

Teledermatology - A proposed Model for the Australian Defence Force

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Background: Teledermatology is becoming increasingly popular as a way of providing specialist review of dermatology patients in remote areas. The deployment of large numbers of Australian Defence Force (ADF) personnel in recent years to regions without ready access to dermatologists prompts a need for alternatives to face-to-face specialist consultations to optimise the care of deployed ADF forces and reduce costly and potentially dangerous patient transfers.

Objective: This article aims to draw on available research to highlight the utility of teledermatology, its use both internationally and within Australia, and its potential application to the ADF, particularly with regard to deployments overseas. Using the available evidence, recommendations are made on how the ADF can incorporate Tele-Derm National, an existing teledermatology service, into its operations.

Conclusions: Tele-Derm National, hosted by Rural Remote Medical Education Online (RRMEO), is a teledermatology service that can be easily adopted by the ADF to support its medical officers when deployed overseas or on exercise in remote localities. The service is established and well utilised, and ADF involvement offers opportunities for reservist specialists to play an active role in the provision of care for deployed personnel without themselves being deployed.

Teledermatology Background

Teledermatology can be defined as the provision of a specialist review of patients with dermatological conditions remotely via the use of information technology. It can involve real-time video conferencing or store and forward protocols, where images of a patient's complaint are captured and sent electronically (e.g. via email, SMS or posting on a website/forum) to the reviewing dermatologist. Teledermatology has been increasingly promoted in recent years as a means of facilitating efficient and cost-effective patient access

Authors	Study Details	Findings
Levin and Warshaw (2009) ⁶	Review of 47 studies comparing diagnostic accuracy of teledermatology compared to face-to-face consultations	Diagnostic accuracy of teledermatology vs. histopathology 37-95% (mean 77%) Diagnostic accuracy of face-to-face consultations vs. histopathology 30-97% (mean 72%)
Oztas et al (2004) ⁷	Images and clinical information of 125 patients viewed by 3 teledermatologists and compared to face-to-face diagnosis made by fourth dermatologist	Mean accuracy was 57% based on images alone, increasing to 70% when clinical information was included
van der Heijden et al (2011) ⁸	Review of 37207 teledermatology consultations in the Netherlands between 2007-2010, involving 1820 general practitioners and 166 dermatologists	Referrals for face-to-face consultations were reduced by 68% through the use of teledermatology GPs found 85% of teledermatology consultations to have an educational effect

Table 1 – Studies into the Diagnostic Accuracy of Teledermatology

to specialist dermatologist opinion and fostering the education of medical practitioners in rural and remote areas.¹⁻⁵ A number of studies, summarised in Table 1, have determined that accuracy of diagnoses and management decisions made through teledermatology consultations is comparable to face-to-face consultations with a dermatologist.⁶⁻⁸ There appears to be, however, a lack of available evidence on the long-term safety effects of utilising teledermatology over face-to-face consultations.

The rapid growth of teledermatology in recent years is illustrated by its increasing use within US Veteran's Health Administration (VHA), which manages one of the largest teledermatology programs in the United States. VHA teledermatology encounters in the first half of the 2014 fiscal year numbered 31,926, representing 14% of all such encounters over the period 2002-14.⁹

In an Australian context, a teledermatology service, Tele-Derm National, is provided to registered medical practitioners who are members of the Australian College of Rural and Remote Medicine through its Rural and Remote Medical Education Online (RRMEO) learning platform. The service has been active since 2003, utilising a store-and-forward format to provide a specialist dermatologist opinion within 24 hours.¹ Indeed, a review of the service analysing all 406 cases submitted over a 12 month period in 2012-13 found that average reply time was only 5.5 hours, with a recommendation to refer to another medical specialist made in only 7% of cases.¹⁰ This illustrates how Tele-Derm National can prevent unnecessary referrals and associated costly and time-consuming travel by patients to larger centres for face-to-face review, as well as reducing professional isolation and facilitating the education of rural and remote medical practitioners.

