Australian Medical Workforce Advisory Committee

THE NEUROSURGERY WORKFORCE IN AUSTRALIA

SUPPLY AND REQUIREMENTS

1999 - 2010

AMWAC Report 2000.3

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
AHMAC	Australian Health Ministers' Advisory Council
AMWAC	Australian Medical Workforce Advisory Committee
AIHW	Australian Institute of Health and Welfare
AN-DRG	Australian National Diagnosis Related Groups
Aust	Australia
CME	Continuing Medical Education
DGP	Divisions of General Practice
DHAC	Commonwealth Department of Health and Aged Care
FRACS	Fellow of the Royal Australasian College of Surgeons
FTE	Full Time Equivalent
GP	General Practitioner
ICD-9-CM	International Classification of Diseases, Ninth Revision
NSA	Neurosurgical Society of Australasia
NSW	New South Wales
NT	Northern Territory
Qld	Queensland
RACS	Royal Australasian College of Surgeons
RRMA	Rural, Remote Metropolitan Areas classification
SA	South Australia
SPR	Specialist to Population ratio
Tas	Tasmania
Terr	Territory
Vic	Victoria
VMO	Visiting Medical Officer
WA	Western Australia

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Appendix B

TERMS OF REFERENCE OF AMWAC AND THE AMWAC NEUROSURGERY WORKFORCE WORKING PARTY

The Australian Health Ministers' Advisory Council (AHMAC) established the Australian Medical Workforce Advisory Committee (AMWAC) to advise on national medical workforce matters, including workforce supply, distribution and future requirements.

AMWAC Terms of Reference

1. To provide advice to AHMAC on a range of medical workforce matters, including:

   - the structure, balance and geographic distribution of the medical workforce in Australia;
   - the present and required education and training needs as suggested by population health status and practice developments;
   - medical workforce supply and demand;
   - medical workforce financing; and
   - models for describing and predicting future medical workforce requirements.

2. To develop tools for describing and managing medical workforce supply and demand which can be used by employing and workforce controlling bodies including Governments, Learned Colleges and Tertiary Institutions.

3. To oversee the establishment and development of data collections concerned with the medical workforce and analyse and report on those data to assist workforce planning.

AMWAC Neurosurgery Workforce Working Party Terms of Reference

As part of its 1999-2000 work plan, AMWAC was asked by AHMAC to prepare a report on the specialist neurosurgery workforce. The AMWAC Neurosurgery Workforce Working Party was established as a sub-committee of AMWAC and was asked to provide a report to AMWAC on the optimal supply and appropriate distribution of neurosurgeons across Australia, including projections for future requirements.

The Working Party held its first meeting on 29 October 1999 and presented a final report to the 16 August 2000 AMWAC meeting. The report accepted at the 19 October 2000 AHMAC meeting.

MEMBERSHIP OF AMWAC

Independent Chairman

Professor John Horvath Physician, Sydney

Members

Nominees of the Australian Health Ministers' Advisory Council

Mr Alan Bansemer Commissioner, Health Department of Western Australia

Mr Robert Wells First Assistant Secretary, Health Industry and Investment Division,
Commonwealth Department of Health and Aged Care

Dr Jeannette Young Medical Superintendent, Princess Alexandra Hospital, Brisbane

Nominee of Australian Institute of Health and Welfare

Dr Richard Madden Director, Australian Institute of Health and Welfare

Nominee of the Australian Medical Association

Dr Robert Bain Secretary General, Australian Medical Association

Nominee of the Australian Medical Council

Dr Lloyd Toft President, Medical Board of Queensland

Nominee of the Australian Vice Chancellors' Committee

Professor Allan Carmichael Dean, Faculty of Health Science, University of Tasmania

Nominee of the Committee of Presidents of Medical Colleges

Dr David Theile Surgeon, Brisbane
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Nominee of the Royal Australian College of General Practitioners

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MEMBERSHIP OF THE NEUROSURGERY WORKFORCE WORKING PARTY

Chairman

Dr David Theile	Surgeon, Brisbane (former President, Royal Australasian College of Surgeons)

Members

Assoc. Prof. Michael Besser	Neurosurgeon, Royal Prince Alfred Hospital, Sydney
Professor Andrew Kaye	Department of Neurosurgery, Royal Melbourne Hospital
Ms Kathy Meleady	Director, Statewide Services Development Branch New South Wales Health Department
Dr Alan Sandford	Manager Health Workforce Section, Victorian Department of Human Services (until March 2000)
Ms Susan Jekel-Sadleir	Policy Officer, AMWAC

INTRODUCTION, GUIDING PRINCIPLES AND METHODOLOGY

Introduction

The main objective of the Working Party has been to promote an adequate supply and appropriate distribution of appropriately trained neurosurgeons across Australia by the year 2010.

Underlying Principles

In compiling this report, the Working Party adopted the following underlying principles:

- the Australian community should have an adequate number of trained neurosurgeons, appropriately distributed to provide the surgical services it requires;
- the community is best served when neurosurgeons have high standards of qualification and work with a high level of ongoing experience matched by appropriate surgical facilities;
- the neurosurgery workforce must provide a range of individual practices from highly specialised to those covering the full spectrum of neurosurgery and making an interface with other surgical specialties;
- all Australian residents must have access to a good standard of neurosurgical care irrespective of geography and economic status. In achieving this, convenience to the patient must be balanced against the quality of services that can be distributed to meet that convenience; and
- an adequate amount of quality service must be provided by both the public and private sectors.

The Working Party defined a neurosurgeon as:
a qualified surgeon who is conducting surgical consultations in neurosurgery, medico legal consultations on neurosurgical conditions or is in a full time or part time academic position relating to neurosurgery. The definition will include those working in salaried positions and/or in private practice. It does not include other practitioners who, for one reason or another, undertake some neurosurgical work as part of their practice; nor does it include training registrars who hold positions in hospitals or the service registrars who work in neurosurgery but are not recognised as being in training positions.

Methodology

In estimating workforce numbers, establishing a profile of the workforce and assessing its adequacy, important sources of data were:

1. The Royal Australasian College of Surgeons (RACS)

The RACS keeps a variety of data, principally on number, age, gender and location of Fellows, and data on training posts and trainees.

AMWAC conducted a survey of neurosurgery RACS Fellows to supplement this data, with information on hours worked, practice patterns, and consultation waiting times, as well as some qualitative information. The results of the survey are summarised in Appendix B.

2. Australian Institute of Health and Welfare (AIHW)

The principal AIHW data source is the annual medical labour force survey which presents national labour force statistics for registered medical practitioners, principally through a survey collected as part of the annual renewal of registration. The numbers presented in this report are estimates produced from the 1997 survey. In producing these estimates, the AIHW has assumed that non-respondents to the survey had the same characteristics as respondents. Overall the survey had an 81.8% response rate.

3. Department of Health and Aged Care (Health and Aged Care) Medicare provider database

Medicare provider statistics define medical practitioners according to the predominant services billed to Medicare. The Medicare statistics include all practitioners who have billed Medicare for at least one service during a financial year.

The major deficiency with the use of Medicare data for workforce planning purposes is that it does not provide data on practitioners who are salaried neurosurgeons in the public hospital system and who do not render services on a fee for service basis. Medicare data thus exclude services rendered free of charge to public hospital patients, to Veterans' Affairs patients and to compensation cases.

4. National Hospital Morbidity Database

The AIHW National Hospital Morbidity database (ICD-9-CM groupings) has been used as a key source of data on service trends. The data are sourced from the AIHW Australian hospital morbidity database for all patients in public and private hospitals in Australia from 1993-94 to 1997-98. The data has been particularly useful in projecting neurosurgery service trends.

5. AMWAC Survey of Neurosurgery Public Hospitals

AMWAC surveyed all neurosurgery public hospitals in Australia in May/June 2000, to obtain information on public hospital specialist vacancies for both consultants/visiting medical officers (VMOs) and salaried/staff specialists. A vacancy was defined as an approved position for which funding is available and for which active recruitment action has been undertaken, but has been unsuccessful. Information was also sought on temporary resident doctors (TRDs) filling vacancies and training position vacancies.

6. Rural, Remote and Metropolitan Areas classification

Wherever possible, distributional data has been interpreted using the rural, remote and metropolitan area (RRMA) classification developed by the Commonwealth Departments of Primary Industries and Energy and the then Department of Health and Family Services (DPIE & DHFS 1994). A summary of the RRMA classification is provided in Appendix A.

7. Australian Bureau of Statistics

The Australian Bureau of Statistics (ABS) population data and projections are used as the sole source on population data. In making its population projections ABS uses three different series. The population projections in this report are based on Series II, where constant fertility and low overseas migration are assumed (ABS 1998).

Key Assumptions

The Working Party would like to emphasise that the projections for neurosurgery supply and requirements are based on the assumption that there will be no significant change in existing national health structures. If changes do occur AMWAC recommends the supply and requirements projections be reviewed.

In conducting the projection analysis, the Working Party has assumed that the current length of the neurosurgery training program will remain unchanged and that the majority of candidates will complete the program within this time frame. The Working Party has also assumed that the pattern of workforce participation and service delivery of the current workforce provides a suitable basis on which to project future workforce requirements.

