Service Model for Area Health Boards

Issued by the Department of Health
August 1989
Service Planning Guidelines for Hospital/Area Health Boards

The production of service planning guidelines is an ongoing process.

The purpose of these guidelines is to provide a broad framework within which Boards can undertake service planning according to their own priorities.

Guidelines published (as at June 1989):
1. Paediatrics
2. Services for the Elderly
3. Obstetric and Neo Natal
4. Renal Dialysis and Transplantation
5. Cardiac Surgery
6. Alcohol and Drug Services
7. Oral Health
8. Cancer Services
9. Neurosurgery
10. Diabetes Mellitus
11. Physically Disabled Adults
12. Child, Adolescent and Family Mental Health

Service models published:
13. Neurology
14. Cardiology
15. Injuries and Diseases of the Musculoskeletal System
16. General Surgery
17. Sexually Transmitted Diseases
18. Gynaecology

Service models in production:
19. Internal Medicine
20. Respiratory
21. Emergency Services
22. Ophthalmology
23. Otolaryngology
24. Mental Health

Copies of all guidelines and models can be purchased from:
Government Printing Office
Publications Division
PO Box 12-411
Wellington
# CONTENTS

<table>
<thead>
<tr>
<th>Members of the Working Party</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>2</td>
</tr>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>Recommendations</td>
<td>5</td>
</tr>
<tr>
<td>Service Definition</td>
<td>7</td>
</tr>
<tr>
<td>Neurology and Other Services</td>
<td>9</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td></td>
</tr>
<tr>
<td>General Medicine</td>
<td></td>
</tr>
<tr>
<td>Psychiatry</td>
<td></td>
</tr>
<tr>
<td>Ophthalmology</td>
<td></td>
</tr>
<tr>
<td>Paediatrics</td>
<td></td>
</tr>
<tr>
<td>Geriatric Medicine</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic Surgery</td>
<td></td>
</tr>
<tr>
<td>Nursing Service</td>
<td></td>
</tr>
<tr>
<td>Other Health Professional Services</td>
<td></td>
</tr>
<tr>
<td>Community Support Services</td>
<td></td>
</tr>
<tr>
<td>The ideal Neurology Service</td>
<td>12</td>
</tr>
<tr>
<td>The Demand for Neurology Services</td>
<td>14</td>
</tr>
<tr>
<td>The Prevention of Neurological Illness and Disability</td>
<td>16</td>
</tr>
<tr>
<td>The Neurological Foundation of New Zealand</td>
<td></td>
</tr>
<tr>
<td>Paediatric Neurology</td>
<td>17</td>
</tr>
<tr>
<td>Neuroradiology Services</td>
<td>18</td>
</tr>
<tr>
<td>Clinical Neurophysiology</td>
<td>19</td>
</tr>
<tr>
<td>Personnel</td>
<td></td>
</tr>
<tr>
<td>Neurophysiologists</td>
<td></td>
</tr>
<tr>
<td>Technicians</td>
<td></td>
</tr>
<tr>
<td>Scientific Officer</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>Specialised Tests</td>
<td></td>
</tr>
<tr>
<td>Workforce</td>
<td>22</td>
</tr>
<tr>
<td>Neurologists</td>
<td></td>
</tr>
<tr>
<td>Paediatric Neurologists</td>
<td></td>
</tr>
<tr>
<td>Neurophysiologists</td>
<td></td>
</tr>
</tbody>
</table>
MEMBERS OF THE WORKING PARTY

Gavin Glasgow, FRACP Neurologist
Auckland (Chairman)

Iris Fegan, RN Charge Nurse
Neurology Service, Auckland Hospital.

Robert Davies, Chief Executive,
Wanganui Area Health Board.

Philip Parkin, FRACP Neurologist
Christchurch.

Richard Frith, FRACP Neurologist and
Clinical Neurophysiologist
Auckland.

Brian Collinge,
Department of Health,
Wellington.

"We believe that good health for all New Zealanders requires their active participation in health policy and health services. The consumer's voice has been left out of decision-making at clinical and administrative levels, and too often is only heard when dissatisfaction becomes intolerable or coincides with political expediency. Women, although the main providers and consumers of health care, are sparsely represented at decision-making levels in the health system.

Given the unacceptable status of Maori health, better and more appropriate provision of health services and care for Maori people is a priority which all health agencies must address."

Royal Commission on Social Policy
ACKNOWLEDGEMENTS

The Working Party consulted widely and received helpful advice and comment from many people. In consequence, the Report has been altered and refined and we gratefully acknowledge the assistance we have been given. We have incorporated views and written comments as far as possible. The Report, of course, reflects the opinions of the Working Party.

We particularly acknowledge the continuing help and stimulus of Brian Collinge and the Service Planning Section of the Department of Health. Frances Buchanan in the Department of Neurology, Auckland Hospital, skilfully typed the text.

We are glad to acknowledge the contributions of the following people:

Dr. T.L. Avery
Dr. A.S. Badger
Dr. P. Baker
Ms. M. Berkeley
Dr. H.M. Bichan
Dr. M. Bycroft
Dr. M. Clark
Mrs. L.M. Clarkson
Mr. R.W. De Witt
Dr. P.B. Disler
Dr. I. Donaldson
Dr. T.C. Doran
Dr. K. Eyre
Dr. D. Fung
Mr. K.E. Greene
Mr. P. Heeney
Dr. J. Hill
Dr. F. Hirst
Dr. R. Hornabrook
Dr. B.E.B. Hyne
Dr. D. Jamison
Dr. R.A. Lawrenson
D.H. Lord
Ms. J. Martinson
Ms. W. Lee Mathias
Dr. R. Moore
Ms. B. Murphy
Dr. M. Pollock
Dr. J. Simcock
Dr. B. Simons
Dr. A. Simpson
Dr. V. Synek
Ms. E. Wang
Ms. Liz Webb
Dr. E. Willoughby

Work Force Development, Head Office
The following Area Health/Hospital Boards responded to a questionnaire providing information about Neurological Services presently in place:


*****
1. INTRODUCTION

The Neurology Service Guidelines have been prepared for the Health Department as one of a series designed to assist forward planning by Area Health Boards. The recommendations are those of the Working Party who sought advice from many colleagues throughout the country and from most of the Area Health Boards in New Zealand.

The Working Party was requested to describe a Neurology Service ideal for New Zealand conditions, an essential feature being equitable access to the Service for all people. It is intended that the guidelines be reviewed in 5 years, by which time major changes can be expected in the investigation and treatment of diseases of the nervous system.

The Working Party was enjoined to draw up practical guidelines for New Zealand conditions, having regard to the resources available. The Guidelines which follow adhere to this condition inasmuch as they are not proposed for North American or British conditions, but it is acknowledged that implementation would increase the overall cost of Neurology Services.

While this report concentrates on service guidelines, these cannot be wholly separated from clinical guidelines, since an ideal service can be delivered only by those with appropriate training.

Among the many helpful and constructive comments made about the draft report, a theme commonly encountered was the question of resource allocation as, for example, between services in the community and technology-based diagnostic services. The Working Party believes it is not competent to determine allocation of resources at the "macro" level and believes that judgements such as this are policy matters.

The problems related to the participation of Neurology Services in rehabilitation and in the long-term care of physically disabled people was also the subject of suggestions and comment. We believe that the Working Party preparing guidelines for the Care of Physically Disabled Adults will consider these matters in detail.

Other professional health services and staff made comments concerning a more detailed description of professional duties and staffing levels. The orientation of these guidelines does, of course, reflect the composition of the Working Party. We continue, for example, to believe that a voluntary postgraduate Nursing Course in Neurology and Neurosurgery would add greatly to the enthusiasm and interest of Nursing Staff working in these disciplines.

