore.[26]

Exceptions aside,[27] ADF operations within Australia typically entail disaster relief tasks such as flood relief in Queensland in 2012[28] and bushfire relief in NSW in 2013;[29] the largest such operation at present remains Operation NAVY HELP DARWIN after Cyclone Tracy in 1974.[30] Although casevacs have usually not been required for participating ADF members during these operations, they have been conducted for assisted civilians,[31,32,33,34] because unlike the ADF's casevac services, civilian medevac organisations are not intended, and are therefore generally unable, to move large numbers of patients simultaneously.

Finally, a routine requirement exists to return 'garrison' personnel to their home locations when they are ill or injured elsewhere (typically during courses). Virtually all intra- and interstate 'garrison' patient transfers use regular public transport aircraft (with or without a medical escort),[35] or civilian aeromedical providers such as the Royal Flying Doctor Service.[36]

Stretcher fit, commercial passenger aircraft.[37] Note how one stretcher case uses the same space as six seats.

Casevac platforms

Casevac platforms can be characterised by the land, sea or air environments in which they operate.

Operational and exercise land ADF casevacs within Australia and overseas generally use dedicated off-road-capable wheeled[38,39,40] or tracked[41] ambulances vehicles, while 'garrison' land casevacs typically use dedicated Service or civilian road ambulances or patient transport vehicles.[42]

Bushmaster ambulance, Urban Operations Training Facility, Shoalwater Bay Training Area, Exercise TALISMAN SABRE 2009.[43] Note the benign nature of the terrain in this instance.

Every RAN Fleet unit can conduct surface maritime casevacs using Rigid Hull Inflatable Boats (RHIBs)[44] or General Purpose Inflatable Boats (GPIBs),[45] while amphibious Fleet units also have organic landing craft.[46,47] However, RHIBs and GPIBs are only marginally fit-for-purpose (especially for stretcher cases), while the scarcity and other high-priority demands on landing craft makes it is unlikely that they would ever be solely dedicated for casevacs. Furthermore, the significant weather and sea state limitations of all these platforms, and alternative means of moving casualties between ships (such as light jackstay), usually mean that if possible, forward and tactical maritime casevacs are best conducted by air.

Launching a RHIB, Unit Readiness Evaluation, HMAS Toowoomba, *2019.[48] The difficulties, dangers and limitations associated with moving stretcher cases via this means should be apparent.*

Ocean-going ships were used during both World Wars for strategic casevacs from overseas, and to move casualties between Australian ports.[49] Extended transit times of up to three months meant they required comprehensive on-board treatment services. For example, although she was the smallest Australian hospital ship in WWII and was only intended to evacuate Army casualties from Port Moresby to Brisbane, MV *Centaur* still required 65 permanently embarked medical personnel, to staff 252 beds plus an operating theatre, dental surgery, laboratory and pharmacy for up to 18 days.[50]

By comparison, 252 stretcher cases can be evacuated over the same route today in seven C-17 sorties of 3 hours 15 minutes flight duration, each carrying up to 36 stretcher patients and 8–10 health staff, plus additional medical and aircrew personnel for fatigue management purposes.[51,52,53] Although additional sorties would be required to move intensive care cases (maximum six per C-17, medical and nursing staff permitting) it should be remembered that such cases from either World War would not have survived long enough to require evacuation.

Strategic aeromedical evacuation from Germany in a RAAF C-17 Globemaster III, 2011.[54] Note the amount of space required for one intensive care casualty.

The 1982 South Atlantic War led to the educational cruise liner SS *Uganda* being used as a hospital ship, and the Royal Navy's hydrographic survey vessels *Hecla*, *Herald* and *Hydra* as 'ambulance ships' for medevacs from the South Atlantic to Montevideo in Uruguay. This was necessary because of the short range of the UK Task Force rotary-wing aircraft within the South Atlantic area of operations, and the non-availability of airfields capable of accepting fixed-wing aircraft until the Port Stanley airport had been recaptured.[55] The mismatch between the huge distances within Australia's area of direct security interest (up to one tenth of the Earth's surface, or 51 million km^2),[56] and the limited range of the ADF's rotary-wing casevac aircraft that cover this area, indicates that if no suitable fixed-wing airfields are available, this remains the case even in the 21st century.[57]

All three Services have a range of rotary- (Navy[58,59] and Army[60,61,62]) and fixed-wing (Air Force[63,64,65]) aircraft, most of which can be fitted with a comprehensive range of stretcher fits and other medical equipment.[66] However, other high-priority demands mean that they are rarely exclusively dedicated for casevac purposes.

Australian Army Special Forces tactical aeromedical evacuation using a US Army UH-60 Black Hawk, Task Force WOLFPACK, Tarin Kowt Afghanistan, 2010.[67] Note the Red Cross marking indicating its dedicated medevac status: the ADF is unlikely to employ its own such aircraft for combat operations.

The plethora of ADF platforms that can be used for casevac purposes (especially for amphibious operations, where combinations of some or all of these assets may be employed anywhere along the casevac chain), and their non-dedicated (and sometimes not even designated) status, supports basing casevac management on a systems-based occupational health model that premises *each* casevac mission as a discrete workplace.

Casevac hazards

The environments in which these casevac platforms operate have their own occupational and environmental hazards. Examples regarding land casevacs include those associated with off-road terrain and on-road traffic,[68] while surface maritime casevacs include the effects of weather and sea state among other seagoing hazards, [69] some of which are also shared with air casevacs in addition to other aviation hazards.[70] Additionally, the lack of Geneva Protocol protection means casevacs can also face operational hazards from enemy action that may threaten the mission, the platform, the personnel and the casualties.[71,72]

In order to manage the risks posed by these hazards, the planning, conduct and monitoring of casevac missions is highly contingent on ADF health staff not only having the aforementioned high degree of clinical acumen (in particular advising when casevac is *not* required), but also a comprehensive understanding of each platforms' capabilities and limitations, as well as the environments in which they operate. This requires dedicated training for the on-scene health staff who request casevacs, the headquarters health staff who assess each request and plan, implement and otherwise control casevac missions, and the health staff who provide the en route clinical care. Furthermore, all these health staff need to work closely with the crews who operate these platforms, and the non-health headquarters staff who command and control them.

These considerations all support basing casevac management on a systems-based occupational health model that premises *each* casevac mission as a discrete workplace.

Casevac training

While no formal land casevac training is provided for ADF health officers, medics from all three Services undergo such instruction during the ADF Medic's Course, conducted via the Army Logistic Training Centre at Bandiana. Likewise, although there is no formal maritime casevac training, all Navy medics receive the same basic seamanship instruction as other entrants at the RAN Recruit School at HMAS *Cerberus*. Selected Navy medics also receive maritime casualty regulation instruction (see below) during the Clinical Manager's Course at the RAN Medical School at HMAS *Penguin*. The RAN Medical School also provides instruction for selected non-health personnel on how to initiate casevacs, during their two-week Minor War Vessel Health Care Provider's Course. Similar courses exist for Army special forces and other ADF personnel.

All Air Force and some Navy and Army medical officers undergo aviation medicine training at the Institute of Aviation Medicine, at RAAF Base Edinburgh. This training includes basic modules on the aviation medicine aspects of fixed-and rotary-wing aircraft casevacs. Selected medical officers undergo further aviation medicine training in the UK.