It should also be noted that as a general course of action, AMWAC favours adjustment to trainee intake as the best long term solution to any anticipated imbalances between expected supply and estimated requirements. Hence the conclusions and recommendations are framed in this context.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

This report describes the current neurosurgery workforce, assesses the adequacy of that workforce, and projects workforce supply and requirements to the year 2010.

The report concludes that the neurosurgery workforce is meeting current requirements and to ensure requirements continue to be met, the number of trainees entering the advanced neurosurgery trainee program should be maintained at current levels. It is recommended that first year advanced neurosurgery trainee numbers be maintained at between six and eight trainees per year from 2001 onwards. To put this into context, there were five trainees entering in 1998, six in 1999, and nine in 2000.

Neurosurgery requirements have been estimated to increase by an average of 1.6% per year. This growth rate is based on the rate of increase in hospital separations following neurosurgery procedures between 1995-96 and 1997-98. This growth rate is slightly above the estimated growth in population combined with the effects of ageing, which is projected to be 1.3% per annum to 2010.

Description of the Current Neurosurgery Workforce

Number of Practising Neurosurgeons

- The Working Party estimated that the current size of the practising neurosurgery workforce is 104.

Distribution

- Neurosurgeons are predominantly located in metropolitan regions, with 87.7% in capital cities, 11.4% in other metropolitan areas and 0.9% in large rural centres, and no neurosurgeons located in other rural or remote areas.

- The national neurosurgeon to population ratio (SPR) is 1:183,763. South Australia has proportionately the greatest supply of neurosurgeons, with an SPR of 1:149,620. Tasmania and Victoria are slightly more generously supplied with neurosurgeons than the national average SPR, while New South Wales/Australian Capital Territory, Queensland and Western Australia show a lower SPR than the national average. No neurosurgeons are located in the Northern Territory.

Age Profile

- Based on the AIHW data, the average age of neurosurgeons in 1997 was 51.1 years and a total of 41.3% of the workforce was over the age of 55 years.

- There were very few neurosurgeons under the age of 35 years (3.5% of all neurosurgeons). The majority of neurosurgeons (87.7%) are distributed fairly evenly among the three 10 year age groups between 35 years of age and 64 years of age, with approximately 30% of neurosurgeons falling into each of these age groups.

- By State/Territory the average age of neurosurgeons ranged from a low of 48.4 years of age in Western Australia, to a high of 56 years of age in Tasmania. Queensland had the largest proportion of neurosurgeons over the age of 65 (14.3%), while South Australia, Western Australia, and Tasmania had no neurosurgeons over the age of 65 years.

Gender Profile

- Women make up 4.4% of the neurosurgery workforce (5 female neurosurgeons), and 6.9% of neurosurgery trainees.

- The neurosurgery workforce has a small proportion of females compared with all other specialties combined (15.6% female in the specialist workforce), but is comparable with the proportion of females in all surgical specialties (3.2% female).

Hours Worked

- The AIHW 1997 survey data show that, on average, neurosurgeons worked 58.3 hours per week and spent an average of 49.9 of these hours per week on direct patient care.

- Neurosurgeons in the 35 to 44 year age group worked the most hours per week (64.6 hours per week, on average).

- The average total working hours per week for neurosurgeons ranged from a high of 63.0 hours per week, on average, in New South Wales/Australian Capital Territory to a low of 52.9 hours per week on average, in South Australia.

Type of Practice

- Based on the AMWAC 2000 survey of the neurosurgery workforce, the majority of neurosurgeons worked in both a salaried or sessional position and in private practice (63.6%), 28.8% worked solely in private practice, and 7.6% worked solely in a salaried or sessional position.

- Overall, an average of 41.6% of their time was spent in a salaried or sessional position and 58.4% of their time was spent in private practice.

Services Provided

- The two key sources of data for neurosurgery services are Medicare data and hospital casemix data. The Health Insurance Commission processes all claims relating to private medical services provided out of hospital, and medical services for private patients in public and private hospitals. It is from this claims database that Medicare statistics are derived. For hospital casemix data, the key source of information is the AIHW National Hospital Morbidity database (ICD-9-CM) for neurosurgery procedures. The collection is based on admitted patient episodes and includes data for both public and private hospitals.

- While Medicare and hospital casemix data cannot be aggregated to provide a picture of national activity, as they are based on different sets of information, when looked at independently they provide a useful indication of the activity and trends in neurosurgery service provision over time.

- In 1998-99, neurosurgeons provided 155,922 Medicare services, an average of 1,417 services per provider.

- In total, utilisation of Medicare items with 100 or more services by neurosurgeons (excluding consultation items) has increased by 6.0% per annum between 1994-95 and 1998-99.

- Between 1994-95 and 1998-99, the neurosurgery specialist Medicare items which showed the greatest increase were spinal rhizolysis (28.4% per annum growth rate), intracranial stereotactic procedure (27.1% growth rate) and intervertebral disc-microsurgical discectomy (20.6% growth rate).

- To examine hospital service trends using this data source, the Working Party selected a range of AN-DRG codes related to neurosurgery.

- Between 1995-96 and 1997-98, the average increase for all selected procedures in total was 3.1% (1.6% per annum).

- By State and Territory, between 1995-96 and 1997-98 the largest increase in selected procedures occurred in the Northern Territory (10.2% per annum), followed by Western Australia (7.9% per annum), Victoria (2.9% per annum), Queensland (1.3% per annum), and New South Wales/Australian Capital Territory (0.5% per annum). For the same period, a decrease in the number of neurosurgery hospital separations occurred in both South Australia (-2.1% per annum) and in Tasmania (-6.9% per annum).

Training Arrangements

- Training in neurosurgery is coordinated by the RACS and overseen by its' Board of Neurosurgery. The RACS requires two years of basic surgical training, normally commencing after the intern year. Advanced training in neurosurgery, which follows the successful completion of basic surgical training, extends over five years, one of which is a research/elective year.

- At present the only accredited training programs are within capital cities in each State, mainly due to the infrastructure required to support a neurosurgical training unit.

- In 2000, there were 23 trainees out of an available 30 training positions.

- New South Wales/Australian Capital Territory had the highest proportion of trainees (47.8%), and Tasmania and the Northern Territory had no trainees.

- Between 1993 and 2000, the number of trainees entering the neurosurgery advanced training program increased by an average of 3.7% per annum, with an average of eight trainees entering the program per year.

- The majority of trainees were between 31 and 35 years old (51.7%). The average age of trainees in 1999 was 32 years and overall 6.9% of trainees were female.

- In 1999 the majority of trainees were in their fourth year of the advanced training program (14 out of 29 trainees or 48.3% of trainees).

Adequacy of the Current Neurosurgery Workforce

The Working Party concluded that the current neurosurgery workforce is adequately meeting current requirements.

Neurosurgeon to Population Ratio

- The national neurosurgeon to population ratio is estimated at 1:183,763 or 0.5 neurosurgeons per 100,000 population.

- Excluding the Northern Territory (which had no neurosurgeons) the specialist to population ratio ranged from a high of one neurosurgeon per 149,620 persons in South Australia to a low of one neurosurgeon per 198,772 persons in Queensland.

- The Neurosurgical Society of Australasia suggests that ideally there should be at least one neurosurgeon per 175,000 population.

- In comparison with some other countries, on a national level Australia is not well supplied with neurosurgeons. However it must be noted that international comparisons suffer because of uncertainties about definitions of specialist neurosurgeons and variations in style and scope of practice and health care systems.

Public Hospital Vacancies

- The 1997 AMWAC survey of all public hospital specialist vacancies, involving all specialties and sub-specialties, found that there was one neurosurgery vacancy. This vacancy was located in Tasmania.

- In May/June 2000 AMWAC surveyed the neurosurgery public hospitals in Australia, to obtain a snapshot of current vacancy rates. The survey results showed that there was one staff specialist vacancy, located in New South Wales, which represents approximately 1.0% of the neurosurgery workforce.

Elective Surgery Waiting Times

- Based on the most recently published national data (1995-96) on elective surgery waiting times by specialty, the median waiting time for neurosurgery was six days for urgent (category 1) patients and 18 days for non-urgent (category 2 and 3) patients.

- The Working Party noted that the 1995-96 data do not reflect current waiting times. In particular, members of the Working Party noted that the waiting times of category 2 and 3 neurosurgery patients, which comprise the majority of all neurosurgery patients, are considerably longer now than as shown by the 1995-96 data.

Consultation Waiting Times

- For a clinically urgent condition, the average waiting time to see a neurosurgeon in his/her private rooms is 2.4 days while a patient presenting to a public sector service would wait, on average, 7.4 days.

- The average waiting time for a standard first consultation with a neurosurgeon in his/her private rooms is 27.9 days while a patient presenting to a public sector service would wait much longer (62.6 days, on average).

Neurosurgeons' Workload

- Overall, 56.1% of neurosurgeons who responded to the AMWAC 2000 survey indicated that their workload was about right, 30.3% felt that their workload was too much and 13.6% felt that it was too little. In total, 38.5% of responding neurosurgeons felt that more neurosurgeons were required in their geographic area.

