

## ORIGINAL RESEARCH

# More is more in remote Central Australia: more provision of primary healthcare services is associated with more acute medical evacuations and more remote telephone consultations

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## ABSTRACT

**Introduction:** This study investigated whether increased numbers of primary healthcare clinical consultations in Indigenous communities in some remote areas of Australia are associated with the reduced need for urgent medical evacuations and remote telephone consultations.

**Methods:** A retrospective comparison study of routinely collected data utilising correlation analysis was conducted. Statistical associations have been measured using Pearson product-moment correlation coefficients. The setting was 20 primary healthcare centres in the Northern Territory servicing  $\geq 5900$  residents between July 2008 and June 2010; data were collected from Central Australia Remote Health and the Royal Flying Doctor Service – Central Operations, Alice Springs base. Main outcome measures included number of acute medical evacuations and number of remote telephone consultations relative to number of face-to-face consultations with Aboriginal health workers, remote area nurses and general practitioners.

**Results:** Statistically significant positive correlations were found between numbers of acute medical evacuations and numbers of face-to-face consultations ( $r=0.659$ ; 95% confidence interval (CI): 0.305–0.855), remote area nurse consultations ( $r=0.481$ ; 95% CI: 0.055–0.765) and general practitioner consultations ( $r=0.798$ ; 95% CI: 0.555–0.920). Significant positive



correlations were also found between numbers of remote telephone consultations and numbers of face-to-face consultations ( $r=0.546$ ; 95% CI: 0.135–0.795) and general practitioner consultations ( $r=0.563$ ; 95% CI: 0.163–0.805).

**Conclusions:** The provision of more frequent healthcare centre face-to-face consultations, including general practitioner consultations, is associated with an increased burden of acute medical evacuations and remote telephone consultation services in this remote setting.

**Key words:** aeromedical evacuations, Australia, medical evacuations, primary healthcare services, Royal Flying Doctor Service.

## Introduction

There are unique challenges to providing primary healthcare services to remote communities in any country. The systematic provision of acute medical evacuations, specifically the timely transport of patients to a higher level of health care when urgent, is one of those challenges. As a primary healthcare outcome, acute medical evacuations are relatively under-cited in the medical literature, except in cases of armed conflict or international travel. For small Indigenous communities in Australia, these evacuations represent a significant and often overburdening aspect of the healthcare service delivery model<sup>1</sup>.

Central Australia, which spans approximately 10% of the land mass of Australia, has only two regional population centres: Alice Springs (population approximately 30 000) and Tennant Creek (population approximately 3500). Both centres have hospitals that provide higher levels of healthcare services. The remainder of Central Australians live in small, highly remote communities (>100 km from regional centres) with populations generally less than 1000. Most of these communities comprise more than 90% Indigenous residents<sup>2,3</sup>. Healthcare centres in these communities are primarily staffed with remote area nurses (RANs) and/or Aboriginal health workers (AHWs). A roster of fly-in, fly-out (FIFO) providers (eg general practitioners (GPs), specialists, allied healthcare providers) deliver clinical services to many of these healthcare centres on a periodic basis. Of note, approximately six of these communities have resident GPs at any one given time. On-site clinical services are

supplemented by remote telephone consultations with offsite-based medical staff: 'programme support' GPs for non-urgent clinical issues, on-call rural medical practitioners (RMPs) for urgent/emergent clinical issues and Alice Springs Hospital consultants and registrars for additional clinical support as needed<sup>4</sup>.

The Australian Government has funded an extension of most aspects of the *Northern Territory National Emergency Response Act 2007* (the Northern Territory Intervention) through the *Stronger Futures in the Northern Territory Act 2012*<sup>5</sup>, reflecting more strides toward Closing the Gap of Indigenous health outcomes<sup>6-8</sup>. One result has been a trend toward increasing the healthcare staffing to the area of focus in this study. Recruiting and sustainably maintaining this healthcare staff with any degree of continuity is becoming more expensive and difficult to accomplish. Recently, the visiting and resident GPs of these Central Australian communities have been increasingly sourced from expensive short-term locum agencies<sup>9</sup>. Anecdotal evidence suggests a similar situation is evolving for RAN staffing. Examining rates of acute medical evacuation is one form of evaluating this unique model of healthcare staffing and is the primary focus of this study. A secondary focus includes examining the utilisation rates of remote telephone consultations by healthcare staff.