The Quotation from the Royal Commission on Social Policy is included because the Working Party believes that matters of principle are dealt with and that the implementation of all guidelines at Area Health Board level will take into account the particular needs of the health of Maori people and the opinions of consumers.
2. RECOMMENDATIONS

General Recommendations

2.1. Neurology Services should be available to all people irrespective of race, age, gender or geographical situation.

2.2. The unacceptable status of Maori health must be recognised and better and appropriate provision of all health services and care for Maori people is a priority.

Recommendations Concerning Neurology

2.3. Access to Neurology Services for newly referred patients should be by reference from a medical practitioner (para 6.1).

2.4. To provide an ideal Neurology Service, one Neurologist is required for a population of 100,000 people (para 11.1).

2.5. One hospital bed dedicated to neurological patients is required for each 20,000 population (para 13.21).

2.6. An isolated Neurology Service requires ready and immediate access to advice and consultation from a Neurosurgical Service (para 14.6).

2.7. Paediatric Neurological Services with appropriately trained Paediatric Neurologists should be established (para 8).

2.8. National Centres of expertise should be encouraged and developed (para 17).

2.9. Neurologists working in isolation should have available special arrangements for annual study leave (para 14.3).

Recommendations Concerning Clinical Neurophysiology

2.10. One Clinical Neurophysiologist is required for each 2,500 test procedures each year (para 11.3).

2.11. A National Training Programme for Neurophysiology Technicians is required (para 10.22).

2.12. National co-ordination of equipment purchasing for Neurophysiology should be established (para 10.3).

Recommendations Concerning Nursing

2.13. A National Programme for Graduate Nurses in Neurology and Neurosurgery leading to a diploma is required (para 4.2).
Recommendations Concerning Community Services

2.14 Suitable accommodation and rehabilitation facilities are required urgently for physically disabled adults (refer to the Service Guidelines for the care of physically disabled adults). (para 6.5)

2.15 Community Services providing support for people with neurological disorders should be supported by Area Health Boards (Appendix 2).

Recommendations Concerning Neuroradiology

2.16 Magnetic Resonance Imaging facilities should be available in one major site promptly and within five years in the main centres (para 9.1).

Recommendations Concerning the Prevention of Neurological Disability

2.17 Public Health Programmes directed to reducing tobacco consumption, reducing alcohol consumption, the prevention of road traffic accidents and the promotion of safety helmets, should be strengthened as means of diminishing the long-term disability related to neurological illness in the community.
3. SERVICE DEFINITION

3.1 WHAT NEUROLOGY IS

A Neurology Service provides for the assessment, investigation, treatment and management of conditions affecting the central and peripheral nervous systems.

Common symptoms leading to referral to a Neurologist include: headache, epilepsy, blackouts, turns and giddy spells, limb pain, unsteadiness of walking, numbness and pins and needles, limb weakness and paralysis, impaired vision and memory impairment.

Underlying common disease processes causing these symptoms include: migraine, stroke, multiple sclerosis, peripheral neuropathy, cerebral tumour, spinal cord compression, motor neurone disease, muscular dystrophy, Parkinson's disease, Alzheimer's disease and psycho-emotional illness.

Neurology also involves the care of patients with neurological complications of general medical disorders such as hypertension, heart disease, infections, diabetes, cancer, drug and alcohol intoxication, and therefore a sound knowledge of internal medicine beyond the boundaries of strict Neurology is required.

The epidemiology of the whole range of neurological disorders in New Zealand has, to our knowledge, never been the subject of investigation in this country. It is, however, reasonable to look to overseas countries in which these studies have been undertaken in order to gauge the likely extent of neurological disease in New Zealand. In the United States, the annual incidence for disease and injury of the nervous system is about 2.5% and the prevalence about 9.5%. In New Zealand terms, this translates to an annual incidence of 82,500 affected people and a point prevalence of 313,500 (nearly 1 in 10 of the population) people affected by a neurological disorder.

3.2 WHAT A NEUROLOGIST DOES

The duties of the Neurologist will vary according to the hospital of appointment. An appointment may be whole-time Hospital Specialist, part-time with private practice, or part-time Hospital with part-time University appointment. Within the hospital setting, the general areas of professional work may include:

3.21 The management of hospital in-patients and the supervision of the medical management of patients by the Registrar and House Physician.

3.22 Consultation service to other Hospital Specialists.
3.23 A consultation and management service for patients at Out Patient Clinics.

3.24 Out Patient Consultation Clinics in other hospitals on a regional basis as required.

3.25 Contribution to a Clinical Neurophysiology Service on a regular basis.

3.26 Teaching Junior Medical Staff and graduate and postgraduate students.

3.27 Medical administration, depending on local circumstances.

3.28 Clinical research, which is an important component in the maintenance of professional standards.
4. NEUROLOGY AND OTHER SERVICES

4.1 NEUROLOGY AND OTHER MEDICAL SERVICES

While Neurology impinges on all specialties in Medicine and Surgery, the relationship to some specialist services is immediate and on-going.

4.11 Neurosurgery. A close working relationship is required with the Neurosurgical Services established in the main centres. This is a two-way relationship (see the Neurosurgical Service Guidelines) and neither a Neurology Service nor a Neurosurgical Service can function optimally in isolation. A Neurology Service which does not have an associated Neurosurgical Service requires special arrangements enabling ready access to consultation and referral from the regional Neurosurgical Service.

4.12 General Medicine. A close relationship is required with General Medical Services, for those patients admitted to a General Ward with a neurological disorder, and for advice on General Medical problems encountered in a Neurology Ward.

4.13 Psychiatry. There should be a close relationship between Neurology Services and Psychiatry in a two-way consultation arrangement. Neurological consultation should be readily available to Psychiatric Services and Psychiatric consultation to a Neurology Service.

4.14 Ophthalmology. Patients with neurological conditions may present to an Eye Service and the Neurologist is often in need of assistance from the Ophthalmologist.

4.15 Paediatric Medicine. The needs of infants and children with neurological disorders are best met by specialists with appropriate training (see below). Where a Paediatric Neurologist is not available, neurological consultation from the adult Neurologist will be required.

4.16 Geriatric Medicine. Many disorders of the nervous system appear later in life and a two-way consultation service with Geriatric Medicine is required.

4.17 Orthopaedic Surgery. This is a specialty frequently requiring the assistance of a Neurology Service.

4.18 Rehabilitation Medicine. See Para 6.5.

4.2 NEUROLOGY AND THE NURSING SERVICE

The Neurology Nurse will be a Registered Nurse whose basic training complies with the standards set by the New Zealand Nursing Council. The Neurology Nurse will possess all the
qualities of a Trained Nurse in a multi-cultural environment, but in addition, will require special attributes suitable for work in the Neurology Service. These are:

4.21 Skill in caring for people with failing intellect and altered mental states.

4.22 Skill and experience in making accurate observations and records of changes in conscious states, acute neurological events such as seizures and in behavioural changes and emotional states.

4.23 A comprehensive understanding of neurological disease processes to enable complete care for patients. Such understanding can be provided to some extent by learning in the ward situation. For the fully trained Nurse in Neurology and Neurosurgery, a special Post-Basic Nursing Course is required (see Recommendation 2.13).

4.24 The Charge Nurse in a Neurology Ward should be a Registered Nurse with not less than one year of postgraduate experience who has completed a Neurology and Neurosurgery Nursing Course and has demonstrated appropriate clinical management and teaching skills in preparation for the Ward/Unit management role.