Projections of Requirements

Population

- Australia has a growing and an ageing population. The 1999 population was estimated at 18.9 million, and the population is estimated to increase by 0.9% per annum to 2010, with ageing of the population expected to add a further 0.4% to the demand for medical services, for a combined growth rate of 1.3%.

Trend in Neurosurgery Service Provision

- The growth rate in the number of Medicare services performed by neurosurgeons (excluding consultation items) increased by 6.0% per annum between 1994-95 and 1998-99.

- Between 1995-96 and 1997-98 the average increase for all selected neurosurgery procedures in total was 3.1% (1.6% per annum).

- Forecasts of future neurosurgery procedures were calculated by applying population projections to the hospital age utilisation data for 1997-98. The forecasts suggest that, in total, across all age groups and gender, the demand for

neurosurgery procedures over the next 20 years will continue to increase by between 1.5% per annum between 1997-98 and 2008, and 1.6% per annum between 1997-98 and 2018.

- For those aged 55 years or greater, the projected growth rate in neurosurgery procedures for the period 1997-98 to 2008 is 2.3% per annum, and between 1997-98 and 2018 it is 2.5% per annum.

- The Working Party concluded that the growth in hospital separations following neurosurgery procedures (1995-96 to 1997-98), of 1.6% per annum, best reflected the likely growth in neurosurgery requirements over the ten year projection period.

Projections of Supply

- The expected number of graduates for the next five years are as follows: five in 2000, six in 2001, none in 2002 (due to a changeover from a four year to a five year training program), six in 2003, and nine in 2004. Excluding the changeover year, 2002, the expected average number of graduates between 2000 and 2004 would be 6.5 per year.

- Assuming the average retirement age indicated by the AMWAC 2000 survey, 63.1 years, it can be estimated that approximately five neurosurgeons per year will retire during the next ten years.

- It is anticipated that the proportion of female neurosurgeons in the workforce may slowly increase, as the proportion of female trainee neurosurgeons (6.9% in 1999) is higher than that represented in the neurosurgery workforce.

Balancing Projected Supply with Projected Requirements

- The Working Party assessed various indicators as the basis for estimating future requirements for neurosurgeons. These indicators included population growth, trends in neurosurgery national hospital morbidity data and Medicare services data.

- Each selected requirement indicator was projected over the period 2000 to 2010, and the projections converted to FTE hours per week using the estimated average hours worked by neurosurgeons. This allowed comparisons to be made with projected supply data, which was similarly converted.

- The Working Party concluded that the per annum increase in hospital separations following neurosurgery procedures best reflected the likely growth range for neurosurgery service requirements. This provides an annual requirements growth range of 1.6% over the ten year projection period.

- The supply of neurosurgeons was projected by ageing the estimated number of neurosurgeons through each year of age, subtracting expected retirements (estimated approximately five per year) and adding expected new graduates.

- The number of neurosurgeons was converted to hours per week by applying the average number of hours worked to head counts in each major age cohort. These supply projections show that, based on the current estimated intake of trainees of 6 per year, supply is projected to increase from the estimated 2000 level of approximately 6,066 FTE hours per week to an estimated 7,404 FTE hours per week in 2010.

- Using these projected supply and requirements scenarios, a slight workforce undersupply is projected to 2006, peaking at 4.9% in 2003. For 2007 and onwards, the projected workforce will be above the estimated neurosurgery service requirements level. Assuming growth in requirements of 1.6% per annum, the resulting notional oversupply is estimated to be 0.5% in 2007, rising steadily to an estimated 3.4% by 2010.

- However, given that the average hours worked per week by neurosurgeons of 58.3 hours were among the highest of any medical specialist workforce, the Working Party considered that it would be useful to assess what the required intake of trainees would be if the average working hours of the neurosurgery workforce were more in line with the hours worked by other surgical workforces. In 1998 this was 56.7 hours per week.

- Three scenarios were summarised, based on varying the level of graduate output. The first scenario shows the likely outcome of maintaining approximately six graduates per year, and suggests a notional undersupply to 2009. The second scenario suggests that if output were seven graduates per year there would be a notional undersupply to 2007, and a slight oversupply thereafter, peaking at 3.8% in 2010. With eight graduates per year, the workforce achieves a balance by 2007 and thereafter there is a possibility of a steadily increasing excess.

- Based on the projection modelling results, the Working Party recommends that the number of graduates be maintained at between six and eight per year for the next few years (ie., ensuring that at least six trainees but preferably eight trainees enter the program each year, starting in 2001). It would seem appropriate that an update of this workforce review be undertaken in 2004-2005.

- It should be noted that the projection model is sensitive to the chosen requirement indicator, number of retirements per year, average hours worked and the age and gender profile of the workforce. If the expected requirement growth for neurosurgery varies from the projected trend of 1.6% per annum, or if any of the other factors mentioned changes significantly, then the model will need to be updated with these scenarios. The neurosurgery workforce is particularly sensitive to changes in these factors due to its relatively small total size.

- Placement of neurosurgery trainees is currently overseen by the RACS Board of Neurosurgery, which has a national selection policy to oversee the relatively small number of neurosurgery trainees across Australia. This is different to other surgical specialty training programs which may have larger trainee numbers and where the selection and placement is done mostly by State/Territory level committees. Although graduates from each State/Territory may train in their own State/Territory, it is not uncommon for trainees to move to different States/Territories, and no trainee can train entirely in one State/Territory, as they cannot spend more than two years in one particular training position. For these reasons, the Working Party feels that the placement of neurosurgery trainees should not be prescribed within this report, but that it continue to be regulated by the RACS Board of Neurosurgery, with consideration given to those States/Territories which are less well supplied by neurosurgeons.

- The Working Party would like to note its concern with the working conditions of neurosurgeons, particularly within public hospitals. The AMWAC survey results showed that some neurosurgeons are frustrated with the public system, and that the environment of public hospital practice is, in some cases, inadequate. While the Working Party acknowledges that the survey results are based on perception rather than trends and statistics, they felt that this point had sufficient merit, such that it is important to note its potential impact on workforce planning and recruitment. The Working Party would like to highlight their concern that difficult working conditions in public hospitals may contribute to neurosurgeons leaving the public sector and moving into the private sector, although this movement may not have an impact on overall workforce balance and adequacy. In the initial instance, the issue of public hospital working conditions needs to be pursued by the RACS and the NSA directly with the relevant State/Territory health authorities.

- The recruitment of neurosurgery trainees is also of concern to the Working Party. The number of qualified applicants to the neurosurgery training program has recently decreased to the point where there were seven unfilled training positions in 2000. If this continues to be the case in future years then ultimately too few trainees will be graduating from the program and this will lead to a developing shortage of neurosurgeons. Based on the survey of the workforce, the key reasons for this may be related to the nature of neurosurgery practice (demands of a neurosurgery practice and hours of work), the cost of medical indemnity insurance and working conditions. Comments also focused on the fact that neurosurgery does not appear as an attractive vocation to medical graduates. Both the RACS and the NSA have indicated to the Working Party that they intend to consider strategies to ensure unfilled training positions does not become a common occurrence.

RECOMMENDATIONS

The Working Party recommends:

1. To achieve an appropriate supply of neurosurgeons the annual average intake to the neurosurgery training program should be maintained at between six and eight trainees per year from 2001 onwards. (There were five trainees entering in 1998, six in 1999, and nine in 2000.)

   The aim of maintaining first year advanced trainee numbers within this range is to match workforce supply with an expected future growth in neurosurgery requirements of 1.6% per annum.

2. That the coordination of the neurosurgery trainee placements continue to be overseen by the Royal Australasian College of Surgeons (RACS) Board of Neurosurgery, in consultation with State/Territory health departments.

   That, subject to feasibility, the Board consider placing trainees in States/Territories which are less well supplied with neurosurgeons, including Queensland, New South Wales/Australian Capital Territory, and Western Australia.

3. That the RACS and the Neurosurgical Society of Australasia, in conjunction with State/Territory health departments, form a national working group to cooperatively develop strategies to overcome concerns regarding recruitment of an adequate number of neurosurgery trainees, facilities and working conditions for neurosurgeons and neurosurgical trainees in public hospitals, and provision of neurosurgery services to non-metropolitan areas.

4. That neurosurgery requirements and supply projections continue to be monitored regularly so that they can be amended if new trends in any of the workforce characteristics emerge or projection assumptions change. That this monitoring be coordinated by the RACS and AMWAC and the results incorporated into the AMWAC annual report to AHMAC. AMWAC will provide all necessary support.

5. That an update of this review of the neurosurgery workforce be undertaken in 2004-2005.

DESCRIPTION OF THE CURRENT NEUROSURGERY WORKFORCE

As discussed in the Introduction, there are a variety of data sources on the numbers, attributes and distribution of neurosurgeons across Australia. While each of these data collections has some deficiency, it is possible to piece together a reasonably accurate, up-to-date and coherent profile of the workforce.

In establishing the profile of the current neurosurgical workforce the Working Party defined:

- the number of neurosurgeons;
- the distribution of the neurosurgery workforce by State/Territory and geographic location using the RRMA classification;
- the age and gender profiles of the workforce;
- the hours worked; and
- the services provided.