Resources recruited to provide the acute medical evacuations from these remote communities include primarily Royal Flying Doctor Service (RFDS), healthcare centre-based vehicles and St John's Ambulance Services<sup>4</sup>. Commercial, private and 'mail plane' air services as well as public transport



bus services are utilised occasionally but issues of cost, public and patient safety and availability are often limiting factors.

There is some evidence that increasing or improving primary healthcare services can reduce avoidable hospitalisations. This is particularly argued in regards to 'ambulatory care sensitive conditions' or 'population preventable conditions' such as diseases avoidable through immunisation or conditions arising as a result of preventable injuries<sup>10-12</sup>. In this study, it has been hypothesised that more GP face-to-face consultations at remote healthcare centres represent one subset of providing increased and higher level primary healthcare services that might be associated with a reduced need for acute medical evacuations. This assumes acute medical evacuation rates to be similar to hospitalisation rates in this remote setting.

Mindful of the above complexities, the primary aim of this study was to examine the hypothesis that levels of healthcare centre staffing leading to increased numbers of clinical consultations, especially in the number of GP consultations, are negatively correlated with acute medical evacuations to hospital in a remote setting.

## Methods

### *Design and setting*

A retrospective comparison study of service data for the time period 1 July 2008 to 30 June 2010 was conducted utilising two de-identified databases: the Central Australian Remote Health (CARH) and the RFDS – South Australia branch/Alice Springs base.

Twenty healthcare centres were identified for study from more than 50 existing remote Central Australian communities with the following selection criteria: (i) greater than 100 km away from nearest regional centre; (ii) tertiary healthcare services provided primarily by Alice Springs hospital and not another interstate or outer regional hospital (eg Mount Isa Base Hospital or Katherine General Hospital);

(iii) primary healthcare services provided at least in part by the CARH/Northern Territory Government; (iv) aeromedical evacuation services provided primarily by RFDS from the Alice Springs base; (v) presence of an airstrip solely servicing the one community; (vi) majority of patients accessing the associated healthcare centres were permanent residents of the communities, not tourists or seasonal workers.

### *Data collection*

Monthly evacuation and consultation data, drawn from the CARH electronic database, were collated for each of the selected healthcare centres. It was compiled in the following categories: number of remote on-call telephone consultations with GPs; number of medical evacuations by road; number of medical evacuations by air.

Monthly healthcare centre staffing data were sourced from a different section of the CARH electronic database and were categorised into number of face-to-face clinic visits; number of face-to-face visits with an AHW, number of face-to-face visits with a RAN; number of face-to-face visits with a GP; number of face-to-face visits with a specialist/allied healthcare provider. Some inconsistencies were identified such as missing data (<3%) for some months and some totals not accurately reflecting the sum of their parts, in which case the provided values were used and added.

Aeromedical evacuation rates by month and by priority of need (code 1–3; see below for definitions) from all remote Central Australian communities were extracted and prepared from the RFDS electronic database by an RFDS statistician. Numbers of code 1 evacuations (life-threatening emergency), code 2 evacuations (urgent medical transfer) and code 3 evacuations (non-urgent/ routine transfer) were then collated for each of the study communities/healthcare centres.

De-identified medical diagnoses of all the aeromedical evacuations from Central Australia, inclusive of the evacuations from the study communities during the specified



2-year period, were similarly provided by the RFDS. These diagnoses were coded using the *International Classification of Diseases*, 9th revision (ICD-9).

Geographic and demographic characteristics of the chosen communities were sourced from the Australian Bureau of Statistics (2006 and 2011), the CARH community profiles database (2011) and other public access online data (eg the Northern Territory Remote Teaching Service website)<sup>13</sup>.