Dermatology in a deployed military environment

The nature of military operations means that personnel are often deployed to regions remote from their home environment, being exposed to a physical climate and potential medical hazards and exposures to which they may not be accustomed. From a dermatology perspective, this means military medical personnel will likely encounter unfamiliar conditions and presentations. Additionally, military medical personnel are often required to work in isolation and under austere conditions, with minimal or no ready access to specialist services to help in the management of patients with non-life threatening conditions.

Australian Defence Force

Statistics are available to give insight into the numbers and types of dermatological conditions seen by Australian Defence Force (ADF) medical personnel in deployed environments.¹¹⁻¹² As ADF deployments in recent years have generally been to the Middle East Area of Operations (MEAO) – Iraq, Afghanistan and their supporting locations, much of the data relates to this region. Bramich (2014) conducted an analysis of all reported encounters by ADF personnel with their medical services in the MEAO between 2008 and 2014.¹¹ All diagnoses relating to these encounters were classified by a descriptor based on the ADF EpiTrack Health Surveillance System (a health surveillance tool based on the 10th revision of the International Classification of Diseases [ICD-10-AM]). Table 2 summarises the some of the findings of the analysis from 2013, noting that presentations for dermatological complaints were often higher than other commonly seen conditions.

Condition (EpiTrack Descriptor)	Average Rate of Presentations# for all MEAO force elements in 2013
Eczematous Skin Conditions	0.12
Other Dermatological Conditions (i.e. non-eczematous conditions)	1.91
Upper Respiratory Tract Conditions	1.89
Intestinal Infectious Diseases	0.70
Disorders of the Back	0.48
Other Musculo-Skeletal Diseases	1.36

Table 2 – Summary of ADF Presentations in the MEAO in 2013 from Bramich¹¹

- Number of presentations per week per 100 members

Colgrave (2011) conducted an audit of all presentations by Australian military personnel to the Special Operations Task Group Regimental Aid Post in Tarin Kowt, Afghanistan during the period 28/2-26/6/2010 (17 weeks).¹² The audit identified 1074 presentations, with the task group averaging approximately 300 personnel during the study period. There were 13 presentations for 'Eczematous Skin Conditions' (1.2% of all presentations, average rate of 0.25 per week per 100 members) and 92 presentations for 'Other Dermatological Conditions' (8.5%, rate 1.80).¹²

These 2 sources suggest that ADF medical personnel deployed to the MEAO will, for every 100 members under their care, see approximately 2 patients per week with a dermatological condition. Having skills in assessing, diagnosing and managing dermatological conditions in a deployed environment would therefore be highly beneficial for ADF medical personnel. These skills could be complemented by advice given remotely by a specialist dermatologist.

Coalition Military in the MEAO

Other research into dermatological presentations by coalition military personnel in the MEAO (Table 3) confirms the high prevalence outlined above and offers insight into the type of dermatological conditions ADF medical personnel may encounter when deployed.

Dermatology in the MEAO Populace

As military medical professionals in the MEAO may be called upon to treat the local populace, an understanding of skin diseases common in communities of the Middle East would be beneficial. A 2009 study of 1545 randomly selected households in two regions of Iraq found that the prevalence of skin diseases amongst the 8000 individuals involved was 27%.¹⁵ This figure was similar across genders and between urban and rural households. Dermatitis (33.2%) and skin infections (33.0%) accounted for the majority of the skin diseases identified, with appendageal diseases (15.9%) and urticarial/erythema multiforme (9.8%) being other prevalent conditions. The high prevalence of cutaneous skin infections noted in the study contrasts with developed countries, such as Australia, where dermatitis and skin cancers are more common. This indicates that a greater appreciation of the range and presentation of cutaneous skin infections would be beneficial to deploying ADF medical officers.