All Air Force health officers and medics undergo additional fixed-wing casevac training at the Health Operational Conversion Unit (HOCU) at RAAF Base Richmond. HOCU also provides a Rotary-Wing Aeromedical Evacuation Course for Navy and Army health personnel, using Army (and sometimes Navy) aircraft. However, this course is primarily focused on ensuring personnel safety when working in and around helicopters, rather than actual in-flight clinical care.

The limitations of simulation aids such as mock-up or permanently grounded aircraft, with respect to aviation hazards such as noise, wind blast, and proximity to rotors, propellers and jet exhaust, mean that all these courses still need actual aircraft on which to conduct at least some of the training.

The hazards associated with working around all these platforms, and the environments in which they operate, demonstrate the extent to which even *clinical* casevac training requires at least *some* occupational health awareness.

Casevac regulation

A key misconception within the general ADF population and the wider Australian community, is that military casevacs are only conducted for battle casualties and other medical emergencies. In fact, most ADF casevacs are conducted for *non*-urgent patients who are either unlikely to resume their normal duties per their operational mission within an acceptable timeframe, or require treatment that may not be particularly urgent, but is simply not available in situ.

In support of this assertion, a previous paper notes that 81 per cent of the 62 087 US military medical

evacuations from the Middle East area of operations in the 10 years from October 2001 were for diseases and non-battle injuries, of which about half were musculoskeletal injuries, mental disorders and ill-defined conditions.[73]

The highly variable degree of patient acuity (hence levels of care required) therefore mean that the primary aim of an efficient and effective casualty evacuation system, is to move the *right* casualties, at the *right* time, in the *right* order, by the *right* means, to the *right* destination medical facilities, with the *right* level of en route clinical care. Casualty regulation ensures that casualties are evacuated directly to health facilities that can not only deal with the numbers they receive, but can also provide the appropriate treatment. The intent is to balance the rate of effort of *both* the evacuation *and* treatment systems, while minimising the number of times that each casualty has to be handled.[74]

These requirements further reinforce the extent to which a high degree of clinical acumen is required, not only by the ADF health staff who request and/or conduct casevac missions, but also the headquarters health staff who assess incoming casevac requests, and then plan, direct and otherwise control which patients move when, by what means, to which destination medical facility and with what level of en route care.

Hence, casualty regulation is far broader in scope than simply being an administrative function, particularly with respect to (again) clinical decision making as to when casevacs are *not* required. Balancing these clinical requirements against the aforementioned occupational, environmental and operational hazards reinforces the extent to which the scope of casualty regulation remains entirely consistent with a strategic-level systems-based occupational health model.

Implications

This paper has already explained why the need to premise *each* casevac mission as a discrete workplace should be based on:

- the plethora of available ADF land- sea- and air-casevac platforms and their non-dedicated (and sometimes not even designated) status
- how the operational, environmental and operational hazards change with each casevac mission
- the extent to which casualty regulation is far broader in scope than simply being an administrative function
- the extent to which clinical staff require at least some awareness of the occupational hazards associated with working around or in their particular casevac platform.

Furthermore, as previously indicated, it is estimated that the ADF presently conducts about 20 strategic AMEs per thousand deployed ADF members per year. This rate will vary depending on factors such as:

- The standard of medical pre-deployment personnel preparation.
- The range of clinical services (capabilities) and capacities (numbers) of the supporting deployed health assets.
- The casualty holding policy, which dictates how long patients are to be retained by the support health assets before either returning them to duty, or evacuating them.

All of these factors depend on the occupational, environmental and operational health risks of each exercise, operation or deployment, the assessment of which is an occupational and environmental health function, irrespective of whether or not it is formally recognised as such.

Another factor affecting strategic AME rates pertains to the deployability status of members with known pre-existing medical conditions. The author has previously highlighted the importance of applying a risk management approach that balances the medical and operational risks posed by deploying such personnel in the first place, against the less-well-acknowledged yet still significant adverse effects of preventing such members from deploying who *can* in fact be deployed.[75] Applying this approach is likewise an occupational and environmental health function.

Conclusion

With ADF personnel arguably exposed to the most diverse range of occupational and environmental hazards of any Australian workforce, high rates of preventable workplace illness and injury indicate the need to improve the management of occupational and environmental health hazards, with better emphasis on prevention rather than treatment. This suggests the need for substantially revised fundamental inputs to ADF health capability, in order to base them on a genuinely holistic and sustainable systems-based occupational health strategic model.

Among other requirements, the ADF's ability to undertake forward, tactical and strategic casevacs is dependent on platforms and deployable health

personnel with the relevant clinical skills and equipment, which can evacuate Service and/or civilian patients, in the right order, by the right means, to the right destination medical facilities, with the right levels of en route care, seamlessly by land, sea, and or / air. This requires a risk management approach by the on-scene health staff and other personnel who request casevacs, the headquarters health staff who assess these requests and then plan, implement and otherwise control the responding mission(s), and the health staff who actually conduct them. All ADF health staff therefore require a comprehensive understanding of each platforms' capabilities and limitations and the environments in which the platforms operate.

Such an approach is therefore consistent with, and should be based on, the aforementioned model.

Author

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

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

Commander Westphalen transferred to the Active Reserve in 2016.

Disclaimer

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

Corresponding Author: Neil Westphalen, neil.westphalen@bigpond.com
Authors: N Westphalen [1,2]
Author Affiliations:
1 Royal Australian Navy Reserve
2 Navy Health Service, C/O Director Navy Health

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Disclaimer: the author was requested to draft this submission, as a member of the AFOEM Policy and Advocacy Committee (PAC). It was cleared by both the Faculty and College PACs prior to submission.

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

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Post-Traumatic Stress Disorder or Post-Traumatic Stress Injury: What's in a name?

D Wallace, E Jallat, R Jetly

Abstract

Background: Post-Traumatic Stress Disorder (PTSD) is a trauma-induced condition that is associated with high healthcare usage and costs, as well as long-term disability. Enabling those affected to seek diagnosis and treatment and removing barriers to care is, therefore, a significant priority.

Results: In the last few years, an argument has been made that changing the name of the condition to Post-Traumatic Stress Injury (PTSI), and hence removing the word 'disorder', may remove some barriers to seeking diagnosis and treatment. This paper describes the historical, scientific and medical basis for the use of the existing term, and argues that there is a lack of evidence that altering the name would have an appreciable benefit for affected individuals.

Conclusion: Serving and ex-serving ADF members and their families affected by PTSD would be better served by holistic approaches to improve education and awareness, encouraging help seeking as early as possible and further high-quality research to improve evidence-based treatment and rehabilitation services that are recovery focused.

Key words: post-traumatic stress disorder; post-traumatic stress injury

Conflicts of Interest: Dr Wallace is employed by BUPA and contracted to the ADF. Mrs Jallat is a member of the Australian Public Service. COL Jetly is a serving member of the Canadian Armed Forces.

Introduction

Post-Traumatic Stress Disorder (PTSD) is a trauma-induced condition that is associated with high healthcare usage and costs, as well as long-term disability.[1] Its 12-month prevalence rate among personnel recently transitioned from the Australian Defence Force (ADF) was estimated in 2015 at 17.7%, almost double that of the Regular ADF in 2010 (8.3%).[2] Enabling those affected to seek diagnosis and treatment and removing barriers to care is a significant priority.