## Statistical analysis

The Statistical Package for the Social Sciences v19.0 (SPSS; <http://www.spss.com>) and Microsoft Office Excel 2007 software packages were used for the statistical analyses. CARH and RFDS clinical and evacuation data were first collected on a monthly basis, then added and averaged per month to help control for a total of 14 missing months of clinic staffing data in 5 of the 20 clinics. The relationships between medical evacuation rates/remote telephone consultations and healthcare consultations at the study healthcare centres were investigated using Pearson product-moment correlation coefficients<sup>14</sup>. The data were adjusted for population size (based on Australian Bureau of Statistics 2006 census data) before correlations were calculated.

## Ethics approval

This study was conducted with the approvals of the Monash University Human Research Ethics Committee – CF10/1164-2010000619 and the Central Australian Human Research Ethics Committee – 2010.09.04.

## Results

In the 2-year study period, the specified 20 healthcare centres provided 206 487 face-to-face patient-provider consultations: 76.0% from RANs, 12.2% from GPs, 10.2% from AHWs, and the remainder (<2.0%) from specialists and allied healthcare providers. In the same time period,

there were 2081 acute medical evacuations, 25.2% of which were road evacuations and 74.8% of which were aeromedical evacuations (Table 1). Aeromedical evacuations from these 20 healthcare centres constituted 52.0% of the total number of aeromedical evacuations in the Central Australia region during this same time period. As expected, the healthcare centres closest by road to the nearest hospital had the greater percentages of evacuations by road compared with by air.

Statistically significant ( $p \leq 0.01$ ) positive correlations were found between the numbers of total acute medical evacuations and the numbers of total clinic consultations ( $r=0.659$ ; 95% confidence interval (CI): 0.305–0.855) and numbers of GP consultations ( $r=0.798$ ; 95% CI: 0.555–0.920) (Table 2). A significant positive correlation ( $p \leq 0.05$ ) was also found between the numbers of RAN consultations and acute medical evacuations ( $r=0.481$ ; 95% CI: 0.055–0.765). No significant correlation was found between AHW consultations and acute medical evacuations. This study's correlation analysis reveals that more face-to-face healthcare centre consultations, in particular with GPs, are associated with more frequent acute medical evacuations to hospital.

A statistically significant ( $p \leq 0.01$ ) positive correlation was found between the numbers of GP consultations and the numbers of remote on-call telephone consultations with GPs ( $r=0.563$ ; 95% CI: 0.163–0.805) (Table 2). A significant positive correlation ( $p \leq 0.05$ ) was also found between total clinic consultations and remote on-call telephone consultations with GPs ( $r=0.546$ ; 95% CI: 0.135–0.795). No significant correlations were found between RAN or AHW consultations and remote on-call telephone consultations with GPs.

Of the diagnostic categories pertaining to all the RFDS evacuations from Central Australia in the two years, the highest represented were respiratory disease (20.5%) and injury/poisoning (19.2%) (Fig1).



**Table 1: Community demographics and healthcare services usage data, July 2008 – June 2010**

Community	Population	Healthcare centre consultations	General practitioner consultations	Remote telephone consultations	Medical evacuations
A	130	7248	693	185	44
B	250	6605	697	364	46
C	200	2845	470	64	10
D	355	9090	1366	639	158
E	207	4795	544	224	42
F	250	8829	822	234	66
G	220	4599	221	202	65
H	247	8546	1244	361	106
I	280	7408	781	320	82
J	379	19959	1398	441	160
K	219	10643	1109	344	77
L	400	17787	2308	663	218
M	215	6962	585	259	64
N	349	17431	2923	535	251
O	218	6057	573	210	53
P	244	4843	473	186	36
Q	559	22471	3608	471	179
R	251	9237	606	154	43
S	272	6868	500	221	66
T	686	24264	4319	797	315
Total	5931	206,487	25,240	6,874	2081

**Table 2: Acute medical evacuations and remote telephone consultations – correlation analysis results**

	Acute medical evacuations		Remote telephone consultations	
	Correlation coefficient, <i>r</i>	95% CI	Correlation coefficient, <i>r</i>	95% CI
<b>Total consultations</b>	+0.659**	0.305–0.855	+0.546*	0.135–0.795
<b>AHW consultations</b>	†	†	†	†
<b>RAN consultations</b>	+0.481*	0.055–0.765	+0.397	–0.060–0.715
<b>GP consultations</b>	+0.798**	0.555–0.920	+0.563**	0.163–0.805

