

# AUSTRALIAN AIR MEDICINE: MORE THAN JUST PATIENT TRANSPORT

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## INTRODUCTION

The geography and demography of Australia made the early development of air medical services almost inevitable. The Royal Flying Doctor Service, which was established in Queensland in 1928, is the world's oldest continuously operating air medical program.

Australia has a population of some 20 million people in a country only fractionally smaller in area than the continental USA. However, more than half of the population live in major cities with populations of greater than 1 million. This contrasts with vast areas with very sparse populations, and correspondingly limited access to health care.

## THE AUSTRALIAN HEALTH SYSTEM

This is a partly socialised medical system with a universal health coverage scheme—"Medicare"—administered by the Federal government. However, delivery of health care is largely the responsibility of the States (of which there are six, plus two less autonomous Territories). The Federal government, via a Medicare tax levy and general revenue (predominantly the latter), subsidises primary health care and outpatient services directly for all Australian residents.

Inpatient services are provided by each State and Territory, with funding from the same source, augmented in most States by funding from State taxes. Each also provides a State-wide government ambulance service from its combined revenue. Hence, health funding for hospital care is essentially a capitation type system, with State-run public hospitals serving as the providers and the Federal government the main payer.

A proportion of patients in public hospitals are funded separately – either through private health insurance or workers' compensation or transport accident insurance. There are also a significant number of private hospitals, most of which, however, provide elective surgery and other non-acute services only.

The relatively sparse population outside the main centres means that only one or two major cities in each State provide a full range of tertiary services. Hence a significant proportion of patients must travel substantial distances to access specialised care.

## AIR MEDICAL SERVICE REQUIREMENTS

The nature of air medical services required within a particular area can be described by a tri-region model with remote, rural, and para-urban regions.<sup>1</sup> All three regions occur within the spectrum of air medical practice in Australia.

The Australian "Outback" is a classic remote region with over 80% of the country's area and a population of less than 350,000 and little in the way of an intrinsic health structure; it is similar to parts of Canada's Far North, or certain desert areas of Africa. Here the provision of almost all health care, both routine and emergent, is heavily dependent on air transport—either by delivering the care to the patient, or vice versa.

In terms of area, most of Australia that is not remote is still rural with occasional small towns and regional centres—comparable to much of Scotland or Ireland, or less populous US states such as Montana or Wyoming. These areas generally have access to basic routine and emergency medical services; more complex or critical patients require referral to tertiary facilities in major cities. Such transfers are often over distances that justify or demand air transport, predominantly fixed-wing although rotor-wing may be used for urgent cases over shorter to intermediate distances. Additionally, regional ambulance services may utilise rotor-wing ambulance services to respond to distant or inaccessible areas.

As outlined above, most of the Australian populace live in or adjacent to major centres, predominantly in the coastal strip of the Eastern states. Local population density in parts of this area is similar to that of Western Europe or the more populous regions of the US. These areas typically have comprehensive basic local medical facilities, with reasonable proximity of tertiary facilities. Paradoxically, though, rapid conventional access to such facilities may be difficult due to urban sprawl and poor road systems. This in itself has been quoted as a justification for rotary wing emergency medical services.<sup>2</sup> Additionally, many Australian urban regions are bordered by areas used for recreational activities such as water, alpine and other outdoor sports. Participants injured in such activities may require aerial rescue and/or EMS.

### DEVELOPMENT OF AIR MEDICAL SERVICES

As early as 1917, the Reverend John Flynn of the Australian Inland Mission conceived the idea of combining aviation, medicine and "wireless" (radio) to produce a "mantle of safety" across the Outback. It was not until 1928 that the first Aerial Medical Service started operating out of Cloncurry in Queensland. A wireless network started simultaneously utilising radios incorporating a pedal powered generator developed by engineer Alfred Traeger (there being no electricity supply in the Outback, and few settlements had generators at that time). Such radios were still in use in some areas over 40 years later, both for emergency use and for other purposes such as distance education. A system of medical kits was also introduced, with numbered oral, parenteral and topical medications that could be administered according to radio directions from a doctor or nurse.

From the outset, Flynn's system offered a complete health service, not just transport, and from early on routine "clinic flights" were performed to strategic locations offering family health care. The provision of a complete medical service rather than just an air ambulance also contributed to the new service's outstanding safety record at a time when flying was still quite hazardous; experienced doctor/nurse teams who were able to administer anaesthesia and perform many surgical and obstetric procedures on-site meant that risky return flights in bad weather or at night could often be avoided.