4.25 The ideal staffing ratio is described under Workforce.

4.3 NEUROLOGY AND OTHER HEALTH PROFESSIONAL STAFF

A Neurology Service will require all the usual services provided by these health professionals in a General Surgical or Medical Ward, or in a general Out Patients' Clinic. In the Neurology Service however, particular skills and professional experience related to the specialty are required. Only these special skills are described below.

4.31 The Physiotherapist. Special knowledge and expertise is required in the assessment and treatment of patients with, for example, weakness of muscles, spasticity, impaired gait or balance. Special skills are required in the management of patients suffering from generalised muscle weakness who have impaired breathing and/or swallowing.

4.32 The Occupational Therapist. The important skills are those related to the assessment and management of functional problems of daily living in a disabled person. Particularly important is the assessment of the problems to be encountered by a disabled person at home, advice on the measures required and the modifications needed.

4.33 The Speech Therapist. The skills required are in the treatment of selected patients with acquired language disorders and
in the training and counselling of patients with speech disorder leading to progressive difficulty with communication or with swallowing disorders.

4.34 **The Dietitian.** Skills required lie in the management of nutrition of patients with disorders of swallowing and in patients with prolonged alterations of conscious level.

4.35 **The Social Worker.** The special skills relate to the young disabled person, to the patient with chronic epilepsy and to head injured patients. A particular problem in Neurology Services is the appropriate placement of young disabled people (see Recommendation 2.14).

4.4 **NEUROLOGY AND COMMUNITY SUPPORT SERVICES**

Increasingly during the last decade, community based support groups have played an important role in the care and support of patients with chronic neurological disabilities. These voluntary organisations perform a very important role in education, liaison with hospital services, support and care in the social environment and constitute an indispensable aspect of a Neurology Service. Some of these community organisations provide services of the greatest importance to patients with neurological impairment and deserve recognition as providers of health care by Area Health Boards. (See Recommendation 2.15). A list of such community organisations and support groups is provided in Appendix I.
5. THE IDEAL NEUROLOGY SERVICE

The ideal Service meets the reasonable needs of the consumer. The primary consumer is the patient, but the referring doctor may also in a sense be regarded as a consumer. The considerations described below should apply to all people in all parts of the country.

There are two components to an ideal service:

(i) The time the consumer has to wait for the service.

(ii) The quality of the service when it is received.

5.1 Patient Waiting Times. The following waiting times set out in 5.5 have been determined by considerations of:

(i) the degree of urgency in the presenting clinical problem.

(ii) the resources available to meet patient needs.

(iii) the need for flexibility required in the provision of a service.

(iv) the provision of a reasonable "brake" discouraging unnecessary or inappropriate referrals.

5.2 Reports to Referring Medical Practitioners

The referring practitioner generally receives information about the patient in a letter from the Neurologist. Secretarial services should be adequate to provide this within one week of discharge from hospital and one week after consultation at a Clinic.

5.3 Who Provides the Service?

The Neurologist will be a Fellow of the Royal Australasian College of Physicians (with Advanced Training in Neurology), or will have had the equivalent training.

5.4 Why Any Waiting Time?

The availability of the Service should be primarily dictated by the medical urgency, with the emphasis being on ensuring attention with little delay. The Working Party considers that for routine non-urgent cases, a short waiting time may be a desirable cost-containing measure, as it discourages inappropriate or trivial referrals.
5.5 WAITING TIMES

Patient Appointments

5.51 Clinic (Out Patient) Consultations:
Non-urgent consultations - within 6 weeks.
Urgent consultations - within 1 week.
Acute consultation - same day.

5.52 Hospital admission (In-Patient):
Non-urgent admission - within 4 weeks.
Urgent admission - less than 1 week.
Acute admission - on the same day.

Investigation Appointments

5.53 Out Patient special investigations:
CT Scanning
EEG.
EMG/Nerve Conduction
Non-Urgent
- less than 4 weeks
Urgent
- within 1 week

5.54 Special Investigations and In-Patient Services:
CT Scanning.
EEG.
EMG/Nerve Conduction.
Angiography.
Myelography.
Urgent
- same Day
Non-Urgent
- within 48 Hours

There should be no significant waiting time for general radiological and laboratory investigations.
6. THE DEMAND FOR NEUROLOGY SERVICES

There are no reliable data enabling a detailed analysis of reasonable demand in New Zealand. In many areas, patients are disadvantaged in access to a Neurology Service. In most Neurology Services in New Zealand there are defects leading to inappropriate "rationing" of the Service.

The following factors have a bearing on the demand for Neurology Services, but they differ from one region to another, depending on how service patterns have evolved locally.

6.1 Referral Patterns
Neurology Services generally respond best to referral from or through Medical Practitioners. A medical knowledge of the role and scope of a Neurology Service ensures that referral will be appropriate.

In approximate order of frequency, a Neurology Service has patients referred from:

- General Practitioners in the Board's area.
- Own Hospital Specialists.
- Specialists in other hospitals within the Board's area.
- Specialists from other Area Health Boards.
- General Practitioners in other Area Health Boards.
- Rarely from ACC, War Pensions and Social Welfare.

6.2 Population Patterns
It is significant for the future demand for Neurology Services that the population is aging. Many of the common problems in Neurology such as stroke, brain tumour and degenerative brain disease become increasingly common in older age groups.

6.3 Epidemiology
Information from Epidemiology gives a measure of the prevalence of chronic neurological disorder in the community (Kurtzke). It does not, however, necessarily describe the demand for services generated. This is because in chronic neurological disorder where no active therapeutic intervention is indicated, a patient may be cared for by the family doctor, or might be directly managed by a Neurology Service. Nevertheless, the prevalence of chronic disabilities such as epilepsy, stroke, head injury, Parkinson's disease, multiple sclerosis and other common chronic neurological disorders gives a measure of the potential demand for Neurology Services.

6.4 Examples of Variation in Local Practice and Demand
In some centres, the Neurologist may be involved in the care and rehabilitation of the head injured patient. In other centres, Neurosurgeons fill this role and in yet others, General Surgeons. In Paediatrics (see below) adult Neurologists may play a
significant part whereas in other Paediatric Services, the General Paediatricians oversee the management of Neurology problems in Paediatrics. Similarly infections such as meningitis are sometimes part of the commitment of Neurologists, in others of the Physician in Infectious Diseases.

6.5 Rehabilitation
With some exceptions, rehabilitation services are poorly developed in New Zealand and the contribution made by Neurology Services to Rehabilitation particularly of the young disabled, is generally minimal. This constitutes an area of potential demand, at present not filled. (Refer to the Service Guidelines for the Care of Physically Disabled Adults)

6.6 AIDS
Should the anticipated epidemic eventuate, it will certainly substantially increase the demand for Neurology Services. Approximately 1 patient in 5 with AIDS will present with symptoms affecting the nervous system before any other complaint and the demand that may be generated in this way is at present only a matter of speculation.

6.7 Future Trends in Neurology
The rapid scientific and technological advances such as in molecular biology, imaging, and immunology are likely to result in radical changes in Medical Services in the next decade. This will include Neurology. The effect on a Neurology Service one or two decades hence has not yet become clear in the Working Party's crystal ball.

**********
7. THE PREVENTION OF NEUROLOGICAL ILLNESS AND DISABILITY

The following factors are identified as contributing to neurological disease and disability.

7.1 **Tobacco Smoking.** There is a significant correlation between the development of atheroma and cigarette smoking. Atheroma is the commonest basis of stroke. Cigarette smoking is similarly closely related to the development of lung and other forms of cancer which may spread to affect the nervous system.

7.2 **Alcohol Abuse.** One of the commonest sites of organ damage in alcohol abuse is the brain and peripheral nervous system. It is a common cause of epilepsy of late onset, of crippling intellectual deterioration (Korsakoff encephalopathy), cerebellar degeneration and peripheral neuropathy.