Cutaneous infections are common reasons for outpatient presentations to civilian dermatology clinics in the MEAO, representing approximately one-third of cases.¹⁶ Superficial fungal infections account for 9% of all cases, with the main causative organisms being *Trichophyton violaceum* causing tinea capitis, *Epidermophyton floccosum* causing tinea cruris, and *Trichophyton mentogrophytes* causing tinea pedis, with *Microsporum* sp. rarely encountered,

Authors	Study Details	Findings
Korzeniewski (2010) ¹³	Review of 2000 outpatient presentations by Polish military personnel in Iraq and Afghanistan 2003-05	Dermatological conditions accounted for 22.8% of all health problems Subgroups included: Allergic diseases (25.6%) Mycoses (16.9%) Pyodermas – folliculitis, impetigo and abscesses (16.4%) Viral diseases (14.6%)
Henning and Firoz (2010) ¹⁴	Analysis of presentations to US Dermatology Clinic in Baghdad over 6-month period in 2008	There were 2696 presentations to the clinic. Conditions included: Eczematous dermatitis (17%) Benign neoplasms (14%) Skin cancers (8%) Bacterial infections (6%) Actinic keratosis (5%)

Table 3 – Dermatological Presentations by Coalition Military Personnel in the MEAO

unlike in western countries.¹⁶ Another cutaneous infection endemic in the Middle East is cutaneous leishmaniasis, a protozoal infection transmitted by the bites of sandflies.¹⁷ As this condition does not occur in Australia, equipping ADF medical officers with an awareness of leishmaniasis and the skills to detect it in deployed and returning ADF personnel is essential to optimise patient care and preserve ADF manpower and capability.

In terms of skin cancer, basal cell carcinomas (BCC) and squamous cell carcinomas (SCC) have a similar incidence among people living in Lebanon, contrasting with the predominance of BCCs in light-skinned populations and SCCs in dark-skinned populations.¹⁶ A recent survey of US military veterans from operations in Iraq and Afghanistan found that only a small minority (13%) of military personnel used sunscreen on a regular basis when deployed, while a majority (77%) spent more than 4 hours working in 'bright sun' per day.¹⁸ The authors hypothesised that, because of these factors, veterans of deployments to Iraq and Afghanistan are at an increased risk of skin cancer. While such complications may take many years to develop, this consideration highlights the importance of ensuring ADF medical officers have the skills and tools available to monitor their dependency over time for skin neoplasms.

Utilisation of Teledermatology in a Deployed Military Setting

This has been evaluated through a retrospective review of the US Department of Defense's (DoD) teledermatology consultation program, a store-and-forward service developed in 2004 providing specialist opinion on dermatological presentations for deployed military medical personnel.¹⁹ Between 2004-12, there were 4328 consultations through the program, with 98% of consults answered by a dermatologist within 24 hours. Teledermatology consultations prevented 46 evacuations for further evaluation during the study period. As medical evacuations in combat zones require a significant logistical effort and place personnel and assets at risk, minimising unnecessary evacuations through the use of telemedicine has obvious benefits for the military beyond simplifying patient care. Further analysis of the DoD program's data from 2011-12 (658 consultations) found that 84% of teledermatology consults involved US military personnel and that the leading diagnoses included eczematous dermatitis (14% on consults), contact dermatitis (9%), evaluation of non-melanoma skin cancer (5%) and psoriasis (4%).¹⁹ These conditions are commonly seen in general practice and, with appropriate advice from a specialist, can easily be managed in location

on an outpatient basis or reviewed at a later date on a non-urgent basis when logistical and safety considerations permit. The DoD's teledermatology program demonstrates the efficiencies that can be achieved on operations through the use of simple store-and-forward technology.

Medical officers in the ADF

Medical officers (MOs) in the full-time ADF are usually employed as generalists, working in a general practice environment on a day-to-day basis. Many ADF MOs are Fellows of the Royal Australian College of General Practitioners, or are in the College's training program working towards their fellowship. Depending on their service (Army, Royal Australian Air Force or Royal Australian Navy) and unit requirements, ADF MOs will often complete subspecialty medical training in fields such as aviation medicine, underwater medicine, Chemical, Biological, Radiological and Nuclear (CBRN) medicine and occupational health and safety.²⁰⁻²² There are no specific courses in dermatology offered in ADF, with MOs expected to gain knowledge and experience in the field through their training in general practice and, if an individual MO so desires, by utilising their annual professional development grant (currently \$10,000 pa) to undertake civilian courses and training.