By the time of Flynn's death in 1951, he had seen his infant service grow to a federation of six divisions and a dozen bases and change its name to the Flying Doctor Service. The value of the system to the people of the Outback was recognised by the granting of the "Royal" prefix in 1955, and the Royal Flying Doctor Service has continued to be a vital part of Outback health services to the present.<sup>3</sup>

Australia was also an early pioneer of rotary wing air medical services. In 1972, only two years after the inception of the ADAC's *Luftrettung* ("Air Rescue") service in Germany, and the same year as the *Flight for Life* program started in Colorado, the *Angel of Mercy* medical helicopter service commenced service in the Mornington Peninsula area of Victoria, near Melbourne. The following year, the Sydney branch of the Surf Life Saving Association of Australia (SLSA) began the nation's first civilian helicopter rescue service, with sponsorship from the Bank of New South Wales (later the Westpac Bank). Initially this service provided over-water rescue only, but the role rapidly expanded to encompass resuscitation of near-drownings and other

medical emergencies with the addition of a physician to the crew. Subsequently, operations expanded to include non-coastal areas and patient transport, with scene flights for trauma and medical emergencies, then inter-hospital transports. Similar programs started in other areas, and by the early 1980s, there were nine Westpac SLSA Helicopter Rescue Service (HRS) bases across five states. The combined medical/rescue role model established by this service continues in many Australian HEMS programs to the current time.

Concurrently, another important development was occurring in South Australia, where a farsighted intensive care physician, Dr. J.E. "Fred" Gilligan, saw the need for an intensive care outreach service to small rural hospitals. He conceived a system that combined existing air ambulance transport with physician-based intensive care teams and mobile intensive care equipment to "take intensive care to the patient, not the patient to intensive care." Another key feature was the provision of immediate clinical advice on interim management of the patient until arrival of the resuscitation/transport team; with the receiving hospital and transport teams assuming responsibility for the patient from the time of first contact. This program was the prototype of critical care transport services in Australia and has since been copied in most States. The term "medical retrieval" coined to describe this concept has become synonymous with critical care transport in the Australasian region.<sup>4</sup>

The 1980s saw a major expansion of demand for non-rescue HEMS operations, particularly inter-hospital transports. This caused some friction within some HRS programs between the respective proponents of rescue and medical operations. There was also an aggressive expansion of SAR optimised HEMS programs in several states by an industrial safety foundation that had expanded into an all-purpose rescue organization: the National Safety Council of Australia (NSCA) Victorian Division. However, in 1988, this organisation sustained a sudden financial collapse with massive unsecured debts, precipitated by substantially fraudulent management.

The upshot of this was the creation of several new or restructured HEMS programs, filling the vacuum left by the collapse of the NSCA services and a contracting HRS network. Some of these services were corporate providers; some were State government services through either Police or other emergency services; while others were charitable community based operations.

This mix of HEMS providers, with different combinations in each State, remains the current situation. Most non-government services operate as some form of non-profit foundations with community support, and also corporate sponsorship. Various banks, utility providers, health insurers and motoring organizations

have all sponsored air medical services at some point. Sponsorship of air medical services is mostly a “win-win” arrangement: The payers (usually the State Ambulance services) get a bargain, the community gets a better service, and the sponsors get good exposure in the media and an improved corporate image.

### CLASSIFICATION OF AIR MEDICAL SERVICES

Consistent with the population density model outlined above, Australian air medical services can be broadly divided into three types: Aerial Health Services, Air Ambulance Services, Critical Care Transport Services, and Combined Services.

#### AERIAL HEALTH SERVICES

Aerial health services provide health care over large areas where flight is the only timely means of travel. The Royal Flying Doctor Service’s network of 11 remote health bases in 5 states<sup>3</sup> (and the smaller Northern Territory Aerial Medical Service) provides a broad spectrum of care, including flying outpatient clinics, arranged patient transports and emergency medical evacuations, which are required for even relatively minor illness and injury. In spite of the title of the service, the RFDS also utilises flight nurses extensively, particularly for routine primary health care. Physicians provide on-line medical advice and are added to the flight crew as required; currently the proportion of flights on which this occurs varies between different bases and ranges from approximately 20 to 40%.

Integral to the operation of the system is the provision of radio communications and also comprehensive first aid kits to remote outposts and communities. In emergency situations these allow even untrained individuals to deliver interim care under on-line guidance until the arrival of a medical team. The distances involved have always mandated the use of fixed-wing aircraft, even for scene flights. Fortunately, most of the terrain involved is relatively flat, meaning scene landings can usually be accomplished on roads or other improvised landing strips.

Other aerial health programs are more specialised, such as Queensland’s Flying Obstetric Service, which provides travelling specialist elective and some emergency obstetric services to a network of small hospitals. Similar programs for ophthalmology and other specialised medical services operate in this and other states.

#### AIR AMBULANCE SERVICES

Air ambulance services may be further divided into fixed- and rotary-wing, with some programs providing one or the other and some both. International air ambulance services are also provided by several organizations, either dedicated, or as part of an integrated critical care transport service.

