AUSTRALIAN MILITARY MEDICINE ASSOCIATION

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STATEMENT OF OBJECTIVES

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

- promoting the study of military medicine
- bringing together those with an interest in military medicine
- disseminating knowledge of military medicine
- publishing and distributing a journal in military medicine
- promoting research in military medicine

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

The Association is totally independent of the Australian Defence Force.

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EDITORIAL
Six months on...

IT IS NOW SIX MONTHS since the tragic and frightening attacks of 11 September (or 9-11 as the Americans now seem to refer to it). The new Bush government has gone from its initial unilateralist and isolationist stance to a more involved (although still often unilateral) role in world affairs. The Australian Defence Force is now actively involved in Afghanistan, the Persian Gulf and central Asia, as well as East Timor, Bougainville and the Solomon Islands, and in the seas to our north. For Navy, this has been one of the largest medical undertakings since the Vietnam War. Coupled with continued uniformed health personnel shortages, this has been a challenging time for all concerned.

I have been fortunate to attend two very good but very different conferences recently. The first of these was the Asia Pacific Military Medicine Conference, which was held in Kuala Lumpur. This conference, co-hosted by the Malaysian Armed Forces and the US Army Pacific, involved an interesting array of presentations and posters. A number of key themes emerged - infectious diseases of military importance, the need for syndromic surveillance systems, and the challenges of military medical interoperability between different nations.

The second conference I attended was the Emerging Trends in Terrorism conference held in Hobart. This conference provided a fascinating review of current trends in all aspects of terrorism, from chemical and biological terrorism to animal liberation movements and cyberterrorism. The overarching theme was that this problem is not going to disappear and we must continue to prepare for it in all its malignant forms.

In this issue, we see a number of different military medical themes, including operational medicine, medical readiness, health training and history. Operationally, the challenges of providing appropriate chemoprophylaxis to aircrew, deploying a Reserve specialist to East Timor and the progress in preventing and treating malaria in the field, are all addressed. Management of malaria and post-traumatic knee defects impact directly on medical readiness while medical simulation offers a solution for resuscitation training. Finally, the challenge posed by a Private soldier who perished in World War I and the history of blood transfusion in Australia remind us of the real knowledge that comes from historical examples. As always, an excellent series of papers, which are now scanned by the National Library of Australia and are available to universities and other subscribers through the Australasian Medical Index.

The next six months promise to be as challenging as the last six months. The operational requirements will no doubt continue, uniformed shortages prevail and the shadow of the collapse of United Medical Protection hangs over all health care. At the very least, there should be a myriad of topics for future papers, reviews, editorials and letters to the Editor.

Andy Robertson
President's Message

Once again, this year has passed more rapidly than previous years. The activities of the Australian Defence Force and its Health Services also continue apace in support of a variety of overseas operations. The health system in Australia has also been struck with a degree of frantic activity, in the cause of indemnity, that it has not seen for some time, and this has kept many in the civilian sector busy and in a state of uncertainty.

Changing of the Guard
In February, Brigadier Wayne Ramsey resigned as Director General, Defence Health Services after just over two years in the position. Wayne was faced with an extraordinarily difficult task when he took over the position in 1999. The Defence Health Service had been through a turbulent period of change flowing from the Defence Reform Programme, and had really not settled down to its new structure with any degree of comfort. Many challenges faced him, not the least being the push for civilianisation in support areas while maintaining operational capability. There was also a need to provide a central policy and strategic planning organisation that was able to meet the needs of both the Health Services and the Service Chiefs. Complicating all of this were the significant gaps in staffing levels, particularly in the higher management areas.

Undaunted, Wayne embarked upon a series of radical overhauls of the Health Services, endeavouring to achieve the structural efficiencies, while maintaining operational capability and strengthening the organisational framework that supports those in the field. There have been many significant successes during Wayne’s tenure but to a large extent the fruits of his endeavours will be borne in future years.

Wayne’s term as Director General was the culmination of a highly successful career during which he contributed significantly to both the Defence Health Service and the operations it undertook. He led the first of the Health Service deployments to Rwanda, and spent a number of years in Land Command, during which time I personally came to know him and value his contributions and advice.

Wayne will, I am sure, flourish in the consultancy world that he has joined, and I am sure all members of AMMA will join with me in wishing him well for the future.

Wayne’s replacement, Air Commodore Tony Austin RAAF, comes to the position with equally impressive credentials. In recent times, Tony has led the Air Force team in Air Command, but has also spent a period working on quality management in Wentworth Area Health Service in the NSW health system. I am sure that this mix of operational and health management experience has well placed Tony to move the Defence Health Services forward into the future.

HM Queen Elizabeth, The Queen Mother
The recent death of Her Majesty Queen Elizabeth, the Queen Mother, while not unexpected, came as a reminder of our mortality and marked the end of a century of remarkable change.

Queen Elizabeth’s passing was of particular sadness to the Royal Australian Army Medical Corps for whom she was the Colonel-in-Chief. Amongst the huge gathering that farewelled the Queen Mother could be seen the familiar slouch hat of representatives of the Corps, marking the close ceremonial links that the Australian Defence Force still has with the Royal Family.

Medical Indemnity
The medical indemnity crisis has raised a number of key issues that are of significance to health.

We are all aware that many of the great advances of medicine were taken as a result of experiences during armed conflict. There was no science involved, and the hardships that soldiers endured as the medical world observed and learnt were too horrific to comprehend.

In the 20th century, medicine turned to science and research to make the advances that have given us the kind of health care that we now enjoy.

In the 21st century, we are looking at quality improvement techniques to go even further, both in terms of achieving better and more consistent outcomes, and ensuring that we are getting the best value for the health dollar spent.

But quality improvement demands that clinicians are prepared to acknowledge that they could have done things better, acknowledge, even, that they may
have made an error. But it is clearly true that many doctors are not prepared to make such open acknowledgements for fear of the litigation that may result (although there is evidence that early and open acknowledgement of error may, in fact, reduce the risk of litigation).

It seems to me that the only logical and sensible outcome of the indemnity crisis is the creation of a national medical compensation scheme, where compensation is determined in a logical way outside the court system, and without taking into account issues of individual fault (we all know that 80 percent of errors are system errors anyway, and probably most of the other 20 percent have a systems component). Where individual clinical performance could have been better, it is managed in the context of quality improvement, in an educative not blame culture, with significant shortcomings being dealt with by medical or health care complaints tribunals.

It is only through taking this great leap forward that we are going to be able to continue the improvements in health care that we all know are possible. Will our governments be bold enough to make this kind of move?

DEFENCE HEALTH SYMPOSIUM
The big event, just around the corner, is the Defence Health Symposium to be held in Sydney from the 26th to the 28th of July. Co-hosted by the Defence Health Services, the Australian Disaster Management Group, the Australian Centre for Posttraumatic Mental Health and the Australian Military Medicine Association, this conference will be the one of the biggest military health conferences held in Australia in recent years. We are proud to be involved with this conference, and it will also offer an opportunity to promote the Association to delegates from around Australia and overseas who might not know of, or might not be members of AMMA. Already, nearly 250 delegates have registered, and the programme is chock full of excellent presentations.

I look forward to seeing you all in July.

Russell Schedlich

AUSTRALIAN MILITARY MEDICINE ASSOCIATION
NOTICE OF THE
11TH ANNUAL GENERAL MEETING
26 July 2002

Notice is hereby given that the 2002 Annual General Meeting of the Australian Military Medicine Association will be held at the Wentworth Hotel, Perth Room, 61 Phillip Street, Sydney, commencing at 5.15pm.

Any member desiring to bring any business forward at this meeting is to give notice in writing to the Honorary Secretary no later than 1700 on Friday 21 June 2002.
An Assessment of the Tolerability and Compliance of Malaria Chemoprophylaxis in Australian Army Aviation Personnel

Anthony Lourensen, Scott Kitchener and Peter Nasveld

ABSTRACT
The Australian Defence Force (ADF) is currently maintaining large numbers of soldiers including aviators in malarious areas of East Timor for peacekeeping duties. The only approved malaria chemosuppressive agent for this group is doxycycline with primaquine post-exposure prophylaxis for vivax malaria. Aircrews are suspended from flying duties for the period of the post-exposure prophylaxis.

All Australian Army Aviation (AAAvn) personnel stationed in East Timor in July 2001 were interviewed on their opinions and experiences of the current chemoprophylaxis for malaria. Aircrew particularly reported erratic or poor compliance with doxycycline and dissatisfaction with primaquine post-exposure prophylaxis. Most aircrew delayed post-exposure prophylaxis on return to Australia due to tasking requirements during which many also reported difficulties with doxycycline compliance. There is a pressing need for the investigation of a flexible antimalarial regime that is suited to the unique needs of AAAvn aircrew.

INTRODUCTION
The Australian Defence Force (ADF) is currently maintaining large numbers of soldiers including aviators in East Timor for peacekeeping duties. The area of operations is known to be malarious. The first choice of malaria chemoprophylaxis is doxycycline (100mg once daily) beginning one day prior to malaria exposure and continued until 14 days after return to Australia. Primaquine (15mg twice daily) is given concurrently with the final 14 days of doxycycline administration for post-exposure prophylaxis. Mefloquine and Malarone® are alternatives if doxycycline is poorly tolerated.

Currently, Australian Army Aviation (AAAvn) aircrew are only approved to use doxycycline as a chemoprophylaxis agent whilst performing flying duties, as neither mefloquine nor Malarone® are approved for use by aircrew. Recently, a study in aircrew of the Israeli Air Force found that mefloquine was safe and better accepted than doxycycline, suggesting that further studies are needed to assess the safety of mefloquine in aircrew. Australian (AAAvn) aircrew who are intolerant of doxycycline are not currently authorised to use mefloquine and are classified as non-deployable into malaria endemic areas.

The use of primaquine for 14 days of post-exposure prophylaxis is known to cause side effects and be associated with compliance difficulties. Aircrew are suspended from flying duties for the period of the post-exposure prophylaxis due to inadequate information on the effects of primaquine on aviation high level tasks. Additionally, aircrew are often required to delay primaquine post-exposure prophylaxis until recreation leave is taken in order to continue flying in the interim. In this case, daily suppressive doxycycline is continued until primaquine post-exposure chemoprophylaxis can be initiated.

Concerns of classification as non-deployable to a malarious area creates the potential for aircrew to avoid declaring adverse drug reactions to either doxycycline or primaquine. The potential also exists for non-compliance with primaquine post-exposure chemoprophylaxis if aircrew are delayed in initiating it due to continuing tasking requirements after return from the malarious area.

2. Major Anthony Lourensen AAvn, is attached to the Western Australian University Regiment, Artillery Barracks, Fremantle, Western Australia. Major Scott Kitchener RAAMC, was attached to Army Malaria Institute, Gallipoli Barracks, Enoggera, Queensland and Lieutenant Colonel Peter Nasveld RAAMC, is attached to Seventh Brigade, Gallipoli Barracks, Enoggera, Queensland.
METHODS
All AAVn unit personnel stationed in East Timor in July 2001 were interviewed on their opinions and experiences of the current chemoprophylaxis for malaria. Personnel were provided with a guarantee of anonymity in order to facilitate open and frank responses without consequences of disciplinary action.

Seventy-nine volunteers (30 aircrew and 49 non-aircrew) from two AAVn units based in East Timor were interviewed. A standardised questionnaire was used and administered by a single interviewer. Four non-aircrew reported probable previous adverse drug reactions to doxycycline and were taking mefloquine as malaria chemoprophylaxis. They were included in the study. The East Timor postings for AAVn units were four months in duration, with most aircrew interviewed undertaking their second tour of duty.

RESULTS
The results are summarised in the following tables:

<table>
<thead>
<tr>
<th>TABLE 1:</th>
<th>Responses to: ‘How long have you been taking doxycycline continuously?’</th>
<th>Aircrew</th>
<th>Non-aircrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mefloquine</td>
<td>0</td>
<td>4 (8%)</td>
<td></td>
</tr>
<tr>
<td>No chemoprophylaxis</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Less than one week</td>
<td>4 (13%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>One to six weeks</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>More than six, but less than 16 weeks</td>
<td>23 (77%)</td>
<td>44 (90%)</td>
<td></td>
</tr>
<tr>
<td>More than 16 weeks, but less than 12 months</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>12 months or more</td>
<td>2 (6%)</td>
<td>1 (2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>30</td>
<td>49</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2:</th>
<th>Responses to: ‘Tell me about your experiences with doxycycline’</th>
<th>Aircrew</th>
<th>Non-aircrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to remember to take it daily</td>
<td>6 (20%)</td>
<td>5 (10%)</td>
<td></td>
</tr>
<tr>
<td>Dislike taking it daily</td>
<td>2 (7%)</td>
<td>1 (2%)</td>
<td></td>
</tr>
<tr>
<td>Concerned about long term effects</td>
<td>2 (7%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Concerned about drug interactions</td>
<td>1 (3%)</td>
<td>1 (2%)</td>
<td></td>
</tr>
<tr>
<td>Unsure of need, as few mosquitoes seen</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Suffer side effects, so don’t take it</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Suffer side effects, so take mefloquine</td>
<td>0</td>
<td>4 (8%)</td>
<td></td>
</tr>
<tr>
<td>No concerns</td>
<td>17 (57%)</td>
<td>38 (78%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 3:</th>
<th>Responses to: ‘It’s quite difficult to remember to take medications daily – what has been your experience on this deployment?’</th>
<th>Aircrew</th>
<th>Non-aircrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missed about 10 days</td>
<td>6 (20%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Missed about 7 days</td>
<td>0</td>
<td>1 (2%)</td>
<td></td>
</tr>
<tr>
<td>Missed about 5 days</td>
<td>3 (10%)</td>
<td>6 (12%)</td>
<td></td>
</tr>
<tr>
<td>Missed about 2 days</td>
<td>13 (43%)</td>
<td>12 (24%)</td>
<td></td>
</tr>
<tr>
<td>Never missed a day</td>
<td>7 (23%)</td>
<td>26 (53%)</td>
<td></td>
</tr>
<tr>
<td>Taking mefloquine</td>
<td>0</td>
<td>4 (8%)</td>
<td></td>
</tr>
<tr>
<td>No chemoprophylaxis</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 4:
Responses to: 'There are some side effects associated with doxycycline – do you think you’ve had any?’ with a request for elaboration as appropriate. (More than one response was received from some individuals.)

<table>
<thead>
<tr>
<th></th>
<th>Previous exposure, no symptoms now</th>
<th>1st fortnight</th>
<th>Ongoing</th>
<th>At night or without food</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aircrew</td>
<td>Non-aircrew</td>
<td>Aircrew</td>
<td>Non-aircrew</td>
</tr>
<tr>
<td>Nausea</td>
<td>2 (8%)</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0</td>
<td>1 (3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>‘Burning throat’ or ‘indigestion’</td>
<td>2 (8%)</td>
<td>1 (3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Photosensitivity</td>
<td>3 (12%)</td>
<td>6 (17%)</td>
<td>3 (10%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>0</td>
<td>0</td>
<td>2 (7%)</td>
<td>0</td>
</tr>
<tr>
<td>Slow healing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

This was the first exposure to doxycycline for five aircrew and 13 non-aircrew. Of those, four non-aircrew were taking mefloquine, two had suffered side effects with doxycycline previously and had deployed on this occasion using mefloquine, and two had commenced this deployment using doxycycline and been changed to mefloquine following intolerance. Some personnel had suffered side effects on previous exposure to doxycycline, and now had no side effects. Others reported transient side effects that had since resolved, whilst some individuals reported ongoing side effects. Several respondents reported side effects from doxycycline when taken at night or without food.

TABLE 5:
Responses to: ‘Have you missed or shortened a post-exposure prophylaxis course?’