The Number of Practising Neurosurgeons in Australia

The data sources used to estimate the size of the neurosurgery workforce are the records of the RACS, the Health Insurance Commission (HIC) Medicare database, and the AIHW medical labour force survey.

The RACS records indicate that in 2000, there were 104 practising Fellows in the specialty of neurosurgery. This figure includes those who undertake mainly medicolegal work and excludes those who are listed as neurosurgery Fellows but are retired and no longer practising.

Medicare data for 1998-99 identified 106 practising neurosurgeons. These data refer to specialists whose main Medicare billing activity was neurosurgery.

The AIHW 1997 annual medical labour force survey reported 119 specialists practising in neurosurgery. For most of these specialists (113) neurosurgery was their main specialty of practice. The survey also reported that five specialists practising in neurosurgery did not report a qualification in neurosurgery (4.2%). The AIHW 1997 survey shows that there are 112 specialists with neurosurgery as their main specialty of qualification.

While the Medicare and RACS figures, 106 and 104 neurosurgeons, respectively, are consistent with one another, the AIHW figure (113 neurosurgeons) is quite a bit higher. The reasons for the difference include that the AIHW data are based on 1997 information whereas the RACS and Medicare figures are more current, based on 2000 and 1998-99 data, respectively. There would have been several retirements from the neurosurgery workforce between 1997 and 1999. In addition, the AIHW data are self-reported, based on survey results, and therefore may include some individuals who are not necessarily actively practising in neurosurgery, but still consider themselves neurosurgeons.

The data from the RACS, Medicare, and the AIHW are summarised in Table 1.

Table 1: Number of neurosurgeons (various sources), selected years

RACS (2000)	Medicare (1998-99)	AIHW (1997)
104	106	113

Sources: RACS, DHAC, and AIHW

Growth in the Neurosurgery Workforce

Table 2 shows the changes occurring in the neurosurgical workforce since 1984-85, based on various data sources.

Medicare data show that the total number of neurosurgeons billing Medicare increased from 75 in 1984-85 to 106 in 1998-99 (an increase of 41.3%, which represents a compound annual increase of 2.5%). The total number of neurosurgeons, based on Medicare data, was the highest in 1997-98 with 109 reported neurosurgeons.

Data from the annual AIHW surveys indicate that between 1995 and 1997 the number of neurosurgeons ranged from 106 in 1995, 102 in 1996, to 113 in 1997. The compound annual increase between 1995 and 1997 was 3.2%.

Population growth between 1984-85 and 1998-99 was 19.5%, a per annum increase of 1.3%.

Table 2: Number of neurosurgeons (various sources), selected years 1984-85 to 1998-99

Source	1984-85	1994-95	1995-96	1996-97	1997-98	1998-99	% increase*
Medicare	75	94	97	106	109	106	2.5
AIHW	-	-	106	102	113	-	3.2

* compound annual increase
\- data not available for this year
Sources: DHAC and AIHW

Some idea of the growth in the neurosurgical workforce across States and Territories can be gained using Medicare data. Medicare data do not reveal the complete workforce but the inclusion criteria are constant and therefore provide an indication of the magnitude of change in the workforce. The data reveal that during the last few years the number of neurosurgeons claiming at least one Medicare benefit per year increased by 12.8%, a compound annual increase of 3.0% (Table 3). In comparison, during the same time period, the population increased by 5.0%, a compound annual increase of 1.2%. Between 1994-95 and 1998-99, the largest increase in number of neurosurgeons occurred in Victoria, which gained an additional six neurosurgeons.

Table 3: Number of neurosurgeons (Medicare), by State/Territory, 1994-95 and 1998-99

Year	NSW/ ACT/ Tas	Vic	Qld	SA	WA	Aust
1994-95	37	23	17	10	7	94
1998-99	39	29	17	11	10	106
% workforce increase*	1.3	6.0	0.0	2.4	9.3	3.0
% population increase*	1.0	0.9	2.0	0.3	1.8	1.2

* - compound annual increase
Sources: DHAC and ABS

Distribution of the Neurosurgery Workforce

Table 4 uses RACS data, AIHW 1997 survey data, Medicare data and ABS data to examine the distribution of neurosurgeons by State/Territory, as compared with the population share in each State/Territory.

The RACS data show that the distribution of neurosurgeons by State/Territory matches the distribution of population fairly well. In South Australia, Victoria and Tasmania, the State's share of neurosurgeons exceeded the share of population for the State. For all of the other States/Territories, their share of neurosurgeons is lower than the State/Territory's population share. Excluding the Northern Territory (which had no neurosurgeons compared with 1.1% of the population) the specialist to population ratio ranged from a high of one neurosurgeon per 149,620 persons in South Australia, to a low of one neurosurgeon per 198,772 persons in Queensland. Overall, the average specialist to population ratio was one neurosurgeon for every 183,763 persons.

The AIHW 1997 survey data and the Medicare 1998-99 data indicate a similar pattern. Overall, the AIHW and Medicare data show that Australia is slightly more generously supplied with neurosurgeons than indicated by the RACS (2000) data. The average specialist to population ratio based on Medicare (1998-99) data was one neurosurgeon per 176,723 persons, and the average ratio based on AIHW (1997) data was one neurosurgeon per 162,563 persons.

All three data sources indicate that there are no neurosurgeons located in the Northern Territory. Neurosurgery services are provided to Northern Territory residents by visiting neurosurgeons, primarily from South Australia, who provide consultations and perform procedures. Emergency neurosurgery services are provided by general surgeons located in the Northern Territory.

Table 4: Number of neurosurgeons and neurosurgeons per 100,000 population, by State/Territory, 1997- 2000

State/ Territory	Number	% of total Neurosurgeons	% of Australian population	SPR	Neurosurgeons per 100,000 pop'n
		RACS (2000)			
NSW / ACT	35	33.7	35.4	1 : 193,091	0.5
Vic	28	26.9	24.7	1 : 168,482	0.6
Qld	18	17.3	18.7	1 : 198,772	0.5
SA	10	9.6	7.8	1 : 149,620	0.7
WA	10	9.6	9.9	1 : 188,650	0.5
Tas	3	2.9	2.5	1 : 157,000	0.6
NT	0	-	1.1	-	-
Australia	104	100.0	100.0	1 : 183,763	0.5
		AIHW (1997)[a]			
NSW / ACT	36	31.6	35.5	1 : 182,894	0.5
Vic	30	26.3	24.8	1 : 153,503	0.7
Qld	20	17.5	18.4	1 : 170,060	0.6
SA	15	13.2	8.0	1 : 98,653	1.0
WA	10	8.8	9.7	1 : 179,810	0.6
Tas	3	2.6	2.6	1 : 157,833	0.6
NT	0	-	1.0	-	-
Australia	114	100.0	100.0	1 : 162,563	0.6
		Medicare (1998-99)			
NSW / ACT	39	36.8	38.0	1:182,505	0.5
Vic	29	27.4	24.8	1:160,259	0.6
Qld	17	16.0	18.5	1:203,435	0.5
SA	11	10.4	7.9	1:135,000	0.7
WA	10	9.4	9.8	1:182,860	0.5
NT	0	-	1.0	-	-
Australia	106	100.0	100.0	1:176,723	0.6

a - figures based on neurosurgeons whose main specialty of practice is neurosurgery
Sources: RACS, AIHW, DHAC and ABS.

Table 5 uses AIHW data (1997) and the RRMA classification to show the distribution of neurosurgeons by geographic location. The AIHW 1997 data indicated that almost all neurosurgeons (99.1%) were located in urban areas (87.7% in a capital city and 11.4% in other metropolitan areas). This distribution pattern has remained relatively consistent, with the 1996 AIHW survey showing 91.2% of neurosurgeons located in a capital city and 8.8% located in other metropolitan areas.

Examining the data by State/Territory, the AIHW 1997 survey data show that in four States (Victoria, South Australia, Western Australia, and Tasmania) all of the neurosurgeons were located in capital cities. The data also show New South Wales / Australian Capital Territory had a large proportion of neurosurgeons in capital cities (86.1%) with the remaining 13.9% located in other metropolitan centres. Queensland, with its different geography, showed a somewhat different distribution,

with 55.0% of neurosurgeons located in capital cities, 40.0% in other metropolitan locations and the remainder (5.0%) in large rural centres.

Comparing the distribution of neurosurgeons to the distribution of all surgeons and the population in each type of geographic location (Table 5), the non-metropolitan areas appear to be relatively poorly supplied with neurosurgeons. However, the data on neurosurgery patients (based on hospital separations following neurosurgery procedures) show that, despite the relatively low supply of neurosurgeons in non-metropolitan areas, the distribution of neurosurgery patients by geographic region is fairly consistent with the population. In total, 65.4% of neurosurgery patients are from metropolitan regions (58.0% from capital cities and 7.4% from other metropolitan areas), as compared with 71.3% of the population in metropolitan areas (63.7% in capital cities and 7.6% in other metropolitan areas).

