



## MEDICAL RETRIEVALS TO TERTIARY REFERRAL CENTRES IN SYDNEY

**A** medical retrieval is a mission in which a doctor (usually accompanied by a nurse or paramedical personnel) travels to a sick or injured patient and accompanies him or her to a hospital, stabilising and managing the patient at the retrieval site and en route. A distinction is made between medical retrieval and patient transport with a medical escort. Medical retrievals may be primary (e.g. from the roadside at the site of a motor vehicle accident) or secondary (from one hospital to another). The vehicles used are road ambulances, fixed-wing air ambulances and helicopters.

The Epidemiology and Health Services Evaluation Branch of the NSW Health Department, in collaboration with the Centre for Health Economics, Research and Evaluation, has carried out a review of all medical retrievals by Sydney-based retrieval teams to tertiary referral centres in Sydney between February 1 and May 31, 1991. The objectives of the review were to:

- enumerate retrievals by road ambulance, helicopter and fixed-wing aircraft;
- determine the demographic and clinical characteristics of the retrieved patients, and the pattern of retrievals by the three vehicle types;
- describe the outcomes;
- assess costs; and
- assess the quality and accessibility of routinely collected data and their suitability for ongoing monitoring of medical retrieval.

This article outlines the organisation of medical retrievals and summarises the findings of the review.

### ORGANISATION AND FUNDING OF MEDICAL RETRIEVALS

The organisation of medical retrievals to Sydney tertiary centres is complex. There are three key components: the operators of transport vehicles, the retrieval teams which provide the medical services and the system which coordinates and activates retrievals.

Four retrieval operators provide the transport. The NSW Ambulance Service operates road ambulances and fixed-wing air ambulances. The Air Ambulance Service is based at Sydney (Kingsford-Smith) Airport. The other three operators provide helicopter services. These are the Westpac Surf Life Saving Association (SLSA), based at Prince Henry Hospital; Child Flight, based at the Royal Alexandra Hospital for Children (RAHC); and NRMA Careflight, based at Westmead Hospital.

Five retrieval teams use the transport vehicles provided by the operators. Two of these teams are employed by the retrieval operators, *viz.* SLSA and NRMA Careflight. The other three teams are hospital-based and are at the Grace Neonatal Intensive Care Unit, RAHC; the Lower Todman Intensive Care Unit, also at RAHC; and the Prince of Wales Children's Hospital. Retrievals are carried out by various combinations of operators and teams.

The three helicopter operators (SLSA, Child Flight and NRMA Careflight) are private non-profit organisations which are individually contracted to the NSW Health Department to provide transport for medical retrievals. The Department's payments comprise a fixed monthly retainer and additional fees which depend on the amount of time for which the helicopter's engine is switched on (engine time).

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## Medical retrievals

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As examples, a crude estimate of the average cost to the Department of helicopter transport for retrieving a neonate from Western Sydney to the RAHC is \$2,935 (allowing 40 minutes engine time) and for retrieving a neonate from the Central Western or South East Region, \$5,285 (allowing 134 minutes engine time).

The costs of NSW Ambulance Service operations are more difficult to determine. Most of the workload of the Air Ambulance Service comprises scheduled transport of patients to and from country areas and, to a lesser extent, unscheduled transport. Medical retrieval operations are estimated to account for 8 per cent of flights. The Air Ambulance Service also has a coordinating function. Medical retrieval constitutes a very small proportion of all road ambulance operations. In addition to road ambulance retrievals *per se*, road ambulances provide ground connections for all fixed-wing air retrievals (e.g. between Sydney Airport and the destination hospital) and some helicopter retrievals (where the helicopter cannot land at the retrieval site or the destination hospital).

The Ambulance Service recoups monies by charging health care institutions according to an engine time formula for helicopter retrievals and a distance formula for road ambulance and fixed-wing air ambulance retrievals. For secondary retrievals by helicopter, half is paid by the referring hospital and half by the receiving hospital.

### CONDUCT OF THE REVIEW

Medical retrievals in the review period were identified from two principal sources: Air Ambulance Service records of secondary and some primary retrievals by fixed-wing aircraft and helicopter, and lists of fixed-wing, helicopter and road ambulance retrievals provided by the five retrieval teams.

Clinical data and data on the operational aspects of individual medical retrievals were obtained from retrieval teams' records, Air Ambulance Service and helicopter flight records and medical records at the receiving tertiary referral centres. The data sought on each case included demographic items, the site from which the retrieval was undertaken, the type of vehicle used, key time points in the retrieval operation, clinical and diagnostic information at various stages during the retrieval and the subsequent hospital stay, length of stay and the outcome. The outcomes were categorised as follows: death, discharge or transfer for terminal care, transfer to an inpatient rehabilitation facility, or discharge to own home or transfer to a lower level hospital (other than for terminal care).