Non-GP specialist medical officers are generally only employed as reservists in each of the three ADF services, with a wide range of specialties, including dermatology, represented. The advent of the tri-service Military Surgical Team has led to the training and employment of full-time medical officers from certain specialties (namely general surgery, orthopaedics, intensive care, emergency medicine and anaesthetics), however for non-acute care specialties, such as dermatology, the ADF will continue to rely of the contribution of reservists for its specialist capability.

The lack of specific training in dermatology for deployed full-time ADF medical officers, combined with the improbability of a reservist dermatologist being deployed to all theatres on a regular or ongoing basis, make it necessary for the ADF to devise and institute a mechanism for ADF medical officers to seek advice on dermatological issues, particularly when deployed on operations.

Proposed use of teledermatology in the ADF

To optimise patient care and facilitate the utilisation of teledermatology by ADF medical officers, particularly those deployed overseas or on exercises in remote areas, the following recommendations are offered:

- Introduce a dermatology component to initial employment training for all ADF medical officers (e.g. Medical Officer Introductory Course for Army). This may include a dermatology specific presentation/workshop run by a reservist dermatologist focussing on common dermatological issues in the military while also outlining conditions commonly seen in MEAO and other areas of current/potential operations (e.g. East Timor, South Pacific region). Training in common dermatological procedures such as cryotherapy and biopsies would also be beneficial, given the often limited dermatology experience of incoming junior medical officers.
- Region and operation specific dermatology education for medical personnel should be provided as part of pre-deployment training. This will reinforce deploying personnel's awareness of commonly encountered dermatological conditions and suggested management protocols.
- Through consultation with the Australian College of Rural and Remote Medicine (ACRRM), the ADF (through Joint Health Command (JHC)) could negotiate for all ADF medical officers to be granted access to RRMEO ('Group Practice' or 'Corporate' membership of ACRRM is an option²³), thereby facilitating their utilisation of its Tele-Derm National teledermatology service. The use of this service by ADF medical officers, particularly when providing care in remote and austere environments (e.g. deployments, exercises, at sea), should be encouraged by their chain-of-command, JHC and Headquarters Joint Operations Command (HQJOC), the tri-service coordinating body for ADF operations worldwide. As Tele-Derm National only requires the posting of simple image files through an internet browser, it is not expected that utilising the service in the field should prove technically problematic.
- JHC and/or HQJOC could create a role of 'teledermatology liaison officer', who would be tasked with disseminating information on Tele-Derm National to ADF medical officers, liaising with the specialists providing advice via the service, and monitoring/approving ADF posts to ensure they comply with operations security (OPSEC).
- The addition of ADF medical officers as contributors to Tele-Derm National would undoubtedly add to the caseload of the two dermatologists and one plastic surgeon who currently provide its specialist advice, particularly during times of high operational tempo. One way of ensuring this caseload remains manageable, as well as encouraging the ADF to 'give back' to the service,

would be to offer reservist dermatologists and plastic surgeons the opportunity to be involved in the provision of teledermatology advice through the RRMEO platform. For example, cases submitted to Tele-Derm National by ADF medical officers might first be forwarded to participating reservist dermatologists or plastic surgeons for their opinion, with these specialists then able to claim the time they spend offering teledermatology advice as 'active service', therefore counting towards their minimum annual service requirement.

- The ADF could explore establishing formal relationships with public and private dermatology practices or clinics, such as the Queensland Institute of Dermatology or the Mater Hospital in Brisbane, allowing for regular placements by ADF medical officers as observers or clinical visitors. This will foster the development skills, such as skin examination, dermoscopy and biopsy techniques often lacking in doctors that have not undergone post-graduate training in dermatology. The Mater Hospital in South Brisbane, for example, offers 4 outpatient sessions in dermatology per week, along with multidisciplinary sessions involving plastic surgery and medical/radiation oncology. The hospital's central location in Brisbane, a large centre for ADF operations, and its enthusiasm in promoting educational opportunities, including clinical fellowships, make it ideal as a potential ADF dermatology 'centre of excellence'.