Table 5: Distribution of neurosurgeons as compared with all surgeons, population, and neurosurgery patients, by geographic location, 1997

	Capital city %	Other metropolitan %	Large rural centre %	Other rural and remote %	Total %
Neurosurgeons	87.7	11.4	0.9	0.0	100.0
All surgeons	76.0	7.7	8.9	7.4	100.0
Population	63.7	7.6	6.0	22.7	100.0
Neurosurgery patients	58.9	7.5	6.3	27.3	100.0

Sources: AIHW and ABS.

A similar geographic distribution pattern was evident from the AMWAC 2000 survey of neurosurgeons, in which all respondents indicated that they were located in a metropolitan region. However, based on the AMWAC survey, 28.3% of responding neurosurgeons reported that they provide services in rural areas. Of those who indicated that they spent some of their time providing services in rural areas, the average time spent was 1.9 days per month, and all services provided in rural areas were consultations only (that is, no operative work).

It is important to note that a neurosurgery practice may not be sustainable within many rural areas, due to the infrastructure required to support a neurosurgery practice, including the availability of clinical support services and staff. The Neurosurgical Society of Australasia (NSA) recommends that a Department of Neurosurgery requires a minimum of two neurosurgeons with the appropriate infrastructure of neuro-radiology, neuro-pathology and neurology. At least eight beds per neurosurgeon are required, together with intensive care facilities, and an appropriate operating room with trained nursing staff and an operating microscope, neuro-navigational facilities, image intensification and Cavitron ultrasonic aspirator. In addition to infrastructure requirements, the population base required to sustain a

viable neurosurgical practice may not be available in many rural areas. The NSA notes that ideally there should be one neurosurgeon per 175,000 population.

Age Profile

According to the AIHW 1997 survey, the average age of neurosurgeons in Australia was 51.1 years (Table 6). Overall, 41.3% of neurosurgeons are aged 55 years and over. By State/Territory the average age of neurosurgeons ranged from a low of 48.4 years of age in Western Australia, to a high of 56 years of age in Tasmania. Queensland has the largest proportion of neurosurgeons over the age of 65 (14.3%), while South Australia, Western Australia, and Tasmania had no neurosurgeons over the age of 65 years. The majority of neurosurgeons (87.7%) are distributed fairly evenly among the three 10 year age groups between 35 years of age and 64 years of age, with approximately 30% of neurosurgeons falling into each of these age groups.

Table 6: Age profile of neurosurgeons, by age group and State/Territory, 1997

State/ Territory	Under 35 yrs %	35-44 yrs %	45-54 yrs %	55-64 yrs %	65+ yrs %	Total (all ages)	Average age (yrs)
NSW/ACT	0.0	34.3	28.6	25.7	11.4	100.0	51.3
Vic	12.9	29.0	19.4	29.0	9.7	100.0	50.4
Qld	0.0	23.8	23.8	38.1	14.3	100.0	51.7
SA	0.0	13.3	46.7	40.0	0.0	100.0	52.6
WA	0.0	60.0	0.0	40.0	0.0	100.0	48.4
Tas	0.0	0.0	50.0	50.0	0.0	100.0	56.0
NT	-	-	-	-	-	-	-
Australia	**3.5**	**29.8**	**25.4**	**32.5**	**8.8**	**100.0**	**51.1**

Source: AIHW

For Australia as a whole the average age of neurosurgeons indicated by the results of the AMWAC 2000 survey (50.2 years) was quite similar to the AIHW data (51.1 years).

Gender Profile

According to the AIHW 1997 survey, the majority of neurosurgeons are male (95.6%). The relatively small number of female neurosurgeons (only 5 across Australia) were located in Victoria and New South Wales/Australian Capital Territory (Table 7). While the neurosurgery workforce has a very high proportion of males compared with all other specialties combined (84.4% male in all other specialties combined), the proportion of males in neurosurgery is slightly below that for all surgical specialties (96.8% male in all surgical specialties combined).

It is anticipated that the proportion of female neurosurgeons in the workforce may slowly increase, as the proportion of female trainee neurosurgeons (6.9% in 1999) is higher than that represented in the neurosurgery workforce. In addition, the female

neurosurgeons currently in the workforce are relatively young, with no female neurosurgeons over the age of 65 years (three under 45 years of age and two between 55 and 64 years of age).

Table 7: Gender profile of neurosurgeons, by State/Territory, 1997

Gender	NSW / ACT	Vic	Qld	SA	WA	Tas	NT	Total
No. male	34	27	20	15	10	3	0	109
% male	94.4	90.0	100.0	100.0	100.0	100.0	0	95.6
No. female	2	3	0	0	0	0	0	5
% female	5.6	10.0	0	0	0	0	0	4.4
No. total persons	36	30	20	15	10	3	0	114
% total persons	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: AIHW

The AMWAC 2000 survey of neurosurgeons showed a similar gender profile for neurosurgeons with 97.1% male respondents and 2.9% female respondents. RACS records (2000) show that there are five females, representing 4.8% of the workforce.

Hours Worked

The AMWAC 2000 survey of neurosurgeons found that, on average, neurosurgeons responding to the survey worked a total of 63.7 hours per week. In the survey total hours worked were defined as total hours spent in patient care, including hours on call that were worked, plus time spent on non-patient care activities such as administration, continuing medical education, teaching and research.

As shown in Table 8, the AMWAC survey responses indicated that only 3.1% of the neurosurgery workforce worked an average of less than 35 hours per week. A total of 49.2% of the workforce worked at least 65 hours per week (32.3% worked between 65 and 79 hours and 16.9% worked more than 80 hours per week). The average hours worked per week ranged from a low of 50.5 hours in Western Australia to a high of 69.0 hours in New South Wales/Australian Capital Territory.

Table 8: Neurosurgeons, average total hours worked per week (%), by State/Territory, 2000

Hours worked	NSW / ACT	Vic / Tas	Qld	SA	WA	Aust.
Less than 35 hours	-	4.3	-	-	16.7	3.1
35 to 49 hours	-	4.3	10.0	14.3	16.7	6.2
50 to 64 hours	31.6	39.1	50.0	42.9	66.7	41.5
65 to 79 hours	36.8	30.5	40.0	42.9	-	32.3
80 hours or more	31.6	21.7	-	-	-	16.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Average hours worked	69.0	65.7	60.3	59.0	50.5	63.7

Source: AMWAC survey of neurosurgeons.

Table 9 shows a variation in the profile of hours worked by age group. In total, 54.0% of respondents under the age of 55 years indicated that they worked more than 65 hours per week on average, with 22.0% indicating that they worked more than 80 hours per week. In comparison, 33.3% of respondents aged 55 years or more indicated that they worked 65 hours per week or more, with none indicating that they worked more than 80 hours per week.

Table 9: Neurosurgeons, average total hours worked per week (%), by age group, 2000

Age group	Less than 35 hours	35 to 49 hours	50 to 64 hours	65 to 79 hours	80 hours or more	Total
Under 55 years	2.0	2.0	42.0	32.0	22.0	100.0
55 years and over	6.7	20.0	40.0	33.3	0.0	100.0

Source: AMWAC survey of neurosurgeons.

Another source of data on hours worked is the AIHW annual medical labour force survey. The 1997 survey results show that neurosurgeons worked an average of 58.3 total hours per week and spent an average of 85.6% of their working hours on direct patient care (49.9 hours per week) (Table 10). The AIHW data show lower average total hours worked by neurosurgeons, than was indicated by the AMWAC survey (63.7 hours per week, on average). Reasons for the differences in the two data sources (the AMWAC survey and the AIHW survey) include the timing of the surveys (the AIHW survey was 1997, and the AMWAC survey was 2000), the way the question is asked in each survey, and differences in survey response rates. The response rate for the AMWAC survey was 61.5%. For the AIHW 1997 survey, the overall response rate for the whole medical labour force was 81.8%, although this may not reflect the actual response rate for an individual specialty such as neurosurgery. The AIHW data are presented here for the purpose of allowing some comparisons between hours worked by neurosurgeons and those worked by other specialists, such as surgeons, as these data are also available in the AIHW survey results.

As shown in Table 10, the AIHW data show that neurosurgeons in the 35 to 44 year age group worked the most hours per week (64.6 hours per week, on average), while

those in the under 35 year age group worked the fewest (35.5 hours per week, on average). Overall, neurosurgeons worked much longer hours than all specialists combined (49.8 total hours per week, on average).

Table 10: Average hours worked by neurosurgeons, by age group, 1997

Age group	Under 35 yrs	35-44 yrs	45-54 yrs	55-64 yrs	65+ yrs	Total
Total hours worked	35.5	64.6	60.6	55.6	38.5	58.3
Direct patient care hours worked	30.5	52.1	54.3	47.1	34.3	49.9
Proportion (%) of direct patient care hours to total hours worked	85.9	80.7	89.6	84.7	89.1	85.6

Source: AIHW

As shown in Table 11, based on the AIHW 1997 survey the largest proportion of the workforce worked between 50 and 64 total hours per week on average (45.1%). A significant proportion of the neurosurgery workforce worked more than 65 total hours per week, on average (33.6%), which is a slightly larger proportion than for all surgeons combined (28.1%) and a much larger proportion than all specialists combined (17.0%).