<table>
<thead>
<tr>
<th></th>
<th>Aircrew</th>
<th>Non-aircrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed all courses fully</td>
<td>9 (36%)</td>
<td>21 (62%)</td>
</tr>
<tr>
<td>Missed more than one post-exposure prophylaxis course</td>
<td>3 (12%)*</td>
<td>0</td>
</tr>
<tr>
<td>Missed one post-exposure prophylaxis course</td>
<td>6 (24%)</td>
<td>4 (12%)</td>
</tr>
<tr>
<td>Shortened to seven days or less</td>
<td>10 (40%)**</td>
<td>5 (15%)</td>
</tr>
<tr>
<td>Shortened to greater than seven days, but less than 14</td>
<td>1 (4%)</td>
<td>1 (3%)**</td>
</tr>
<tr>
<td>Erratic compliance</td>
<td>1 (4%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Intends to miss post-exposure prophylaxis course if symptom free after stopping doxycycline</td>
<td>2 (8%)</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

(*One aircrew missed one course due to ‘adverse events’; **One aircrew due to ‘adverse events’)

Five aircrew and 15 non-aircrew had not previously used post-exposure prophylaxis. Of the 15 non-aircrew, one was taking doxycycline long term (two years and 10 months) and intended to continue to do so on return to Australia in order to continue flying duties. Another had been evacuated from a previous deployment due to suffering an adverse drug reaction to doxycycline and post-exposure prophylaxis was not undertaken, and another individual was involved in a trial of tafenoquine post-exposure prophylaxis following a previous deployment.

36% of aircrew and 12% of non-aircrew had omitted post-exposure prophylaxis with primaquine, while 44% of aircrew and 18% of non-aircrew had shortened their post-exposure prophylaxis courses without medical direction.
TABLE 6:
Responses to discussion about ‘eradication’ (post-exposure prophylaxis) and the question ‘Tell me about your experiences with the post-exposure prophylaxis course’

<table>
<thead>
<tr>
<th></th>
<th>Aircrew</th>
<th>Non-aircrew</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>6 (24%)</td>
<td>4 (12%)</td>
<td>Post-exposure prophylaxis delayed until leave due to tasking requirements</td>
</tr>
<tr>
<td>Vomiting</td>
<td>1 (4%)</td>
<td>1 (3%)</td>
<td>Doxycycline compliance erratic when post-exposure prophylaxis delayed</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>2 (8%)</td>
<td>0</td>
<td>Non flying component hampers the operations of the unit</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>1 (4%)</td>
<td>2 (6%)</td>
<td>Alcohol abstinence is socially restrictive, especially on post-exposure prophylaxis on leave</td>
</tr>
<tr>
<td>Wind or bloating</td>
<td>0</td>
<td>2 (6%)</td>
<td>Delay post-exposure prophylaxis on leave by one week so can drink alcohol</td>
</tr>
<tr>
<td>Headaches</td>
<td>1 (4%)</td>
<td>2 (6%)</td>
<td>Drinks alcohol on post-exposure prophylaxis</td>
</tr>
<tr>
<td>‘Not right*’</td>
<td>4 (16%)</td>
<td>4 (12%)</td>
<td>Unaware of belief to abstain from alcohol</td>
</tr>
<tr>
<td>No side effects</td>
<td>11 (44%)</td>
<td>21 (62%)</td>
<td>Will forego post-exposure prophylaxis</td>
</tr>
</tbody>
</table>

(*This group consistently found it very difficult to describe how they felt whilst using post-exposure prophylaxis. It was described variously as ‘not feeling right’, ‘not feeling 100%’, ‘not myself’, ‘difficulty in concentrating’, and ‘difficulty in planning things’.)

TABLE 7:
Responses to ‘Do you have any suggestions as to how the chemoprophylaxis and post-exposure prophylaxis courses could be improved?’ Some personnel gave more than one response.

<table>
<thead>
<tr>
<th></th>
<th>Aircrew</th>
<th>Non-aircrew</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly chemoprophylaxis</td>
<td>14 (47%)</td>
<td>14 (29%)</td>
</tr>
<tr>
<td>Habituate personnel to malaria chemoprophylaxis by using vitamin C tablets when on exercise</td>
<td>0</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Chemoprophylaxis which does not require post-exposure prophylaxis</td>
<td>5 (17%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>A shorter post-exposure prophylaxis course</td>
<td>9 (30%)</td>
<td>6 (12%)</td>
</tr>
<tr>
<td>A post-exposure prophylaxis course compatible with flying duties</td>
<td>6 (20%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>An alternative to primaquine due to the side effects</td>
<td>0</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Post-exposure prophylaxis that is compatible with alcohol consumption</td>
<td>1 (3%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Delay post-exposure prophylaxis so personnel can enjoy unrestricted social activities post deployment</td>
<td>0</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>No suggestion for improvement</td>
<td>1 (3%)</td>
<td>10 (20%)</td>
</tr>
<tr>
<td>Happy with the current system</td>
<td>2 (6%)</td>
<td>13 (27%)</td>
</tr>
</tbody>
</table>

DISCUSSION
A higher proportion of aircrew reported difficulty remembering to take doxycycline and displayed erratic or poor compliance when compared to the non-aircrew. This difference may be due to variations in the daily routine of aircrew, including rotating between day and night crewing, and spending time away from base on missions. Non-aircrew are generally not exposed to these variations, tending to have a set daily routine. Both AAWn units approached made doxycy
cline freely available in a common area. In both, names were checked against a nominal roll to ensure daily compliance. Despite this system, a significant proportion of both aircrew and non-aircrew were still experiencing difficulties with compliance. Compliance would be likely to improve if a system of supervision was added to the self-registration of compliance.

With such a high rate of ‘missed days’ amongst the aircrew, the potential exists for sub-optimal doxycycline chemoprophylaxis. The risk of malaria infection is compounded by the mobility of the aircrew resulting in time spent in areas where collective vector control measures such as fogging and application of larvicide to groundwater are poor or non-existent.

Aircrew and non-aircrew reported adverse events whilst taking doxycycline at approximately the same rates – 66% of aircrew compared to 59% of non-aircrew. Most adverse events reported were mild in nature, although for aircrew these may have the potential to impinge upon the safety of flight operations, particularly night vision googgle missions. Whilst non-aircrew may accept mild side effects, pilots and loadmasters may experience impaired concentration at critical points of flight, especially landing, formation flying and hoisting operations.

Four non-aircrew reported suffering significant adverse events from past exposure to doxycycline and were taking mefloquine as malaria prophylaxis. One aircrew reported suffering from significant side effects from past exposure to doxycycline and elected to take no chemoprophylaxis. The individual had not sought medical evaluation for fear of being classified as non-deployable to malaria endemic areas (effectively being restricted to flying operations in Australia only). This situation highlights the need for an alternative malaria chemoprophylaxis to be available to aircrew who suffer adverse events whilst taking doxycycline.

Both aircrew and non-aircrew reported high rates of dissatisfaction with the post-exposure prophylaxis course, with the aircrew reporting at higher rates. Post-exposure prophylaxis is generally used differently by aircrew than non-aircrew. About two thirds of aircrew reported delaying post-exposure prophylaxis on their return to Australia due to AATAN tasking requirements. Approximately half of this group also reported difficulties with doxycycline compliance during the period of delayed post-exposure prophylaxis. Many reported a pattern of not taking any suppressive chemoprophylaxis is on their return to Australia, feeling healthy, and then not undertaking post-exposure prophylaxis in the absence of illness. Non-aircrew typically take post-exposure prophylaxis on their return to Australia, with no restriction on duties during this time.

About one third of aircrew and non-aircrew disliked the restrictions of alcohol abstinence whilst taking post-exposure prophylaxis. Alcohol abstinence is not a requirement of post-exposure prophylaxis; nonetheless this was a commonly held perception. Despite this perception, about one third of aircrew and non-aircrew consumed alcohol whilst taking post-exposure prophylaxis. A small proportion delayed their post-exposure prophylaxis course by one week in order to take alcohol.

Approximately one third of aircrew had missed post-exposure prophylaxis courses completely. A further third of this group (36%) had missed more than one course, three times more frequently than with non-aircrew. Higher rates of non-completion by aircrew are considered to be due to a combination of delay in initiating post-exposure prophylaxis, adverse events and social restrictions whilst on recreation leave resulting in diminished motivation to complete the post-exposure prophylaxis requirements. Individuals in this group specifically identified waning compliance on doxycycline when post-exposure prophylaxis was delayed. The perception was that they experienced “good health” and were malaria free and that there was little or no benefit in continuing with long-term doxycycline or initiating the post-exposure prophylaxis with primaquine. Despite citing adverse events as an issue, the reason for the majority of ‘short courses’ of primaquine was a lack of motivation rather than adverse drug reactions (Table 5).

Adverse events were commonly reported on the post-exposure prophylaxis course (Table 6). Nausea was a common complaint along with a subjective feeling of being ‘not right’. Aircrew tended to have been exposed to post-exposure prophylaxis courses more than non-aircrew. This may explain the higher rate of adverse events compared to non-aircrew. As most aircrew tend to eradicate some time after their return to Australia on their leave, it is unlikely that their adverse events are due to any change in environmental or social conditions associated with homecoming.

Of the non-aircrew, more than half were satisfied with, or had no suggestions for change to the current malaria chemoprophylaxis regime (Table 7).
In contrast, the majority of aircrew (27/30) suggested improvements. Weekly chemoprophylaxis would be preferred, particularly by aircrew (47%) in order to improve compliance. Chemoprophylaxis without the need for post-exposure prophylaxis, or at least a shorter post-exposure prophylaxis course was also identified (17% & 30% respectively). This would result in less impact on flying operations, as well as potentially removing the requirement for any delay in initiating post-exposure prophylaxis resulting in improved compliance. Aircrew specifically identified a preference for post-exposure prophylaxis compatible with flying duties (20%).

CONCLUSIONS
Current malaria chemoprophylaxis and post-exposure prophylaxis regimes currently in use in the ADF are not meeting the requirements of AAAvn aircrew. Aircrew delaying post-exposure prophylaxis for extended periods of time until taking their recreation leave is associated with significant problems with compliance. Whilst aircrew tolerance to doxycycline is no different to non-aircrew, aircrew compliance is poorer. The lack of any approved alternative to malaria chemoprophylaxis compatible with flying duties is precipitating non-disclosure of intolerance due to concerns about being classified as non-deployable for flying operations in malarious areas.

There is a pressing need for the investigation of a flexible anti-malarial regime that is suited to the unique needs of AAAvn aircrew. Preferences are for weekly chemoprophylaxis and a shorter post-exposure prophylaxis course compatible with flying duties. An alternative to doxycycline, compatible with flying duties, is also required. Further investigation into the effects of alternative malarial chemoprophylaxis agents on the performance of high-level tasking in AAAvn aircrew is required.

REFERENCES
Simulation and training for military resuscitation teams

A.M. Ellis, A.D. Hendrickse and R.W. Morris

ABSTRACT
Training military personnel to manage military casualties is difficult. Within the Australian Defence Force (ADF), experience of major trauma is limited to those who work routinely in the emergency and trauma environments. Despite the increase in operational activity in recent times, the opportunities for medical teams to obtain sufficient and realistic experience remain limited. Traditional methods of training are perceived to lack realism whereas the full-scale simulated environment is recognised in other domains as enhancing the quality of training. This paper describes the training program aimed at improving the management of military casualties. During a two year period, medical teams from the Australian Defence Force attended training sessions at the Sydney Medical Simulation Centre. They were required to manage a series of medical emergencies, which were videotaped. The recordings were used to facilitate a debriefing session at which human factors were highlighted as a component of integrated clinical management. Simulated training is an excellent way of improving knowledge, skills and behaviour. Personnel have identified the level of realism and the capacity to reproduce events in “real-time” to be a major factor in the value they attribute to this method of training. The incorporation of high fidelity simulators into team deployment training may prove to be a cost-effective method of improving the performance of medical teams on operations.

INTRODUCTION
Training military personnel to manage military casualties is difficult. Experience of major trauma is limited to those who work routinely in the emergency and trauma environments. Even those who work routinely in such environments experience a civilian pattern of trauma, which is different in significant ways from military trauma. For example, penetrating injury is relatively uncommon in the Australian civilian environment. Although there has been an increase in operational activity in recent times, the opportunities for medical teams to obtain the necessary experience remain limited. Traditionally, training has relied on methods of instruction that are perceived to lack realism. Lectures, skill stations and “mouled” actors or manikins are not real enough. Strategies to place Australian Defence Force members in civilian trauma hospitals have been excellent but may be limited by numbers, “hands-on experience”, doctrinal and lack of collective training issues.

In other domains, which include civil and military aviation, the full-scale simulated environment is recognised to enhance the quality of training. The simulated environment is well recognised beyond aviation and is now routinely used in the military environment to train on weapons and weapon systems, command and communication systems and in critical decision-making. Recognising the potential for the application of the simulation environment for medical training, the Sydney Medical Simulation Centre has developed expertise in medical simulation.

1 Ellis AM, Hendrickse AD, Morris RW. Simulation and training for military resuscitation teams. Aust 5 Ml Med 2002; 11(1).
2 Major A.M. Ellis, MBBS FRACS(Orth) FAOrthA RAAMC, is Senior Lecturer, Department of Orthopaedics and Traumatic Surgery, University of Sydney, and Officer Commanding Medical Company, 5 Brigade Administrative Support Battalion (aellis@med.usyd.edu.au). Major A D Hendrickse, BM FRCLA RAAMC, is Specialist Registrar in Anaesthesia and Intensive Care and Defence Medical Services Visiting Fellow, Sydney Medical Simulation Centre, Royal North Shore Hospital, Sydney (adhinoz_2000@yahoo.co.uk). Dr R W Morris, MBBS FANZCA, is Director, Research and Development, Sydney Medical Simulation Centre, Royal North Shore Hospital, Sydney and Clinical Senior Lecturer, Department of Anaesthesia and Pain Management, University of Sydney.
In 1998, courses were developed for the Australian Defence Force as a collaborative project with Medical Officers of the Royal Australian Army Medical Corps. The ultimate aim of this method of training is to produce better-prepared medical teams and thus reduce the "learning curve" effect that often blights the early stages of operational team deployment.

The smallest building block of health support within the Australian Defence Force is the resuscitation team. Each resuscitation team consists of a medical officer, a nursing officer, an advanced medical assistant, a medical scribe and an orderly. The role of the resuscitation team is to work together and manage effectively the resuscitation of military casualties, using methodology developed in advanced trauma life support to rapidly diagnose and treat life-threatening injuries. Onward transfer to a surgical facility for definitive treatment would then be considered after resuscitation and stabilisation of the casualty.

The critical point to be made is that teams and not individuals perform resuscitation of casualties. In order to work effectively as a team, each member must bring a minimum knowledge set, competence in certain skills and a role defined by a duty statement. Understanding the importance of the team in the process of resuscitation, the Australian Defence Force has developed a doctrinal environment that encourages teamwork by standardised equipment, treatment protocols and policy directives. This allows interchange between teams, such as might occur on operational duty, secure in the knowledge that equipment and protocols will be identical and new team members will be assuming corresponding roles.

**TRADITIONAL TRAINING**

A significant amount of instruction occurs in the classroom. Training on "part task trainers" has been an essential part of this and skills such as intubation, cannulation and cardiopulmonary resuscitation are traditionally taught using such methods. Added to this are field exercises using surrogate patients and the contribution of this to team training is important. Casualties on such exercises are often "moulaged" and may carry cards describing the mechanism of injury, often with photographic representation of genuine injury. The progress of the casualty through the health facility will be controlled by directing staff who will advise the team of changes in the state of the casualty's condition and efficacy of any treatment. Additionally, individual skills are often improved by means of College-accredited courses including the Field Nursing Course and the Early Management of Severe Trauma Course of the Royal Australian College of Surgeons. For others, the use of an attachment to civilian hospitals through a process known as a strategic alliance enables regular members of the Australian Defence Force to experience civilian trauma. At a medical assistant level, however, this can be limited by restrictions on direct patient care associated with registration and professional issues.

All the training detailed above allows the participants the opportunity to learn and practise skills before exposure to a military casualty. Unfortunately, the lack of realism associated with the traditional environment detracts from the overall learning experience. There is a gap between training and experience and this remains wide enough for those Australian Defence Force personnel undergoing such training to report that they do not get a "feel" for the specialty of military trauma.

Australian Defence Force teams need to sustain high levels of operational preparedness and capability. ADF Health Teams often have to deploy at short notice into situations where large numbers of casualties need to be treated. Such situations have included civilian aid to the victims of the Vanimo tidal wave or civilian casualties associated with peacekeeping operations, including East Timor.

Recognising this, medical officers of the Australian Defence Force approached the Medical Simulation Centre and the Department of Anaesthesia and Pain Management at the University of Sydney and, in collaboration, developed courses for military simulation aimed at providing an experiential training environment of simulated battlefield injury reproduced with a high degree of fidelity.