\* $p \leq 0.05$ . \*\* $p \leq 0.01$

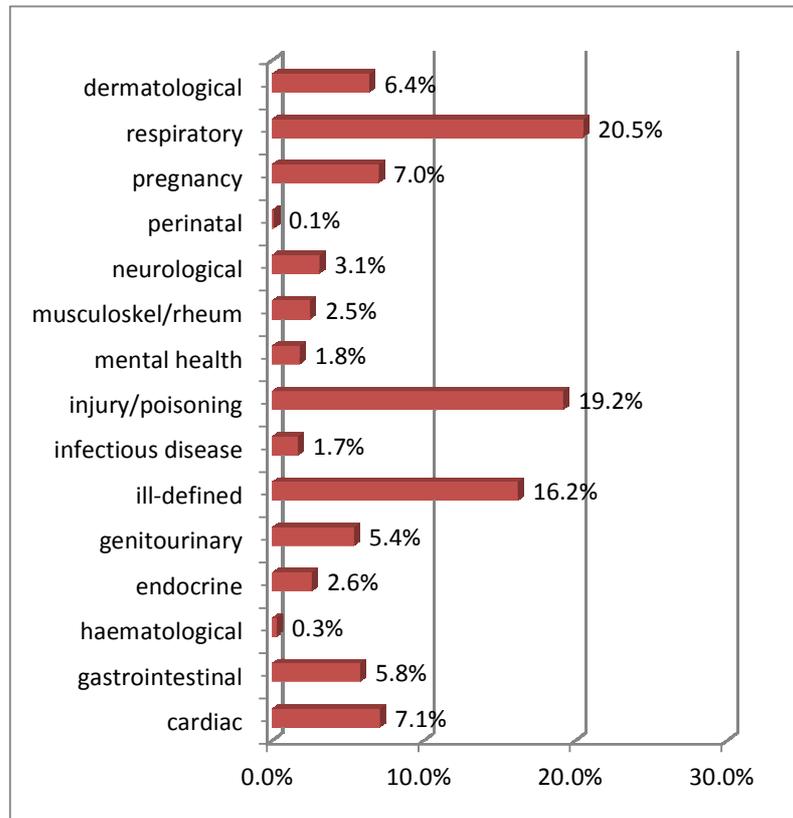
†Correlation was non-linear on scatterplots.

AHW, Aboriginal health worker. GP, general practitioner. RAN, remote area nurse. CI, confidence interval

## Discussion

In this study, it was hypothesised that more face-to-face patient-provider consultations, especially those provided by GPs, in a remote health centre would be associated with reduced need for acute medical evacuations. Results of this study's correlation analysis unexpectedly suggest that the opposite may be true. More face-to-face healthcare centre

consultations with GPs were associated with more, not less, frequent acute medical evacuations to hospital. Furthermore, more cumulative face-to-face healthcare centre consultations, inclusive of all the provider types, were associated with more frequent acute medical evacuations. This is an important finding with obvious economic implications as the drive to increase and improve healthcare services to many diverse parts of rural and remote Australia is still under way.



**Figure 1: Diagnostic categories for Royal Flying Doctor Service medical evacuations to hospital, Central Australia, July 2008 – June 2010.**

Several factors might help to explain these results:

- Given the documented increase in the burden of chronic disease in this primarily Indigenous population within the past decade<sup>15</sup>, perhaps patients are becoming more unwell and requiring more frequent hospitalisation.
- Poor health literacy and the resultant domination of acute medical presentations could be outcompeting the opportunities for chronic, preventative health interventions. The time and resources required of the healthcare centres to stabilise patients and then await the arrival of the RFDS aircraft to arrive or, at times, drive the patients the several hours to the hospital themselves, often requires closure of the centres to other less urgent presentations for hours on end<sup>1</sup>. This in turn results in less time available for primary and secondary prevention programs.
- These findings may be a function of the Northern Territory Intervention and concern regarding the increased scrutiny over healthcare practices, which may lead to over-caution and thereby more medical evacuations.
- The increased general practice consultations might be reflective of busier doctors, who are then less able to help manage time-consuming events in the clinic, and therefore call for support even if these cases are not life-threatening events.