7.3 **Head Injury.** Road traffic accident as a cause of head injury is the commonest cause of brain damage in young people and leads to chronic disability, varying from comparatively slight alterations of intellect and personality to severe and complete permanent physical and mental handicap.

In the industrial situation, safety helmets protect against brain damage and similarly are of great importance in protecting motor cyclists and bicyclists from head injury.

7.4 **Hypertension.** It is known that hypertension is the important contributing factor to stroke and screening for elevated blood pressure may lead to simple means of reducing the risk such as losing weight, reducing alcohol consumption, increasing exercise, and possibly medication.

7.5 A significant cause of life-long neurological disability arises from brain damage at birth. Excellence in antenatal care and delivery will reduce the numbers of brain damaged infants.

7.6 Clinical and laboratory research into neurological disorders allows improved understanding of diseases of the nervous system and potentially leads to preventive measures. The New Zealand Neurological Foundation is the major neurological research organisation aimed at improving the understanding of diseases of the nervous system and its funds are derived exclusively from the public.

*******
8. NEUROLOGY SERVICE TO INFANTS AND CHILDREN -

PAEDIATRIC NEUROLOGY

In New Zealand (with the partial exception of Auckland) the Neurology of infants and children is in the hands of adult Neurologists and General Paediatricians. This is unsatisfactory, because there is a content of Paediatric Neurology which distinguishes it from Adult Neurology and cannot be met without special skills and training. This includes:

(i) The Neurology of neonates and infants.

(ii) A detailed knowledge of developmental Paediatrics so that delay and deficit of development, learning and communication disorders can be adequately assessed.

(iii) The diagnosis and management of metabolic abnormalities of infancy and childhood presenting as neurological disorders.

(iv) The diagnosis and management of cerebral palsy.

(v) Knowledge of inherited neurological disease.

(vi) Knowledge and experience in the interaction between Medical Services and Education and Welfare Services, especially as it relates to the care of the disabled child.

The Paediatric Neurologist requires an adequate knowledge of General Paediatric and Neonatal Medicine, just as the adult Neurologist requires an adequate knowledge of general Internal Medicine. Also required, is an adequate knowledge of the principles of adult Neurology.

The Paediatric Neurologist should not have responsibility for general Paediatric Services.

Paediatric Neurology requires close links with the services in adult Neurology, Neurosurgery, Neurophysiology and Neuroradiology, but should remain primarily part of a Paediatric Service within a hospital system.

It is a regional service, and requires appropriate arrangements between Hospital/Area Health Boards.

************
9. NEURORADIOLOGY SERVICES

9.1 Neurologists in clinical practice require the services of general Radiology and Neuroradiology. Patients in a Neurology Service will require general Radiology investigations, including plain x-rays of the skull, chest, abdomen and limbs, special x-ray procedures including barium studies and ultrasound investigations of various parts of the body. In addition to such general services, Neurologists require ready access to skilled Neuroradiology. Neuroradiology principally involves the radiological investigation of the central nervous system. The special studies required include imaging of the brain, its coverings and the blood vessels supplying and draining it (CT scanning, plain x-rays, angiography and magnetic resonance imaging), imaging of the spinal cord, its coverings and the surrounding bone (plain x-rays of the spine, CT scan, myelography and magnetic resonance imaging), imaging of peripheral nerve structures (e.g. imaging of nerves as they pass through other parts of the body, for example, brachial plexus, lumbosacral plexus) and less commonly imaging of muscles. As a general principle, Neuroradiology Services in New Zealand are sub-standard when compared with other developed countries. Computerised Tomographic Scanning is an essential tool in neurological practice which spares the patient other painful and prolonged tests such as pneumo-encephalography and arteriography. In some areas there are long waiting lists, such that in non-urgent cases it is impossible to obtain a CT scan, whereas semi-urgent cases (which should be investigated within weeks), often wait months to a year. Similarly in some centres, waiting times for urgent procedures including myelography and arteriography are unacceptably long.

Magnetic resonance imaging is an established neuro-diagnostic tool with proven value in a number of neurological diseases. It is particularly effective in identifying disease processes affecting parts of the nervous system which are poorly imaged by CT scanning (for example, posterior fossa, spinal cord). Magnetic resonance imaging is not available in New Zealand at present. Initially plans should be made to provide magnetic resonance imaging in one major centre but it is likely that within 5 years magnetic resonance imaging should be readily available in each of the centres where there is a combined Neurological and Neurosurgical Service.

9.2 The ideal waiting time for a neuroradiological service should be similar to that for other tests required by neurological patients (see paragraphs 5.13 and 5.14).

9.3 The Neuroradiology Service should be provided by a Neuroradiologist - that is a Radiologist who has had special training in those areas of Radiology peculiar to patients with neurological disease. Specific equipment required for the performance of these tests is beyond the scope of this report, but further information can be seen with reference to the report of the Organ Imaging Review Committee, 1987.
10. CLINICAL NEUROPHYSIOLOGY

10.1 DEFINITION

Clinical Neurophysiology involves a variety of investigations performed on the central and peripheral nervous systems, muscles and special sensory organs. The majority of the tests are made using sophisticated electronic equipment and the performance of these tests requires special expertise. The tests usually performed include electroencephalography (EEG), nerve conduction studies and electromyography (EMG), and evoked potential (EP) studies (somatosensory, visual and auditory). Other special studies, including electroretinography, electronystagmography and intensive investigation of epilepsy, are usually also performed in Departments of Clinical Neurophysiology where there are clinicians with special expertise in the performance of these tests. Neurophysiological tests are complementary to the clinical neurological examination and cannot replace clinical evaluation. In some circumstances, electrical tests confirm clinical impressions, whereas on other occasion they provide information that is not readily available from the clinical examination.

10.2 PERSONNEL

10.21 Clinical Neurophysiologists.

A Clinical Neurophysiologist is a person with special training in Clinical Neurophysiology. This person should be a Neurologist with adequate clinical training, who has then had additional training, particularly in the areas of electroencephalography and studies of peripheral nerve and muscle. In some centres, neurophysiological tests are performed by Neurologists with lesser training in Clinical Neurophysiology, but it is preferable that such people should be able to refer to an expert in Clinical Neurophysiology, particularly where difficult problems are encountered.

Area Health or Hospital Boards should ensure that Physicians practising Clinical Neurophysiology are kept up to date with latest clinical developments. In main centres, Clinical Neurophysiologists may still be practising in relative isolation and it may be necessary on occasions for a Clinical Neurophysiologist to travel overseas to a larger centre to gain further expertise in his or her area. Where a Neurologist is practising in a smaller centre, and performing Clinical Neurophysiology as part of his work, provision should be made for him or her to attend a larger centre for further experience and for refresher courses.

Neurophysiological tests should not be performed or interpreted by medical practitioners who have not had adequate training in Clinical Neurophysiology.
10.22 **Neurophysiology Technicians.**

Each Unit requires Technicians with expertise in Clinical Neurophysiology. There is no national training programme or formal qualification for Neurophysiology Technicians in New Zealand, and the majority acquire their skills during an "apprenticeship" period. The most appropriate qualification available for Technicians in Clinical Neurophysiology in New Zealand, is the New Zealand Certificate of Science. Clinical Neurophysiology Technicians should be encouraged to attend the closest Technical Institute to study for the New Zealand Certificate of Science. Area Health Boards or Hospital Boards should be encouraged to allow some time for Technicians to study towards these qualifications. Where a Technician is required in a smaller centre, he or she should be encouraged to travel to a larger centre to gain basic experience and training. Technicians should also be allowed to attend larger centres from time to time for refresher courses.