Fixed-wing air ambulance services normally provide elective and emergent interhospital transport over distances too great to practically utilise road transport. There is essentially one such service per State (albeit with a varying number of bases) run in conjunction with each State’s ambulance service. There are also in some States supplementary (usually contracted commercial) services offering a lower acuity level of service – seated or simple stretcher patients only. This allows the higher level services to focus on acute care patients.

Rotary-wing ambulance services are predominantly used for scene transport – although those with (routine or optional) critical care staffing may provide a comprehensive service (see below). Many helicopter ambulance services, particularly in coastal areas, also provide hoist rescue capability (see Figure 66-1). This historical capability does offer some economy of scale in allowing a single aircraft to perform both the extrication and patient care/transport. Deployment of clinical teams by hoist also allows the patient to be stabilised prior rather than subsequent to extrication.



Figure 66-1: Helicopter scene response may include Search and Rescue and hoist rescue. (Courtesy CareFlight)

#### CRITICAL CARE TRANSPORT SERVICES

Critical care transport services have become an integral part of the overall critical care system in nearly all States, necessitated by the need to bring critical patients at small, often far away, hospitals with limited facilities, to one of a limited number of major tertiary (equivalent to Level I hospitals in the USA) facilities.

## Principles and Direction of Air Medical Transport

Such services are normally based at major hospitals and operate either as an outreach of these hospitals or as a State or regional resource under the authority of the ambulance service. They typically offer transport by road and air—either fixed or rotary wing aircraft or both, depending on distances and urgency. This is similar to the many US air medical programs that also offer critical care ground transport. Some do not have their own transport vehicles, but utilise ground or air ambulances from other providers as required.



Figure 66-2: Interhospital transport by helicopter and integrated with critical care road transport. (Courtesy CareFlight and RFDS Western Ops)

There are separate neonatal retrieval services in most areas, either statewide or regional programs, some of which encompass paediatrics and/or maternal transport also. In other regions paediatric retrievals are performed by general (i.e., adult) services.

The value of quality medical retrieval services is recognised by the national specialist medical colleges (US Board equivalents) of the critical care disciplines of emergency medicine and anaesthesia/critical care, who have developed and promulgated minimum standards for transport of the critically ill.<sup>5</sup> These include system issues, numbers and qualifications of staff, equipment, communications and aircraft/road vehicle specifications.

This system has evolved to a high standard in most of Australia, in no small part due to these rigorous minimum standards mandating critical care physician-based teams, and high equipment and monitoring levels, regardless of the vehicle used. It is now mandatory for critically ill ventilated patients to be transported with mechanical ventilation, capnography, and invasive monitoring. Most critical care transport services achieve this by utilizing some variation of the “stretcher bridge” mobile intensive care module concept.<sup>6</sup> These devices, incorporating ventilator, monitors, and infusion pumps, attach to the patient litter or gurney and permit

“bed to bed” continuation of monitoring and therapy in multiple transport vehicles and also during secondary gurney transport within the hospital.

### COMBINED SERVICES

Many programs provide more than one of the categories of service. The RFDS, as well as its primary rural aerial health role, also provides the fixed-wing air ambulance service in several States.<sup>3</sup> Many of the HEMS, especially the community-based non-profit programs, provide air ambulance, critical care transport and search and rescue (SAR) services.

This means that the mission spectrum of typical Australian HEMS is perhaps the most diverse and demanding in the world. A single aircraft may be required to be capable of critical care transport (possibly dual patient), specialty missions such as neonatal and balloon pump transports, scene response to multi-casualty incidents, and both land and water SAR/hoist rescue. Many of these missions may involve long range response and/or “high and hot” conditions. This results in a very high minimum specification for air medical helicopters; with the Bell 412 and SA365 Dauphin series being the commonest aircraft used — while smaller aircraft such as the BK117 struggle in this combination of roles.



Figure 66-3: Rural health care delivery, including even scene response by fixed wing. (Courtesy of Dr Steven Langford, RFDS Western Ops)

### AIR MEDICAL STAFFING

Staffing of Australian air medical services more closely resembles the European than the American model, with significant use of physicians as air medical crewmembers at least part of the time, although there are variations between States. The reasons for this are multiple, but predominantly related to the demographics outlined above. For interfacility transports from many smaller hospitals the air medical team must often provide the diagnosis and pre-transport stabilisation that is taken for granted in many North American and European settings.

## Air Medical Physician Association

For more routine work, most rural health and fixed-wing air ambulance services operate with (usually single) flight nurse staffing, with physicians added as required for critical patients. Staffing of rotor-wing services is more variable. Some use ambulance (EMT and/or paramedic) staffing for scene response and hospital-based teams to comply with critical care transport standards<sup>5</sup> for interhospital flights. Others use a single team for both – most commonly physician-paramedic.