Table 11: Number of neurosurgeons, average total hours worked per week as compared with all surgeons and all specialists, 1997

Average hours worked per week	Less than 35 hours	35 to 49 hours	50 to 64 hours	65+ hours	Total
No. neurosurgeons	10	14	51	38	113
% neurosurgeons	8.8	12.4	45.1	33.6	100.0
% all surgeons	11.5	17.7	42.8	28.1	100.0
% all specialists	15.7	27.8	39.5	17.0	100.0

Source: AIHW

Table 12 shows the average total working hours per week for neurosurgeons ranged from a high of 63 hours per week, on average, in New South Wales/Australian Capital Territory to a low of 52.9 hours per week on average, in South Australia. In terms of time spent on direct patient care, excluding Western Australia, neurosurgeons in Tasmania reported the largest proportion of total hours worked spent on direct patient care (93.5%), while those in Queensland reported the lowest proportion of total hours worked spent on direct patient care (78.3%).

Table 12: Average hours worked per week by neurosurgeons, by State/Territory, 1997

State/Territory	NSW / ACT	Vic	Qld	SA	WA	Tas	NT	Total
Total hours worked	63.0	55.6	56.2	52.9	58.4	53.5	0	58.3
Direct patient care hours worked	55.0	48.8	44.0	47.8	a	50.0	0	49.9
Proportion (%) of direct patient care hours to total hours worked	87.3	87.8	78.3	90.4	-	93.5	-	85.6

a – data suppressed due to low survey response rate.
Source: AIHW

Type of Practice

Respondents to the AMWAC survey were asked to indicate the proportion of time they spent in a salaried or sessional position and in private practice. The majority indicated that they worked in both a salaried or sessional position and in private practice (63.6%), with 28.8% indicating that all of their time was spent in private practice, and the remaining 7.6% spent all of their time in a salaried position. Overall, respondents indicated that, on average, 41.6% of their time was spent in a salaried or sessional position and 58.4% of their time was spent in private practice.

Services Provided

Surgical services in Australia are provided through Medicare and through other insurance arrangements in fee for service practice, and through the government funded public hospital system. Detailed service specific data on medical services which attract Medicare benefits are available for several years, while hospital casemix activity data are only available for recent years.

The HIC processes all claims relating to private medical services provided out of hospital and medical services for private patients in public and private hospitals. It is from this claims database that Medicare statistics are derived. While Medicare data only cover private practice billing activity, they do enable some broad conclusions to be drawn about the average number of services being provided per provider, and enable the identification of longer term trends. In addition, Medicare data can be separated into services provided by specialists and those provided by non-specialists.

For hospital data, the key source is the AIHW National Hospital Morbidity database (ICD-9-CM) for neurosurgical procedures and diagnosis. The collection is based on admitted patient episodes and includes data for both public and private hospitals.

The Medicare and hospital morbidity databases cannot be aggregated to provide a picture of national activity as they are based on different sets of information. However, when looked at independently they provide a useful indication of the activity and trends in neurosurgery service provision over time.

Medicare Services

Table 13 shows Medicare items with 100 or more services (based on 1998-99 data) provided by neurosurgeons. The data shown do not include consultation items (104 – initial consultation in consulting rooms, hospital or nursing home; 105 – subsequent consultation in consulting rooms, hospital or nursing homes), which would make up the majority of neurosurgery Medicare items. Between 1994-95 and 1998-99, the neurosurgery specialist items which showed the greatest increase were spinal rhizolysis (28.4% per annum growth rate), intracranial stereotactic procedure (27.1% growth rate) and intervertebral disc-microsurgical discectomy (20.6% growth rate). In total, utilisation of Medicare items with 100 or more services by neurosurgeons has increased by 6.0% per annum between 1994-95 and 1998-99.

Table 14 shows that in 1998-99, neurosurgeons provided 155,922 Medicare services, an average of 1,417 services per provider.

Table 13: Medicare items with 100 or more services by neurosurgeons (excludes consultation items), 1994-95 and 1998-99

Medicare item		1994-95	1998-99	% change 1994-98	Annual % increase*
40330	Spinal Rhizolysis	642	1,745	171.8	28.4
40306	Spinal Canal Stenosis	1,031	1,267	22.9	5.3
40301	Intervertebral Disc-microsurgical discectomy	427	904	111.7	20.6
40300	Intervertebral Disc laminectomy for removal	898	808	-10.0	-2.6
40303	Recurrent Disc Lesions	1,031	728	-29.4	-8.3
39709	Craniotomy	568	673	18.5	4.3
40803	Intracranial Stereotactic Procedure	256	669	161.3	27.1
39331	Carpal tunnel release	447	512	14.5	3.5
39712	Craniotomy for Removal of Meningioma	506	390	-22.9	-6.3
39800	Aneurism	354	334	-5.6	-1.4
39015	Ventricular reservoir, ext venticular drain	229	329	43.7	9.5
40009	Cranial, Cisternal or Lumbar Shunt - revision/ removal	339	309	-8.8	-2.3
40003	Cranial or Cistersal Shunt Diversion	370	281	-24.1	-6.6
39330	Neurolysis	274	277	1.1	0.3
40332	Cervical decompression of spinal cord	a	258	-	-
39603	Intracranial haemorrhage- osteoplastic craniotomy or extensive craniectomy	229	248	8.3	2.0
39600	Intracranial haemorrhage- burr-hole craniotomy	175	232	32.6	7.3
48648	Spine, bone graft to, (postero-lateral fusion)- 1 or 2 levels	193	222	15.0	3.6
39715	Pituitary Tumour	175	212	21.1	4.9
40600	Cranioplasty – reconstructive	126	182	44.4	9.6
39327	Neurectomy, neurotomy or removal of tumour from deep peripheral nerve	129	180	39.5	8.7
39112	Cranial nerve, intracranial decompression of, using microsurgical techniques	106	142	34.0	7.6
40312	Intradural Lesion – laminectomy	156	127	-18.6	-5.0
40309	Extradural Tumour or Abscess - laminectomy	134	125	-6.7	-1.7
39703	Intracranial tumour, cyst or other brain tissue, burr-hole and biopsy of	74	105	41.9	9.1
39109	Trigeminal gangliotomy, by radiofrequency, balloon or glycerol	119	101	-15.1	-4.0
30075	Biopsy - Lymph Gland,Deep Tissue or Organ (S)	74	100	35.1	7.8
	Total	**9,062**	**11,460**	**26.5**	**6.0**

* compound annual increase
a – less than 30 services during the year.
Source: DHAC

Table 14: Neurosurgery Medicare services and providers, 1998-99

	Top 25%	26-50%	51-75%	76-100%	Total
Number of providers	28	28	28	26	110
Number of services	112,339	23,849	16,530	3,204	155,922
Average number of services per provider	4,012	852	590	123	1,417

Source: DHAC

Hospital Casemix Data

For hospital casemix data, the key source of information is the AIHW National Hospital Morbidity database (ICD-9-CM) for neurosurgery procedures. The collection is based on admitted patient episodes and includes data for both public and private hospitals. To examine hospital service trends using this data source, the Working Party selected a range of AN-DRG codes related to neurosurgery. Table 15 shows hospital separations for the selected AN-DRG codes, and indicates that the average increase for all selected procedures in total was 3.1% (1.6% per annum). The majority of selected procedures (28 out of the 41 selected procedures) showed an increase in number of hospital separations between 1995-96 and 1997-98. Comparing the increases in neurosurgery hospital separations to population growth for the same period (2.8% between 1995-96 and 1997-98), 21 out of the 41 selected procedures showed an increase in excess of the population growth rate.

Table 15: Hospital separations for neurosurgery procedures, 1995-96 to 1997-98

AN-DRG code and description	1995-96	1996-97	1997-98	% change 1995-97	Annual % change*
53 Other disorders of nervous system with cc	1,901	2,865	3,070	61.5	27.1
818 OR proc for infectious and parasitic diseases age > 54 with cc	759	878	949	25.0	11.8
3 Tracheostomy except for mouth, larynx or pharynx age > 15	5,341	5,891	6,484	21.4	10.2
414 Back and neck procedures or spinal fusion with malignancy or with cc	3,128	3,320	3,776	20.7	9.9
28 Extracranial vascular procs with non-maj cc	1,334	1,484	1,607	20.5	9.8
25 Spinal procedures with cc	219	235	259	18.3	8.7
23 Craniotomy with cc	3,099	3,513	3,625	17.0	8.2
902 Other procs for other injuries without cc	9,487	10,591	11,024	16.2	7.8
39 Cranial and peripheral nerve disorders with cc	1,619	1,789	1,870	15.5	7.5
416 Back and neck procedures	9,177	10,243	10,579	15.3	7.4
26 Spinal procedures without cc	1,004	1,056	1,143	13.8	6.7
54 Other disorders of nervous system without cc	4,790	5,275	5,438	13.5	6.5
870 Tracheostomy for multi sign trauma > 15	508	533	561	10.4	5.1
41 Nervous system infection except viral meningitis	2,338	2,365	2,564	9.7	4.7
31 Procs for cerebral palsy, muscular dystrophy, neuropathy with cc	549	564	589	7.3	3.6
34 Peripheral and cranial nerve and other nervous system procs age < 55	2,991	3,138	3,193	6.8	3.3