In the last few years, an argument has been made that changing the name of the condition to Post-Traumatic Stress Injury (PTSI) may remove some barriers to seeking help for affected individuals. Those in favour of the change argue that the word 'disorder' is stigmatising—no one wants a 'disorder,' let alone to seek treatment for one. A secondary argument has been that the word 'injury' provides a better description in the context of trauma causing a physical injury to brain physiology.

Based upon a paper prepared to assist members of the Prime Ministerial Advisory Council on Veterans' Mental Health in their recent consideration of proposals for use of the name PTSI instead of PTSD, this article provides a brief history of the origins of PTSD diagnosis and describes the debate about the proposed name change. It argues that there is no evidence that the word 'disorder' does in fact stigmatise, nor that the word 'injury' necessarily provides the required solution to removing barriers to seeking diagnosis and treatment for those with PTSD.

History of the term PTSD

PTSD is a medical condition with a defined set of diagnostic criteria described in the *Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5)*.[3] First introduced in *DSM-III* in 1980, the diagnosis was the result of advocacy by groups representing traumatised individuals, in particular Vietnam veterans. Shephard[4] described how PTSD was politically inspired from the outset; originating as

'Post-Vietnam Syndrome,' as described by veterans organisations and sympathetic psychiatrists, but later changed to PTSD, when research from Holocaust and Hiroshima survivors was added.

Prior to DSM-III, post-traumatic illness was conspicuous among medical conditions for the many names given through history. First described in the nineteenth century, these conditions included railway spine,[5] nostalgia, irritable heart[6] and disordered action of the heart in the Boer War.[7] During World War II, shell shock, not yet diagnosed, nervous and neurasthenia were used.[4] World War II led to diagnoses such as war neurosis, combat fatigue, psychoneurosis and non-ulcer dyspepsia.[7] This plethora of diagnoses surely impeded understanding of post-traumatic conditions, delayed the development of treatment and contributed to barriers to care and patient stigma; arguably providing historical evidence of the negative impact of changing diagnostic terms.

The inclusion of PTSD in *DSM-III* was thus an important positive step, since it clearly distinguished the condition from other mental disorders, such as generalised anxiety disorder (GAD), noted that it required tailored treatment and provided a common language for clinicians, researchers, educators and consumers to enable comparison of populations and treatments around the world.

Origins of the name change debate

In 2011, as the rate of suicide rose alarmingly in the US Army, LTGEN Peter Chiarelli, then Deputy Chief of Staff of the US Army, wrote to the American Psychiatric Association (APA), the publishers and owners of the *Diagnostic and Statistical Manual of Mental Disorders*, asking them to change the name of Post-Traumatic Stress *Disorder* to Post-Traumatic Stress *Injury*. He had apparently begun using the term 'Post-Traumatic Stress' to address the problem of stigma and barriers to care; but after discussions with a number of psychiatrists, he hit upon the term Post-Traumatic Stress *Injury*. His advocacy for the change opened up a significant debate in the US. Despite some support from US psychiatrists, the APA decided in 2012 not to change the name, retaining the term Post-Traumatic Stress *Disorder*, but with amended diagnostic criteria, in the *DSM-5*3 in 2013.

Nevertheless, debate continues, and appears to be coordinated by a US website, *Post-Traumatic Stress Injury*.[8] Readers of the website are encouraged to send emails to the APA *DSM-5* committee to lobby respectfully for the suggested change in the name, with the website arguing,

'The 'D' in PTSD, the word, 'disorder,' discourages some from seeking care, from revealing their condition and from feeling a sense of honor, when their PTSD is just as honorable as any physical injury. When an injury is earned in battle, awards are given. There is no Purple Heart for PTSD. While the APA uses the term 'disorder' for most diagnoses, there are many diagnoses without that word: Anorexia, Bulimia, Parasomnia, Social Phobia to name a few'.

However, anorexia nervosa and bulimia nervosa are both classed as eating disorders, parasomnias are sleep-wake disorders and social phobia has been renamed social anxiety disorder. Interestingly, no case has been made to change GAD, major depressive disorder, adjustment disorder and substance use disorders, some of which have been reported as being more common outcomes of trauma than PTSD.[9]

In Australia, former Chief of Army turned academic, LTGEN Peter Leahy (Retd), spoke publicly in support of the suggested name change in 2012[10] and 2013.[11] While a quick examination of publicly accessible social media showed a small number of sympathetic comments supporting the change, the authors were not aware of any organised campaign or movement for change within Australia.

What is a 'mental disorder'?

Part of what made the *DSM-III* so practical and widely accepted was its inclusion of the concept of 'mental disorder.' Fisher and Schell[12] described how this concept has been retained in subsequent editions and in *DSM-5* was defined as per Box One, with the World Health Organization definition of 'injury' for comparison.

Box One: Comparison of definitions of 'mental disorder' and 'injury'

Definition of 'mental disorder' (DSM-5)[3]	Definition of 'injury' (WHO)[9]
'A syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning … usually associated with significant distress or disability in social, occupational, or other important activities'.	'A (suspected) bodily lesion resulting from acute overexposure to energy (this can be mechanical, thermal, electrical, chemical or radiant) interacting with the body in amounts or rates that exceed the threshold of physiological tolerance'.

3 *Diagnostic and Statistical Manual of Mental Disorders. Fifth Edition. Arlington: American Psychiatric Publishing: American Psychiatric Association; 2013.*

9 *World Health Organisation. International Classification of External Causes of Injuries, Version 1.2; 2004.*

Some proponents of PTSI argue that PTSD is a biological trauma,[13] as there is evidence it responds to biological treatment such as Stellate Ganglion Blocks.[14] They argue that the affected person is not 'disordered,' but instead that brain function is 'injured.' The *DSM-5* definition of mental disorder, however, does point to *biological* dysfunction, which is arguably a better description of PTSD than 'injury', which implies a wound or physical damage. Indeed, Fisher and Schell[5] concluded that the term 'injury' should be reserved for cases where an external physical force is the direct cause of the reaction. Furthermore, while a condition may respond to a biological treatment, this does not necessarily mean that the trauma is purely biological in nature.

McFarlane[15] argued that PTSD should be viewed as a systemic illness, recommending the adoption of a staging model[16] that accounts for a sequence of emerging patterns of biological deregulation, psychological symptoms and somatic pathology. There is growing evidence that for some, PTSD takes time to develop[17] and while in a sub-syndromal form has been associated with higher rates of suicidal ideation,[18] alcohol abuse,[19] withdrawal from loved ones,[20] increased anger and aggression,[21] as well as increased usage of health care services and work absences.[20] The *DSM-5* definition of 'disorder' better encompasses the diverse range of sub-syndromal and emerging patterns of dysfunction than the word 'injury,' particularly since injury implies a single point in time when a wound occurred.

Is 'disorder' actually stigmatising?

Stigma is the negative evaluation resulting from a social label[22] and can be attributed internally (i.e. personal beliefs about mental illness or mental health treatment) or externally attributed (i.e. public stigma, the extent to which an individual believes that he or she will be stigmatised by others). 'Concerns about what others think' was identified as an important barrier for seeking treatment in the National Comorbidity Survey.[23] Furthermore, a meta-analysis by Vogt[24] pointed to numerous studies that suggest stigma is a key barrier to treatment-seeking in general. Therefore, it is plausible that fear of PTSD-related stigma may act as a barrier to seeking treatment among affected individuals.

