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International EMS Systems: New South Wales, Australia

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1. Introduction

1.1. NSW geography

Australia has an area of 7,692,024 km^2 and a population of 19,169,083. The state of New South Wales (NSW) has an area of 801,428 square kilometres and a population of 6,663,700 (June 2002). It contributes 10% of the land area of Australia and 34% of the population. The length of the coastline is 2007 km with an east-west distance of 1450 km (Fig. 1).

Approximately 90% of the NSW population resides within 100 km of the coast. The population density is greatest in the Greater Metropolitan Region around Sydney, an area of 1580 square km, population of 4,154,722. Only 0.6% live in regions classified as remote or very remote (based upon distance to regional townships). The climate is generally mild, although temperature extremes range from −20 °C (Charlotte's Pass) to 50 °C (far Western NSW). The highest point is 2228 m at Mt. Kosciuszko. However, most of NSW is below 500 m in altitude.

2. Ambulance Emergency Services

The primary provider of pre-hospital services is the Ambulance Service of NSW (ASNSW), a state government funded organisation. It began in 1885 as the Civil Ambulance and Transport Brigade. It is the only organisation allowed by law to provide pre-hospital road ambulance emergency services. Private ambulance services can provide services to major sporting events eg trackside at motor sport events. All emergency calls are directed to one of five ambulance controlled call centres via a single emergency phone number (000). All emergency responses are tasked by the ASNSW. Specialist areas of the ambulance service include aeromedical services and the Medical Retrieval Unit (MRU). A total of 2,983 people are employed by the Ambulance Service of New South Wales, 2,701 of which are ambulance officers, of which 24% are female [1].

Classification of ambulance officers is based upon skill levels. These include paramedic, advanced life support officer, general duties ambulance officer or Patient Transport Officer levels. The highest skill level incorporates non drug assisted intubation (sedation post intubation is permitted), defibrillation, intravenous fluids, needle thoracostomy, intravenous/intraosseous drugs (e.g. adrenaline, atropine, calcium chloride, glucose, frusemide, glucagon, glyceryl trinitrate, lignocaine, metoclopramide, morphine, midazalom, naloxone, salbutamol, sodium bicarbonate and acetylsalicylic acid) as well as inhalational methoxyflurane. Administration of these skills is based upon pre determined protocols. Ambulance officer activities are also directed by a number of urban and rural trauma triage (bypass to major trauma centre) protocols. Medical oversight is provided for by a Chief Medical Officer and a Medical Advisory Committee.

Pre paramedic training is carried out over a 3 year period and involves a combination of classroom theory, hospital attachments and probationary road period. Progression to paramedic level is based upon merit. There is regular recertification at all levels. Officers may be selected for further training in specialised areas such as high angle and water rescue, urban search and rescue and helicopter crew. Ambulance Officers traditionally have worked in pairs of the same skill level. This is currently being altered so that paramedics generally are paired with a more junior officer to enable a higher percentage of overall vehicles to be staffed by a paramedic.

The ASNSW operates predominately Mercedes Sprinter, Ford Transit van and Ford F250 road vehicles.

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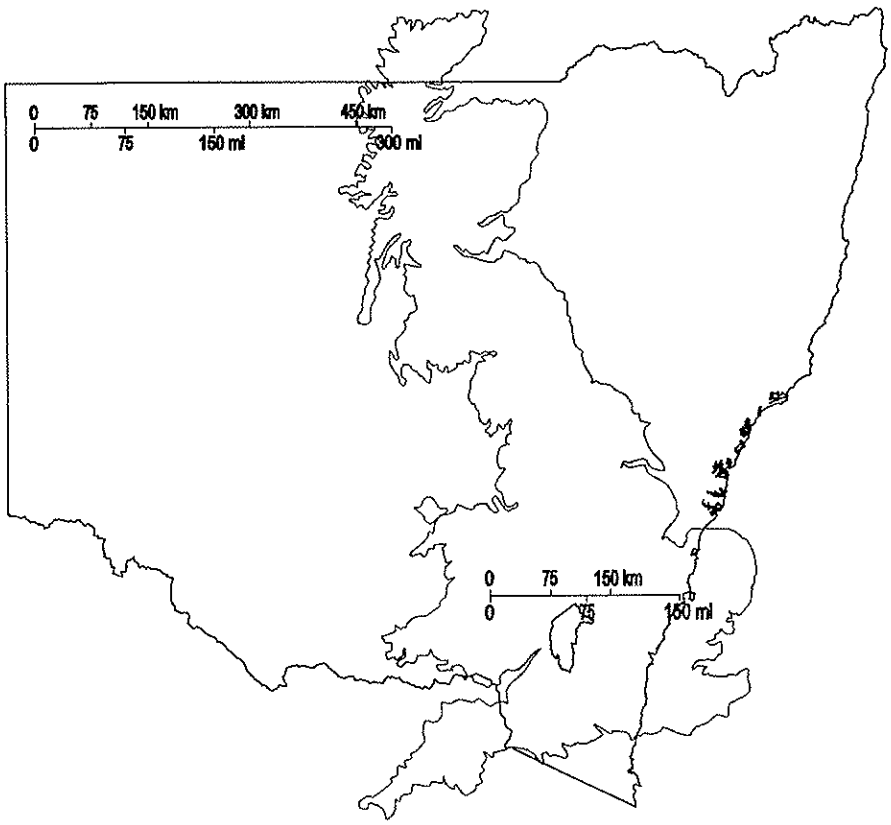