Table 15 *(cont'd…)*: Hospital separations for neurosurgery procedures, 1995-96 to 1997-98

AN-DRG code and description	1995-96	1996-97	1997-98	% change 1995-97	Annual % change*
454 Medical back problems (age > 74 without cc) or (age < 75 with cc)	11,841	12,288	12,633	6.7	3.3
232 Vascular procs except maj recon without pump without cc	5,915	6,108	6,309	6.7	3.3
84 Neurological and vascular disorders	1,304	1,313	1,390	6.6	3.2
939 Aftercare without Sdx of history of malignancy	10,825	11,905	11,532	6.5	3.2
20 Acute quadraplegic/paraplegia, with or without OR proc	1,328	1,410	1,412	6.3	3.1
37 Cerebrovascular disorders except TIA with cc	15,267	15,678	16,056	5.2	2.6
415 Spinal fusion	3,146	3,154	3,304	5.0	2.5
24 Craniotomy without cc	3,961	4,206	4,153	4.8	2.4
40 Cranial and peripheral nerve disorders without cc	9,254	9,633	9,699	4.8	2.4
59 Nervous system neoplasms age > 64	1,949	2,010	2,039	4.6	2.3
60 Nervous system neoplasms age 25-64	2,580	2,467	2,677	3.8	1.9
32 Procs for cerebral palsy, muscular dystrophy, neuropathy without cc	5,156	5,244	5,278	2.4	1.2
29 Extracranial vascular procs without cc	3,117	3,070	3,073	-1.4	-0.7
50 Severe head injury	1,138	1,119	1,114	-2.1	-1.1
455 Medical back problems age < 75 without cc	48,657	46,970	46,932	-3.5	-1.8
51 Moderate head injury	3,367	3,142	3,197	-5.0	-2.6
38 Cerebrovascular disorders except TIA without cc	13,776	13,694	13,065	-5.2	-2.6
27 Extracranial vascular procs with maj cc	444	468	418	-5.9	-3.0
33 Peripheral and cranial nerve and other nervous system procs age > 54	533	479	493	-7.5	-3.8
61 Nervous system neoplasms age < 25	954	776	881	-7.7	-3.9
522 Pituitary procedures	431	417	393	-8.8	-4.5
950 Extensive OR proc unrelated to principle diagnosis	12,154	18,880	11,027	-9.3	-4.7
22 Ventricular shunt revision with no other OR proc	538	470	479	-11.0	-5.6
872 Craniotomy for multiple significant trauma	95	84	70	-26.3	-14.2
820 ORP for infect and para dis < 55 without cc	3,278	1,625	1,474	-55.0	-32.9
Total	**209,252**	**220,350**	**215,829**	**3.1**	**1.6**

*compound annual increase
Source: AIHW

Table 16 shows hospital separations for procedures indicating neurosurgery (see Table 15 for a description of the procedures included), by State/Territory. The data show that between 1995-96 and 1997-98, the largest increase in numbers occurred in the Northern Territory. For the same period, a decrease in the number of neurosurgery hospital separations occurred in both South Australia (-4.2%) and in Tasmania (-13.3%).

Table 16: Hospital separations for neurosurgery procedures, by State/Territory, 1995-96 to 1997-98

Year	NSW/ ACT	Vic	Qld	SA	WA	Tas	NT	Aust
1995-96	69,646	53,937	35,864	22,145	20,132	6,473	1,065	209,262
1996-97	73,962	57,501	37,761	21,168	21,456	7,347	1,155	220,350
1997-98	70,301	57,137	36,833	21,206	23,443	5,615	1,294	215,829
% change 1995-97	0.9	5.9	2.7	-4.2	16.4	-13.3	21.5	3.1
Annual % increase*	0.5	2.9	1.3	-2.1	7.9	-6.9	10.2	1.6

* compound annual increase
Source: AIHW

Table 17 shows hospital separations following neurosurgery procedures, by private and public sector. The proportion of hospital separations for the private sector has remained relatively consistent, at about 35%.

Table 17: Hospital separations for neurosurgery procedures, by private and pubic sector, 1995-96 to 1997-98

Sector	1995-96	1996-97	1997-98
Private	71,565	81,000	75,842
Public	137,687	139,350	139,987
Total	209,252	220,350	215,829
% private	34.2	36.8	35.1

Source: AIHW

Training Arrangements

Training in the surgical specialty of neurosurgery is coordinated by the RACS and overseen by its' Board of Neurosurgery. The RACS requires two years of basic surgical training, normally commencing after the intern year. Advanced training in neurosurgery, which follows the successful completion of basic surgical training, extends over five years, one of which is a research/elective year. Trainees can only undertake accredited training within an accredited neurosurgery training unit, and the maximum time that can be spent in one training unit is two years.

Each accredited training unit must have a structured educational program, including surgical audit, a tutorial program, neuro-radiology sessions, clinical meetings with neurologists and journal club. A candidate will not be approved for Fellowship until he/she has passed the Part II examination, had satisfactory progress reports from the specialty surgical supervisor of training, achieved the necessary volume of operative experience, and taken part in a research project. In addition to the intra-hospital activities, each State runs a tutorial program for trainees. The Board of Neurosurgery runs two major teaching seminars each year for all trainees from Australia, New Zealand and Singapore.

At present the only accredited training programs are within capital cities in each State, mainly due to the infrastructure required to support a neurosurgical training unit. The requirements for an accredited neurosurgery training unit are outlined by the Board of Neurosurgery of the RACS and include specialised support facilities, equipment, and staff, and a minimum volume and range of surgery per trainee. In general, there must be a minimum of three neurosurgeons for one accredited trainee and four neurosurgeons if there are two accredited trainees. The head of the unit, or supervisor of neurosurgical training, should spend at least 60% of their time within the hospital.

An accredited training unit must have the following equipment available: electroencephalogram (EEG) and electromyogram (EMG), computerised axial tomography (CAT) with 24 hour access, digital subtraction angiography, medical resonance imaging (MRI) access, stereotactic equipment, modern operating microscopes, and operative ultrasound. The required support services include neuro-radiology, medical neurology, neuropsychology and neuropsychiatry, accident and emergency, rehabilitation services, appropriate library facilities, intensive care unit, neuropathology access, dedicated secretarial support and office space for the unit, evidence of a regular surgical audit of diagnosis and outcome, and adequate office space for the training registrar.

In terms of volume and range of surgery, the RACS considers that there must be a minimum of 400 major neurosurgical procedures covering the whole scope of neurosurgery performed annually per advanced trainee; a minimum of 60 histopathologically verified tumours annually; 24 active neurosurgical beds; a minimum of five half day operating sessions per week per trainee, plus operating theatre time for emergencies. An affiliated hospital is only accredited if there is a minimum of 100 major neurosurgical procedures performed there annually, and rotation of trainees to other institutions must be based on a clear statement of the value of such a rotation.

The number of suitably qualified applicants to the neurosurgery training program has recently decreased to the point that there are now several vacant neurosurgery training positions. As shown in Table 18, in 2000 only 23 out of the available 30 training positions were filled. In 1999 there were 29 neurosurgery trainees, while in 2000 the total number of trainees dropped significantly, to 23. The decrease between the years is due to the fact that there were fewer suitable applicants to the training program in 2000 and many of the trainees already enrolled in the neurosurgery training program in 1999 would have completed the program by 2000.

The AMWAC survey asked respondents to indicate what they thought the reasons were for the recent decrease in qualified applicants. Based on the survey responses, the top three reasons for the decrease in qualified applicants were ‘demands of neurosurgery practice’, followed by ‘hours of work’ and ‘cost of malpractice insurance’ (see Appendix B).

Table 18: Neurosurgery training placements, by hospital and State/Territory, 2000

State/Territory	Hospital	Training Positions	Trainees
New South Wales / Australian Capital Territory		**12**	**11**
	New Children's, Westmead	1	1
	Prince of Wales	2	2
	Royal North Shore	2	2
	Royal Prince Alfred	2	2
	Sydney Children's, Prince of Wales	1	1
	St. Vincent's	1	1
	Westmead	2	2
	Woden Valley	1	0
Victoria		**8**	**6**
	The Alfred	1	0
	Austin and Repatriation	1	1
	Monash Medical Centre	1	1
	Royal Children's	1	0
	Royal Melbourne*	2	3
	St. Vincent's	2	1
Queensland		**4**	**2**
	Princess Alexandra/Mater Children's	1	0
	Royal Brisbane	2	2
	Royal Children's	1	0
Western Australia		**3**	**3**
	Sir Charles Gardiner	3	3
South Australia		**3**	**1**
	Royal Adelaide	3	1
Australia		**30**	**23**

* One of the three trainees at the Royal Melbourne Hospital is undertaking research in 2000 and is therefore not occupying one of the two clinical training positions.
Source: RACS

Table 19 shows the distribution of neurosurgery trainees by State/Territory. In 2000, there were 23 neurosurgery trainees throughout Australia, with New South Wales/Australian Capital Territory having the highest proportion of trainees (47.8%), and Tasmania and the Northern Territory having no trainees.