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### TASKING AND COORDINATION

Obviously this varies for different types of services. There are also variations between different regions and States. Routine flights by rural health services and air ambulances are scheduled in consultation with communities and outlying hospitals. Emergency flights are usually tasked via regional Ambulance coordination centres, which are also responsible for the secondary road transports for fixed-wing flights. Coordination requirements for critical care transports include: confirming the need for transport and the level of escort required; providing clinical advice on interim management; dispatching an appropriate team and vehicle; and identifying/confirming a destination hospital and unit. Clinical triage mechanisms have been developed and described to identify patients requiring particular levels of escort.<sup>7</sup> In different regions this is provided in different ways—either via the ambulance coordination centre, or by hospitals or the air medical programs themselves.

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### ASSOCIATIONS, RESEARCH AND EDUCATION

Since the early 1990s, Australia and New Zealand have had their own air medical association, the International Society of Aeromedical Services (ISAS) Australasian chapter.<sup>8</sup> As the name suggests, it started as an affiliate branch of the European-based parent organization, but runs independently. ISAS Australasia has an annual conference, publishes a regular newsletter, and has developed and promulgated an advisory set of minimum standards. There is also a specific flight nurses association, *Flight Nurses Australia*, and a special interest group for physicians under the auspices of one of the specialist medical colleges.<sup>9,10</sup>

There is an active research and publication history with air medicine in Australia, although to date predominantly from the physician staffed critical care transport services. Predominant foci of research and publication have been case reports and descriptive articles, and

equipment development, with only a few outcome-based studies to date. However, at the time of writing a major randomised outcome-based study is in progress, looking at the influence of scene response by physician-based airborne critical care teams on mortality and morbidity from neurotrauma.<sup>11</sup> This is believed to be the first of its kind in the world.

Australia offers several degree, diploma, and certificated courses in or relating to air medicine through a number of universities and organizations. There are also in-house training programs in most major air medical services.

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### SAFETY

Air medical safety remains a concern in Australia, predominantly (but not exclusively) related to rotary-wing operations, and particularly in one state, with several fatal accidents in the last five years.<sup>12</sup> These predominantly relate to night operations in VFR aircraft.

There have to date been wide variations in safety initiatives between air medical services. Some programs have strong safety cultures, with cockpit resource management training, full IFR certification and operation, safety incident reporting programs, simulator training, HUET, etc. In other programs these are notably lacking – especially for medical crew, particularly if these are provided from outside the program itself (hospital or regional ambulance service).

After the publicity surrounding the recent spate of HEMS accidents and the results of some of the investigations into these, it appears likely that there will be considerably more focus on safety in most jurisdictions. In particular, future contracts for provision of air medical services to State authorities are likely to incorporate much more rigorous minimum standards for safety and safety programs.

### REFERENCES

1. Munford BJ & Beehan SJ (1997). Development of a Model for Air Medical Services. In: ADAC/International Society of Aeromedical Services *AIRMED 96 Congress Report*. 1997:597. ADAC Luftrettung GmbH.
2. Fischer RP, et al. (1984). Urban Helicopter Response to the Scene of Injury. *J Trauma* 24:196.
3. Royal Flying Doctor Service of Australia [www.flyingdoctor.ncl](http://www.flyingdoctor.ncl).
4. Gilligan JE, McCleave DJ, Nicholson B, et al. (1977). Retrieval of the critically ill in South Australia: a co-ordinated approach. *Med J Aust* 2:849-55.
5. JFICM/ACEM Policy document IC10 (2003): Minimum Standards for Transport of Critically Ill Patients. [www.jficm.anzca.edu.au/publications/policy/ic10\\_2003.htm](http://www.jficm.anzca.edu.au/publications/policy/ic10_2003.htm)
6. Wishaw KJ, Munford BJ and Roby HP (1990). The CareFlight stretcher bridge - a compact mobile intensive care module. *Anaes & Int Care* 18(2):192-5.
7. Lee A, Lum ME, Beehan SJ and Hillman KM (1996). Interhospital Transfers: decision making analysis in critical care areas. *Critical Care Medicine* 24:618.
8. International Society of Aeromedical Services (Australasia) [www.isas.org.au/](http://www.isas.org.au/).
9. Flight Nurses Australia [www.isas.org.au/FNA/Home](http://www.isas.org.au/FNA/Home).
10. Australian and NZ College of Anaesthetists - Special Interest Group: Critical Care in Unusual Environments. [www.anzca.edu.au/ccqa/sig\\_general/ccue/index.htm](http://www.anzca.edu.au/ccqa/sig_general/ccue/index.htm).
11. NRMA CareFlight: Head Injury Retrieval Trial [www.careflight.org/site/index.cfm?display=2284](http://www.careflight.org/site/index.cfm?display=2284).
12. Holland J and Cooksley GB (2005). Safety of helicopter aeromedical transport in Australia: a retrospective study. *Med J Aust* 182:17-19.