Medico-legal Implications

The proposed use of a teledermatology service, such as Tele-Derm National, in the ADF raises potential medico-legal concerns, particularly involving patient privacy and practitioner liability. Capturing and forwarding images of patients along with their clinical details creates the potential for privacy to be compromised. Additionally, ADF Medical Officers may be uncomfortable relying on a teledermatology opinion where the option exists for them to evacuate a patient (albeit via expensive and potentially dangerous means) for face-to-face specialist review. Likewise, dermatologists providing teledermatology advice may be concerned about their liability in 'treating' patients on the basis of a clinical history and photographs.

Tele-Derm National recognises the potential for teledermatology to cause medico-legal concerns. Users of the service must register with ACRRM and sign-in when accessing Tele-Derm National. Users read and agree to an 'Acknowledgement and Disclaimer' page prior to being able to open any of the patient cases in

the teledermatology forum. By agreeing to the terms on the acknowledgement page, users confirm they are registered medical practitioners in Australia and hold appropriate medical indemnity insurance. They also acknowledge that the service is not a substitute for a doctor's clinical judgement, that there is less of a margin for error in face-to-face consultations compared to teledermatology, and that patients have given informed consent (including signing the Tele-Derm consent form) for their images and case details to be posted on Tele-Derm National. All such images and details need to be de-identified prior to posting.

Major medical indemnity providers in Australia have provided written guidance to their members on the use of telemedicine. The Medical Insurance Group of Australia (MIGA) has stated that it has 'no objection' to the use of telemedicine in situations where the medical service would otherwise be inaccessible, provided professional standards of duty of care and documentation are maintained.²⁴ MDA National's policy telemedicine is that duty of care and clinical responsibility should be clearly defined between the clinicians involved (the Tele-Derm National 'Acknowledgement and Disclaimer' is an example of this clarification) and that patients should give informed consent, prior to telemedicine being utilised.²⁵ The policy confirms that professional indemnity insurance covers issues arising from the provision of telemedicine services, but does highlight that general practitioners performing specialist procedures under the direction of a specialist may be held to the same standard of care as the supervising specialist, meaning GPs should only perform procedures recommended through teledermatology

they are confident they can perform to a comparable standard of a specialist.²⁵ The Medical Indemnity Protection Society (MIPS) requires that medical practitioners participating in telehealth services hold appropriate qualifications and experience, and that they practice in accordance with RACGP and Medical Board of Australia guidelines on telemedicine.²⁶

Conclusion

The increasing popularity, accessibility and utility of teledermatology, particularly using store-and-forward protocols, offers opportunities for the ADF to optimise the provision of medical care to its deployed forces and reduce the need for costly and potentially dangerous patient transfers. To fully exploit this technology, it is recommended the ADF establish formal ties with existing service providers to offer teledermatology access for its deploying medical officers, and encourage the involvement of its reservist dermatologists and plastic surgeons in the provision of teledermatology specialist opinion. The RRMEO Tele-Derm National program, complemented by the provision of dermatology training and placements in dermatology clinics for ADF medical officers, provides an ideal medium for the ADF to easily incorporate teledermatology into its operations.

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References

1. Muir J. Telehealth: the specialist perspective. *Australian Family Physician*. 2014 Dec;43(12):828-30.
2. Lim A, Egerton I, See A et al. Accuracy and reliability of store-and-forward teledermatology: Preliminary results from the St George Teledermatology Project. *Australasian Journal of Dermatology*. 2001;42(4):247-251.
3. Muir J, Lucas L. Tele-dermatology in Australia. *Studies in Health Technology and Informatics*. 2008;131:245-53.
4. Landow S, Mateus A, Korgavkar K et al. Teledermatology: key factors associated with reducing face-to-face dermatology visits. *Journal of the American Academy of Dermatology*. 2014;71(3):570-576.
5. Boyers L, Schultz A, Baceviciene R et al. Teledermatology as an educational tool for teaching dermatology to residents and medical students. *Telemedicine and e-Health*. 2015;21(4):312-314.
6. Levin YS, Warshaw EM. Teledermatology: A review of reliability and accuracy of diagnosis and management. *Dermatologic Clinics*. 2009;27(2):163-176.
7. Oztas MO, Calikoglu E, Baz K et al. Reliability of web-based teledermatology consultations. *Journal of Telemedicine and Telecare*. 2004;10(1):25-28.
8. van der Heijden J, de Keizer N, Bos et al. Teledermatology applied following patient selection by general practitioners in daily practice improves efficiency and quality of care at lower cost. *British Journal of Dermatology*. 2011;165(5):1058-1065.