A national training programme leading to a recognised Diploma in Clinical Neurophysiology for technicians would be more appropriate than the current programme available at technical institutes. This would provide uniformity in training, allow more equitable grading of technicians in various centres and would be more relevant to human clinical neurophysiological testing than the NZCS. Such a programme would ideally consist of a combination of "correspondence" teaching while the technician is gaining practical training at the local hospital, and concentrated training courses for 3-4 weeks each year at one of the major metropolitan hospitals or technical institutes. Although there are potential logistic problems considering the small number of technicians spread throughout New Zealand, plans should be made for such a national training programme.

Although tests may be performed by Technicians without direct supervision by a Neurophysiologist, it is inappropriate that Technicians make reports on the investigation and this practice should be strongly opposed.

10.23 **Scientific Officers.**

In some circumstances, non-medically trained Scientific Officers with special expertise in Clinical Neurophysiology may perform neurophysiology tests on patients with neurological disorders. Although such Scientific Officers may develop special skills in Clinical Neurophysiology, they do not have the clinical expertise of a Neurologist to ensure that the test is appropriate or the results clinically relevant. Whenever a Scientific Officer is performing these tests, a Medical Consultant should be available to provide the necessary clinical perspective to the interpretation of the tests. Scientific
Officers who perform neurophysiological tests should be encouraged to visit larger centres, particularly if there is not a Neurologist with special expertise in some areas of Neurophysiology available locally.

10.24 Each Department of Clinical Neurophysiology will need suitable back-up support from an electronics laboratory to allow regular equipment maintenance.

10.3 Where equipment is to be purchased, advice should be sought from Clinical Neurophysiologists in established laboratories about the types of equipment being considered. Consideration should be given by the Department of Health and Area Health Boards to co-ordinated equipment purchasing to provide uniformity throughout the country, and to ensure satisfactory back-up facilities are available from the manufacturers. Specific recommendations about equipment will be found in Appendix II.

10.4 SPECIALISED NEUROPHYSIOLOGICAL TESTS
There are some tests in Clinical Neurophysiology which will require a greater level of expertise and use more sophisticated equipment than are available in standard laboratories. These tests also tend to be more time-consuming than usual. Examples include intensive investigation of epilepsy, sophisticated EMG tests and other investigation of peripheral nerve disease. (See below under National Referral Centres).

10.5 THE IDEAL CLINICAL NEUROPHYSIOLOGICAL SERVICE
The ideal Service involves the provision of neurophysiological tests within the guidelines for other services (see Paragraphs 5.53 and 5.54).
11. WORKFORCE

11.1 Neurologists
There is no exact comparison between the requirements for Neurologists in New Zealand and in similar countries such as Australia, United Kingdom, and United States of America, though the most appropriate comparison is with Australia, where at present there is approximately one Neurologist to serve 120,000 people. Having regard to the patterns of practice in New Zealand, the current experience of Neurology Services in New Zealand and to provide adequate consultation and management of patients, the aim should be one Neurologist for 100,000 of population. This calculation excludes the commitment a Neurologist may have to undergraduate education or to major medical or University Administration. It includes the requirements of Neurologists in Neurophysiology. It includes the commitment of Neurologists to Private Consulting Practice and does not exclusively refer to public hospital service. (2, 3.)

11.2 Paediatric Neurology
In the United States of America, it is considered that one Paediatric Neurologist is required to service a population of 100,000 children under the age of 15 (4). Children in this age group make up 24% of the New Zealand population. Such a service is required now in Auckland and should be available in Waikato, Wellington and Christchurch. Such a programme can be implemented only gradually and the advent of fully trained Paediatric Neurologists would decrease proportionately the services required of general Paediatric Physicians.

11.3 Clinical Neurophysiologists
In the New Zealand setting, there should be approximately one full-time equivalent Clinical Neurophysiologist for each 2,500 tests performed per year. The ratio of Neurophysiologists to staff, however, will differ slightly depending on local requirements and the availability of Scientific Officers to assist with performance of tests (5).

11.4 Neurophysiology Technicians
There should be one Technician for 1,000 patient tests per year, this ratio depending on local circumstances including the sophistication of the tests performed.

11.5 Nursing Service
The staffing ratio required to provide a high standard of observation and care covering a ward for a 24 hour period, is .70 staff for each bed. (This allows for illness and holidays). The mix of skills should be 75% Registered Staff and 25% Enrolled Nursing Staff, depending on the changes in patient dependency in the area.
Such changes in patient dependency and levels of care required, will at times require a shift of this ratio, and a potential variation in the overall staffing levels. 0.7 staff for each bed equates to 17.5 whole-time equivalents for a 25 bed ward.

11.6 **Physiotherapists**
1.3 FTE Physiotherapists and 0.25 FTE Physiotherapists and 0.25 FTE Physiotherapy Assistants are required for a ward of 25 patients. Changes in patient disabilities, levels of physiotherapy management required, availability and commitment to long-term care, to rehabilitation and follow-up may require a shift of this ratio.

11.7 **Occupational Therapists**
One Occupational Therapist is required for a ward of 25 patients. Additional staff may be required, depending on commitment to long-term care, to rehabilitation and follow-up.

11.8 **Speech Therapists**
The requirement is for 0.2 Speech Therapists for inpatient management in a 25 bed ward. Additional staff may be required, depending on commitment to long-term care, to rehabilitation and follow-up.

11.9 **Dietitians**
0.2 Dietitians required for a 25 bed Neurology Ward.

11.10 **Social Workers**
One Social Worker is required for a 25 bed Neurology Ward.

11.11 **Secretarial Staff**
The Secretarial Staff should be such that discharge letters and clinic letters are promptly typed and delivered within one week and that the correspondence and records of the Service are kept promptly up to date.

**********
12. NEUROLOGY AS A REGIONAL SERVICE

The recommendation that one Neurologist is required for 100,000 persons clearly means that not every Area Board can sustain a Neurology Service. A Neurology Service will almost always be a Regional Service and Areas Boards will either provide or receive Neurology Services across boundaries. The extent and complexity of a Neurology Service will be dependent on the population of an Area Board.

We describe below the structure of a Neurology Service for Area Boards serving various populations ranging from Metropolitan Centres down to small Area Health Boards.

The Area Health Boards are not described by name, particularly as it is expected that some amalgamations and changes will occur. The following sections will describe the ideal Neurology Service for an Area Health Board with a given population.
13. THE NEUROLOGICAL SERVICE
IN A METROPOLITAN REGION
(POPULATION MORE THAN 150,000)

13.11 THE NEUROLOGY UNIT
This should be staffed by Neurologists fulfilling the Specialist Neurologist training criteria. The clinical responsibilities of Neurologists in metropolitan areas must be confined to patients with neurological disorders. There is no place for Neurologists in these areas taking responsibility for the care of patients with general medical disorders. The number of Neurologists required is dependent upon the population served. A ratio of one Neurologist per 100,000 population is an optimal level. (See Para 11.1)

13.12 As communication with General Practitioners and with other Physicians is a vital part of neurological practice of any type, adequate secretarial facilities are an essential component of consultative work. General Practitioners should receive formal correspondence within one week of an out-patient consultation, or of discharge of a patient from the ward.

13.13 Incorporated within the Unit should be a Department of Clinical Neurophysiology, appropriately staffed and fulfilling the guidelines described above.

13.14 Junior Staff. Registrars in a Neurology Service will have responsibility for both in-patient and out-patient management. For in-patient services, as an example, a 25 bed Ward should be staffed by two House Physicians and two Registrars. Out-patient services provided by Registrars would include assessment of patients in consultation with senior colleagues and training in various aspects of Neurology including Clinical Neurophysiology.