Fig. 1.

There are also specialty vehicles such as motorcycles and four wheel drive vehicles for rapid paramedic response (Fig. 2). Dispatch is via a Computer Aided Dispatch and most vehicles are fitted with Mobile Data Terminals for messaging and Automatic Vehicle Location. An electronic patient record and mobile data terminal with data transfer to receiving hospitals is currently undergoing trials. A Medical Priority Despatch System (MPDS) for improved prioritisation of tasking has also been recently introduced.

The ASNSW employs 16 flight nurses to provide flight nursing services to patients transported by fixed wing aircraft. Fixed wing aircraft were first introduced in 1967 and helicopters in 1983. In the 12 months from July 2001 till June 2002, the ASNSW responded to over 858,000 calls, transported 573,485 patients (17% trauma), 4,490 by fixed wing (5,347 flight hours, 50% of which required hospital admission to the receiving hospital within 12 h) and 2,220 patients (4,416 flight hours) by helicopter.

Fig. 2. Intensive Care Medical Retrieval Road Ambulance.

3. Aeromedical services

The type and distribution of aeromedical services is illustrated in Fig. 3. The ASNSW uses four Super KingAir B200C fixed wing aircraft. Each aircraft can carry two stretcher patients and two sitting patients with the majority of patient transfers (93%) being with a crew of one flight nurse and one pilot. The remaining 7% involve the flight nurse and, either a medical officer from any of the medically staffed adult retrieval services or a medical officer and retrieval nurse from the neonatal/paediatric retrieval service. The Royal Flying Doctor Service (RFDS) [2] provides additional aircraft and staff, with one aircraft at Dubbo (central western NSW) and another at Broken Hill (far west NSW). The RFDS was established as a charity organisation to overcome the difficulty of sparse medical services in the vast distances of inland ("Outback") Australia and flew its first mission in 1928. It has bases throughout regional