However, following an extensive review, Fisher and Snell[12] concluded:

> *'There is little empirical evidence documenting the nature of PTSD-related stigmatisation specifically or demonstrating negative effects of PTSD-related stigmatisation on treatment utilisation.'*

They were also careful to point out that a better understanding of root causes of potential stigmatisation would be required before drawing conclusions that the term 'disorder' was in fact stigmatising. Furthermore, they argued that there was no known evidence that a psychiatric 'injury' produced less stigma than a psychiatric 'disorder,' and concluded that altering the label without major changes to how the condition is defined, how diagnosed individuals are treated and how the military uses the information about diagnosis and treatment, meant it would be unlikely to generate dramatic changes in treatment-seeking or treatment utilisation.

Fisher and Schell[12] also questioned whether any research had been done among veterans as to whether they want a change in the name. They further argued that PTSI may give the erroneous impression that the condition is determined only by discrete events from the past, and not as part of a continuing pathological process, which as noted earlier has been supported by recent research[16]. Additionally, recent Australian research[25] indicated that even when current serving and ex-serving ADF

members held high levels of stigma-related beliefs, the vast majority still engaged in mental health care.

What has been tried or suggested?

Members of the Canadian Armed Forces (CAF) were exposed to operational stressors in the 1990s of a frequency and intensity far greater than in recent memory. Operations in Rwanda, Somalia and the former Yugoslavia took a toll in the form of psychological casualties. Several high-profile enquiries recommended a change in the way Canada, a country that did not share the Vietnam experience with its allies, approached PTSD. It was decided to enhance clinical expertise and capacity; but there were concerns that stigma and other barriers to care would limit the use of services by those most in need. To address this, a cultural shift was considered necessary.

In 2001, the term 'operational stress injury' (OSI) was coined by Lieutenant Colonel (Retd) Stéphane Grenier, as part of the development of a peer-support program in CAF, known as the Operational Stress Injury Social Support Program (OSISS)[26]. As OSI includes not only PTSD, but also depression, anxiety, mania, dysthymia and bipolar disorder, it is not a clinically accurate term, but one whose 'purpose is to serve the profession of arms'.[27] The OSI concept was designed to reduce stigma, to provide education that PTSD was not the only problem resulting from deployments, and to legitimise psychological difficulties as 'real injuries.'

OSI has been a useful paradigm within the CAF, permitting tangible opportunities for leadership to demonstrate the equal footing of physical and psychological injuries such as awarding the same 'sacrifice medal' for those with OSI and physical injuries such as amputation. Great gains have been made over the years by the CAF in reducing stigma, increasing help seeking and improving capacity; however, it would be inaccurate to attribute all of them to the term OSI. As the introduction of the OSI concept coincided with the implementation of a range of programs, including stigma-reduction campaigns, mental health training and education throughout the military career cycle, high-quality mental health research, a doubling of mental health providers and enhanced clinician training, it is hard to isolate the impact of the change in language to OSI.[3] Finally, the question could also be asked whether those with PTSD from non-operational causes (e.g. military sexual trauma) have conversely felt stigmatised by the term OSI.

Anecdotally it is known that some military leaders have been informally dropping the term 'disorder' and referring to 'Post-Traumatic Stress.' This may have a place in describing a person who does not meet the clinical criteria for PTSD but who is nonetheless experiencing stress following a significant incident (though the DSM does provide suitable alternatives such as 'Acute Stress Disorder or Adjustment Disorder'). PTSD, by contrast, refers to a condition that develops when an individual does not recover spontaneously. The difficulty with calling PTSD 'Post-Traumatic Stress' is that it fails to differentiate between a normal stress response to a significant incident, and a response that continues over a longer time period resulting in significant impairment.

What would happen if the name was changed?

If PTSD was renamed PTSI by the ADF and the Australian Department of Veterans' Affairs (DVA) what would be the likely practical implications? Firstly, mental health personnel would have to be educated about the change. When corresponding with civilian specialists and researchers, the new condition may have to be referred to as 'PTSI (ADF) also known as PTSD (*DSM-5*),' on a transitional basis, to ensure clarity. Creating a new condition may generate anxiety in patients searching for information on the effectiveness of treatments and the likely prognosis of the new malady, so veterans and serving members of the military would also need to be educated about the change. Nevertheless, a name change to PTSI would be unlikely to allow a member with this condition to suddenly be made fit to deploy or permit the removal of restrictions on access to weapons, ammunitions and explosives because of a risk of suicide or harm to others. Furthermore, it would not reduce the ADF's duty of care to members.

Obviously, a great deal of work and expense would be required to allow the ADF and DVA to have its own unique psychiatric condition. Perhaps this could be better spent on population health approaches and mental health promotion initiatives aimed at reducing stigma and encouraging early help seeking; for example, psycho-education programs and community awareness initiatives with greater family engagement. Similar strategies saw a reduction in the rate of suicide in Australia following the introduction of a national prevention strategy in 1999[28] and health promotion programs aimed at reducing smoking and skin cancer have also shown success.

Conclusion

Forty years have passed since advocates campaigned to have PTSD recognised. Veterans played a key role in the deliberations that resulted in the *DSM-III* diagnosis of PTSD. It is now an established and widely accepted condition based upon a wealth of research, including treatment trials, and the name is used globally by mental health clinicians, researchers and the public. The name is also scientifically and medically appropriate, as the generally accepted definition of the word 'disorder' aligns more closely with the aetiology and disease progression than that of 'injury'.

The authors acknowledge that there are barriers to seeking treatment for PTSD and other mental disorders in serving members and veterans,[25] and that removal of these barriers and encouraging affected individuals to seek treatment early is an important goal. However, there is no evidence that changing the name of one condition will reduce stigma, remove barriers to care or strengthen recovery. As van der Kolk[29] observed, 'New terms are invented with every generation in order to overcome the stigma of the previous term. So people don't like psychologically wounded people … Whatever name you give it, sooner or later it would become a derogatory word'.

Given the historical, scientific and medical basis for the use of the existing term, and the lack of evidence that altering the name would have an appreciable benefit for affected individuals, the case for change falls short. If further research indicated that a change would materially reduce barriers to seeking treatment, then such a change may be warranted at that time. Until then, serving and ex-serving ADF members and their families affected by PTSD would be better served by holistic approaches to improve education and awareness, encouraging help seeking as early as possible and further high-quality research to improve evidence-based treatment and rehabilitation services that are recovery focused.

Corresponding author: D Wallace
Duncan.wallace2@defence.gov.au
Authors: D Wallace[1,2], E Jallat[1], R Jetly[3]
Author Affiliations:
1 Australian Defence Force Centre for Mental Health
2 University of New South Wales
3 Canada Department of National Defense

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Scaffolded Clinical Skills Development for Clinical Managers in the Royal Australian Navy

Dale Edwards, David Young

Abstract

The Clinical Manager (CM) has been described as a linchpin to the healthcare capabilities of the Royal Australian Navy (RAN). Education and development for this important role has undergone substantial change in recent years, moving from an internally operated course to an externally provided higher education qualification. These changes in education include the manner in which clinical skills training is delivered. It is now embedded into a scaffolded approach that takes the learner from introduction of underlying knowledge to skills trainers, simulation, cadaveric training and whole of sick bay simulation. This article seeks to outline the changes that have occurred in CM education, and describes the scaffolded approach used to develop their clinical skills.