**MILITARY SIMULATION METHODOLOGY**

**The Sydney Medical Simulation Centre**

The Sydney Medical Simulation Centre is based at the Royal North Shore Hospital, St Leonards, New South Wales, Australia. The Simulation Centre opened in 1997 primarily to provide a simulated environment for anaesthesia training and subsequently has developed a number of courses in other fields, including
trauma management. The Centre relies on an experienced faculty working in major trauma centres with anaesthetic and surgical backgrounds in both the civilian and military fields.

Within the Centre is a simulation suite that uses an advanced simulator manikin of a type manufactured by MedSim-Eagle Simulation Inc., Fort Lauderdale, Florida. This “full patient, high-fidelity simulator” is an adult-sized manikin fitted with a variety of electromechanical and pneumatic devices and connected to a computer and a variety of sensors. Complex software programs enable the manikin to operate automatically by controlling the vital functions. Sophisticated mathematical modelling of the manikin’s physiological and pharmacological responses to physical interventions, or drug administration, allows integration with the control systems so that realistic responses can occur in “real time”.

The manikin is constructed in such a way as to allow the full range of airway manipulations and instrumentation from basic head tilt and chin lift, through endotracheal intubation to the provision of a surgical airway. Chest trauma has been modelled to allow a variety of pathological states from simple pneumothoraces to cardiac tamponade to be simulated. The manikin can be cannulated and pulses can be palpated. The blood pressure is generated by the computer model and can be supplied to monitoring equipment when appropriate. Sensors monitor interventions such as oxygen therapy, ventilation and drug administration, and the appropriate physiological responses are programmed to occur realistically. The manikin can be spoken to and questioned relying on a member of the directing staff to provide the appropriate response using a microphone linked to a loud speaker located by the head. Neurological signs and symptoms, including arm movement, may be simulated and the manikin also exhibits pupillary reflexes.

The scenarios can be tailored individually to allow specific training aims to be incorporated into cases. Teams using the Centre have included those from the Royal Australian Navy, who have simulated medical emergencies associated with diving and decompression illness, and Joint Service teams who have been tasked with providing medical support with chemical, biological and radiological capabilities to security forces at the Sydney Olympics. The level of difficulty of each scenario can be modified to take into account differences in the requirements of various teams allowing an almost endless permutation of available scenarios.

**The Process of Simulation**

Over the last two years, more than 200 ADF personnel have been trained through the Centre, principally members of the Australian Army and Navy. Training has included the specific preparation of resuscitation teams for operational deployment overseas as well as the basic training of new teams and continuation training of experienced ones.

The process of training using the simulator is straightforward. Members usually train for a day or so in the unit environment, refreshing both individual and team skills prior to spending their time at the simulator. It is then usual for two teams from a unit to attend, alternating as either active participants or observers in a variety of resuscitation scenarios, usually numbering between four and six, during the course of a day.

The process of simulator training involves six stages:

- **Orientation.** Objectives for training are set along with an introduction to the Centre.
- **Familiarisation.** The students are introduced to the simulation manikin, learn about its characteristics and are given the opportunity to practice appropriate skills such as intubation and cannulation prior to a full scenario-based simulation (This is an important step in diffusing anxiety and recognising the strengths and limitations of the simulation environment).
- **Simulation.** Over a 20 minute period, full scenario-based simulation occurs without interruption. The simulation is recorded on video and also broadcast in an adjacent viewing room where other members of the unit watch the resuscitation and prepare to participate in the debriefing.
- **Debriefing.** This takes about 30 minutes and is a peer discussion process facilitated by the senior

**Scenarios**

Complex computer modelling, associated with high-fidelity representation of the response to medical intervention, allows elaborate injury scenarios to be developed (e.g. Table 1). Typically the scenarios are of blast, penetrating or violent injury, such as might be encountered by a standard resuscitation team. Envenomation and myocardial ischaemia and other emergencies are also regularly modelled.
| Summary:                           | Mine Injury                               |
|                                  | Soldier with multiple fragment injuries and traumatic amputation leg. |
|                                  | Significant Hypovolaemia                  |
|                                  | Hypoxia                                   |
| Set-Up:                          | Moulaged multiple wounds to lower limbs, traumatic amputation leg, and abdomen punctures. |
| Manikin                          | Supplemental oxygen in situ               |
| Settings                         | Lying on field stretcher with field medical report |
|                                  | Spontaneous movements and painful stimuli |
|                                  | Self-ventilating RR20 SpO2 85% on air     |
|                                  | Class 3 shock BP 100/60, P110 low volume  |
|                                  | Trigger hypovolaemic shock scenario.      |
| Expected Responses:              | Initial assessment                         |
|                                  | Follows CTR Hypovolaemic shock and abdominal injury. |
|                                  | Venous access and fluid resuscitation     |
|                                  | Nasogastic tube, IDC and antibiotics.     |
|                                  | Consider airway control if unconscious.   |
|                                  | Assess priority and plan evacuation       |
| Debriefing Points:               | Early recognition of hypovolaemic shock.  |
|                                  | Prompt treatment of life-threatening conditions before completion of initial assessment |
|                                  | Haemorrhage control.                      |

medical officer of the unit concerned and an instructor from the Simulation Centre. During the debriefing, the video is used as a framework for discussion (All participants and observers get an opportunity to discuss a range of clinical and human factor issues).

- **Conclusion.** The process of reviewing the day’s events including a summary of lessons learned during the day.
- **Feedback.** All participants are asked to fill out an anonymous course appraisal questionnaire.

**MEASURING THE EFFECTIVENESS OF SIMULATION TRAINING.**

**Methods**

By means of a questionnaire, participants in military simulator training courses reviewed ranges of variables. These included factors that might affect individual performance, teaching style and instructor style and an overall self-assessment of performance in the simulator environment.

**Results**

For the purpose of assessing attitudes and value of training, the questionnaire was administered to 62 course participants. This included eight doctors, 10 Nursing officers and 44 Medical Assistants. Approximately one half were full time members (30) and a similar proportion females (29).

**Value as a training activity**

In general, the activity was reported by participants as having high training value. Participants were asked to use a visual analogue scale to rate aspects of training in the simulator. One correlated with poor and five with
TABLE 2: Value of Simulation as a Training Activity (n=64).

<table>
<thead>
<tr>
<th>Visual Analogue Response</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>No Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing a Simulated Problem</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>48</td>
<td>1</td>
</tr>
<tr>
<td>Reviewing the Video</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>11</td>
<td>47</td>
<td>3</td>
</tr>
<tr>
<td>Discussing the Case with the Group</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>16</td>
<td>43</td>
<td>2</td>
</tr>
<tr>
<td>Receiving Feedback from Instructors</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>Overall</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>11</td>
<td>47</td>
<td>2</td>
</tr>
</tbody>
</table>

excellent. When asked to rate the overall value of the activity all rated the value as greater than four, with 38 (90.6%) rating the activity as five. In particular, the vast majority of activity subsets within the simulation scenario were rated by most participants as greater than four out of five on the VA scale (see Table 2).

Individual comments were sought as to the most useful and least useful aspects of the training. Thirty-five comments were entered (54.6%) with respect to most useful and five (7.8%) with respect to least useful. The comments were overwhelmingly positive, for example:
- "Equally useful to me as a non medical person to a medical person in everyday life."
- "Video debrief – good critical appraisal of scenario."
- "The practical side of things in such a realistic situation. Feedback after scenarios. Familiarity and practice and to see other roles."
- "The group discussion that focused on “the team” – usually discussion focused on medical officers only"
- "Reflection, Team building."
- "Extremely useful."
- "Feedback - know when you go wrong and how to fix it up. Using new equipment and knowing which bits work and which don’t."

Effect of various simulation environment factors on performance

The simulation environment is highly realistic yet not real. The manikin, though high fidelity in terms of the software models that drive the simulated responses, has limitations. Subtle changes of physiological response such as colour change, sweating and capillary return (a measure of peripheral circulation) cannot yet be modelled. The simulation environment is potentially threatening. There is a testing and competency element and individuals must perform with other team members in a scenario in which “the patient” may potentially die. About two thirds of participants (60.9-76.5%) found their performance improved by the factors of the simulation environment and only a small number (mean 2, 3.1%) found their performance degraded by these factors (Table 3).

DISCUSSION

Simulation training helps in the learning process. It enhances the acquisition of knowledge and skills by providing a realistic environment for training and it facilitates learning by setting it in a relevant clinical context (experiential learning).8

Training in a high fidelity simulator helps learning at different levels. It can enhance the acquisition of

TABLE 3: Effect of Simulation Factors on Performance (n=64)

<table>
<thead>
<tr>
<th>Visual Analogue Response</th>
<th>Degraded</th>
<th>Not Affected</th>
<th>Improved</th>
<th>No Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Simulator</td>
<td>4</td>
<td>9</td>
<td>49</td>
<td>0</td>
</tr>
<tr>
<td>Operating Room Environment</td>
<td>0</td>
<td>19</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>Equipment</td>
<td>2</td>
<td>17</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>Scenario Design</td>
<td>1</td>
<td>11</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>Presence of Peers</td>
<td>1</td>
<td>17</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td>Anticipation of Stressful Events</td>
<td>4</td>
<td>15</td>
<td>40</td>
<td>3</td>
</tr>
</tbody>
</table>
knowledge and skills, reinforcing the importance of these by setting training in a realistic environment using scenario based episodes of care to place such learning in a real time relevant clinical context.

For the individual, patient error committed in the simulation environment is safer. Although a scenario may lead to death and the environment is perceived as real, the events are less traumatic than in a clinical situation. Shortly after the ending of the scenario, the recognition that such an event has occurred in a simulation environment rapidly becomes apparent. Though the environment is perceived as stressful, respondents in this survey did not significantly report degradation of behaviour by environmental factors. They individually and consistently reported simulation to have high value and the process of debriefing and video replay of critical events featured strongly in this. It is reasonable to infer from this that participants found the ability to become aware of error by this means to be an important reason for the value of the experience.

By basing training in the Sydney Medical Simulation Centre, expert opinions and advice can be readily available for training sessions so enabling the reinforcement of key points and the clarification of uncertain ones during the simulation process. The debriefing process has always included clinicians with high levels of appropriate experience including qualifications as EMST instructors and University appointments. Rather than using whatever becomes available in “real life”, simulation training can be planned in advance to include rare or difficult events. It has been shown that in anaesthesia some trainees have preferred training in the simulator to training in the operating or emergency room for these reasons. In the training with ADF, it is not possible to obtain real life exposure to some injury. The successful modelling of chemical warfare agents and the effects of blast and fragmentation, both extremely rare in civilian experience, has shown simulation training to be the most realistic way of training ADF members to respond to these injuries.

Simulation training for resuscitation teams works in two ways. Individuals are able to obtain new knowledge and can experiment with “cause-and-effect” relationships observing realistic responses to treatments given or interventions performed. They can learn how to use new equipment or protocols and they can do so in stages or at their own pace. Team training is especially suited to the use of video debriefing.

Resuscitation is a crisis event and memory of such events is often inaccurate. Individual members of a team often perform in relative isolation and a video recording of the scenario provides an opportunity for all to observe their own work and that of others. Human factors become apparent during video debriefing. Team function is a combination of individual and team skills (Figure 1).

Leadership, communication, situational awareness and resource utilisation are often issues that are not readily brought to mind when assessing performance, but aviation work showed how deficiencies in these areas could diminish team effectiveness. Observers can view the video recording and can assess clinical and behavioural skills, although it maybe difficult to accurately correlate the performance in the simulator with that in ‘real-life’.

**FIGURE 1**: Simulation centres on mission rehearsal, a number of factors come into play.

**HOW DOES SIMULATION WORK?**

**INDIVIDUAL**

- Knowledge
- Minimum Qualifications
- Duty Statement
- Competence
- Skill

**TEAM**

- Human Factors
- Mission Rehearsal
- Verification and Assessment
- Validation and Assessment

- Leadership
- Command and Control
- Role Practice
- Familiarity

- Treatment Protocols
- Standard Equipment
- Health policy
- Directive
- Training Directives

**DOCTRINE**

Experience with significant numbers of military teams being trained through the simulation centre has shown that time spent in the simulator is perceived as excellent training. In general, advanced patient simulator training is highly rated, as is the teaching style, particularly in the use of video debriefing. The simulated environment is felt to be challenging, realistic and practical and is beneficial with respect to aspects of teamwork in a way rarely seen in the peacetime.
environment. The environment is felt to be stressful because of the video scrutiny and personal performance by many is felt to be sub-optimal presumably because of this factor. Others, however, felt that performance was enhanced by the extra anxiety.

**CONCLUSION**

Medical Simulator training is an excellent way to improve knowledge, skills and attitudes. Personnel have identified the level of realism, and the capacity to reproduce events in real time, to be a major factor in the value they attribute to this method of training. This method of training is consistently rated very highly by the majority of participants and has thus been shown to be a very effective way of developing competence and capability in the building block of ADF Health operations; the resuscitation team. The incorporation of high-fidelity simulators into pre-deployment training may prove to be a cost-effective method of improving the performance of medical teams on operations.

**REFERENCES**

Case Report: Self treated relapsing Vivax Malaria?1

Scott Kitchener and Bruce Ashford2

ABSTRACT
This is a report of a case of malaria in which the patient presumably inadvertently partially treated an undiagnosed episode of malaris before presenting with a probable relapse of the initial episode. It is presented for discussion with military health professionals who may see such cases.

CASE HISTORY
The patient was a male 50 kilogram infantryman who had an unremarkable previous medical history (Australian Defence Force Medical Employment Classification 1). He began mefloquine chemoprophylaxis prior to deploying into East Timor and reported no adverse effects following the loading dose.

Within two weeks of arriving in the area of operations he presented with headache, initial insomnia and early waking, and muscle and joint aches, which he did not feel impaired the performance of his duties. His sleep disturbance typically followed picquet duty. He ceased mefloquine chemoprophylaxis and began doxycycline 100mg daily.

Three months after transferring to doxycycline, he presented with arthralgia, fevers and chills, sweats, sore throat and a productive cough with yellow sputum. He was noted to have sublingual lymphadenopathy and pharyngitis, which was treated with Betadine gargle. At this time, having spoken with a friend who had leptospirosis, he began self-treating (undisclosed) with doxycycline 100mg twice daily. After some improvement the following day, he developed peripheral paraesthesia, loss of appetite, myalgia and increasing tiredness by the third day. No malaria parasites were seen on thick and thin blood films. He was treated with chest percussion and oxygen delivered by mask. By the eighth day, symptoms had resolved and he returned to doxycycline 100mg daily.

Six weeks after the onset of the previous episode, he developed nausea, fever, chills, myalgia and began double dosing with doxycycline again. Symptoms abated the following day. They, however, returned on the third day when he represented febrile (390 C), alert and orientated, though sweating profusely and complaining of headache, cough and shortness of breath. At this time, he was noted to have no clinical abnormality of the neurological or respiratory systems and no hepatosplenomegaly. Intravenous fluid and simple analgesia were begun as the patient was turned into the Regimental Aid Post.

Plasmodium vivax trophozoites and gametocytes (680/µL) were identified on blood slides. Treatment with Chloroquine 1500mg over the next three days produced rapid recovery and he moved to Dili for repatriation and further management by AMI clinicians.

DISCUSSION
The patient deployed on mefloquine chemoprophylaxis. He ceased medication shortly after entering East Timor, despite a symptomless loading dose, which suggests that the circumstances of the deployment, at least, contributed to the initial symptoms. His first clinical episode occurred well after conclusion of mefloquine chemoprophylaxis and is unlikely to be related.

The febrile periodicity (second daily) of the earlier clinical episode is consistent with vivax malaria and the same as that observed subsequently. The symptomatology is also similar with the second episode and consistent with vivax malaria. This supports the hypothesis that he has suffered two episodes of vivax malaria, the first being only partially treated.

Doxycycline is generally effective in suppression of vivax malaria for Australian soldiers1. If the earlier clinical episode reported in September was related to a P. vivax infection, this could imply a failure of
doxycycline chemosuppression. In favour of this is that the patient normally took doxycycline with breakfast; he, however, recalls missing two tablets only when on patrol two weeks prior to the first clinical episode. The incubation period for vivax malaria is approximately two weeks.

The soldier has used double dose of doxycycline for eight days during the acute phase of a condition consistent with malaria. Doxycycline treats malaria, including vivax malaria, slowly and by only addressing the blood stages leaving residual hepatic stages (hypnozoites) unaffected. The overall efficacy and possible time to reappearance of parasites from failure of such a treatment with doxycycline is difficult to determine. Treatment with quinine and doxycycline (100mg twice daily for seven days) can allow reappearance of parasitaemia as early as two weeks after starting treatment due to their short half-lives suggesting failure to clear all parasites, compliance or absorption problems, or false (original) positive blood smears.