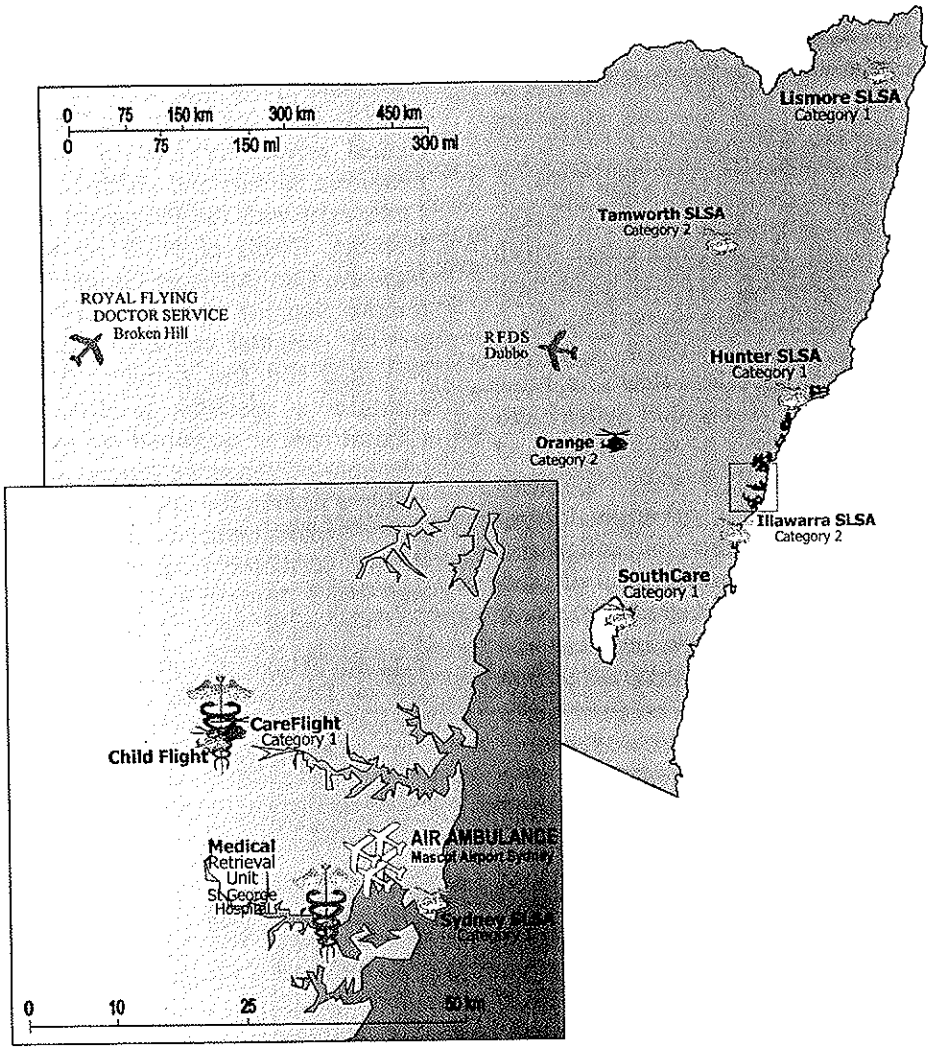

Fig. 3. Distribution of Aeromedical/Paramedical Services in NSW and the Australian Capital Territory.

Australia. When the Service first began, the responsibilities of the Flying Doctor were to fly to urgent cases, render first aid and, if necessary, transport the patient to hospital. It also provided advice by radio and made available less urgent medical and dental clinical services to remote location by flying out the appropriate staff and equipment. These objectives remain much the same today. Funding is from Commonwealth, State and Territory Government sources, donations and fundraising activities. Rescue helicopter services began in the early 1970's and were medically staffed by the early 1980's.

Helicopter services are medical/paramedic, medical/nurse (paediatric/neonatal only) combinations, or paramedic only. Type of aircraft include the Augusta A119 Koala, Bell 407B, Dauphin C, Bell 412 and 412EF, BK117. The majority, but not all, are Instrument Flight Rated (IFR) and winch capable. Medical staffing for aeromedical services is by specialists and senior trainees from the disciplines of anaesthesia, emergency medicine and intensive care. Sydney based services are accredited for training by the respective specialist training Colleges. Regional services obtain their medical staff from that region's base hospital.

There are two Sydney rescue helicopter services, one (NRMA CareFlight) [3] provides medical and helicopter aircraft for tasking through the ASNSW and the other (Sydney Aeromedical Retrieval Services) provides medical staff in conjunction with the Lifesaver Southern Region Helicopter Rescue Service helicopter operation [4]. Both also support aircraft within regional NSW [5,6]. These services provide on site and separate on call staff on a 24 h, 7day, (24/7) basis. They pursue a strong research interest [7–28] These interests have encompassed systems, equipment and clinical, within the domains of pre and interhospital transports. Of particular note was the development and description in 1987 of the CareFlight Stretcher Bridge (Mobile Intensive Care Unit Module) enabling in transit storage and use of patient monitoring, ventilation and infusion devices

[7], benefits of physician presence and other aspects of pre hospital trauma care [10,16,21,23,25–27], disaster management [18–20,24], description and evaluation of transport systems [12,13,22,28] and notable equipment and clinical case reports [7,8,18–20,22].

Specialty training for the helicopter rescue services medical and paramedical staff includes Mass Casualty Incidents, Urban Search and Rescue, high angle, winch and water rescue, and Breathing Apparatus/Chemical Biological and Radiological hazard training (Fig. 4).