Keywords: clinical manager, clinical skills, scaffolding

Background

The manner in which advanced clinical skills in paramedic or out of hospital care are initially trained and subsequently maintained can have a significant impact on skill performance and practitioner self-efficacy. Within the RAN the CM is a senior sailor who holds a clinical scope of practice that incorporates advanced clinical skills that the authors suggest is comparable to a combination of a civilian Intensive Care Paramedic and Extended Care Paramedic, combined into one role. The training of clinical skills for CMs has undergone a number of changes in recent years with the introduction of the Bachelor of Paramedic Practice (BPP) Australian Defence Force Conversion.[1] This course, offered by the University of Tasmania (UTAS) in partnership with the Royal Australian Navy Medical School (RANMS), has become a key element in the CM qualification. This article will outline the educational method and implementation of a scaffolded approach to clinical skills development incorporated into the current CM course.

The CM course is the RAN's premiere medical course for Navy Medics, and prepares them to take the senior clinical role in the Navy's Major Fleet Units (MFU). The CM qualification is a prerequisite for promotion from Leading Seaman to Petty Officer, and is the first step in the move from a tactical patient-centred view to a strategic-capability view of patient management. The CM course is a voluntary course and is open to any Medical Sailor that has completed at least 12 months at sea, two years as a leading seaman and has been recommended by command for the CM role. Most sailors reach this qualification period at the 8 to 12-year mark of their career.

Prior to the introduction of the current collaboration between UTAS and the RANMS, the CM course was delivered over 12 months as a face-to-face vocational program, supported by ADF Reserve specialists for clinical skills delivery. Following a review into the CM course in 2013, it was decided to outsource a component of the course to assist in maintaining the highest standard of delivery and to maintain practice at or above the industry standard. An initial trial was completed in 2015 utilising an external provider delivering core components on the CM course. This pilot program, incorporating the Advanced Diploma in Paramedical Science (Ambulance), proved the CM course could be delivered as a mixed methods course. Despite this positive experience the Advanced Diploma of Paramedical Science (Ambulance) was deleted from the Australian Health Training Package in 2015,[2] necessitating a change in provider.

Following the aforementioned changes to the health training package, the RANMS approached UTAS to explore how the BPP conversion degree might be used to address the qualification requirements of the CM program. The BPP conversion is a degree entry program offered by UTAS since 2011, and is designed to provide a qualification pathway for paramedics and military advanced medics to transition their prior vocational qualifications through to the new industry standard bachelor degree. The BPP conversion

course has been attracting increased interest from military medics for a number of years, raising its profile across the defence forces.[3] Following a period of consultation between the parties the BPP (ADF Conversion) was developed.

This new degree entry program incorporated all of the capabilities associated with the BPP, which align with much of the capability set of the CM, along with the modification of some units to incorporate the advanced clinical knowledge and capability set required of a CM not normally offered at paramedic level (see Table 1). In addition to the UTAS BPP program, the RAN Medical School continues to deliver components of the CM course focused on Maritime Sickbay Management, Mental Health in the deployed Remote and Maritime Environments, Aviation Medicine, Underwater Medicine and Primary Health Care. The new course was successfully trialled in 2016 following which, the course was adopted for a longer-term contract from 2017.

Table 1. Advanced clinical skills in the CM Course

Endotracheal Intubation
Surgical Airway
Finger Thoracostomy
Tube Thoracostomy

As reflected in Table 1, clinical skills incorporated in the CM course include endotracheal intubation, surgical airway using the scalpel/finger/bougie technique, and finger and tube thoracostomy. These clinical skills are delivered by a team of educators incorporating Intensive Care Paramedics, CM instructors from the RANMS and Emergency Physicians with a defence force clinical background. This range of educators enables the delivery of knowledge and skills that incorporate a wide range of professional contexts, providing a well-rounded graduate perspective.

Clinical skill development in the BPP/CM course

A key feature of the clinical skills development in the new CM course is the scaffolding of clinical skills to enhance learner transition from novice through to proficiency at an entry level for the newly acquired capabilities. Scaffolding in the context of clinical learning can be described as a process of introducing the new knowledge and associated skills, offering an opportunity for initial skill development in an initially low-fidelity context with support from instructors. With progressive advancement of the learner's performance, the learning environment or experience increases in fidelity, along with a gradual reduction in learner support as the learner gains independence.[4,5] This type of educational design aligns with the gradual release of responsibility (GRR) model in which the instructor releases responsibility for the student's learning as the student's knowledge and proficiency increases and they move towards independence.[6] Figure 1 represents a modified GRR model reflected in the clinical skills teaching model used in the CM course.

Figure 1

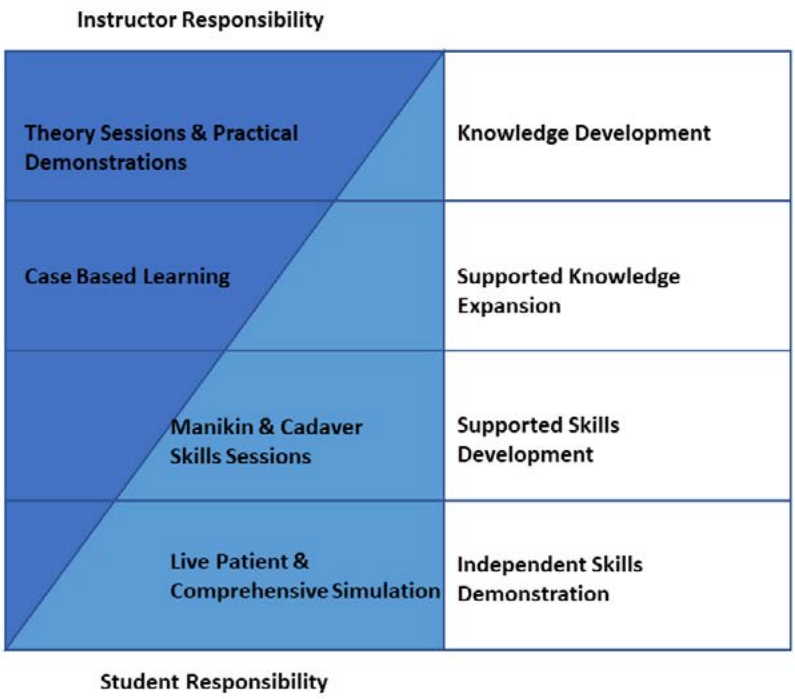

Table 2. Bondy Rating Scale (11)

Scale Label	Professional standard	Quality of clinical performance	Assistance
1 Independent	Safe Outcome achieved Appropriate Behaviour	Confident, proficient Appropriate time Accurate knowledge	Without supportive cues
2 Supervised	Safe Outcome achieved Behaviour mostly appropriate	Confident, efficient Reasonable time Occasional knowledge prompting	Occasional supportive cues
3 Assisted	Safe Outcome mostly achieved Behaviour generally appropriate	Skilful in some aspects, inefficient in others Delayed time Requires some explanation	Regular directive cues in addition to supportive cues
4 Marginal	Safe only with guidance Outcome incomplete achieved Behaviour generally appropriate	Unskilled, inefficient Prolonged time Continual knowledge prompting	Frequent directive cues
5 Dependent	Unsafe Outcome not achieved Behaviour inappropriate	Lacks confidence, efficiency Unable to complete Very limited knowledge	Continual verbal and physical directive cues

In the CM course, students receive theory content in small group lectures and workshops, complimented by case-based learning sessions to encourage a whole of patient view point. Students then gain initial exposure to the practice of clinical skills using skills trainers and simulation manikins such as the Laerdal® Airway Management Trainer[7] and the SimMan® ALS.[8] This allows the learner to develop an understanding of the application of clinical skills in a safe environment where they have space to make errors and the time to receive corrections on their skill performance.