Several limitations were encountered in this study. The population data for each community at times varied widely between the two Census findings and other internet-based sources. This may be partially explained by the time of sourcing. 2006 Census findings were utilised in the analysis of this study but considerable changes in the populations of the communities occurred between 2006 and the more recently released 2011 Census findings. The overall populations of these chosen study communities decreased by 8.85%, as well as the averaged percentage of Indigenous peoples, from 93.5% to 90.0%<sup>2,3</sup>. This would suggest the increased numbers of medical evacuations are not related to an increasing population over the 2 years. This variability can also be somewhat explained by the high day-to-day mobility of the Indigenous populations of this area. Many family units live regularly between two or more communities. Also, major fluctuations in population occur with unpredictable 'sorry business' and other traditional practices. As a result, many Indigenous patients access more than one of the healthcare centres regularly. All of these factors proved difficult to account for in the final analysis of results.

These data are secondary data, and as such were routinely collected for clinical purposes, not research purposes. There were inconsistencies in both datasets. For example, sporadic clinic visits from providers as part of the Northern Territory Intervention were included in the numbers collated of healthcare centre consultations but specified as 'specialist' consultations, not strictly according to provider type. In reality, then, more GP consultations took place at those affected communities than the present study's data could capture and this could have an impact on the results. Nevertheless, the authors believe that this impact would be quite small given that the percentage of 'specialist' consultations taking place at any one given study healthcare centre was relatively small overall.

In the RFDS dataset, an unexpectedly large proportion (16.2%) of the aeromedical evacuations were classified diagnostically as 'ill-defined', meaning the cause for evacuation was known very imprecisely (eg because the recorded cause was only a symptom or an abnormal laboratory test result). Yet this represented the third most common diagnosis of patients medically evacuated in Central

Australia in the 2-year study period. This potentially compromises the quality of diagnostic comparison that can be made with other studies. Despite this limitation, the prominence of respiratory and injury/poisoning-related conditions in the diagnostic breakdown of this study concurs with other published medical evacuation data and the available national data on hospital separations for Indigenous people<sup>1,16,17</sup>. The majority of the diagnostic categories associated with aeromedical evacuations occurring in this study population fall within the 'ambulatory care sensitive conditions' or 'population preventable conditions' classifications, which has relevance to the original hypothesis proposed. However, determining which evacuations were truly unavoidable could not be assessed from these data but would be of interest in any follow-up study.

The number of communities that could be included in the study was limited by the need to control for important confounders (as described in the methods section). Accessing data from the other five non-government and community-controlled organisations operating healthcare centres in Central Australia was ultimately not feasible within this project's limited resources but would be an ideal direction for any future study.

Distinguishing between increased numbers and increased efficacy of remote healthcare staffing or services would also be useful in any future study of acute medical evacuations. This would help reinforce which elements of remote primary healthcare models are essential to improve healthcare outcomes<sup>18</sup>. In addition, exploring the gap between the number of acute medical evacuations and the number of true hospital stays resulting from the transport would provide further healthcare outcomes evaluation that would help guide how best to improve the diagnostic capabilities and frameworks of remote health centres.

## Conclusions

This article has presented the unexpected and interesting finding that more patient-provider consultations (for this



study provided in 20 remote primary healthcare centres in Central Australia) is associated with more acute medical evacuations and more remote telephone consultations with an on-call GP. Further studies are warranted to establish whether this association of 'more is more', when it comes to providing healthcare services and medical evacuations especially, can be reproduced and generalised to other similarly remote communities. In the meantime, these findings inform funding bodies and policy-makers of Central Australia by challenging the contemporary wisdom that the provision of more clinical consultations at the primary healthcare level can reduce the number and economic burden of medical evacuations.

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