While doxycycline cannot be relied upon for causal prophylaxis (removal of liver and blood stages of P. vivax), the release of blood stage merozoites is generally well suppressed by doxycycline. Therefore, at some stage, this patient has transiently allowed establishment of infection. It is possible that the first clinical episode was true vivax malaria only partially treated with double dose doxycycline, suppressing parasitaemia below detectable levels, then gradually re-establishing to another clinical episode.

As the possibility exists that the confirmed episode was a relapse of vivax malaria, the patient was also treated with 6mg/kg primaquine given as 30mg daily with food for 16 days. He tolerated this treatment well. Three months later, he has not developed further parasitaemia.

CONCLUSION
The only recalled non-compliance with doxycycline is the most likely time for instigation of infection. Self-treatment with doxycycline 200mg daily only slowly manages P. vivax parasitaemia; however, doxycycline 100mg daily may be less likely to maintain chemosuppression of an established (albeit low grade) parasitaemia.

Overall, this case demonstrates the requirement for vigilant and compliant prophylaxis. It also re-enforces the value of history in the clinical diagnosis of malaria. This should encourage generalist Medical Officers to undertake initial management of malaria with confidence.

REFERENCES
A View From The Front

The John Thomson Oration 2000: Private Bosisto – The Debt and the Challenge

Rob Atkinson

INTRODUCTION

A FEW YEARS AGO, a French farmer discovered the body of an Australian soldier – namely Private Bosisto – near a feature called ‘the windmill’ close to a village of Pozières. This soldier had been missing in action since 1916 and was part of the 27th Battalion, Australian Imperial Force, and was killed in an attack that began at 2100 on the 4th of August 1916.

As he was missing in action, he remained on the regimental books, which were inherited by 10/27 RSAR, the Army Reserve Battalion in South Australia. The Commanding Officer, LTCOL Doug Strain, energetic and with initiative, noted the administrative requirements for the soldier to be buried appropriately. Thus, a detachment from the Battalion went to France and, with full ceremonial honours, interred Private Russell George Bosisto with his mates.

FORENSIC FINDINGS

What were the forensic findings? There was no formal forensic examination. However, he was found with his water bottle almost cut in half and had two fractured femurs. The possible wounds were such that he may well have been saved today had he been retrieved.

He had full kit, minus his helmet. He had a fixed bayonet, with the weapon loaded on action and 200 rounds of ammunition. He carried his grenades; thus he was going into battle when he died. His webbing was made of kangaroo skin, which had not rotted and had been thus personalised. Private Bosisto also carried two officer’s pips in his pocket. There were two theories to explain this, neither of which are mutually exclusive.

The first was that if he were captured by the Germans, who did not know the difference between Australian officers and men, he would put on the pips and be treated better as an officer.

The second theory is based on the Australians being paid a lot more than other armies and a party going on behind the lines. The British had Officers Clubs, which were very good, and the British did not know the difference between Australian officers and soldiers. Thus two pips would gain him access to this. Private Bosisto had been let out of detention in order to take part in this battle.

Private Bosisto was making the best of life, understanding full well that he had a high chance of dying – which he subsequently did. All ten members of his section died, and he was found 200 metres ahead of the others. Therein lie the debt and the challenge of how to deliver, in modern times, the health care our soldiers deserve.

MILITARY MEDICINE

The nature of Military Medicine demonstrates a paradox. On one hand, there is ostensibly a fit and healthy force, probably the fittest members of the community the military is designed to defend. On the other hand, the potential for major damage to this force exists from disease, accident and combat.

In peacetime, Military Medicine is preventative and sports medicine orientated, documenting the medical status of the force to maximise its deployability. Essentially, peacetime is a quiet time, enabling the development of doctrine and plans using the best available knowledge and technology for the next operation. The amount of medical knowledge has doubled since 1992 and the management of this amount of information, technology and skill, and its integration with the Australian Defence Force, is essentially best practice in peace and war.

The knowledge edge rests in the teaching hospitals and private practices in peace-time and balancing civilian skills and operational requirements is

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2 Brigadier Rob Atkinson is an Army Reserve orthopaedic surgeon. This paper was given as the John Thomson Oration in 2000.
the key to training for war and training to win. The knowledge edge needs to be brought to the cutting edge of operational health.

In War, or Military Operations Other Than War, there is an increased demand for medical services and how the balance between civilian medicine and operational medicine is managed will reflect our ability to deliver.

WAR AND MILITARY OPERATIONS OTHER THAN WAR
Casualty surges reflect operational activity. There are peaks and troughs. In the battles of World War I and in World War II this was demonstrated obviously. In the Western desert there were sporting knee injuries during the quiet times.

Sport is encouraged for fitness, morale, team play and elimination of boredom. This was similar to the pattern of injuries in the Gulf War. The force was getting ready. It was training, they were playing sport, and they had injuries. The overall aim is to conserve manpower and maintain effective troops in the field.

Does lifesaving surgery do this? Not really, but given the values of our democracy, we have the higher obligation to the soldier who places himself in harm’s way for his community, to save his life and limbs. It is a confidence and morale booster and indirectly contributes to the calibre of the force and its effectiveness. First aid, evacuation, triage, resuscitation, stabilisation and definitive medical care all consume assets. If winning the battle saves lives, does this elaborate activity contribute to the effectiveness of the Force? If motivation and leadership are the keys to the mind-game of winning, the answer is emphatically, yes.

Our enemies in South Vietnam used weapons to main in order to undermine morale, to consume assets and destroy the political will to win. The casualty evacuation techniques in battle and surgery gave confidence to the troops although the effectiveness of the television campaign on the political world was obvious.

What about recent wars – for example, the Gulf War? The two United States hospital ships of 1000 beds did not take combat casualties. What message did the deployment of such assets to the front line deliver? First, to the enemy it was a clear message of caring for the troops, in sharp contrast to the care given to the Iraqi troops. The Allies were prepared to risk significant assets, which were vulnerable to mine or missile attack, and demonstrated commitment and a will to win. The Marine pilots said that if the aircraft were hit they would nurse their aircraft back to the ocean and ditch the ship.

We were not busy, however, but each day brought the possibility of large numbers of casualties from combat or chemical and biological warfare. The real cases were from accident and sport, and the commonest operation in the Gulf War was arthroscopy of the knee, with a 70% return to duty. There were 1400 medical and nursing staff. What could be done whilst we were waiting? We ran lectures and courses. There were fitness programs and we drilled: abandon-ship drill, chemical and biological warfare drill, mass casualty drills, finally ending with the 'mother of all drills': we could take 30 major casualties at once.

Research and other protocols were developed and tri-service doctrine for the ADF came of age amongst those of us from the three services who served there. We looked after each other. Ships hit mines near us (USS TRIPOLI and an AEGIS cruiser) and one Silkworm missile was taken out 20km away by HMS Gloucester. One hundred-plus Scud missiles landed somewhere in the sea. The neurosurgeon on board had not operated for six months. The cardiothoracic surgeon, a friend, leaked a berry aneurysm and the neurosurgeon would not operate. The patient was treated conservatively, evacuated, and recovered.

If you are waiting for cases, how long do you go before skills and confidence drop to an unacceptable level? Do you rotate the staff every three months or so? And what about continuing education courses with CD-ROM, video etc to maintain skills? Rotating from a busy civilian environment brings those skills, so short rotations have an advantage.

What about modern endoscopy, particularly arthroscopic surgery? It is equipment-intensive but patient-friendly, being non-invasive. There was a 70% return to duty in the Gulf War and that is a massive conservation of manpower and a force-multiplier. If those troops had been sent home and someone else had to return to take their place and to be trained as a member of the team, there would be a considerable loss.

I identified six patients in my five weeks in East Timor who could have had arthroscopic surgery, and this included the RSM who had a loose body locking his elbow. He could unfortunately have been locked into the saluting position.
If we are rotating medical specialists from busy civilian practices and the teaching hospitals, why not use them in the quiet times as they wait for potential disasters? This could save money and keep all the staff busy, maintaining skills better than drills. The standards of arthroscopic surgery should be higher than in civilian practice, which depends entirely on the standard of the equipment — which should be the best.

In 1992, 3 Forward General Hospital deployed to RAAF Edinburgh. $250,000 worth of endoscopic and other equipment was loaned from industry and utilised under canvas, treating a number of serving members. Industry was compliant as they saw this was an opportunity to demonstrate their equipment to medical specialists who were potential purchasers, or certainly a significant influence within their civilian practices and teaching hospitals.

In 1997, $80,000 worth of equipment was loaned to the 2 Division exercise on Bathurst Island for arthroscopic surgery. The Tiwi Islanders are naturally good Australian Rules footballers and, with the advent of football boots, demonstrated a large number of knee injuries, which could be treated under canvas, taking them from the Darwin Hospital waiting list, which was extensive. Ear and eye surgery, in large numbers, was also performed in a short time.

We are like ‘firemen’ waiting for the big blaze: the mass trauma load, the vehicle that hits a mine or the battle casualties. The major road crash or the air disaster, plus the ever-present possibility of combat casualties, are more likely in war than in Military Operations Other than War.

In Grenada, 70% of wounds were peripheral and probably the best figures for modern combat troops wearing body armour — not too dissimilar to combat in South Vietnam. The pieces that protrude get hit anyway, and a head or thoracic central wound may well be fatal.

Anaesthetics and emergency medicine remain within the ‘core activities’, but the other specialties on deployment move into major high velocity trauma, which is not common in civilian Australian practice. We train for this, an example being, the Definitive Surgical Trauma Course run by the Royal Australasian College of Surgeons with the recent military module.

Our surgical teams for ten years have been aimed at a General surgeon and an Orthopaedic surgeon together, to get as broad a base as possible and provide mutual support.

During quiet times, there is surplus medical staff that can be used for humanitarian work. This can be in-house, where a patient is brought to the facility, as well as aid to the civilian hospitals nearby and outreach to villages, etc. Rwanda, Bougainville and East Timor have all demonstrated this. Forensic support and postgraduate training and meetings have occurred and built bridges between countries on UN missions and shared medical knowledge. Malaria is not a major issue for Ghanaian doctors. The first UN medical conference in Geneva in 1997 developed to some degree from the postgraduate activity in Rwanda.

Orthopaedics can be divided into limb-saving surgery, stabilisation and evacuation. Arthroscopic surgery has an internal operating environment — namely the joint itself — and, given the technology, can be easily applied, with a high return to duty. The balance between the two capitalises on the civilian skills of the deployed specialists. It maintains a background of activity and a steady preparation for the surge. The application of modern medical technology in the field is the foundation for future developments.

LEADERSHIP
What is the thread that ties all this together? It is leadership. We do not know who the father of modern American business managerial practice is; however, we do know who the mother is. This is Mary Parker Follett. In the 1920s she advocated a flat management structure, as opposed to the hierarchical structure, and this has been adopted generally. She said that leadership comes from ability and not a position in the hierarchy, and that this is empowering of all individuals who can demonstrate initiative and move forward in their own environment. This is the thread that binds all our activities together in a common purpose.

The Defence Secretary at the beginning of 2000 said we have spent $12 billion per annum on the ADF but could not put 3000 troops into East Timor without an extra levy on the citizens. He asked, why was this so? — which is a reasonable question. The Minister of Defence, the Chief of the Defence Force and the Defence Secretary considered all aspects of Defence and presented the view that the bureaucracy had ‘learned helplessness’.

They came up with a number of meetings, workshops and presentations to generate an attitudinal
change and a revitalising of the bureaucracy. I have distilled five of their leadership points, namely:

- accountability
- responsibility
- transparency
- good communications and
- the avoidance of stovepiping

If these words are used in practice, as opposed to being seen as bureaucratic jargon to be acknowledged only until the wind changes, then we can achieve what is best for the defence of this nation.

The leadership issue is not new, and Aristotle, one of the students of Socrates, has written in regard to ethos, pathos and logos, the central features of leadership as he saw it. Ethos is your ethical behaviour and the higher you get in any structure the more scrutiny comes upon you and personality defects become more obvious; and without good ethical behaviour, our credibility – and thus leadership – will fail. Pathos is the passion, and how much one cares for the task in hand. Logos is the knowledge and skill required to achieve the task.

CONCLUSION
In conclusion, the focus of all our efforts is on the soldier, sailor and airman who places himself in harm’s way for the citizens of this nation.

What is the building block of the ADF? Well, Private Bosisto, with his initiative and courage, his joie de vivre and his attitude to authority, is that building block. In 1916, the Anzac tradition was just beginning but it has gone on from there and is the very ethos of how we do business in the ADF. The Private Bosisto’s of the ADF are alive and well, just read the paper, and if we are to train for war, and train to win, it is our work to nurture the Private Bosisto’s. That is the debt and therein lies the challenge of bringing the knowledge edge to the cutting edge of operational health.

‘Fighting Fit – Defence Health’

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SYMPOSIUM 26-28 July 2002 The Wentworth, Sydney

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Articular cartilage transplantation for post-traumatic defects in the athletes knee: A Review

Sindy Vrancic

"Ulcerated cartilage is a troublesome thing, once destroyed is not repaired" Hunter, 1743

ABSTRACT
OSTEOCHONDRAL DEFECTS are common sequelae of traumatic injuries to lower limb weight-bearing joints. The knee joint is the most commonly affected joint in the athletic population. When these defects persist, the incongruity of the joint surface can lead to mechanical joint dysfunction. Disintegration of the surrounding articular cartilage may lead to osteoarthritis of the affected compartment, causing pain and disability in this relatively young athletic population. The treatment of these injuries is controversial, with a number of options available.

The ideal option for the treatment of the osteochondral injury in the knee is one that aims to treat the defect early and aggressively before the onset of osteoarthritis in the affected joint. Articular cartilage transplantation is described in the literature as an effective method to achieve this outcome in the athletic population. Osteochondral allografts and autografts are two techniques that are currently being utilised to restore joint congruity. This article reviews the current literature and results of articular cartilage transplantation for the treatment of post-traumatic defects in the knee.

INTRODUCTION
OSTEOCHONDRAL INJURIES present serious diagnostic and treatment difficulties in the athletic population. There are few long-term studies and no general consensus in the current literature as to the best way to manage these lesions. In the treatment of focal defects, the optimal management is for the replacement with a like substance. This article is a review of the current literature on two methods of cartilage transplantation currently being employed to treat these defects, with the emphasis on treatment in the young, active population.

BACKGROUND
When a segment of articular cartilage is separated from its surrounds, along with its underlying subchondral bone, an osteochondral lesion is produced. Trauma, osteonecrosis, osteochondritis dissecans and some hereditary abnormalities can cause these defects to occur, with trauma being the major contributor in the adult population. Breakdown of articular cartilage can result in severe pain and disability, and may progress to premature osteoarthritis.

The knee is the most commonly involved joint, with 75% of all osteochondral injuries occurring in this joint. They occur two to three times more commonly in males, but this ratio is on the decline due to the increased participation of females in sporting activities. Osteochondral injuries frequently occur in the second to fourth decade.

AETIOLOGY
Articular cartilage injuries are very common in the athletic population. One study found chondral lesions in 63% of >31,000 knee arthroscopies. These injuries occur when repetitive and prolonged joint overload, or a sudden impact, provides high compressive forces to the tissues and high shear stress also at the subchondral bone interface. A subchondral fracture occurs as a result of these forces acting tangentially to the joint surface. In contact sports, or those involving torsional stresses on the lower extremity, focal articular defects commonly occur.

The most common injuries that can lead to an osteochondral injury in the knee are patella disloca-
tions and anterior cruciate ligament (ACL) ruptures. The momentary dislocation-relocation of the patella may cause an osteochondral fracture of the lateral femoral condyle. A pivoting injury on a fixed weight-bearing knee may result in the anterior tibial spine abutting the medial femoral condyle while the ACL is injured. Bobic¹ noted that of the 250 patients treated at his clinic for an ACL injury, as many as 70% had some form of chondral lesion.

DIAGNOSIS
Pain is the most common symptom of a chondral injury, and may be associated with an effusion or locking. A haemarthrosis may herald an intra-articular injury, including an osteochondral fracture. Radiographs are often normal. Cartilage defects that extend to subchondral bone frequently mimic other intra-articular knee pathology. Differential diagnoses of the injury may include meniscal pathology, loose body and ligamentous injury. Diagnosis is also challenged by attempting to differentiate between osteochondral lesions and early gonarthrosis. The distinction is important, as treatment options differ between the two diagnoses.