Tasking of state wide retrieval services is by the Medical Retrieval Unit (MRU). The MRU is a functional unit of the ASNSW, located within Sydney and can be accessed by all hospitals within NSW and Australian Capital Territory (ACT) through a dedicated toll free number. It is staffed 24/7 by onsite trained ambulance staff and onsite daytime (on call night) medical staff. The Unit has a fulltime medical director and 4 other (total of one other full time position) senior medical staff. All of the medical staff have continual and extensive retrieval experience in addition to current critical care consultant appointments in tertiary hospitals. Their role is to provide clinical advice and support to the referring medical staff, Air Ambulance Flight nurses, ambulance officers and retrieval services. They also liaise with nominated and/or potential receiving facilities/medical services (e.g. bed finding) to facilitate the timely delivery of critically ill patients to the most appropriate level of service. The MRU may be involved as part of a co-ordinated response to a Major/Disaster Medical Incident.

Paediatric and neonatal transports are co-ordinated separately from the ASNSW, through the NSW newborn and pædiatric Emergency Transport Service (NETS) [29]. NETS is the Sydney based state wide clinical service for medical retrieval of critically ill newborns, infants and children up to 16 years of age. Links exist with the Pregnancy and Newborn Services Network (PSN) of NSW as well as the Paediatric Intensive Care Advisory Group. The PSN is responsible for the planning and coordination of NSW and ACT tertiary perinatal services. Access to NETS is via a dedicated toll free number. NETS Retrieval Teams comprise a specialist paediatric doctor and nurse. Clinical care is optimised by specialist advice using a telephone conferencing system. Such advice may require multiple parties, for example retrieval specialists, intensivists (paediatric/neonatal), paediatric emergency physicians, paediatric surgeons, toxicologist, obstetricians and others. Transfer and clinical management decisions can be made in a co-ordinated and collaborative fashion. Modes of transport include helicopters (BK 117 or Dauphin N2), road vehicles and fixed wing aircraft (from the ASNSW). It is separate operationally and administratively from the adult aeromedical services.

4. Critical care plan

Care of the critically ill is in keeping with the state Critical Care Plan (CCP). The CCP is based upon the

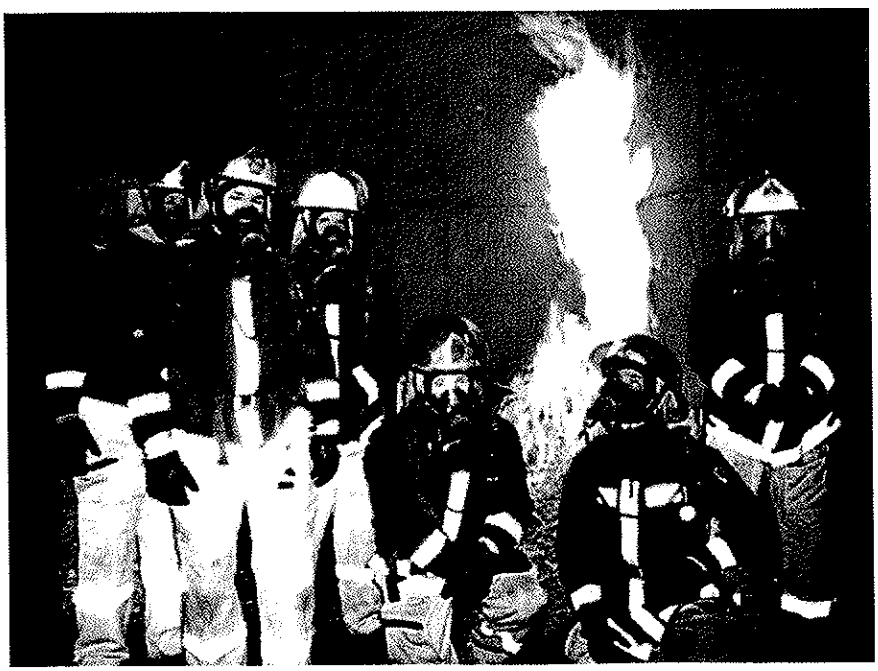

Fig. 4. Retrieval Medical staff undergoing Breathing Apparatus training.

existence of a number of regional critical care networks. Each such network is administratively aligned with an Area Health Service (AHS). NSW has 6 Metropolitan and 8 Rural AHSs. These networks are responsible for the development of clinical links between referring and the tertiary receiving hospital for that AHS. Within those links there is the provision for easy access to tertiary services, clinical support mechanisms and in rural regions a regional retrieval service. This structure is designed to retain clinical ownership and responsibility within each region, whilst facilitating equity in access to critical care services for patients in need of such services.