13.15 Neurological Consultants must have ready access to specialised neuroradiological facilities and to Specialist Neuroradiologist Consultation, as described above.

13.21 IN-PATIENT SERVICES
The Neurological Service in a metropolitan region must have access to hospital beds exclusive to the specialty. Neurologists will use these beds for both elective and acute emergency neurological admissions. While a number of patients presenting to hospital with an acute neurological illness will be admitted under General Medical Teams, it is believed that in the interests of good patient management, many such patients should be admitted directly under the care of a Neurologist. The number of neurological beds required is related to the Regional Service provided by the particular Hospital Board/Area Health Board. A ratio of approximately one bed to 20,000 population served is
recommended, but this may be influenced by the number of cases that can be admitted directly to a Neurosurgical Ward. Centres with a smaller number of Neurosurgical beds may therefore require a greater number of Neurology beds.

13.22 The Neurology Unit should be situated in the principal hospital within the metropolitan area, rather than in one of its subsidiaries. Because Neurology and Neurosurgery Units share many similar needs for inter-specialty consultation, for specialised investigations, and for rehabilitation and management, it is ideal for patient management and cost effective for the two specialty units to be closely sited. Both units must therefore be situated in the same hospital, and should be within close geographic proximity, as patients are frequently transferred between the two specialties.

13.23 In an ideal service, patients with acute neurological disorders should be able to be admitted directly to a Neurological Ward with no waiting time. The waiting time for elective cases should be no longer than four weeks.

13.24 Special neuroradiological procedures such as CT scanning, myelography and angiography should be available to in-patients with a delay of no longer than two days.

13.25 There should be ready access to neurosurgical consultation, with a delay not exceeding two days for routine in-patients.

13.3 HOSPITAL CONSULTATIVE SERVICE

An important function of a Neurological Unit is to provide a prompt and adequate Consultative Service. Requests for in-patient consultation in the Unit's hospital should be met within two days. Other large hospitals within the region are likely to require regular formal visits for consultation once or twice a week, depending upon their size. Access to more urgent neurological consultation, however, must be available to such hospitals if required.

13.4 OUT PATIENT NEUROLOGY SERVICE

There are two facets to such a service -

13.41 Consultation Service: New Patients

This is an important role of a metropolitan unit. It is recommended that referrals fulfilling the medical criteria of urgent should be seen within one week, and non-urgent cases be seen within six weeks. Acute cases should be seen on the same day. It is stressed that an adequate support structure of Junior Medical Staff, Clerical Staff, Secretarial Staff and Out Patient Nursing Staff are necessary for this to be achieved.
13.42 Management Service: Follow-Up Patients

A number of out-patients will require regular or semi-regular follow-up visits. These will usually include patients with uncommon or complex disorders in which management by the General Practitioner will require supervision by a Neurologist. The majority of patients with common chronic neurological disorders, such as migraine, epilepsy and the like, will be able to be managed long-term by General Practitioners, but a proportion of such patients will require on-going neurological advice and supervision to supplement the care given by General Practitioners.

13.5 Consultation Service to Outlying Areas

A metropolitan unit has a commitment to provide a visiting consultation service to the non-metropolitan areas defined elsewhere. This commitment, and the ability to meet it, is determined by the number of Neurologists available and the non-metropolitan population served.

13.6 Clinics for Patients with Specific Disorders

It may be appropriate in certain centres to offer out-patient Consultative Clinic Services to patients with special or common disorders. This will depend upon the local neurological workforce and local expertise in the particular disorders. Examples are patients with headache, epilepsy, Parkinson's disease, multiple sclerosis, muscle disorders, neuro-ophthalmic conditions and the like.

13.70 Paediatric Neurology

There should be a Paediatric Neurology Service associated with children's facilities and functioning in a manner generally similar to that of the Adult Neurology Unit.

13.71 Clinical Neurophysiology

There should be a Department of Clinical Neurophysiology as part of the Neurological Unit in each of the metropolitan centres. Standard tests in Neurophysiology (EEG, EMG, EPs) should be available on a regular basis. The Department should be headed by a person with special training in Clinical Neurophysiology. It is probable that other Neurologists working in the Unit will also perform neurophysiological tests, but they may wish to refer from time to time to the Clinical Neurophysiologist for advice about difficult cases. Paramedical Staff will be required in the ratios described above (Paragraph 11.4). A Clinical Neurophysiology Unit in a metropolitan centre will require a full range of neurophysiological equipment, including dedicated EMG and evoked potential machines. It is likely that both EEGs and evoked potentials will be performed in
Intensive Care Units in metropolitan centres, and therefore portable machines will be necessary.

13.72 **Neuroradiology**

A fully established Neuroradiology Service is required in each metropolitan centre. There should be ready access to CT scanning, angiography and other special neuroradiological investigations. In populations of this size, particularly where there is a Neurosurgical Unit associated with the Neurological Service, planning should be made for the installation of equipment to perform magnetic resonance imaging.

13.73 **Neurosurgery**

At present there is a Neurosurgical Service in each of the four main centres. In metropolitan centres where there is not a Neurosurgical Unit (e.g. Hamilton), there must be a close working relationship with the nearest Neurosurgical Service to allow ready consultation and transfer of patients requiring neurosurgery. In metropolitan centres without immediate neurosurgical expertise, acute neurosurgical disorders such as expanding intracranial haematomas will need to be dealt with by a General Surgeon.

13.74 **Neuropathology**

In each metropolitan centre, there should be Specialist Neuropathology Services available. This requires a Pathologist with expertise in the interpretation of specimens from patients with neurological disease. This requires adequate facilities for the performance and interpretation of biopsy material of nerve, muscle and brain, as well as the competent evaluation of neuropathology specimens obtained at autopsy. In some circumstances, it may be necessary to obtain the Neuropathology Services available at a national centre of expertise in neuromuscular disorders (paragraph 17.3).

13.75 **Neuropsychology**

A Clinical Psychologist trained in the special area of Neuropsychology is necessary in each of the major metropolitan areas. Such a person would be expected to have particular expertise in the neuropsychometric evaluation of neurological patients, including those with head injury. The services of such a person could be used jointly by both a Neurology and Neurosurgery Service.

13.76 **Other Health Professional Services**

A Neurology Unit in a metropolitan area requires optimal neurological nursing, with at least some of the Nursing
Staff specially trained in neurological nursing. To function effectively, a Neurological Ward also requires Physiotherapy, Occupational Therapy, Social Work, Speech Therapy and Dietetic services, as described above (Section II).
14. THE NEUROLOGICAL SERVICE
IN NON-METROPOLITAN REGIONS
(POPULATION BETWEEN 100,000 and 150,000)

14.1 A population of this size will support the appointment of a Specialist Neurologist who fulfils the criteria defined above. As in metropolitan areas, the clinical responsibilities of a Neurologist serving this population should be confined to Neurology and the Neurologist should not have any responsibility for General Internal Medicine. It is likely that a Neurologist serving this population size will be practising in "isolation" from other neurological colleagues, and it is essential that such a person is able to attend regular refresher courses on at least an annual basis. This could be accomplished by regular visits to a metropolitan Neurological Service for at least several days at a time, but overseas study leave should also be encouraged. Area Health Boards or Hospital Boards employing a Neurologist, should plan to provide locum services (for example by a Senior Neurology Registrar from a metropolitan hospital) to maintain the local Neurological Service.

14.2 In-Patient Services

Ideally, the Neurologist should have access to hospital beds exclusively for neurological patients, though it is expected that the Neurologist will share a ward with other Medical Specialists. Depending on the population size, a Neurologist will require between 5 and 8 dedicated Neurology beds.