Magnetic resonance imaging (MRI) is a non-invasive method of imaging the chondral defect, but its role in the diagnosis of these defects is still disputed. O'Shea et al.⁷ demonstrated that in 83% of cases, the primary diagnosis of a knee injury could be accurately obtained with history, clinical examination and plain radiographs. They concluded that MRI was not a necessary tool for the evaluation of traumatic knee injuries.

Arthroscopy is the diagnostic tool of choice for osteochondral lesions in the knee, with the accuracy of arthroscopy being reported to be between 69% and 98% for the evaluation of traumatic knee injuries⁸. It has been shown by Boden et al.⁹ that arthroscopy was more cost effective than MRI in the evaluation of acute traumatic knee injuries.

There are a variety of classifications for articular injuries in the knee. The most commonly used system is the Outerbridge classification¹⁰, which is based on the qualitative appearance of the cartilage surface, as seen at arthroscopy:

- Grade 1: softening with swelling
- Grade 2: fragmentation and fissuring
- Grade 3: fragmentation and fissuring > 0 inch in diameter
- Grade 4: subchondral bone exposed

Classification is important for prognosis, and to identify those lesions best suited for repair techniques.

EVALUATION OF CURRENT TREATMENT MODALITIES
There is a lack of knowledge in the current literature about the natural history of acute osteochondral injuries in the knee. This leads to problems when evaluating current treatment options, as there is nothing to compare the outcome to. Linden¹¹ reviewed seventy-six knee joints, which had a diagnosis of osteochondritis dissecans, over a period of thirty-three years. He concluded that symptomatic osteoarthritis in the knee joint of patients with osteochondral lesions of their femoral condyle tended to begin approximately ten years earlier in life than symptoms of primary osteoarthritis. At least twenty years appears to be the time between onset of symptoms related to the osteochondral defect and evidence of osteoarthritis. Most studies on new interventions in the current literature have a more limited follow-up period, so the long-term efficacy of these treatment options is still unknown.

Osteochondral grafting
Various advances in the understanding of the physiology and biomechanical properties of articular cartilage have led researchers to explore different treatment options, depending on the size of the defect. In the treatment of focal cartilage defects, replacement with like tissue is recommended¹². Articular cartilage injuries in the knee can be treated with osteochondral allografts and autografts. Each method has the common goal of filling the defect with a stable hyaline cartilage graft. The aim is to retard the onset of post-traumatic osteoarthritis in this young population of athletes, and the resulting pain and disability associated with it.

The choice of allografts and autografts both have positive and negative aspects. Allografts have limited availability and can only be harvested in areas with appropriate tissue banking facilities. They, however, do not cause any problems with donor site morbidity. Autografts are readily available but harvesting can cause problems locally for the patient.

Osteochondral allografts
As a technique for the treatment of localised defects in the knee, fresh osteochondral allografts, from young
cadaveric donors, is the one with the longest clinical experience\(^1\). This experience extends over several decades, with at least three centres in North America routinely performing this procedure since the 1970s.

The perfect candidate for the osteochondral allograft is the young individual with a single, focal defect in an otherwise healthy knee that has not yet progressed to post-traumatic osteoarthritis\(^6\). Articular grafts are best transplanted fresh, to maintain the viability of the chondrocytes. The chondrocytes are immunogenic, but humoral antigens cannot penetrate the intact articular cartilage matrix. Tissue typing is not required, and rejection appears to be insignificant in this transplantation process\(^2\). The possibility of disease transmission is inherent in any allograft transplant, but there have been no documented cases of transmission of disease in the current studies to date.

The mature cartilage surface is transplanted along with a shell of subchondral bone ranging from 3mm to 10mm thick. The benefit of this transplant is the mature cartilage does not need to “heal” to provide the biomechanical properties required of a weight bearing joint. All that is necessary is for the underlying subchondral bone to be incorporated into recipient bone stock by the process of “creeping substitution” (allograft bone incorporation).

Allografting relies on the availability of fresh donor material and experienced staff to harvest and handle this material. Donor and recipient are matched solely on size, using the mediolateral dimensions of the tibia. The transplantation process involves two surgical teams, one for the preparation of the donor graft and the second team for the recipient surgery. The graft is bedded via an arthroscopy, and internal fixation or press fit is required for graft localisation.

The first series of patients to undergo fresh osteochondral allograft transplantation began in 1972 and McDermott et al\(^3\) reviewed the first 100 patients. The average age of the patients was 48 (range: 11 to 78), with an average follow-up of six years (range: 0.5 to 13). Conclusions drawn from this review reveal a high success rate of 73% in patients with traumatic defects in the knee. Single pole grafts performed better than bipolar grafts and post-traumatic defects healed better than those caused by degenerative arthritis or spontaneous osteonecrosis.

The authors then went on to review 91 cases of post-traumatic knee defects, which also underwent fresh allograft transplantation with an average follow up of 68 months (range: four to 174 months). 75% of grafts were clinically successful at five years, 64% at ten years and 63% at 15 years\(^6\). This same group in 1997 reviewed 123 patients with an average age of 35 years (range: 15 to 64) and showed a 93% graft survival at five years, 71% at ten years and 61% at 20 years\(^5\).

Chu et al\(^6\) replicated this outcome with a review of 55 knees with an average follow up of 73 months (range: 11 to 147 months). 84% of unipolar allografts and 50% of bipolar grafts had regained virtually normal use of their resurfaced knees. They showed that fresh osteochondral shell allograft resurfacing of massive full thickness articular cartilage defects consistently returned near normal function and comfort to 42 of 55 patients (76%), with 73% of knees receiving allografts > ten years ago have continued to have good ratings at follow up.

The final large study reviewed was by Aubin et al\(^3\) who examined their results in 72 patients, average age 27 (range: 15-47 years), with a minimum follow up of five years. Excellent long-term survival was demonstrated with 83% surviving without additional surgery as long as ten years post transplantation and a projected survivorship of 74% at 15 years.

Results of osteochondral allografts are encouraging when appropriate patient selection occurs. This method appears to be most successful in young, active candidates with defects >3cm in diameter. The success of osteochondral allografts appears to be more reliant on biomechanical properties of graft placement than on graft rejection\(^7\). Patient selection and technical proficiency are the most significant factors in clinical success rates.

Osteochondral autografts (Mosaicplasty)

Dr Hangody and Dr Kárpáti developed Mosaicplasty in Budapest in the early 1990’s and, by the end of 1998, had performed this procedure on 463 patients. For the athletic population within this patient group, the major concern was not only the hyaline cartilage survival but also the involved joint’s performance under extreme weight bearing loads.

Mosaicplasty is a one-stage arthroscopic procedure that harvests multiple osteochondral grafts from non-weight bearing areas of the ipsilateral patello-femoral joint. Approximately 60-80% of the defect is filled with the transplanted grafts, with the
rest of the area reconstituting with fibrocartilage “grouting”19. By using multiple cylindrical grafts of small sizes, the congruity of the defect in relation to the surrounding recipient cartilage was maintained.

The results show a hyaline-like congruous surface at the site of focal defects20. At the eight-year follow-up, Hangody et al21 showed a 92% good to excellent result in patients receiving grafts to the femoral condyle, and 88% for tibial resurfacing, with a low complication rate. The concern with this procedure is donor site morbidity but patients to date rarely have symptoms secondary to the donor site, which heal with fibrocartilage.

Smaller studies by Outerbridge et al22 followed ten patients with an average age 29 years (range: 18-40) for an average period of six and a half years (range: four to nine years) who underwent grafting from the lateral facet of the patella into a defect in the weight bearing portion of femoral condyle. Their results showed that all ten patients were satisfied with the results of the surgery and had returned to their recreational sporting activities. The authors have suggested that it is the reconstruction of the articular integrity, which allows the patient to resume all activities. All the patients reviewed reported an improvement in terms of pain, swelling, giving way and over-all function.

A study by Maracci et al23 reviewed 13 patients treated with autologous osteochondral grafting to their knee, with 12 out of 13 patients being satisfied with their outcomes. Menke et al24 used a lateral facet patella graft in a 37-year-old patient with a large medial femoral condyle defect. Ten years post-surgery, the patient mobilised without pain and had a full range of motion. No radiographic signs of degenerative arthritis were found.

Interest in this procedure has expanded over the past few years. There are two definitive advantages over other techniques of transplantation; it is a one step procedure that can be performed arthroscopically and it is a low cost procedure. The limitation is the size of the lesion to be grafted, with the upper limit reportedly being 6-8 cm2.

CONCLUSION
There is a serious lack of studies in the area of healing joint cartilage damage. None of the procedures reviewed here have their outcomes compared to a non-operative group, and neither procedure has been trialled against the other.

Osteochondral allografts have an excellent outcome in the young, compliant individual, but the availability of cadaveric donors and specialised centres for the harvesting of the graft severely limit this option.

Mosaicplasty is a one step arthroscopic technique, which harvest grafts from the non weight bearing portion of the patients knee, alleviating the potential risks associated with autologous transplants. It does appear to be a favourable option, but results have only been studied since 1992, so medium term results only exist to date.

As stated by Tyyni18 and confirmed by this review of the literature, randomised, well-controlled studies comparing available methods to treat cartilage injuries are altogether lacking.

REFERENCES
Six Australian battalions have served in East Timor since the beginning of the International Force in East Timor (InterFET) and transition to the United Nations Transitional Administration in East Timor (UNTAET). Whilst many other Australian Defence Force (ADF) Units have also served with InterFET and UNTAET forces, this paper will be limited to discussing the comparison of malaria attacks rates between these six battalion groups to discern factors contributing to mitigation of malaria non-battle casualties.

EAST TIMOR
The transmission of malaria is related to the geography and demography of East Timor. The wet season typically arrives in the last quarter of the calendar year and continues into the first quarter of the next year. The vector for malaria, the female Anopheles mosquito, steadily increases in number over the wet season due to the increased availability of breeding sites. The vector numbers peak several months after the beginning of the season. Transmission follows some months later as increased numbers of susceptible humans become infected.

The only reservoir for the malaria parasite is a human. Some humans, exposed to malaria for much of the year, maintain a degree of immunity that allows them to tolerate persistence of the parasite in their body without experiencing significant clinical symptoms. These semi-immune carriers of the parasite, as well as people acutely infected and ill with malaria, are reservoirs of the parasite.

The distance of an indigenous population, who carry the parasite, from ADF personnel is a risk factor as the flight range of the vector is generally no more than 1.5km. The vector also will not exist or fly higher than approximately 1500m above sea level, nor more than a few metres above ground level.

Initially, populations in the rural areas of East Timor were sparse. As stability improves in the UN territory, internally displaced persons are returning to their homes, which are now in close proximity to several ADF Units. Occasionally, ADF Units have been established adjacent to the path of transient populations.

As East Timor recovers from the infrastructure damage, improved drainage and water storage systems will reduce the number of breeding sites available for the vector. Simultaneously, the recovering health of the population and improved management of malaria cases at health clinics will reduce the size of the parasite reservoir.

PROTECTIVE MEASURES
Personal protective measures (PPM) include commitment to a 'sleeves down' policy, routinely sleeping under impregnated bed nets, regular application of mosquito repellent to exposed skin and pyrethrin dipping of uniforms and bed nets as well as adherence to anti-malarial medication (chemoprophylaxis). After the outbreak of malaria during InterFET, soldiers were

1. MAJ Scott Kitchener was the Officer Commanding, Clinical Field Section, Army Malaria Institute and SQNLDR Patricia Warwarek was the Staff Officer 2, Health Surveillance in the Directorate of Preventive Health
likely to have become more aware of malaria and perhaps more compliant with PFM. It is not possible, however, to accurately comment on the comparative compliance with such measures. It is also salient to recognise that several Battalions had conducted exercises in malarious areas prior to deployment to InterFET or UNTAET and sustained malaria non-battle casualties from these exposures.

As well as environmental variables and proximity of malaria parasite reservoirs, battalions have varied in the range and nature of employed protective measures. Preventive Medicine (PM) assets, including personnel, equipment and consumable items were in short supply for the early forward Units in InterFET. Subsequent Units have deployed with larger and more robust integral PM assets under direct command. Later, health and entomological assessment and research teams from the Army Malaria Institute augmented PM assets.

**BATTALION ANALYSIS**

While a comparison of the malaria attack rates of each Battalion serving in East Timor may provide some information regarding prevention and management of malaria, any analysis or comparison of attack rates must be approached cautiously as many environmental, medical and operational variables are involved.

2 RAR

In September 1999, the Second Battalion, RAR, became the first ADF Battalion to land in East Timor with InterFET. This Unit remained in the area of operations until mid-January 2000. As the wet season developed, 2RAR deployed out from Dili to part of the area now designated the Australian Battalion area of operations (AUSBATT). This area extends north from the central mountains of the territory along the border to the Savu Sea. Second Battalion included a resolute though small and lightly equipped PM element, which had difficulty obtaining equipment and supplies. Despite their best efforts, the first ADF malaria case in East Timor occurred in an outbreak striking 2RAR, following exposures in the Batugade area.

This was a particularly difficult location to hold, with an overwhelming vector problem and an enormous reservoir of parasites available in the transiting internally displaced persons returning from West Timor. The Battalion sustained 19 malaria cases during the four months of deployment in East Timor, an operation attack rate of approximately 3%.

3 RAR

The Third Battalion, 3RAR, deployed shortly after 2RAR into Dili, later onto the border on the Matana Plain and then into the Enclave of East Timor.

The first malaria non-battle casualties from 3RAR were particularly severe with the clinical situation aggravated by the isolation for evacuation. The initial sub-units sustaining these non-battle casualties were experiencing overwhelming exposures to the malaria vector and parasite in the west of the Enclave around Citrana. In late 1999, this area was being rejuvenated both by returning waters into the river delta and returning villagers into the area, providing both vector and parasite. The Battalion headquarters and logistic elements were similarly exposed as the main city of Oecussi, situated on a flat, wet, coastal plain, rapidly increased in population.

Most of the Battalion redeployed to Australia in February 2000 after five months in the area of operations, having sustained 26 cases, an operation attack rate of approximately 4%.

5/7 RAR

The Fifth/Seventh Battalion, RAR, maintained security in Dili early in the InterFET operation. The Battalion later extended operations and bases out to Liquicia and others areas around Dili. On a prolonged deployment, 5/7RAR then relieved 2RAR on the northern border in January 2000. The nature and location of operations of this Battalion potentially contributed to the few malaria non-battle casualties sustained.
however, the duration of operations on the northern border areas is comparable to that of 2RAR.

Several significant factors of 5/7RAR mitigated vector borne disease non-battle casualties. The integral mobility of many of the sub-Units of the Battalion allowed withdrawal from hazardous malaria exposure locations during high transmission periods in the evenings. The Battalion made significant use of heavy engineering support particularly in the Batugade area to reduce vector-breeding sites. The Battalion deployed with a well structured, equipped and supported PM team (1CSSST), which undoubtedly benefited 5/7RAR in the prevention of vector borne disease.

Subsequent Battalion Groups have had the advantage of the template provided by 5/7RAR (1CSSB) Group. Despite an extended deployment during a long wet season, the Battalion sustained only 13 malaria non-battle casualties in East Timor, an operation attack rate of less than 2%.

6RAR
With the establishment of UNTAET, 6RAR relieved 5/7RAR in the northern border area. This Battalion was supported by elements from 7BDE including a significant PM team (7CSSST). The Battalion also had the benefit of integral mobility and employed engineering support to further reduce malaria vector exposures. Initial assessments of a ‘dry season’ rotation perhaps reducing malaria exposure were reviewed as rates of malaria from (civilian) health clinics were found to peak after the midyear. Sixty Battalion were likely to have been exposed to the steady rise of parasite burden from increasing transmission occurring after vector breeding sites were established in the wet season and vector numbers increased.

While also using predominantly doxycycline for chemoprophylaxis, 6RAR sustained only seven non-battle casualties from malaria in East Timor, one of which was a reinfection giving an operation attack rate of less than 1%.

1 RAR
The First Battalion, RAR, relieved 6RAR into the second wet season of ADF involvement in East Timor. The Group was similarly equipped with a significant PM team augmented by elements of the Army Malaria Institute performing functions of an health and entomological assessment team as well as taking a field research role investigating alternative malaria chemoprophylaxis. The 1RAR Battalion Group sustained no malaria non-battle casualties in the area of operations.