The NSW retrieval system, co-ordinated through the MRU provides a critical role in making these networks function in terms of co-ordination of the referral process and ultimate transport of referred patients. The activity of the CCP is overseen by a number of multidisciplinary Committees, both at the regional (AHS) and State level. There is a state based multidisciplinary committee that overseas the functioning of the MRU and all state retrieval services. A NSW Health sponsored telehealth initiative linking tertiary referral hospital based critical care services, regional hospitals and retrieval services is currently under development.

5. Emergency departments

In NSW there are 143 public hospitals which have Emergency Departments. Emergency Department (ED) capabilities are rated on a six level scale [30]. Level six represents full trauma centre capabilities which must have 24/7 access to Emergency Physicians, Neurosurgery and Cardiothoracic surgery. In NSW there are nine level 6 Emergency Departments (of which 2 are paediatric only) in Sydney, and one in Newcastle. On a typical day in NSW around 5,000 adults will be treated in Emergency Departments, of which 29% are admitted. In 1994/95 there were over 1,565,000 attendances and approximately 1.8 million in 2000 [31]. At the same time the clinical complexity of patients has increased, with progressively higher admission rates and a greater proportion of patients in the lower urgency categories requiring detailed evaluation and hospital admission.

Over a third of all Australian children (< 15 years) live in NSW. In this state there are 3 children's hospitals. The two Sydney based hospitals have dedicated paediatric emergency departments (level 6) and staffed by paediatric emergency physicians (either FRACP or FACEM) and trainees from both colleges. Together these two departments see around 70,000 children per annum. All children's hospital emergency departments act as a tertiary referral point for children through out NSW. Children and young people, up to their 16th birthday, requiring tertiary care, are managed in the children's hospitals. From a system perspective, there is collaboration between the three children's hospitals, particularly in managing intensive care resources. Such communication is frequently facilitated through NETS.

Unintentional injuries (Motor vehicle accident [MVA] and falls) make up 12% of all hospital admissions. Urban mortality is 591/100,000 population, compared to age adjusted rural mortality of 647/100,000 population. Mortality is strongly negatively correlated with population classification of accessibility (i.e. more remote locations have a higher mortality). The overall MVA death rate is 9.5/100,000 population (a decrease by 50% from the 1980 rate) or 1.1×10^6 vehicle km travelled. The hospital admission rate is 193/100,000 population. The hospital admission rate for firearms is 2.4/100,000 population, 28.5% being due to handguns [32].

The Australasian College for Emergency Medicine (ACEM) [33] primarily is responsible for the training and examination of specialist emergency physicians for Australia and New Zealand The Royal Australasian College of Physicians (RACP) trains and accredits paediatric emergency physicians. ACEM currently has 556 Fellows and 969 trainees, with NSW accounting for 148 of the active Fellows. The supply of emergency physicians throughout Australia and New Zealand currently cannot meet demand, and is not expected to do so within at least five years. ACEM has a vital interest in the quality of emergency medical care provided to the community and therefore has a wide range of subsidiary objectives relating to emergency department accreditation, policies and standards for the emergency medical system, teaching and research, publication, and those aspects of the medico political framework that have a direct impact on health outcomes for emergency patients.

6. Major medical incidents

Management of major medical incidents is dictated by the NSW Department of Health's HEALTHPLAN. This is a component of the multi-agency response under the guide of DISPLAN. The NSW Health Counter Disaster Unit is responsible for policy, planning and training for preparedness for major incidents. Planning involves purchase, storage and distribution of personal protective equipment, antidotes to Chemical and Biological agents, rapid identification of such agents and training of key personnel.

7. Summary

The state of NSW covers a vast area, most of which is sparsely populated. EMS greatest challenge is providing

critical care services over these distances. The creation of networks and centralised communication/referral processes help link distant rural and tertiary urban health facilities. Ambulance services are expanding to incorporate newer communication technologies as well as strengthen their existing diverse skills. The relationship of pre hospital medically staffed retrieval services and the ambulance service has features that make it unique in comparison to other international environments. Pre hospital education and research occurs at, and between, all levels. Managing the increasing magnitude and complexity of demand for hospital critical care services continues to challenge both government and specialty training bodies.

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