14.3 Consultation Services

The Neurologist should provide a prompt and adequate Consultative Service, similar to that in metropolitan hospitals. Requests for in-patient consultation in the hospital should be met within 2 days, but, depending on the geographic spread of other hospitals served by the sole Neurologist, waiting times may be longer. Out Patient Consultation services will also be similar to those provided by a metropolitan hospital. It is important to recognise, however, that the Neurologist practising in isolation cannot provide a full service 52 weeks of the year, and therefore, alternative arrangements for neurological cover during this time will need to be made (for example by General Physicians, locum Neurologist or Senior Registrar in Neurology from a metropolitan centre).

14.4 Clinical Neurophysiology

The establishment of Clinical Neurophysiology in a population centre of this size depends on the availability of a person with some training in Clinical Neurophysiology. For example, if the Neurologist has expertise in electromyography, it would be appropriate for that person to obtain the necessary
equipment and perform EMG studies, rather than have patients in that area travel to a metropolitan centre for the test. Neurophysiological equipment should not be purchased and a laboratory established, however, if the Neurologist is not able to perform or supervise the tests. If a Clinical Neurophysiology Laboratory is established, it will be necessary to have Technician support - generally one Technician should be sufficient to perform the expected number of EEG and other studies generated by a population of this size. Patients who require sophisticated neurophysiological investigation (for example, EMG studies of neuromuscular transmission disorders, sphenoidal lead EEGs etc) will need to travel to the nearest metropolitan centre.

14.5 Neuroradiology

Access to specialised neuroradiological tests is required by a Neurologist in a population centre of this size. On-site CT scanning is essential. Basic Radiology, including skull and spine radiographs and plain tomography, will be available in all centres of this size. Depending on the skills of the Radiologists available and equipment, myelography and angiography might be performed. Patients requiring neuroradiological investigations not available locally will travel to the nearest metropolitan centre.

14.6 Neurosurgery

Neurosurgical Services will not be available on site for population centres of this size. Head injury and its immediate complications must be managed by a local General Surgeon. Advice about the management of such cases should be readily available from a Neurosurgeon in the nearest metropolitan centre. Patients with semi-urgent or non-urgent neurosurgical problems will be referred to the nearest metropolitan centre. Neurosurgical patients should be seen at the Neurosurgical Clinic within 6 weeks. The Neurologist must have a close liaison with the nearest metropolitan Neurosurgical Service to facilitate ready transfer of patients and to discuss management problems by telephone as necessary.

14.7 Neuropathology

Neuropathological Services will generally not be available in population centres of this size. A general Pathologist will be able to interpret some neurological specimens, including autopsy material, but specialised Neuropathology opinion will be obtained from the nearest metropolitan centre.

14.8 Other Health Professional Services

Because of the small number of Neurology beds in a non-metropolitan hospital of this size, a dedicated Neurology Nursing
Service and other full-time health professionals will not be possible. The services of Physiotherapists, Occupational Therapists, Speech Therapists, Dietitians and Social Workers will be shared with other medical specialties, but the required ratio of paramedical personnel to patients should be similar to that in a metropolitan service.

14.9 **Neuropsychology**

Neuropsychological Services will generally not be available in population centres of this size. Patients requiring specialised neuropsychological evaluation will need to travel to the nearest metropolitan centre.
15. NEUROLOGICAL SERVICE
IN A NON-METROPOLITAN REGION
(POPULATION 50,000 to 100,000)

15.1 In centres with a population of this size a Neurological Service could be provided by a General Physician with a special interest in Neurology. As a general principle, this person should be a Physician fully trained in General Internal Medicine, a requirement which would be met by the diploma, Fellowship of the Royal Australasian College of Physicians and this person should, in addition, have had not less than 2 years experience at Registrar or Senior Registrar level in a Neurology Service as part of his or her Advanced Training. There will be insufficient patients with neurological problems to justify such a Physician spending all of his time in neurological practice and this Physician must be willing to accept responsibility for in-patient General Medicine, along with other Physicians with differing special interests in the same hospital. The Physician with an interest in Neurology requires support from a fully developed metropolitan Neurology Service, as such a Physician will be unable to provide a full range of diagnostic services. His liaison with a metropolitan hospital should be both for discussion of patient management problems, as well as ready referral of patients with more difficult problems.

15.2 Specialist Neuroradiological Services will not be available. In population centres this size there will be at least one Radiologist. Skull and spine radiographs will be available and should be interpreted on site by the Radiologist. In addition, general tomography and ultrasound services might also be available, depending on the level of expertise and special interests of the Radiologist concerned.

15.3 Clinical Neurophysiology
Physicians with an interest in Neurology may have acquired expertise in an area of Clinical Neurophysiology such as EMG. It would be appropriate for the equipment to be provided so that studies can be performed without the need for patients to travel to larger centres. As a general principle, EEG and evoked potential services will be performed in the nearest regional or metropolitan centre. Although it may be possible for some of these tests to be performed locally at greater convenience to the patient, the number of patients tested in such a small centre is likely to be small and without supervision a high quality service cannot be provided. Disadvantages of having the services available in small centres include duplication of equipment and lack of expertise by the operators. Although it is a disadvantage to patients to travel to larger centres, the opinion of the Working Party is that it is more appropriate for patients to travel, if possible, so that the neurophysiological information obtained is of the highest quality.
16. NEUROLOGY SERVICES
FOR NON-METROPOLITAN HOSPITALS
(POPULATION LESS THAN 50,000)

16.1 A population of this size may generate sufficient problems in Neurology to justify a visit to the hospital from the Neurologist in the region. This Neurologist will come from the nearest regional or metropolitan centre. The Visiting Neurologist should provide visits to the hospital for clinic appointments, in-patient consultation and discussions with Physician and General Practitioner at approximately 6 weekly intervals. The frequency and duration of the visits would be influenced by the local population and the patterns of practice. These visits should contain a teaching component, the exact format of which will vary from one place to another. Patients with more urgent neurological problems will need to travel to the nearest regional or metropolitan centre for neurological care. Similarly, Clinical Neurophysiological Services will also be obtained from the nearest Clinical Neurophysiology Unit.

16.2 Neuroradiology
There will be no on-site Neuroradiology. Plain skull and spine radiographs may be performed by a Radiographer or another person (for example the local General Practitioner) and may be interpreted by the local General Practitioner or Physician. Patients requiring any other neuroradiological procedures will require transfer or referral to a larger centre.

16.3 Other Health Professional Staff
To assist in the long-term care of patients, a Physiotherapist, a Speech Therapist and Occupational Therapist should be available.
17. NATIONAL SERVICES

17.1 There are some neurological disorders that require investigation and treatment of such a specialised nature that it is unlikely that every metropolitan area would be able to provide the expertise or technology to meet the patients' requirements. In some instances this may justify referral to an overseas centre. In other cases, however, it would be more cost effective to establish a national centre. The following are some examples that should be considered:

17.2 **Intensive Investigation of Epilepsy**

The investigation and surgical treatment of patients with intractable epilepsy requires sophisticated clinical and neurophysiological evaluation and surgical treatment of a specialised kind. The equipment required to perform prolonged EEG recordings, video monitoring, ambulatory monitoring and electrocorticography is expensive and requires special expertise. In New Zealand, this need would be most appropriately met by establishing the technology and expertise to manage this important clinical problem in one of the metropolitan areas. Such a specialised Service would require specific funding for equipment and for the training of appropriate personnel, but this would be cost-effective when compared with the alternative of referring each patient to an overseas centre. Auckland is the only centre in New Zealand which could at present provide such a service. At Auckland Hospital, there are specialised neurophysiological techniques of the sort required for investigation of these patients. Neuropsychological evaluation is available, and neurosurgical expertise is also available. An active programme for investigation and treatment of these patients has already been established, but for it to continue, it will need to be formally funded as a national centre.