4 RAR
The Fourth Battalion (Cdo), RAR, relieved 1 RAR in April 2001. The Group deployed with significant and experienced integral PM assets augmented by health and entomological assessment teams from AMI. The AMI team in collaboration with the medical elements of the Battalion Group also assessed the suitability of weekly malaria chemoprophylaxis using mefloquine (a registered anti-malarial agent). Analysis of this assessment will be available shortly. The 4RAR(Cdo) Battalion Group sustained only one malaria non-battle casualty in the area of operations.

DISCUSSION
The AMI deployment to East Timor began with investigation of the malaria outbreak during InterFET. Since the outbreak, investigations have concentrated on recording the impact of malaria, antimalarial chemoprophylaxis, identifying and mapping the vector in the field, testing the acceptability of bed nets and repellents, and charting resistance to antimalarial drugs among the local malaria parasites. The vector for malaria is widely present in the AUSBATT and the local populations are effected by malaria seasonally, though to some extent all year. There is no evidence of resistance to doxycycline in East Timor, though the effectiveness of doxycycline was questioned. This is
TABLE 1: (ADF) Malaria cases presenting in the East Timor area of operations

MALARIA IN THE FM AO

consistent with the experience on other military operations\(^1\). Other military forces have found weekly malaria chemoprophylaxis regimens more suitable for operations\(^2\) and exercises in malarious areas\(^3\) and may have been the case during InterFET for those peacekeeping forces using weekly mefloquine\(^4\).

Initially, the operational attack rates for 2RAR and 3RAR were comparable to that recorded for Australian Forces in Vietnam prior to the introduction of effective malaria chemoprophylaxis with Dapsone in 1968. The subsequently developing pattern in preventative management of malaria at the Battalion level is quite evident with the evidence now available (Table 1). The distinct reduction in operational malaria with the deployment of PM assets integral to 3/7RAR and sustained with 6RAR supports the value of these assets when well equipped, supported and commanded.

As East Timor re-establishes infrastructure, a reduction in breeding sites for vectors and the human carriage of malaria parasites will reduce the malaria risk. Notwithstanding this potential reduction in malaria exposure, 4RAR Battalion Group, which carried comparable PM assets to that of the 6RAR Group, sustained only one malaria non-battle casualty during a deployment in similar seasons. 1RAR Group deployed with no malaria casualties. The apparent additional factors of weekly malaria chemoprophylaxis and the presence of an health and entomological assessment team augmenting PM assets has allowed the ADF to deploy a sizeable unit of professional educated soldiers into a highly malarious area on hazardous operations while sustaining minimal non-battle casualty from malaria.

CONCLUSION
Progressively, the integration of PM elements and health and entomological assessment teams has apparently reduced non-battle casualties sustained from malaria. Tailoring malaria chemoprophylaxis has contributed. The next challenge is prevention of post-deployment malaria non-battle casualties through further tailoring of antimalarial agents for operations.
REFERENCES


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INTRODUCTION

HIPPOCRATES ADVISED, “he who would become a surgeon should join an army and follow it”. Acceleration of scientific development and advances in methodology and practices often result from the exigencies of war, and can be demonstrated in the impact that involvement in conflicts, particularly the Second World War, had on medicine in Australia. An examination of the specific area of blood transfusion will highlight not only the legacy that war conferred in this area but will also underscore the theoretical issues underlying such development. The term “blood transfusion”, for the purposes of this paper, should be taken as a blanket term that includes the transfusion of whole blood, including blood related products including serum or plasma, unless a specific product is otherwise identified. The term ‘serum’ is used as it was in the original reference and may include items, which are in actuality plasma.

By drawing on the work of Thomas Kuhn in which he attributes the development and utilisation of scientific theory to a ‘paradigm shift’ in practitioners’ knowledge rather than an accumulation of ‘facts’; this examination will acknowledge the role of non-scientific factors in this process. Rather than considering the incorporation of blood transfusion into treatment regimens as being a progressive, incremental process based on the accretion of individual discoveries and inventions, this paper will seek to identify other factors that lead to its universal acceptance after World War II. A brief overview of the history of blood transfusion makes evident the theoretical knowledge that had been developed, but not exploited, over a 300-year period. This overview will provide a background to the identification of some indicative factors operating in World War II which enabled the imposition of new paradigms of scientific knowledge, facilitated technological diffusion and provoked opportunities to extensively experientially test accumulated theoretical knowledge. The factors examined include the experience of medical officers working with mass casualties and in desperate circumstances such as a Prisoner of War (POW) hospital; the ways in which information was promulgated; and the training which medical officers serving in the military received. The impact of exposure both within the military and on the home front to blood transfusion as practitioners, donors and recipients during the war years, and the post-war expectations that this exposure engendered are also considered.

The literature concerning the relationship between war and medicine has been overwhelmingly dominated by practitioner-centered accounts of how medicine has benefited from and been advanced by war. A review of the Australian literature that addresses the confluence of war and medical advances shows, not surprisingly, that writers who are both medical practitioners and military personnel dominate the field.

Various articles addressing the issue have appeared in the Medical Journal of Australia in the period between 1919 to 1951, authored by personnel of the Australian military medical services as wartime or post-war pieces and by Allan Walker, the official Second World War medical historian. The former Surgeon General of the Australian Defence Force, Major-General John Pearn has published a book on the subject recently made it the focus of an address to the US Uniformed Services University of Health Sciences. Additionally, the issue has been addressed either obliquely as part of a wider theme in various publications, such as the official war histories, biographies and histories of specific subjects such as microbiology, malaria, or blood transfusion. Some of the studies would fall under the category of medical antiquarianism rather than that of the history of medicine.

2 Pam Frost formerly worked in the Defence Health Service Branch and is now a project officer for the Defence Safety Management Agency.
Taking blood transfusion as a specific issue, there has been little published which tackles, in an Australian context, the toxic from a theoretical rather than a technical or narrative point of view. In a 1990 article, Mark Cortiula, Fellow at the Unit for the History and Philosophy of Science at the University of Sydney, states that historiography of transfusion medicine and blood banking in Australia is underdeveloped and what is available are “…whiggish and rather hagiographic examinations”.[27] Cortiula has begun the work of redressing this deficit, with several articles in print and with recently published book.[29] Pamela Sampson, at Flinders University, has based her soon-to-be-submitted history doctorate on the issue of blood transfusion.[30] Being informed by the discipline of history rather than that of medicine, these contributions to the topic of blood transfusion promise to extend the parameters and focus of the history of medicine. Continuing this approach, this paper, using a theoretical underpinning, seeks to add another dimension. It will begin the task of exploring the issue of blood transfusion in World War II and its subsequent acceptance into the canon of remedial and therapeutic treatment regimes. The approach will examine the development of blood transfusion services and will focus on the way in which the war environment led to the establishment of new paradigms of medical knowledge, in the sense of Kuhn’s theory.[2] The technicalities of the process will only be dealt with in so far as they pertain to the understanding of the wider issues.

HISTORICAL BACKGROUND
A brief overview of the global history of blood transfusion will provide a background for understanding the progression of the acceptance of blood as a means of remedial and therapeutic treatment within Australia. The vital importance of blood has been realized from the earliest recorded history. The Old Testament, the classical writers of Greek and Rome, and the writings of the ancient Egyptians all contain references to blood, but relate to its mystical qualities rather than its medicinal value.[31] Ancient civilisations such as the Aztecs employed the shedding of blood as part of sacrificial rituals.[32] Bloodletting was depicted in Egyptian tomb paintings as early as 2500 BC; as a form of therapy phlebotomy continued well into the twentieth century[33]. However, the therapeutic value of the transfer of blood from one creature to another was first noted in the writings of Pliny the Elder (A.D. 23-79) in which he describes the drinking of blood of the gladiators in the arena as a remedy for epilepsy[34].

The 1615 writings of Libavius of Halle contain one of the earliest references to the actual transfer of blood from person to person; however there is no evidence that the procedure was any more than an idea.[33] When the first human transfusion occurred has been the subject of debate: it has, on occasion, been attributed to a Jewish physician in 1492, when the blood of three youths was allegedly transfused into the veins of Pope Innocent VIII. However, both Keynes[35] and Tintuss[36] argue that this was a misinterpretation of the facts and that the boys were bled to death to produce a draught for the aging Pope.

It was not until after William Harvey’s theory of the circulation of blood was published in 1628[37] and provided the underpinning concept for the development of the practice of blood transfusion, that further reference to blood transfusion has been noted in the literature. Francesco Folli, a Florentine physician, claimed to have performed human blood transfusion in 1654,[38] but Keynes[35] contends that there is no confirmation of this in the writings of others. In 1659, Richard Lower, at the suggestion of Dr. (Sir) Christopher Wren, transfused the blood of one animal to another.[39] However, a variety of authoritative evidence for the first human blood transfusion attributes the honour to Jean-Baptiste Denis (Denys), a French physician, who in 1667, transfused the blood of a lamb into a human thus performing the first medical transfusion.[39, 40, 41, 42] Concurrent experimentation was being carried out in France, England and in Italy but it was curtailed firstly, by a ruling of the Supreme Court in France under which the Faculty of Medicine of Paris (which was opposed to blood transfusion) had to approve all transfusions[40] and ironically, in 1678, by a Papal edict which forbade any transfusional surgery[43]. The fatal consequences of the incompatibility of animal and human blood and human blood of different types would have also contributed to the disrepute.

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3. Edwin Clarke defines ‘medical antiquarianism’ as ‘… uncritical, repetitive, biographical, institutional and anecdotal writing’[26]
into which this procedure fell. The possibilities engendered by blood transfusion hence fell into neglect for over a hundred years, with only isolated references in the literature.

Not until the nineteenth century did James Blundell, a noted physician, establish through his animal experimentation the incompatibility of the blood of different species. Blundell performed the first human-to-human blood transfusion, injecting the blood of several donors with a syringe in 1818. The next half-century was dedicated to experimentation with a variety of apparatuses and anticoagulants. The independent discovery in 1901 of agglutinins and isoagglutinins in blood by Landsteiner and Shattuck in Vienna and London respectively lead to the identification of the initial four blood groups by Jansky in Prague in 1907 and by Moss in America in 1910. Blood grouping techniques enabled the further development of blood transfusion procedures but the problem of clotting outside the vein still posed considerable difficulties except through direct transfusion, which presented innumerable difficulties of its own. An indirect method, which depended on coating the vessel into which the blood was drawn with paraffin wax, was used with some success during World War I.

Nonetheless, although transfusion using sodium citrate as an anticoagulant had been successfully carried out in 1914, it was not until 1917 that the citrate method was used in military hospitals in France. While military surgeons recognized the effectiveness of transfused blood as a therapy, the system of delivery needed development. Dr. J. Powers, in a paper presented to the Queensland Branch of the British Medical Association in 1920, described the methods of blood transfusion carried out at the 2 Australian General Hospital and specifically mentions the use of citrated blood transfusion. He also hypothesized that, given the benefits derived from transfusion in war surgery, that there must be scope for this procedure in civil life.

While work on blood transfusion did continue, research was desultory. Hanigan, in his treatise on blood transfusion in World War I, identifies that abandonment of wartime research by clinical investigators after the war was a common reaction. He attributes such abandonment to either the unique characteristics of the clinical problem or the “associated misery.”

As a corollary to discoveries about the properties of blood, blood transfusion equipment also underwent development. The coagulating property of blood required apparatus that enabled transfer of blood directly. Quills and silver tubes were used by Lower in his experiments; Blundell's combined pump and funnel called an ‘impeller’ and his ‘gravitator’, which as the name implies, used gravity as the motive force were his solutions for infusing blood. Roussel's apparatus for direct transfusion was in use during the Franco-Prussian War of 1870-71 and Australian Dr. Julian Smith demonstrated a vastly improved rotary pump for the same purpose at a symposium held at the Royal Australian College of Surgeons in April 1942. This apparatus was used for experimental work in malarial transmission in the Malaria Research Unit in Cairns for the rapid transference of unaltered blood from donor to recipient. The Kimpton-Brown tube, developed in 1913, was one of the vessels coated with paraffin wax used for indirect transfusion until the citrate method, was more commonly used. In the battlefields of France in 1917, Canadian Oswald Robertson adapted apparatus developed by American Lewisohn in 1913 to assist in the process of mixing the blood with the citrate. In contrast to the application of new knowledge, advances in equipment were a necessary adjunct to innovation in technique and perhaps most support a technologically deterministic view.

In the period between the Wars, blood transfusion contributed a small part to the repertoire of the medical practitioner. The synergies created by World War II, however, lead to blood transfusion becoming a routine protocol in remedial and therapeutic treatment. In the intervening period, blood transfusion spasmically enlivened the discourse in the Medical Journal of Australia, indicating that while there was an ongoing interest in blood transfusion, it was not widely practiced or understood.

The relatively low demand for blood meant that, prior to World War II, there was no national blood service operating in Australia. The Spanish Civil War of 1936-39 however, provided a rehearsal for what was to come for the rest of the world in the Second World War. The Barcelona Blood Transfusion Service under the direction of Federico Duran-Jorda is credited with proving conclusively the practicability of supplying wounded men in forward medical institutions with stored blood from civilian donors. Responding to the lessons learned in that conflict, a national blood transfusion service was established in 1939, expanding...
the rudimentary Red Cross Blood Banks that had been established in Melbourne in 1929 and in Western Australia in 1935. This followed a meeting between Red Cross and the Defence Department, with the State blood banks remaining autonomous but being overseen nationally. To address the anticipated demand for blood, the Australian Army Medical Service organised blood collecting centres in each of the capital cities, staffed by specially trained army medical officers, orderlies and Red Cross volunteers. During World War II, the Red Cross Blood Transfusion Service, working in close association with the 2nd Australian Blood and Serum Preparation Unit, commanded by Robert J. Walsh, supplied blood and serum to every unit of the Australian Military Forces, the US Army in the Southwest Pacific area and the British Pacific Fleet of the Royal Navy. By October 1945, 96,620 donors had been enrolled and 114,120 litres of serum and 35,722 litres of whole blood had been distributed to both the military and civilian community. The blood services had demonstrated a capacity to respond to not only the war demands but to civilian requirements as well.

Finally, since Landsteiner's original discovery of blood groups at the turn of the century, many more sub-groups had been added to the original four. In 1940, Landsteiner and Wiener extended the understanding of blood typing with the discovery of the Rhesus agglutinogen. In the same year, Moureau in France independently demonstrated the same finding, but his discovery was not passed on to the British or Americans because of the war. The significance of the discovery of the Rhesus blood group is that it overcame one of the last obstacles to safe blood transfusion by identifying the additional component which could render blood incompatible for transfusion.

The numerous technical problems to be overcome in order to render blood transfusion safe are evident in the brief outline above. They included the prevention of blood clotting after removal from the body; the storage of blood; blood grouping, testing and cross matching; and methods and techniques of transfusion therapy including equipment. Nevertheless, given the potential contribution of blood transfusion to the reduction of morbidity and mortality, the prerequisite technical and scientific investigation lacked impetus. Its development as an effective remedial and therapeutic treatment in the post-World War II period took close to 300 years from the first authenticated transfusion, and it was more than one hundred years from the Harvey's publication of his discovery of blood circulation in 1628 to the acceptance of blood transfusion as routine practice.

THE IMPETUS FOR TRANSFUSION

Many histories of medicine are concerned with technological determinism and 'progress'. A technologically determinist view, that is, that changes in society are the product of changes in tools and techniques, has some validity and certainly blood transfusion could not have been carried out successfully and safely without advances in blood grouping, methods of transfusion and storage of blood. However, technologies are not value-neutral and technological change is not inevitable. Social processes are also involved in the uptake of innovations and economic and political factors govern the acceptance and absorption of scientific discovery and usually, the concepts and the practices that contribute to the advance develop interactively. Consequently, there were periods when knowledge was available but there appeared to be reluctance on the part of medical practitioners and researchers to employ the new techniques. In 1918, a Lancet editorial declared that up until four years prior, surgeons were unwilling to perform "the operation" of transfusion. Indeed, by the end of World War I, many of the obstacles to transfusion had been overcome, with the identification of the Rhesus factor the major undiscovered complication. It appears then that what stood in the way of its acceptance was the practitioners will to use it.