Following the opportunity to develop their skill performance in a low-fidelity setting using skills trainers and manikins, CM students are then introduced to performing the clinical skills on cadavers at the UTAS School of Medicine in Hobart, Tasmania. The use of fresh frozen cadavers provides a degree of functional high fidelity not present in the majority of manikins,[9,10] which may provide a semblance of structural accuracy of anatomy, but do not respond in a tactile manner consistent with reality. Examples of the improved tactile fidelity experienced by learners using fresh frozen cadavers includes realistic sensations, such as the mobility of a larynx when attempting surgical airway insertion, or the ability to experience the feel of a finger sweep during the performance of a finger thoracostomy or tube thoracostomy. The benefit of higher tactile fidelity in these infrequently performed yet high risk skills should not be underappreciated.

Throughout the conduct of clinical skills training, CM students are required to maintain a clinical skills portfolio. Students are expected to get the instructor they are working with to complete an achievement record for each performance, indicating the level of the performance. The context of their practice is also recorded (i.e. manikin or cadaver-based performance). This allows the learner to review their progress and make use of instructor comments to reflect on their progression in skill development. The clinical skills portfolio is graded using the Bondy Rating Scale[11] reflected in Table 2. Students are required to achieve five independent performances of the skill at each level prior to progressing to the next, for example a learner must achieve five consecutive independent endotracheal intubations on a manikin prior to moving on to cadaver performances, and similarly, must achieve five consecutive independent performances on a cadaver prior to moving on to live patient performances under the supervision of an anaesthetist.

To provide the greatest opportunity for the CM students to consolidate what they have learned over the course, nine weeks of clinical placement are conducted across the various disciplines the CM is expected to be proficient in. The placements include three weeks with a NSW Ambulance intensive care crew, focusing on their emergency response, initial assessment and management of immediate life threats and the diverse intensive care case load. The second placement period is three weeks in an operating theatre working with the anaesthetist to

hone their airway management skills. This focuses on supraglottic airway and endotracheal tube insertion and management; the difficult airway and failed airway (can't intubate, can't ventilate) process. The theatre placement is essential to the fourth stage of the scaffolded approach to the clinical skill development; moving each student from theory to manikin and cadaver before exposure to live patients to demonstrate competence. Final placement is conducted in a remote practice environment currently with the Torres and Cape Hospital and Health services in Far North Queensland. These three weeks of placement aim to provide the students an opportunity to work in the remote austere environment, in a health service that utilises the Primary Clinical Care Manual as its clinical guideline. These locations are chosen as it is the closest analogue to mimic the role 1 medical facility of a RAN ship at sea.

Rounding out the CM course a 48–72-hour final simulation is completed by each student to demonstrate a consolidation of all components of the 11-month course. This simulation has the student take over a ships sickbay, complete a departmental audit of all equipment and medical stores, and manage a number of clinical presentations ranging from primary health care presentation to emergency response situations for both paediatric and adult patients. Students utilise the full range of their newly acquired capabilities including the advanced clinical skills described above in the management of these simulations. The students are required to liaise with all stakeholders in real time to affect the evacuation of patients from the maritime environment where appropriate. The ability of the student to demonstrate command and control of a small medical team, provide clinical guidance and risk assessment support to command and meet environmental health issues for the simulated crew is also an important part of this final assessment.

The scaffolded approach used in the CM course provides clinical skills training that takes the learner from skill trainer to manikin-based simulation, cadaver-based simulation, live patient skill performance and finally, whole-of-case simulation. While there is a dearth of literature supporting this approach in a cohort of Navy learners, the use of simulation has been shown to raise performance outcomes of learners as well as improving learner satisfaction with the learning experience.[12,13] Simulation using cadavers has further been shown to increase the self-confidence of learners in their skills performance.[13] The goal of the scaffolded model of clinical skills training described here is to produce a practitioner that is well prepared to practice in an environment in which supervision and support opportunities are limited or remote, such as the environment aboard a MFU.[14]

Future directions

Having established a scaffolded model for the delivery of clinical skills training for CM's, there is a clear need for evaluation to establish an understanding of the impact of the educational model. Therefore, future directions include: an evaluation of the learning experience to explore the value in the eyes of the learner; skill and knowledge retention studies and studies into practitioner self-efficacy following completion of this model of education; a review of clinical skill use in both actual and simulated case presentations following qualification. This last point, review of skill use, can serve as a foundation to underpin any agenda and strategies for the creation of a recertification program to reinforce infrequent skill performance to maintain CM capabilities. Furthermore, this article explores the clinical skills training provided to CMs and does not explore the wider health services provided or leadership and management functions of a CM. While these elements are addressed in the course undertaken, they are an area for further exploration and discussion beyond the scope of this article.

Conclusion

The RAN medic (and particularly the CM) has been described as a linchpin of Navy's healthcare capability.[14] The manner in which CMs are educated and trained for their clinical skills is likely to have significant impact on knowledge and skill retention as well as their self-efficacy in practice. This article has described the current model used in the education and assessment of advanced clinical skills in the CM course and the BPP (ADF Conversion). Through the scaffolded approach described, graduates of the CM course have a solid foundation upon which they can build their future clinical practice and professional development.

Corresponding Author: Dr Dale Edwards
Dale.Edwards@utas.edu.au
Authors: D Edwards[1], D Young[1,2]
Author Affiliations:
1 University of Tasmania
2 Royal Australian Navy

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Civilian university and military collaborative partnerships: bridging the divide between healthcare professionals and practices

K Woodbury, J Woodward

Introduction

Many Defence organisations have demonstrated the beneficial outcomes of effective collaboration with external agencies.[1, 2] Research undertaken in 2017 by the Major Extremity Trauma Research Consortium (METRC) advocates for the recognition and adoption of more collaborative engagement between Defence and civilian health professionals.[2] While Defence has a long-standing tradition of senior medical Reserve appointments, which facilitate civilian/Defence clinical exchange, opportunities for interagency training for medics and nurses are less common. The possibility of interagency operations either in the event of domestic crises or offshore humanitarian and disaster response appears to be increasing. In the light of this, interoperability becomes increasingly important. While the initiatives described here are small-scale, they do respond to this environment and demonstrate the transferability of skillsets and the importance of interagency understanding.

Civilian University-Defence collaboration

In recognition of the significance and importance of collaborative engagement, the author, an academic from Queensland University of Technology (QUT), School of Clinical Sciences and former Nursing Officer in the Australian Army, facilitated and led an interagency clinical training opportunity between paramedic science students studying at QUT and clinical personnel of the Australian Army posted to 2nd General Health Battalion (2GHB). This interagency training is outlined in Table 1.

Table 1. Interagency training exercises and opportunities between QUT & 2GHB

- QUT students being clinical role players for TAJI medical certification activities. These were clinical certification exercises necessary for the ADF and NZDF clinicians who were deploying to Iraq as part of Task Group Taji.
- 2GHB clinical personnel assisting in the facilitation of clinical tutorials for QUT students
- 2GHB personnel being afforded an invitation to attend paramedic clinical lectures of interest at QUT
- 2GHB personnel being clinical role players and participants in QUT paramedic activities at the Queensland Emergency Services Whyte Island facility
- QUT students being clinical role payers for EX Giant Viper. This was a minor certification exercise for 2GHB, to certify the Battalion to support exercises to a specified level.