9. Landow S, Oh D, Weinstock M. Teledermatology within the Veterans Health Administration, 2002-2014. *Telemedicine and e-Health*. 2015;21(10):769-773.
10. Byrom L, Lucas L, Sheedy V et al. Tele-Derm National: A decade of teledermatology in rural and remote Australia. *Australian Journal of Rural Health*. 2016;24(3):193-199.
11. Bramich L. EpiTrack - operational comparisons. Joint Operations Command Australia; 2014.
12. Colgrave N. Special operations task group regimental aid post presentations, Tarin Kowt, Afghanistan: February - June 2010. *Journal of Military and Veterans' Health*. 2011;19(3):13-19.
13. Korzeniewski K. Prevalence of skin diseases among soldiers of military operations in Iraq and Afghanistan. *International Review of the Armed Forces Medical Services*. 2010;82(1):61-66.
14. Henning JS, Firoz BF. Combat dermatology: the prevalence of skin disease in a deployed dermatology clinic in Iraq. *Journal of Drugs in Dermatology*. 2010;9(3):210-214.
15. Al Samarai A. Prevalence of skin diseases in Iraq: a community based study. *International Journal of Dermatology*. 2009;48(7):734-739.
16. Kurban RS, Kurban AK. Lebanon. In: Parish L, Millikan L, ed. by. *Global dermatology: diagnosis and management according to geography, climate and culture*. New York: Springer-Verlag; 1994. p. 297-300.
17. Eiras D, Kirkman L, Murray H. Cutaneous leishmaniasis: current treatment practices in the USA for returning travelers. *Current Treatment Options in Infectious Diseases*. 2015;7(1):52-62.
18. Powers J, Patel N, Powers E et al. Skin cancer risk factors and preventative behaviors among United States military veterans deployed to Iraq and Afghanistan. *Journal of Investigative Dermatology*. 2015;135(11):2871-2873.
19. Hwang J, Lappan C, Sperling L et al. Utilization of telemedicine in the U.S. military in a deployed setting. *Military Medicine*. 2014;179(11):1347-1353.
20. Defence Jobs Australia. Navy medical officer - employment training [Internet]. 2016 [cited 17 February 2016]. Available from: <http://www.defencejobs.gov.au/navy/jobs/MedicalOfficer/EmploymentTraining/?entryTypeId=5>
21. Defence Jobs Australia. Army medical officer - employment training [Internet]. 2016 [cited 17 February 2016]. Available from: <http://www.defencejobs.gov.au/army/jobs/MedicalOfficer/EmploymentTraining/>
22. Defence Jobs Australia. Air Force medical officer - employment training [Internet]. 2016 [cited 17 February 2016]. Available from: <http://www.defencejobs.gov.au/airforce/jobs/MedicalOfficer/EmploymentTraining/>
23. Australian College of Rural & Remote Medicine. Membership types [Internet]. rrmeo.com. 2015 [cited 2 May 2016]. Available from: <http://rrmeo.com/college-membership/membership-types>
24. Menillo A. Medico-legal Issues: Telemedicine. *Medical Insurance Group Australia Bulletin* [Internet]. April 2006 [cited 2 May 2016]:2. Available from: <http://www.miga.com.au/library/April%20Bulletin.pdf>
25. MDA National. Risk Management for Telemedicine Providers. *Defence Update*. Autumn 2006:8-12.
26. Medical Indemnity Protection Society. Telehealth - telephone or video conferencing. *MIPS Review*. Autumn 2012:6.