Application of Thomas Kuhn's theory provides a possible explanation as to why blood transfusion had not been accepted as a routine medical protocol prior to World War II. According to Kuhn's theory, scientific development, rather than being an incremental process, an accumulation of individual discoveries and inventions, is the result of 'scientific revolutions' which require a paradigm shift in thinking. 'Paradigm' in this context refers to "universally recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners." Much as the acceptance of germ theory required a paradigm shift in practitioners' thinking to become inculcated into normal practice, so too with blood transfusion. In the case of blood transfusion, the expe-
perience of World War II was the catalyst through which it gained general acceptance by the medical fraternity and by which it was introduced into the treatment regimen of everyday medical practice. As Diana Dyason argues in her article relating to William Gilbee and the issue of consent to the principles of germ theory at the turn of the twentieth century at the Melbourne Hospital, there is a need to “examine the non-scientific factors in the development, evaluation and utilisation of scientific theory.” In the case of blood transfusion, the advent of war is the major non-scientific factor that led to blood transfusions incorporation into the medical practitioner’s repertoire as a routine procedure. Along with the necessary impetus to research in particular directions in order to solve specific problems, as Dyason says, “the mere existence of knowledge is no guarantee that it will be applied”.

As has been shown, the knowledge pertaining to blood transfusion was available, but was not yet being widely used. A further catalytic impetus was required. The working environments, both intellectual and applied, engendered by World War II facilitated this necessary evolution in thinking. An examination of a selection of non-scientific factors will illustrate the way in which that occurred. Foremost among these factors was the powerful demonstration offered by the successful treatment of mass casualties with blood and blood products. Even the prisoner of war camps offered examples of the efficacy of blood transfusion under the most primitive of conditions. The ability of the blood transfusion service to respond to the demand for blood was a complementary factor in the equation and the effectiveness and practicability of blood banking services was also established in meeting this requirement. A system of training in blood transfusion techniques and the provision of guidelines and instructions to medical officers serving in the military during the war ensured consistency and standardisation of procedures that enabled widespread diffusion of a corpus of knowledge. Furthermore, as well as establishing the practicalities of blood transfusion, personal experience in World War II of medical practitioners, donors and recipients created expectations of a post-war blood transfusion service that was equivalent to or exceeded that available during the war. While not complete, examples such as these, which will be elaborated further, clearly identify alternative factors to a simplistic explanation that focuses on technological advances as to why such a paradigm shift in thinking and practice occurred.

In 1947, Doctor Lucy Bryce, Honorary Director of the Red Cross Blood Transfusion Service, commenced an article published in the Medical Journal of Australia with the statement: “Since the use of human blood and its derivatives as therapeutic agents... has increased so greatly during the past few years, the maintenance of adequate donor panels must be accepted as an essential feature of modern medical practice.”

Blood transfusion was used to great effect in Japanese POW camps. Captain J. Markowitz wrote in a report written from Nakom Paton POW Hospital in Thailand in 1945: “[T]eams trained and supervised by the author performed 3800 transfusions, and in addition, as MOs got to know about it, it was used successfully up and down Thailand by others. The author feels therefore that the method has distinct value as an emergency measure.”

The statement clearly demonstrates how knowledge pertaining to blood transfusion was diffused during the war, even in the deprived environment of a POW camp. Markowitz goes on to say: “Care was required in our early transfusions to conform with the Hippocratic maxim primo non nocere (sic). The theoretical objections to it in practice do not operate.”

His report makes clear that the medical conditions encountered in the camp, where prisoners “died in droves” prompted the extensive use of blood transfusion to combat malaria, bacillary dysentery, tropical ulcers, pellagra, beri-beri and starvation. The dire conditions in the POW hospital created a circumstance where the benefits to be accrued from blood transfusion far outweighed the risks involved. That blood transfusion was used in such a multitude of ways with
such a high degree of success and a low rate of reaction ("13%, and much of that was contributed to malaria") with the most rudimentary equipment provided strong empirical evidence for its efficacy.55

The military doctrinal system was also the ideal vehicle for the promulgation of standardised technical information to medical officers in the field, which could then be incorporated into civilian practice at the conclusion of the war. For example, the Army Medical Technical Instruction 52 "Solvac Solutions and Wet Serum" issued in 1941 promulgated information on the subject of the abnormalities of appearance of glucose solutions.56 The Royal Australian Navy issued Technical Instruction No. 7 and the Royal Australian Airforce Medical Technical Instruction No. 10 which provided those services with details on blood banking techniques and the preparation, assembly and use of transfusion apparatuses.57 The Services' bureaucratic systems ensured that medical officers were receiving identical information and that procedural techniques were uniform. As a result, there was a cadre of medical practitioners in post-war practice that had been trained and indoctrinated in a standard way. Even before the end of the war, a chapter in a Medical Journal of Australia Supplement published in 1943, entitled 'War Medicine and Surgery', extolled the importance of blood transfusion in these fields. The supplement promulgated information in respect of the supply and use of blood and blood substitutes not only to medical practitioners serving in the military, but to all Medical Journal of Australia subscribers.57

The benchmarks that this standardisation provided facilitated the practices and ideas to become more universally accepted.

As early as 1943, there was recognition that an expanded blood transfusion service was necessary for the civilian population. In 1944, Lucy Bryce wrote a report on post-War organisation of blood transfusion services that laid the foundation for the development of a peacetime Service, with the Red Cross Blood Transfusion Service continuing and adapting its wartime role.58 The use of blood transfusion in treating wounded soldiers demonstrated its life-saving benefits and the lessons learnt from wartime experience could be applied to the treatment of civilian sick and wounded. Prior to the war, blood transfusions, using small amounts of blood and fraught with technical difficulties, were performed in hospitals only on rare occasions. A small number of donors were called on to donate blood on an as-required basis, and were often the friends and relatives of the patient. There was insufficient demand at individual hospitals to warrant collection and storage of quantities of blood and the delay in obtaining blood often meant that the patient died in the interim.

Apart from the experiences of war providing empirical evidence of the value of blood transfusion, civilian medical practitioners recruited from around the country were often introduced to the techniques of blood transfusion through their military service. Before deploying overseas, medical officers gained experience in blood transfusion in civilian hospitals using army equipment and training continued on deployment. The Red Cross produced a 16 millimetre training film that was shown in overseas units. Australian medical officers also visited British transfusion units and received help and advice from them.59

Military service also gave general practitioners the opportunity to work with some of the pioneers of blood transfusion research within Australia such as Dr. Ian Wood and Dr. Cyril Fortune, who had also been recruited. The invaluable experience and learning thus gained could be carried over into post-war civilian practice.

The experience gained in wartime could be applied on the home-front and provided remedial treatment for blood loss not just due to industrial and road accidents, during operations and for treating burns, anaemia and infection but also for blood loss due to childbirth. This meant that blood was required in large quantities and that serum, unavailable prior to the war, was also in demand: medical practitioners, particularly those who had served in the armed forces, had become accustomed to routinely having access to blood and serum.60 In 1949, Cabinet approved Commonwealth financing of a cooperative venture of blood fractionation between the Commonwealth Serum Laboratories and the Australian Red Cross Society61 and in 1954, financial support for the Red Cross Blood Transfusion Service itself.62 In 1953, a MJA editorial commented that procedures of blood transfusion had proved so beneficial during World War II that the resultant increased demand for blood of tenfold 'would have seemed fantastic in 1943'.63 In 2000, an MJA editorial reported that the Australian Red Cross Blood Service recorded over one million donations in 1998-99.64
The change to thinking about blood transfusion brought about by war service extended beyond the medical fraternity. From very early in the War, the Director-General of Medical Services – Army, Major General Rupert Downes, introduced the blanket blood group testing of Defence Force recruits.\(^{11}\) The procedure, which was unique among the Commonwealth Forces, no doubt contributed to the universal ready acceptance by Australian servicemen and women to the idea of blood transfusion and blood donation that carried over into post-war attitudes towards it\(^{11}\). In a study conducted in the United Kingdom in 1967, five percent of donors, when questioned about their motivations in donating blood, stated they first became donors as members of the services during World War II and 6.7 percent of donors said that they began donating blood as a contribution to the war effort\(^ {12}\). While comparable statistics are not available for Australia, given the similarities of the two blood services, it is likely that the British response would be at least indicative of the Australian response and that perhaps higher response rates for these categories could be expected in the Australian context.

The Australian community, as well as responding to war needs as donors also experienced the significance of blood transfusion at a local level. While within Australia, transfusion services were not needed in response to enemy action, the techniques and organisation which had been set up to cope with such an eventuality provided a rapid response capability to anticipated burn injuries in widespread bushfires in Victoria in 1944\(^ {13}\). Contingency planning for war was thus translated into a response to an emergency situation applicable in peacetime and provided an illustration of how the new knowledge and techniques could be of benefit to the community.

**CONCLUSION**

The history of blood transfusion spans more than three centuries. An examination of that history shows that using a technologically deterministic approach to explaining why blood transfusion had not been accepted as a routine medical protocol prior to World War II is insufficient. Application of Thomas Kuhn’s theory, that a paradigm shift in thinking is required, does however provide a possible explanation for the relatively late acceptance of the practice of blood transfusion into medical protocols. Selection of some indicative factors operating in World War II demonstrates the way in which new paradigms of scientific knowledge were imposed, technological diffusion was facilitated and opportunities to extensively experientially test accumulated theoretical knowledge was provided in relation to blood transfusion. The factors examined here include how the experience of medical officers working with mass casualties, both on the battlefield and in POW hospitals, established blood transfusion as a formidable addition to the medical practitioner’s treatment regimen. The bureaucratic standardisation of procedures and training which medical officers serving in the military received also contributed to the acceptance of blood transfusion as a routine procedure by providing benchmarks and uniformity of practice. Exposure within both the military and civilian communities to blood transfusion as practitioners, donors and recipients during the war years lead to post-war expectations that such a service should be available to the entire community and predicated the maintenance and expansion of blood transfusion services. The examination has focused on the way in which the war environment lead, in the sense of Kuhn’s theory, to the establishment of new paradigms of medical knowledge and that in the case of blood transfusion, that the advent of war is the major non-scientific factor which lead to its incorporation into the canon of medical doctrine. The arguments presented here provide a persuasive account of how Kuhn’s dictum “As in manufacture, so in science – retooling is an extravagance to be reserved for the occasion that demands it. Crises are a necessary precondition”\(^ {14}\) can be applied. World War II provided such a crisis in the medical field and changed the way in which medicine utilised the “tool” of blood transfusion.
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What can you say to those who say that you can “cook up” biological warfare agents in the kitchen and kill thousands?

Try positioning this account of the nascent British program from before World War II alongside Ken Alibek’s account of the Soviet program (as told in “Biohazard” from Random House). What comes through such a comparison is the need to commit huge resources to make it work and, in the case of the British program, not necessarily succeed.

Brian Balmer’s account is based on documents, now publicly accessible, from various United Kingdom committees over a thirty-five year period. Anyone with familiarity with bureaucratic processes and “Yes Minister” will find familiar themes here. Repeated delays for approval, policy vacuums and funding shortfalls all loom large in the slow progress over these years. In contrast to the Soviet program of the late 20th Century, the account of British development suggests considerable ambivalence about offensive research and weapons development as well as the gradual drift away from this area of focus. Perhaps it is heartening that the UK program failed to receive such investment and was re-directed into defensive issues because it suggests that the backyard terrorist is unlikely to succeed in causing mass casualties.

From the historical perspective, this account reminds us that networks such as the UK Public Health Laboratory Service (PHLS) were developed to counter the effects of disease agents during war. The same parallel exists in the United States where the Epidemic Intelligence Service (EIS) was established in the Cold War to counter the use of biological warfare, and continues as part of the CDC today. These services have come to the forefront again as the terrorist threat is re-examined internationally and public health brought back into “the loop” again: plus ça change! This account is worth a dip just to remind ourselves that we can still learn from history.

1. Reviewed by Dr Michael Hils
ABSTRACTS FROM THE LITERATURE

Submitted by James Ross


BACKGROUND
The Federal Aviation Administration's Office of Aerospace Medicine is responsible for the certification of pilots with diabetic conditions. The present study evaluated the use of postmortem vitreous humor and urine glucose levels in transportation accident fatalities as indicators of potentially incapacitating medical conditions or performance impairment.

METHODS
Vitreous humor and/or urine from 192 accident fatalities were analysed for glucose using a hexokinase method. Cases with values below the lower limit of detection (10 mg · dl-1) and above three standard deviations (SD) from the mean were not included in the final statistics. All cases more than five SD above the mean were deemed abnormal and a full case history was evaluated based on the available medical history.

RESULTS
The mean vitreous humor glucose concentration was 30 ± 21 mg · dl-1 (N=98), while it was 27 ± 16 mg · dl-1 in urine (N=127). Of the 192 cases, nine were identified as having abnormal glucose levels. Abnormal glucose levels were found in five of the eight cases with a known diabetic condition. Glycosuria or low renal threshold was reported in two fatal pilots; one of these pilots had an abnormal glucose level.

CONCLUSIONS
Hyperglycemia can be established from the vitreous humor and urine glucose levels. All of the abnormal glucose cases detected were previously identified during the medical certification process or had a medical reason for the abnormal level. Elevated vitreous humor and urine glucose levels have proven useful in identifying individuals with a pre-existing diabetic condition that might have been a factor in the accident.

COMMENT
The expectation clearly was that some people would have had previously unrevealed glucose intolerance/diabetes. That none were detected is remarkable in itself. What is not determined is how compliant with restrictions and management were those who were already known to the FAA. That the vitreous glucose levels were raised suggests control was suboptimal. Cause of the accidents had not been made public in most cases.


BACKGROUND
Little has been published about the aeromedical management and disposition of aviators who attempt suicide, and almost no such information about military aviators exists in the open literature. The few available data are scattered and frequently anecdotal.

METHODS
The authors reviewed all case reports of flyers evaluated at the USAF School of Aerospace Medicine's Aeromedical Consultation Service (ACS) between 1981-96 for possible return to flying duties after a suicide attempt, and prepared a representative case report.

RESULTS
Between 1981 and 1996, the ACS evaluated 14 trained aviators (pilots and other aircrew members, excluding flight surgeons) who had attempted suicide. Of these, 11 (79%) ultimately received a recommendation for return to flying duties.

CONCLUSIONS
In most instances the underlying stressors included failed intimate interpersonal relationships, administrative or legal problems, psychiatric disorders, death of spouse, or job conflicts. Evidence of abuse of alcohol or other substances was found in 54% of an earlier,

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larger data set of attempters. Some data on aircrew suicide completion were available and are reported. The top medical priorities after such attempts should be to diagnose what is wrong, and to treat it. In spite of the common assumption that a suicide attempt inevitably ends a military flying career, some attempters can return to safe and effective flying duty after appropriate psychotherapy. If the flier regains physical and mental health and maintains them for at least 6 months after treatment, then that flier may be evaluated by an outside aeromedical psychiatric consultant such as the ACS (to avoid transference issues between flier and therapist) for possible return to flying duties. Waiver action should be based on the underlying psychiatric diagnosis, not the suicidal attempt itself. Follow-up may be accomplished through periodic mental health evaluations in conjunction with routine physical examination procedures. Issues involving substance abuse and security clearances must be handled through the appropriate channels.

COMMENT

Attempted suicide is of grave concern in the aviation environment, having been graphically demonstrated by the Silk Air and Egypt Air crashes of recent years, which were the result on intentional aces by the pilot. Thus, putting a pilot back in the air after an episode of attempted suicide is one of great moment. That so many were returned to flying status after such an event is very significant. The 14 considered by ACS were a select group; many others were permanently grounded locally and were not sent to ACS at all. The assumption was that return to flying status was the successful end point; what is really needed is a long term follow up on their outcome.


PURPOSE

In response to mission imperatives, transport aircrews must often sleep at inappropriate circadian times resulting in inadequate sleep. This study was undertaken to determine whether either melatonin or zopiclone could facilitate early circadian sleep, and to assess whether either of these medications would result in a psychomotor performance decrement, which would preclude their use in aircrew.

METHOD

Thirteen subjects from DCIEM completed a double-blind cross-over protocol. All subjects were assessed for psychomotor performance during three drug conditions (placebo, 10 mg melatonin, and 7.5 mg zopiclone), which were separated by one week. Each of these conditions involved two nights of sleep, back-to-back, with the first night being a normal circadian control sleep (23:00 h bedtime, arising at 06:45 h), and the second night being an early circadian drug sleep (drugs at 16:45 h, 17:00 h bedtime, arising at 23:45 h). All subjects were tested for psychomotor performance, on both nights of each of the three drug conditions, pre- and post-sleep. Further, during the early circadian drug night, all subjects were tested every hour after arising at 23:45 h (24:00 h until 07:00 h). At the beginning of each psychomotor test session, subjects were asked for their subjective levels of sleepiness and fatigue.