There were considerable variations in the data available on individual cases.

### KEY FINDINGS

During the four-month period February 1-May 31, 1991, 533 medical retrievals were carried out by Sydney-based retrieval teams to tertiary referral centres in Sydney (4.4 per day on average). These comprised 33 primary and 500 secondary retrievals.

All 33 primary retrieval cases were adults. Of the 500 secondary retrieval cases, 44 per cent were neonates, 29 per cent were children (aged up to 12 years inclusive) and 27 per cent were adults.

TABLE 1

SECONDARY MEDICAL RETRIEVALS TO SYDNEY REFERRAL CENTRES, FEBRUARY-MAY 1991: LOCALITY OF REFERRING HOSPITAL AND TYPE OF TRANSPORT VEHICLE BY AGE GROUP OF PATIENTS

Referring Hospital	Transport Vehicle		
	Road Number (%)	Helicopter Number (%)	Fixed-Wing Number (%)
<b>NEONATE</b>			
Inner Sydney	73 (98)	1 (02)	—
Outer Sydney	46 (73)	17 (27)	—
Other Urban	9 (36)	16 (64)	—
Rural	—	28 (51)	27 (49)
<b>CHILD</b>			
Inner Sydney	29 (97)	1 (03)	—
Outer Sydney	53 (78)	15 (22)	—
Other Urban	5 (42)	6 (50)	1 (08)
Rural	2 (06)	10 (29)	22 (65)
<b>ADULT</b>			
Inner Sydney	6 (86)	1 (14)	—
Outer Sydney	18 (38)	29 (62)	—
Other Urban	—	17 (100)	—
Rural	1 (02)	22 (38)	35 (60)
Incomplete data on 10 cases			

Of the 33 primary retrievals, 31 were by helicopter. Of the secondary retrievals half were by road ambulance, one-third by helicopter and one-sixth by fixed-wing aircraft. A road ambulance was used for three-fifths of the neonates and children, but only one-fifth of the adults. A helicopter was used for 29 per cent of neonates, 22 per cent of children and 54 per cent of adults, and a fixed-wing aircraft was used for 12 per cent of neonates, 16 per cent of children and 27 per cent of adults.

To describe the locations from which patients were retrieved, the State was divided into four zones.

- **Inner Sydney** Central, Southern, Northern and Eastern Sydney Health Areas
- **Outer Sydney** Western and South-Western Sydney and Wentworth Health Areas
- **Other urban** Illawarra, Central Coast and Hunter Health Areas
- **Rural** The Health Regions

For secondary retrievals, the localities from which patients were retrieved varied markedly among the age groups (Table 1). The majority of neonates (63 per cent) and children (68 per cent) came from Sydney metropolitan localities while a large proportion of adults (45 per cent) came from rural regions.

The majority of neonates (78 per cent) and children (91 per cent) were retrieved to the RAHC and the Prince of Wales/Prince Henry group of hospitals, regardless of the locality from which they came. Less than one-quarter of the neonates referred from outer Sydney localities were taken to Westmead Hospital; 45 per cent of them went to the RAHC and 22 per cent to Prince of Wales Children's Hospital. Only 6 per cent of children from outer Sydney went to Westmead, while 60 per cent went to the RAHC. By contrast, 29 per cent of all adults were retrieved to Westmead, 23 per cent to the Prince of Wales/Prince Henry group and 21 per cent to Royal North Shore Hospital. Two-thirds of the adult retrievals to Westmead Hospital were from outer Sydney and most of the rest from rural areas.

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## News and Comment

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reports including the first Biennial Report of the Australian Institute of Health which Peter Lewis used as a reference to make the above statement.

The sequence of events which explains this error is as follows:

- The 1986 figure for Australia issued by the Australian Bureau of Statistics (ABS) was 8.8 infant deaths per 1000 live births. However, the United Nations recorded a figure of 9.8 in the demographic year book for 1986. This has now been recognised and the United Nations demographic year book for 1988 now shows trends for the past five years revising the 1986 figure downwards, in line with the ABS estimate of 8.8.
- The annual report issued by UNICEF, *The State of the World's Children*, used the incorrect figure of 9.8 which it rounded to 10 per 1000 live births.
- The Australian Institute of Health used the UNICEF figures in its first biennial report, *Australia's Health 1988*. The correct 1986 ABS figure of 8.8 (rounded to 9) was quoted on page 41 of the report, but the UNICEF figures were used to compile a graph on page 42, showing international comparisons. Subsequently, an incorrect statement was made by the institute based on the graph 'despite the substantial decline in Australia's infant mortality, it does not compare favourably with other equally developed countries among which Australia ranks 18. Japan, Singapore and most European countries have lower rates.'