In the first instance, the training was facilitated on a casual and ad hoc basis, whenever 2GHB had the need for role players, or QUT had relevant reciprocal opportunities available. In 2017, funding was secured to legitimise and further develop shared educational opportunities between 2GHB and QUT.

The funding was awarded to develop collaborative clinical training, education and research opportunities between the University and Defence health personnel. In concert with the activities outlines in Table 1, a major component of the funding involved the development and initiation of an inaugural QUT & Military: future health directions symposium, which was held in September 2018 (www.qutmfhd.com).

Key relationships

High level collaborative agreements were negotiated, and interagency planning of the symposium activities was instigated in early 2018.

The symposium was hosted at QUT Kelvin Grove campus, where speakers from both Defence and the paramedic program presented interactive, conversational talks about their field of speciality, professional interest or emerging issues in health. The day ended with a clinical and operational capability demonstration. This involved the deployment of

2GHBs evacuation and resuscitation assets to the QUT campus, in order to facilitate an interagency clinical response. This involved QUT paramedic science students working alongside 2GHB medics in a clinical scenario involving stabilisation and transport of a patient from the point of injury to the resuscitation bay for continued treatment. Clinical skills exchange was facilitated by the conduct of these scenarios, which involved QUT paramedic science students working with 2GHB clinical personnel to demonstrate health interoperability across professions, as illustrated in Figure 1. The scenarios were live streamed to the lecture theatre, recorded for future training and watched live by symposium participants on site.

The symposium's intent was to bring together practicing health professionals from multiple settings: Defence, emerging health professionals undertaking study at QUT, and civilian health practitioners interested in the interface of health between Defence and civilian sectors. Three broad areas of interest were addressed by 19 presenters (see Table 2 for details).

Implications and future directions

Feedback from the symposium was overwhelmingly positive and provided constructive suggestions for future development opportunities. Future iterations of the symposium would encourage a better balance of presenters, to ensure the voices of a wider range of ranks of Defence military personnel were heard. In addition, the symposium would be open to all ADF health personnel; RAAF were present at the 2018 symposium, and we would welcome and encourage their and Navy's attendance and participation at future symposiums.

Conclusion and recommendations

Defence and civilian health sectors do not work in isolation. During disaster response and recovery, for example, there is often overlap in their efforts. In addition, best clinical practice is vital to all health practitioners, and opportunities to share best contemporary practice and explore the application of novel ideas is imperative to the best clinical outcomes for our patients, whether Defence or civilian.

The QUT & Military: future health directions symposium has the ability to bring together health practitioners from all fields with various levels of skills and knowledge, to learn from each other. Importantly, it also gives a voice to emerging and

Figure 1.

Table 2. Broad areas of interest and specific topics presented at the QUTMFHD symposium

CLINICAL EDUCATION & TRAINING	
• Why we need collaboration and integration	QUT
• Clinical competency, currency and collaboration	ADF
• Mindset of a learner	QUT
• Army medic to civilian paramedic	QUT
• Finger thoracotomy	QUT
• Land based trauma system	ADF
• Real learning comes from clinical placement	QUT
• Epigenetics of PTSD	QUT
RESEARCH & CLINICAL INNOVATION	
• Tribes and finding our 'why'	ADF
• CPR induced consciousness	QUT
• 8/9 RAR rehabilitation	ADF
• AACAP	ADF
• HEADS: acronym for TBI patient handover	QUT
• Female to female learning in Iraq	ADF
• Literature review of patient cooling in cardiac arrest	QUT
MENTAL HEALTH, HOLISTIC PATIENT CARE & HEALTH CARE CONTINUUM	
• Life threatening critical bleeding	QAS
• Role of a paramedic: what is reality?	QUT
• Double degree: paramedic and nursing	QUT
• Resilience	ADF

new clinicians in a supportive and collaborative environment.

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Corresponding Author: Kerri Ann Woodbury
Kerriann.welch@qut.edu.au
Authors: K Woodbury[1], J Woodward[1]
Author Affiliations:
1 Queensland University of Technology

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Plasmodium knowlesi infection in an Australian soldier following jungle warfare training in Malaysia

K Roe, A Thangarajan, K Lilley, S Dowd, D Shanks

Abstract:

An Australian Army soldier developed a fever after returning to Australia following a three-month deployment to Rifle Company Butterworth, Malaysia. Ten days prior to presentation he had participated in jungle warfare training at Burma Camp, Pulada in Johor, Malaysia. No known direct contact was made with monkeys, which were known to be in the area. Earlier he had stopped his doxycycline chemoprophylaxis for a few days during an episode thought to be due to gastroenteritis. Blood examination showed infrequent *Plasmodium* species ring-stage trophozoites on thick film. As the ring-stage trophozoites were morphologically different from *P falciparum*, blood was sent to the ADF Malaria and Infectious Disease Institute at Gallipoli Barracks for species confirmation. The soldier was treated with oral artemether-lumefantrine (Novartis, Coartem®) and became aparasitemic in two days. Subsequent nucleic acid studies confirmed the diagnosis as *Plasmodium knowlesi*, a parasite of macaques. Two weeks following treatment he was admitted to the hospital for glandular fever but was shown not to have had a recrudescence of his original infection.

Keywords: malaria, *Plasmodium knowlesi*, military training, chemoprophylaxis

Malaria risk to Australian soldiers in Southeast Asia is remarkably low compared to previous generations, but low risk is not equivalent to zero risk. Febrile episodes in soldiers returning from the tropics still need to be considered as possible malaria infections, as demonstrated in the following case report. A 21-year-old Australian soldier presented on 1 March 2018 to Edinburgh Health Centre at RAAF base, Edinburgh, having been recalled due to the results of a blood test from a week prior while in Malaysia. His original illness had been an episode of gastroenteritis following jungle warfare training at Burma Camp, Pulada, Johor, 26 January to 8 February 2018. On 16 February, the soldier had noted the onset of fatigue and gastroenteritis. On 20 February, he presented to sick parade at Butterworth Health Centre and was told to stop his doxycycline as it was likely making his gastroenteritis worse. He was reviewed on 23 February, with his gastroenteritis resolving but continuing fatigue; at this time, he was afebrile. Blood was drawn for investigations showing mild thrombocytopenia (73 000/mm3) and mild transaminase elevation (<2x upper limit of normal range). By 26 February, he was again reviewed, complaining of continued fatigue and nocturnal fever; his temperature was 37.5° in the clinic. The working diagnosis was a non-specific viral illness. As the soldier was unable to further participate in unit activities, he was scheduled to fly back to Australia on 28 February when further blood was drawn including a malarial smear. He had also resumed his doxycycline chemoprophylaxis at that time.

A blood film taken 28 February in Malaysia was subsequently reported to have contained rare malaria parasites thought to be *Plasmodium knowlesi*. When recalled on 1 March, the soldier was still taking his malaria chemoprophylaxis of doxycycline 100 mg daily. The eradication course of 30 mg primaquine daily for 14 days was not started until 2 March 2018. Since he was not ill and further blood tests were pending, it was decided to await either a confirmatory blood test or any fever prior to specific treatment. Blood taken on 2 March was subsequently shown to have rare malaria ring-stage trophozoites thought on morphological grounds not to be *P falciparum*. See Figure 1.