RESULTS

Relative to placebo (339.5 min) the subjects slept more on melatonin (370.2 min, p < 0.01), and zopiclone (373.3 min, p < 0.01). Performance in serial reaction time (SRT) task (p < 0.001), logical reasoning task (LRT) (p < 0.001), serial subtraction task (SST) (p < 0.02), and Multitask (MT) (p < 0.03) were impaired for all three drug conditions immediately on awakening, compared with pre-sleep performance, as a result of a sleep-inertia effect. With respect to the subjective data, sleep inertia effects were evident for sleepiness (p < 0.001), mental fatigue (p < 0.002), and physical fatigue (p < 0.05). For SRT, LRT, and SST, performance recovered to pre-sleep levels within 1.25 h of awakening, and for MT recovery occurred 2.25 h after awakening. There were no differences in performance or subjective measures between placebo, melatonin and zopiclone.

CONCLUSIONS

Both zopiclone and melatonin improved sleep relative to placebo. After sleep inertia, performance recovered to pre-sleep levels for all tasks and was sustained at
that level throughout the balance of the testing period. There was no impact of melatonin or zopiclone on performance measures compared with placebo.

**COMMENT**

Well, more sleep, but if the performance following sleep was not improved, what of it? The study needed to go further to look at longer term effect and performance towards the end of the day following sleep to see if performance is sustained in the medicated personnel versus the placebo.


The value of the electroencephalograph (EEG) as a screening device in aviation medicine is questioned, because few subjects are disqualified on grounds of an EEG exam. At the Netherlands Aeromedical Institute, pilot applicants are rejected with a diagnosis of epilepsy or with severe EEG abnormalities (including epileptiform patterns where epilepsy is highly suspected). Although several studies have shown a low incidence of epileptiform EEG abnormalities in candidate pilots, subjects with an epileptiform EEG have a substantially increased risk of sudden incapacitation during their flying careers. In this review, we calculate the probability that a candidate with epileptiform EEG, but no history of epileptic seizures, will develop seizures during his flying career. This probability is about 25%, more than 12 times higher than for subjects with normal EEG and no history of epileptic seizures (2%). Subjects with epileptiform EEGs not only have increased risk of future epileptic seizures, but additionally it is recognised that epileptiform EEG discharges may be associated with episodic functional impairment, which can be a danger when a subject is flying. Taking this into account, one should consider rejecting all candidates with epileptiform EEGs in the future. This is at the expense of a small group of subjects with false-positive EEGs, but we believe that concern for public safety must override other considerations in these rare cases. To improve the understanding of the usefulness of the EEG in pilot screening procedures, an international classification and coding system should be developed, so that data from different countries can be compared.

**COMMENT**

The use of EEGs during pilot screening has not been popular in western countries. The feeling is that EEG changes, in the absence of clinical changes, are very subjective with many false positives.


**OBJECTIVE**

The use of camp stoves in an enclosed or poorly ventilated space is clearly not recommended due to the risk of carbon monoxide (CO) poisoning. Instances may arise, however, when use for a limited time is necessary. We sought to find differences in CO levels between various fuels used to power a commercially available camp stove.

**METHODS**

A comparison was made between unleaded gasoline, kerosene, and white gas (Coleman fuel). The stove, fuels, and CO detector were all purchased from local retailers. A 0.4-m3 space was constructed with a cardboard box. Three trials were performed using each fuel in which water was heated over the stove for five minutes. Measurement of the CO level within the box was taken every 30 seconds.

**RESULTS**

Kerosene created CO levels of 714 (SD = 113.5) parts per million (ppm) at two minutes but was out of the measurable range of >999 ppm within four minutes on each of its trials. White gas burned the cleanest, with an average of 212 ppm (SD = 27.8) at two minutes and 348 ppm (SD = 76.0) at five minutes. Unleaded gasoline created 305 ppm (SD = 27.1) at two minutes and 464 ppm (SD = 31.6) at five minutes.

**CONCLUSION**

All of the fuels created a high level of CO in a short period of time. White gas burned the cleanest and would be preferred to unleaded gasoline or kerosene in the event that the unvented use of a camp stove was necessary.
COMMENT
Take home message: ALWAYS vent when using a camp stove. This will be of significance if in an escape and evade situation, trying to minimise heat generation, but really there should be few times when some venting is not possible.


Although ciguatera fish poisoning is generally a mild, self-limited disease, both life-threatening acute reactions and troublesome chronic symptoms can occur. Because ciguatera has been largely confined to tropical locations, a relative lack of recognition exists among many US physicians. As access to tropical locations has increased, so has the distribution of ciguatera. Herein, we present a case report and review the current literature on ciguatera.

COMMENT
Slightly more common in Australia’s area of interest but still not something a clinician will recognise immediately. A useful review of the condition.


OBJECTIVE
The tactical environment of the nighttime battlefield precludes the use of white light to perform medical procedures. This study sought differences between two alternatives to white light to facilitate intravenous access. A comparison was made between Night Vision goggles (NVGs) and a low level light source (Fingerlite).

METHODS
Fifty eight volunteers were paired. Each member of the pair attempted intravenous access on his or her partner in darkness using both techniques. One attempt per method was allowed. Success was confirmed by the free flow of blood from the catheter.

RESULTS
Of the 58 attempts using NVG, 32 were successful and 26 failed. In the Fingerlite group, there were 46 successful attempts and 12 failures. These differences reached statistical significance (p<0.02).

CONCLUSION
This study suggests that in conditions requiring darkness a Fingerlite offers a clinical advantage over NVG in obtaining intravenous access.


PURPOSE
Determine the short-term effects of creatine supplementation on performance of military tasks, thermoregulation, and health risks.

METHODS
Male military personnel were randomly assigned to a creatine (N=8) or a placebo (N=8) supplementation group. Testing was conducted at baseline, after a six-day load phase (20g/day) and after 4 weeks of taking 6g/day. Measurements included body composition, liver/kidney function tests, core body temperature during a ten-mile march and five-mile run, and performance on physical tasks.

RESULTS
Serum and urine creatine increased significantly in the CR group. Body mass and number of pull-ups performed increased significantly in the CR group but not the CON group by week 4. No significant difference between the CR and CON groups were found for other performance measures.

CONCLUSION
Creatine supplementation increases body mass and pull-up performance but did not cause acute health problems. Creatine did not increase core temperature compared with placebo under the environmental
conditions of the study, and it is unlikely that creatine will enhance the overall readiness or performance of soldiers.

**COMMENT**

Good study, other than the numbers were small. Creatine does not appear to be dangerous, but nor is it of significant benefit, so why bother? The concern about overheating probably arises associated with dehydration, use of ephedrine concomitantly, and other factors.


Midshipmen at the US Naval Academy have recently suffered epidemics of upper respiratory tract infections. Seeking to determine cause, in June 1998 we enrolled 1243 (99.5%) of 1249 new midshipmen (plebes) and followed them during their first 11 months of training. Eighty-five plebes sought medical attention for acute respiratory disease. Using culture, serologic studies, and polymerase chain reaction, considerable evidence for respiratory pathogen infection was found among the ill subjects: Chlamydia pneumoniae in 42 (32.6%), Mycoplasma pneumoniae in 19 (25.3%), influenza in 11 (14.2%) Streptococcus pneumoniae in six (7.3%) and adenovirus in one (1.2%). Additionally, 873 (81%) of the 1077 plebes who completed an end-of-year questionnaire complained of having one or more respiratory symptoms (>12 hours) during their first year of school. Of these, 132 (15%) reported that the symptoms significantly affected their performance. Study results suggest that respiratory infections were frequent, had a significant adverse impact on training and were often attributable to bacterial pathogens.

**COMMENT**

Chlamydia and Mycoplasma are not bacteria. There did not seem to have been an epidemic during the year of the study. The most prominent pathogens seem a little skewed; influenza is very underrepresented; presumably, the common viral pathogens were to be found in the illnesses, which did not get to the medical centre. But not one case of Epstein Barr virus?


Risk taking, decision making and stress factors are strongly associated with military operations. The authors used the Bond and Lader mood and alertness scale and a new scale, Evaluation of risk proneness (EVAR) to assess risk proneness in a maritime counter terrorist exercise. EVAR items are distributed among five factors: self-control, danger seeking, energy, impulsiveness and invincibility. In the study, ten pilots were submitted to strenuous night flights with limited sleep deprivation. Compared with baseline data, pilots reported an increase in impulsiveness, whereas EVAR factors were consistent in a control group comprised of nine navy crew members. Correlations were observed between mood and alertness and risk factors. These results illustrate how EVAR can be used to evaluate change in risk proneness in individuals submitted to various stressors. But further studies are required to weigh stress factors and environmental conditions in risk propensity with a larger population of various age and personality traits.

**COMMENT**

Early days. The idea is to evaluate personnel to see if they are too prone to risk taking and risk proneness before setting out on a mission. The aviation community already embraces risk assessment. The military community needs to extend it to a far wider audience, including medical missions. This tool may prove valuable but much more work is needed.

Submitted by Andy Robertson


COMMENT
The April 25 edition of the New England Journal of Medicine contains a series of articles on smallpox. As Drazen comments in his perspective, there is more information on smallpox in this journal than he hopes you ever need. Bicknell and Fauci argue the pros and cons of mass vaccination versus 'ring vaccination' and the way ahead for smallpox vaccination. These articles provide an excellent starting point for developing an understanding of the smallpox policy issues that are perplexing many countries post September 11.


BACKGROUND
To evaluate the potential to increase the supply of smallpox vaccine (vaccinia virus), we compared the response to vaccination with 10(8.1), 10(7.2), and 10(7.0) plaque-forming units (pfu) of vaccinia virus per milliliter.

METHODS
In this randomized, single-blind, prospective study, 680 adults who had not been previously immunized were inoculated intradermally with undiluted vaccine (mean titer, 10(8.1) pfu per milliliter), a 1:10 dilution, or a 1:10 dilution of vaccinia virus with use of a bifurcated needle, and the site was covered with a semipermeable dressing. Subjects were monitored for vesicle formation (an indicator of the success of vaccination) and adverse events for 56 days after immunization.

RESULTS
Success rates did not differ significantly among the groups and ranged from 97.1 to 99.1 percent after the first vaccination. Both the undiluted and diluted vaccines were reactogenic. In addition to the formation of pustules, common adverse events included the formation of satellite lesions, regional lymphadenopathy, fever, headache, nausea, muscle aches, fatigue, and chills consistent with the presence of an acute viral illness. Generalized and localized rashes, including two cases of erythema multiforme, were also observed.

CONCLUSIONS
When given by a bifurcated needle, vaccinia virus vaccine can be diluted to a titer as low as 10(7.0) pfu per milliliter (approximately 10,000 pfu per dose) and induce local viral replication and vesicle formation in more than 97 percent of persons.

COMMENT
This is useful research, which will extend the current US and world stockpiles of vaccine should there be another smallpox outbreak.
SUCCESSES

The following AMMA members have achieved success through honours, awards, promotions, publications, etc. Members will note that these items are not complete. The Editor needs sources of information from the three Services and from our civilian members as well, so that this section of your journal can truly reflect the cross-section of our membership.

Updates can be fixed to CAPT Andy Robertson on (02) 6266 2314 or emailed to andyandlaura@bigpond.com

DEFENCE FORCE PROMOTIONS

- A/WGCDR Adeline Chong to WGCDR
- MAJ Wendy Taylor to LTCOL
- SQNLDR Karen Leshinskas to WGCDR

DEFENCE FORCE MOVEMENTS

- CMDR Robyn Walker to DPH
- CMDR Alison McLarer to DFMO

RETIREMENTS

- CAPT Jenny Firman will retire on 24 May 02 and will be the new Chief Medical Officer for the Defence Force Recruiting Organisation.

AMMA PRIZE

The AMMA Prize for the Best Student on the Medical Officers' Nuclear, Biological and Chemical Defence Course was awarded to Mr Stephen Scanlon from DSTO.

AWARDS & GRANTS

AMMA have a number of awards and grants available to members. Deadline for all awards is 30 June 2002. For those wishing to do a research project within defence, the project must be approved by ADHREC (The Australian Defence Human Research Ethics Committee). Information kits for new researchers are available from the ADHREC Executive Secretary on Tel: (02) 6266 3818 Fax: (02) 6266 4982

Research Grant - $1000
A grant presented towards new or ongoing research.

Journal Editors Prize - $750
For best paper by an AMMA Member published each year in the AMMA Journal.

Patrons Prize - $250
Best article published in a peer-reviewed journal by an AMMA member – must be a health related article.

Australian Military Medicine Prize - $500
Best essay by an AMMA Member on a chosen topic. The topic for 2002 is: 'The role of Military Medicine in countering terrorism'. For further information contact the AMMA Secretariat or visit the website.

AMMA CONTACTS

For all general AMMA inquiries contact the Secretariat.

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Fax: (03) 6234 5958
Email: amma@leishman-associates.com.au
Website: http://amma.trump.net.au/

AMMA WEBSITE

Visit AMMA's website at: http://amma.trump.net.au/
The website is constantly evolving and any contributions are welcome.

AMMA CONFERENCES

2002 Conference
The 11th AMMA Scientific Conference will be held in collaboration with the Defence Health Service as part of the Defence Health Symposium in Sydney from 26-28 July 2002 at the Wentworth Hotel, Sydney. The program has been posted to all AMMA members. If you require extra brochures or more information please call Leishman & Associates on (03) 6234 7844

JOURNAL

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All queries regarding the Journal should be directed to the editor:

Andy Robertson
Tel: (02) 6266 4483
Fax: (02) 6266-2314
Mobile: 0410 626 829
Email: andyandlaura@bigpond.com
## CONFERENCE AND MEETING CALENDAR

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INSTRUCTIONS FOR AUTHORS

Australian Military Medicine welcomes articles and other contributions on all aspects of military health care. Articles submitted may be subject to peer review. Articles must be offered exclusively to Australian Military Medicine for publication. Articles which have been published elsewhere will only be considered if prior approval has been received from the original publisher and they are of importance to the field of military medicine. All accepted manuscripts will be subject to editing. Contributions should be sent to:

The Editor
Australian Military Medicine
16 Gaylard Place
GORDON ACT 2906
andyandlaura@bigpond.com

MANUSCRIPT REQUIREMENTS

One hard copy and one electronic copy of the manuscript should be submitted. The typed copy should be typed double-spaced and single-sided on A4 paper. The electronic copy should be on disk or sent by e-mail. The text in both hard and electronic copies should be unformatted. The electronic copy may be in any common word-processor format.

Contributions should be between 500 and 5000 words in length. Letters to the Editor should not exceed 500 words or 10 references. The Editor may consider any contributions outside these limits. Any articles reporting on human subjects involved in experiments must contain evidence of approval by the relevant institutional ethics committee.

The title page should include the article title; list of authors, including details of their full name, military rank, postnominals, position and institutional address; and, preferably, an abstract of the article (150-200 words). Contact details for the principal author, including postal address, e-mail address, telephone and fax numbers, should also be included.

Headings and sub-headings should be consistent throughout the article and conform with articles previously published in the Journal. No text, references, or legends to figures or tables, should be underlined.

Illustrations, figures and pictures should not be embedded in the document. Their intended position, however, should be clearly indicated. Illustrations and pictures should be saved as separate documents in TIFF, GIF or JPEG formats. Tables may be embedded in the paper.

Photographs may be black-and-white or colour. They should be provided in soft-copy, preferably as JPEG files, but may be provided as hard-copy. Slides must be converted to soft-copy graphics files or to photographs.

Abbreviations mean different things to different readers. Abbreviations are only to be used after the complete expression and the abbreviation in brackets has appeared. For example, the Australian Defence Force (ADF) may then be referred to as the ADF.

SI units are to be used for all articles. Any normal ranges should also be included.

References should be in accordance with the “Vancouver” system (see MJA 1991; 155: 197-202, or www.mja.com.au/public/information/uniform.html). References in the text should be numbered consecutively as they are cited and should appear as superscript numbers (e.g. text12). References are collated at the end of the article. Annotation of the references should accord with the abbreviations used in Index Medicus. Where there are seven or more authors, list only the first three then use et al. Authors are responsible for reference accuracy. An example of the reference system is as follows:


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