In fact, the revised figures show that in 1986, Singapore had the same rate of infant mortality as Australia. Of the 24 major European countries listed by the United Nations, only 7 had an infant mortality rate lower than Australia. If the correct 1986 figure of 9 per 1000 had been used, Australia would have ranked about 11th, not 18th, as stated by the institute.

In addition, it is important to indicate that infant and perinatal mortality data is very difficult to compare on an international basis because of the complexity and differing interpretations of the definitions of 'live births' and 'infant deaths'. The difficulties are further compounded by the different data used by the United Nations as compared by individual countries for legal purposes. In addition, Keirse<sup>1</sup> working in Holland and Gerald Lawson<sup>2</sup> in a detailed study in Newcastle, NSW, have both shown the widely differing practices of doctors when certifying deaths in the perinatal period. Australian definitions appear to be more stringent than many other countries in the sense that perinatal deaths are recorded as deaths of living infants, which in many other countries would be regarded as miscarriages.

These views on the difficulty of international comparisons of infant and perinatal death rates are shared by the Editor of the *Australian and New Zealand Journal of Obstetrics and Gynaecology* who said: 'International differences in the definition of a stillbirth confound intercountry comparisons of perinatal mortality and almost certainly influence the gestation at which a foetus born with "any evidence of life" will be registered as a live birth instead of a spontaneous abortion'<sup>3</sup>.

These are not matters purely of academic interest. Despite the difficulties in comparisons of the data between countries, comparisons are made with great passion at international conferences and in debates about the virtues or otherwise of homebirths, birth centres, technological interventions in midwifery, and in any arena in which the standards of maternal and infant care are debated.

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1. Keirse MJN. Perinatal mortality rates do not contain what they purport to contain. *Lancet* 1984; 1:1166-1169.
2. Lawson GW. Under-reporting of perinatal mortality. *Aust NZ Obstet Gynaecol* 1987; 27:312-314.
3. In Lawson GW above.

## Medical retrievals

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A simplified classification of the reasons for retrieval indicates the majority of neonates were retrieved because of an actual or potential need for respiratory support. Non-traumatic causes predominated in children, while head injury and other trauma accounted for almost half the adult retrievals, with non-respiratory medical problems explaining the other half. Endotracheal intubation was performed in two-thirds of the patients and in most cases it was done by staff of the referring hospital.

Outcomes appeared to be favourable for 77 per cent of the neonates, 86 per cent of the children and 62 per cent of the adults. The majority of children and half the adults were discharged directly to their homes, while more than half the neonates were discharged to lower-level hospitals. Twelve per cent of neonates, 8 per cent of children and 20 per cent of adults died.

Some general observations were made about the choice of transport vehicle. At the extremes of distance there was no choice of vehicle type; road ambulances were used for short distances and fixed-wing aircraft for very great distances. Where retrievals involved distances for which there was the potential to choose among the vehicle types, time factors could be compared. For example, there was a clear time advantage for helicopters over road ambulances for neonatal retrievals from outer Sydney. Nevertheless, road ambulances were selected in almost three-quarters of cases. For secondary medical retrievals from rural Health Regions within the range of helicopters, helicopters were found to provide a substantially more expeditious service than fixed-wing aircraft. This advantage was reflected in the choice of vehicle, with helicopters dispatched in three-quarters of cases.

Detailed results of the review will be published elsewhere. Recommendations arising from it include:

- The strategic placement of medical retrieval teams, transport facilities and receiving hospitals warrants careful consideration, with greater emphasis given to the development of all three of these elements in Western and/or South Western Sydney.
- Clear guidelines should be established for the choice of vehicle types. For short-range urban retrievals, road ambulances should be used. For long-range retrievals from rural sites, fixed-wing aircraft should ordinarily be used. However, for longer-range urban retrievals and for rural retrievals within the range of helicopters, clinical criteria should be applied to determine the urgency of each case, and this should be a major factor in determining the choice of vehicle type.
- Consideration should be given to greater participation of the rural retrieval networks in the management of medical retrievals.
- Uniform case data should be collected on all medical retrievals.
- Adequate data should be collected to enable monitoring of the cost of medical retrieval operations. In particular, data should be collected to monitor the costs to the Ambulance Service of the use of road and fixed-wing air ambulances in medical retrievals.

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