Figure 1: Giemsa stained blood film showing a ring form trophozoite of Plasmodium knowlesi *from the soldier taken on 2 March 2018.*

That same evening the soldier developed a fever to 38.9° and was started on oral artemether-lumefantrine (Novartis, Coartem®) to receive 6 doses over 60 hours. His symptoms rapidly resolved and his blood was free of parasites by day four post treatment. Two weeks following his treatment for malaria, he returned to the clinic with fever to 38° and feeling unwell as noted by fever and myalgia. Because of his history of tropical infection, he was admitted to the infectious disease service of the Royal Adelaide Hospital. Repeated blood films showed no parasites confirming that his malaria had not recrudesced after treatment. Serological evidence (IgM and IgG positive) of Epstein Barr virus was noted but no other diagnoses were confirmed despite extensive investigations. Polymerase chain reactions done at the ADF Malaria and Infectious Disease Institute from samples taken on both 2 and 3 March showed identity using *P knowlesi* primers as shown in Figure 2. To our knowledge, this is the first known case of *P knowlesi* to be confirmed in an ADF soldier.

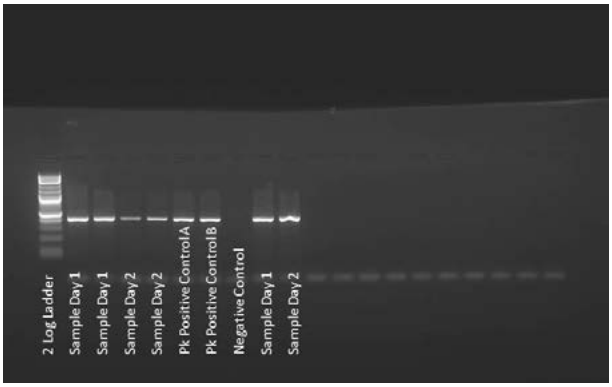

Figure 2: Photo of gel electrophoresis of products of polymerase chain reaction showing identity with Plasmodium knowlesi. *Lanes labelled as marked on photo with samples from 2 and 3 March.*

Figure 3: Photo of Macaca fascicularis, *the long-tailed or crab eating macaque, which is the most common reservoir host of* Plasmodium knowlesi. *Photo from Wikipedia 2007 by André Ueberbach under Creative Commons Attribution*

Plasmodium knowlesi is a species of primate malaria usually found in long-tailed and other macaques of South and Southeast Asia as shown in Figure 3.[1] Unlike *P falciparum*, *P knowlesi* has a 24-hour growth cycle that allows it to rapidly grow to high parasitaemia. This rarely happens in its natural host, the long-tailed macaque, but in the Indian or rhesus macaque, a lethal hyperparasitaemia rapidly occurs.[2] Although originally found to infect humans after natural exposure in Malaysia in 1960s, this was thought to be a very rare event.[3] In the 2000s, in other states of Malaysia (Sabah, Sarawak), numerous human malaria cases thought to be due to *P malariae* on morphological grounds, were subsequently shown by genomic analysis to be *P knowlesi*.[4] These infections were typically of adult men who worked in the jungle and if not rapidly treated could result in death. Unlike *P falciparum*, severe *P knowlesi* does not present as cerebral malaria; its most common severe forms being due to anaemia, acute kidney injury or pulmonary failure.[5] *P knowlesi* is uniformly drug sensitive as its primate reservoir hosts do not receive antimalarial drugs.[6] Chloroquine is a standard treatment, but artemisinin combination therapy is now preferred either as artemether-lumefantrine for oral use or intravenous artesunate if the patient cannot tolerate oral medication.[7]

Because of the success of malaria control and the near elimination of ordinary malaria from Malaysia, there are very few human malaria infections remaining. Most plasmodial infections in Malaysia are now due to *P knowlesi*. There are 1000–3000 reported infections each year of *P knowlesi* in East Malaysia, but in Peninsular Malaysia it remains a relatively unusual infection.[8] The changing ecology of Malaysia with extensive conversion of the natural jungle habitat of the monkeys into palm oil plantations has caused macaques to move into areas

where they may be more frequently in proximity to humans. The anopheline vectors are not the usual ones associated with human malaria in Southeast Asia such as *An minimus* and *An dirus* which are usually forest fringe mosquitoes. *An leucosphyrus* and related species are thought to be the main vector of *Plasmodium knowlesi.* These mosquitoes are more frequently found inside the jungle rather than the forest fringe which likely explains why this zoonotic infection is associated with jungle warfare training.[9] Epidemiological risk factors for *P knowlesi* infection include males >15 years of age, plantation workers who sleep outside buildings or whose houses have open eaves, as well as living in areas where monkeys are known to reside.[10] The soldier's particular exposure was very likely during night-time jungle warfare training operations in Johor, Malaysia, where the reservoir monkeys are known to exist.

Prevention of *P knowlesi* is not different from preventing other less exotic malarial infections. Mosquito avoidance measures such as repellents and nets are often not practical during jungle warfare training. Reliance has to be placed on malaria chemoprophylaxis, typically consisting of either daily doxycycline or atovaquone-proguanil. Doxycycline has the added advantage of effectiveness against scrub typhus and leptospirosis which are both infectious disease threats during jungle warfare training. Gastrointestinal disturbances or inability to eat during survival training does not favour doxycycline and thus there are times when atovaquone-proguanil will be preferred. The recent registration of tafenoquine, a long acting 8-aminoquinoline similar to primaquine, has now provided the ADF with an additional chemoprophylaxis option. Compliance with chemoprophylaxis in areas thought to have low malaria risk is often suboptimal. ADF Medical Officers need to be aware that deployments of soldiers to Malaysia, especially those conducting jungle warfare training in areas known to have resident macaque populations have the occasional risk of *P knowlesi* infection which should reinforce the need for compliance with force health protection measures.

Contributors:

KR and AT were the medical officers responsible for the clinical case, GDS was responsible for initiating this report as well as the writing of the first draft of the manuscript. KL was responsible for malaria blood film diagnosis and SD did the polymerase chain reactions. All authors participated in writing the final manuscript.

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Corresponding author: Dennis Shanks
dennis.shanks@defence.gov.au
Authors: Kristin Roe BMBS[1], Arun Thangarajan MBBS[1], LTCOL Ken Lilley RAAMC[2], CAPT Simone Dowd RAAMC[2], Prof G. Dennis Shanks MD[2,3]
Author Affiliations:
1 RAAF Edinburgh Health Centre, Edinburgh, SA
2 Australian Defence Force Malaria and Infectious Disease Institute, Enoggera, QLD
3 University of Queensland, School of Public Health, Herston, QLD

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Notes

JMVH call to authors

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

ISSUE DATES AND DEADLINES

Volume	No	Issue Date	Submission Deadline	Advertising Deadline
April 2020 – Transition to Civilian Life				
28	2	April 2020	1 January 2020	1 March 2020
July 2020 – Global Health Security				
28	3	July 2020	1 April 2020	1 June 2020
October 2020 – Preparing for Conflict & Disaster | 2020 AMMA Conference Abstracts				
28	4	October 2020	As per AMMA Conference Submission Process	1 September 2020

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

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

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