17.3 **Neuromuscular Disorders**

The investigation of patients with certain neuromuscular disorders requires laboratory facilities and technical expertise of a specialised kind, sufficient to justify the existence of a national centre for such disorders. At present, sophisticated and detailed study of patients with peripheral nerve disease is available only in Dunedin and it would seem appropriate for the role of the Dunedin Unit to be expanded, so that it is formally recognised as the national centre of excellence in peripheral nerve diseases.

Some patients with peripheral nerve, muscle, or neuromuscular transmission disorders require sophisticated EMG tests (for example single fibre electromyography) and it is likely that patients requiring these tests will need to travel to one or two metropolitan centres in New Zealand, depending on the availability of a Clinical Neurophysiologist with training in this area.
17.4 **Other Potential National Centres**

There are other areas in Neurology where special expertise is needed and it is possible that national centres of expertise in the study of movement disorders, multiple sclerosis and neuro-ophthalmology could be established.
GLOSSARY

AIDS (acquired immune deficiency syndrome) - a set of diseases caused by a virus transmitted sexually and amongst intravenous drug users who share needles. The disease is usually fatal. Some have predicted that there will be a major epidemic of this disease, but the magnitude of the problem cannot at this stage be predicted.

Angiography - an X-Ray technique where an injection of radio opaque material is injected into arteries or veins to enable X-Rays of these vessels to be taken.

Atheroma - degenerative disease of the walls of arteries; a common underlying cause of stroke.

Barium Studies - X-Ray studies using radio opaque material, usually in the stomach or bowel, to obtain outlines of the gastrointestinal tract.

Cerebellum - the part of the central nervous system which controls balance, co-ordination and gait.

Cerebral Palsy - brain damage sustained in early life, often resulting in abnormalities of gait and motor control and sometimes in intellectual impairment.

Clinical Neurophysiology - investigation of the nervous system using electrical tests (see Electroencephalography, Electromyography and Evoked Potentials).

Computerised Tomography (CT) - an X-Ray technique in which images of a thin slice of the body are constructed by a computer to provide high quality pictures of parts of the body in various planes. It is non-invasive and has replaced other painful and time consuming tests such as pneumoencephalography.

Dietitian - a person trained in the scientific use of diet in health and disease.

Electroencephalography - recording of the electrical activity of the brain.

Electromyography - electrical recording from normal and diseased muscles.

Electronystagmography - electrical recording of eye movements to study components of the mechanisms in the inner ear and brainstem controlling balance and eye movements.

Electroretinography - electrical studies of the function of the retina.
Epidemiology - the study of the incidence and prevalence of disease in the community.

Epilepsy - a syndrome in which seizures (convulsions) occur as a result of an underlying dysfunction of the brain.

Evoked Potentials - electrical recordings made after stimulation of sensory receptors (visual, somatosensory and brainstem auditory evoked potentials).

General Medicine - study of all diseases that affect the human body.

Geriatric Medicine - medical practice dealing with diseases of the elderly.

Hypertension - high blood pressure.

Immunology - the area of medical practice involved with the body's defence mechanisms against a variety of disease processes.

Intracranial haematoma - a blood clot inside the head; this often produces increased pressure in the head and may compress surrounding brain.

Magnetic Resonance Imaging - a radiological technique using electromagnetic fields and computer processing to obtain high quality images of the body without exposure to radiation.

Molecular Biology - the study of mechanisms of inheritance of disease.

Myelography - an X-Ray technique in which a liquid contrast material is introduced into the spinal canal by injection to allow radiographs of the spinal cord and its surroundings to be taken.

Neonate - newborn.

Nerve Conduction Studies - electrical tests to determine the speed of transmission of impulses along peripheral nerves.

Nervous System - the brain, spinal cord, nerves, muscles and special sense organs.

Neurologist - a medical specialist with expertise in diseases of the nervous system.

Neurology - the area of medical practice dealing with diseases of the nervous system.

Neuroradiology - radiology of the nervous system.

Neurosurgery - surgery of the nervous system.
Occupational Therapy - area of paramedical practice dealing with rehabilitation of physically and mentally disabled patients with particular reference to coping with day-to-day activities.

Ophthalmology - medical practice dealing with diseases of the eye.

Orthopaedic Surgery - medical practice dealing with diseases of bones and joints.

Paediatrics - medical practice dealing with diseases of children.

Peripheral Neuropathy - diseases of the peripheral nerves.

Posterior Fossa - the back part of the cranial cavity containing the cerebellum and brainstem.

Pneumoencephalography (air encephalography) - an X-Ray technique whereby air is injected into the spaces in and around the brain. This is painful and has been replaced by CT scanning.

Psychiatry - medical practice dealing with mental illness.

Radiology - the area of medical practice in which X-Ray techniques are used to investigate the structure and function of parts of the body in health or disease.

Speech Therapy - area of paramedical practice dealing with patients with disorders of speech and swallowing.

Spinal Cord - a component of the central nervous system contained within the spine; this has many fibre pathways which carry impulses to and from the brain.

Ultrasound - a radiological technique using sound waves to outline internal organs.
REFERENCES

2. Service Guidelines for the Care of Physically Disabled Adults.

**********
APPENDIX I

COMMUNITY ORGANISATIONS AND SUPPORT GROUPS AVAILABLE FOR THOSE WITH NEUROLOGICAL ILLNESS IN NEW ZEALAND

Alzheimer's Disease Society
Attendant Care Scheme
Co-ordinating Council for the Disabled
Cancer Society
Cerebral Palsy Society
Crippled Children Society
Counterstroke
Epilepsy Association
Paraplegic & Physically Disabled Foundation
Motor Neurone Society
Huntington's Disease Association
Medi-Call
Multiple Sclerosis Society
Muscular Dystrophy Association
Myalgic Encephalomyelitis Society
Head Injury Support Groups
The New Zealand Society for the Intellectually Handicapped (IHC)
Parkinson's Disease Society
Meals on Wheels Services
Various Residential Facilities for the Disabled
Various Nursing Homes and Hospitals Privately Funded
Various Local and Community Groups
COMMUNITY SERVICES FUNDED BY HOSPITAL BOARDS

Community Mental Health Service
Community Workshops
Domiciliary Physiotherapy
Domiciliary Occupational Therapy
Extramural Nursing Service
Community Social Work Services

**********
APPENDIX II

Equipment Requirements in Neurophysiology

EEG Machines - There should be at least one 16 channel machine per 1,000 EEG investigations per year with, in addition, a smaller portable unit for use in other parts of the hospital. Where special and prolonged EEG investigations are performed, it may be necessary to have an additional more sophisticated (e.g. 21 channel) machine.

EMG and Nerve Conduction Study Apparatus - There should be one machine per 1,000 patient EMG investigations per year. This requirement will vary, depending on the number of operators, the sophistication of the equipment, and the complexity of the tests to be performed. In large centres, the machine should have facilities for motor unit potential triggering, single fibre electromyography and other sophisticated peripheral nerve and muscle tests.

Evoked Potential Studies - A machine capable of recording and averaging evoked potentials will be required in larger centres. The tests performed depend on the experience of the Clinical Neurophysiologist, and the available Technician support. If recordings are made in Intensive Care Units, a portable machine will be required. In some centres, it may be appropriate to purchase a machine which combines EMG and evoked potential capabilities and this is particularly appropriate in smaller centres.

Other pieces of equipment (for example for electronystagmography, electoretinography etc) could be acquired by Units with special expertise in these areas.

**********