Table 19: Neurosurgery trainees, by State/Territory, 2000

State/Territory	Total number of trainees	% of trainees	% of population
NSW / ACT	11	47.8	35.4
Victoria	6	26.1	24.7
Queensland	2	8.7	18.7
South Australia	1	4.3	7.8
Western Australia	3	13.0	9.9
Tasmania	0	-	2.5
Northern Territory	0	-	1.1
Total	**23**	**100.0**	**100.00**

Source: RACS

Table 20 shows that between 1993 and 2000, the number of trainees entering the neurosurgery advanced training program increased by an average of 3.7% per annum, with the largest number of trainees entering the program in 1996. Since 1993 an average of 8 trainees per year have entered the neurosurgery advanced training program.

Table 20: Number of trainee neurosurgeons commencing the neurosurgery advanced training program, 1993-2000

	1993	1994	1995	1996	1997	1998	1999	2000	% change
Number of new trainees	7	7	8	15	8	5	6	9	3.7

* compound annual increase
Source: RACS

As shown in Table 21, the majority of trainees were between 31 and 35 years old (51.7%). The average age of trainees in 1999 was 32 years.

Table 21: Trainee neurosurgeons, percentage by age group, 1999

Age group	Up to 30 yrs	31 – 35 yrs	36 – 40 yrs	Unknown	Total
% of trainees	20.7	51.7	6.9	20.7	100.0

Source: RACS

Table 22 outlines the gender and training status of neurosurgery trainees. In 1999 the majority of trainees were in their fourth year of the advanced training program (14 out of 29 trainees or 48.3% of trainees). Overall, only 6.9% of trainees were female.

Table 22: Gender and training status of trainee neurosurgeons, 1999

Year of training	1st year	2nd year	3rd year	4th year	5th year	Total
Male	6	2	4	13	2	27
Female	0	1	0	1	0	2
Total	**6**	**3**	**4**	**14**	**2**	**29**

Source: RACS

The AIHW 1997 survey found that neurosurgery specialists-in-training worked an average of 71.2 hours per week, with 57.8 of those hours spent on direct patient care. When comparing hours worked by specialists-in-training to average hours worked by neurosurgeons (based on AIHW data), the data show that trainees work an average of 12.9 more hours per week. Trainees spent a slightly lower proportion of their total work hours on direct patient care (81.2%) than neurosurgeons (85.6%) (Table 10).

The Main Characteristics of the Neurosurgery Workforce

Neurosurgery is a small workforce (104 neurosurgeons), with 0.5 neurosurgeons per 100,000 population and an estimated one neurosurgeon for every 183,763 people.

The workforce is unevenly spread among the States and Territories, with New South Wales/Australian Capital Territory, Queensland, and Western Australia being relatively poorly supplied, as compared with their share of the population. There are no neurosurgeons located in the Northern Territory, although the Territory has a 1.1% share of Australia's population. Neurosurgery services are provided to Northern Territory residents by visiting neurosurgeons, with emergency neurosurgery services provided by general surgeons located in the Northern Territory. The majority of neurosurgeons practise in capital cities or other metropolitan areas (99%), with only 1% of the workforce located in rural areas.

Women currently represent only a small proportion of the neurosurgery workforce (approximately 5%, or 5 female neurosurgeons across Australia).

The age profile of the workforce is reasonably well distributed, with AIHW 1997 survey data showing an average age of 51.1 years, with 41% of the workforce over the age of 55 years. It is anticipated that this group of neurosurgeons (more than 55 years of age) will proceed through to retirement during the next ten years. The age profile varies across States and Territories, with neurosurgeons in Western Australia being below the national average age for neurosurgeons and those in Tasmania being above the national average age. The average age of neurosurgeons in the other States/Territories is quite close to the average age of neurosurgeons in Australia as a whole.

The AIHW 1997 survey data estimate that neurosurgeons work, on average, 58.3 hours per week. Overall, neurosurgeons worked much longer hours than all specialists combined (49.8 total hours per week, on average). The majority of the neurosurgery workforce works more than 50 hours per week (79%). A significant proportion work more than 65 total hours per week, on average (34%), which is a slightly larger proportion than for all surgeons combined (28% of all surgeons worked more than 65 hours per week, on average).

ADEQUACY OF THE CURRENT NEUROSURGERY WORKFORCE

There are a number of indicators of the adequacy of a medical workforce and no single measure can provide a definitive assessment. However, by examining each of the following it is possible to gain an indication of whether the workforce is adequately meeting current demand or if there is a significant shortfall or oversupply. The indicators chosen by the Working Party were:

- neurosurgeon : population ratio;
- public hospital vacancies;
- waiting times for elective surgery and consultations; and
- perceptions of the adequacy of the current workforce.

Neurosurgeon : Population Ratio

The national neurosurgeon to population ratio is estimated at 1:183,763 or 0.5 neurosurgeons per 100,000 population. Excluding the Northern Territory (which had no neurosurgeons) the specialist to population ratio ranged from a high of one neurosurgeon per 149,620 persons in South Australia to a low of one neurosurgeon per 198,772 persons in Queensland (Table 23).

The NSA suggests that ideally there should be at least one neurosurgeon per 175,000 population. In addition, the Society recommends that a Department of Neurosurgery requires a minimum of two neurosurgeons with the appropriate infrastructure of neuro-radiology, neuro-pathology and neurology.

In comparison with some other countries, on a national level Australia is not well supplied with neurosurgeons. However, it must be noted that international comparisons suffer because of uncertainties about definitions of specialist neurosurgeons and variations in style and scope of practice and health care systems. In Canada the 1996 national neurosurgeon to population ratio was estimated at 1:171,168 (Hugenholtz, 1996, p 4), although the recommended ratio is higher than that. The Canadian Federal/Provincial Advisory Committee on Health Manpower (1984) recommended a ratio of 1:165,000 for the year 2000, and the National Specialty Physician Review of the Royal College of Physicians and Surgeons of Canada (1988) recommended a ratio of 1:130,000 (Hugenholtz, 1996, p 10). The ratio in the United Kingdom is 1:500,000 (Popp and Toselli, 1996, p 181), and in the United States it is approximately 1:60,000 (Harrington, 1997, p 317; and Popp and Toselli, 1996, p 181).

Table 23: Neurosurgeons to population and number of neurosurgeons per 100,000 population, by State/Territory, 2000

State/ Territory	Number	% of total Neurosurgeons	% of Australian population	SPR	Neurosurgeons per 100,000 pop'n
NSW / ACT	35	33.7	35.4	1 : 193,091	0.5
Vic	28	26.9	24.7	1 : 168,482	0.6
Qld	18	17.3	18.7	1 : 198,772	0.5
SA	10	9.6	7.8	1 : 149,620	0.7
WA	10	9.6	9.9	1 : 188,650	0.5
Tas	3	2.9	2.5	1 : 157,000	0.6
NT	0	-	1.1	-	-
Australia	104	100.0	100.0	1 : 183,763	0.5

Source: RACS

Sustainable Neurosurgery Practice

The NSA suggests that, ideally there should be one neurosurgeon per 175,000 people. Comparing this NSA specialist to population ratio (SPR) with the actual SPRs (Table 23), the national specialist to population ratio is slightly below (1:183,763) the suggested benchmark. The SPR for New South Wales/Australian Capital Territory, Queensland, and Western Australia are well below the benchmark SPR, indicating an undersupply, while the other States/Territories (with the exception of the Northern Territory where there are no neurosurgeons) are above the benchmark. South Australia in particular has a reasonably high neurosurgeon to population ratio (1 : 149,620), indicating that it is well supplied with neurosurgeons.

In addition to the recommended specialist to population benchmark, the NSA recommends that a Department of Neurosurgery have a minimum of two neurosurgeons and at least eight beds per neurosurgeon. Appropriate infrastructure is also required, and includes neuro-radiology, neuropathology, neurology, intensive care facilities, appropriate operating room with trained nursing staff and an operating microscope, neuro-navigational facilities, image intensification, and Cavitron ultrasonic aspirator. It is important to note that a neurosurgery practice may not be sustainable within many rural areas, due to the specialised infrastructure required to support the practice.

Public Hospital Vacancies

The AMWAC definition of a vacancy is an approved position for which funding is available and for which active recruitment action has been undertaken, but has been unsuccessful.

A 1997 AMWAC survey of all public hospital specialist vacancies, across all specialties and sub-specialties, found that there was one neurosurgery vacancy, located in Tasmania. To obtain more current information, in May/June 2000 AMWAC surveyed public hospitals where neurosurgery is performed, to gain a snapshot of

current vacancy rates. The results showed that there was one staff specialist vacancy, located in New South Wales.

New South Wales Health has advised that the vacancy is not necessarily due to an inadequate workforce supply, but could in part be due to situational factors. The vacancy is in a metropolitan hospital with a relatively small neurosurgery service. The inability to fill the position may be due to lack of patient throughput and perceived lack of clinical support, as it was a single-neurosurgeon 'department'. Conditions have recently improved with the neurosurgery service in that hospital being formally networked with a neighbouring principal referral hospital.

One vacancy represents approximately 1.0% of the neurosurgery workforce.

It should be noted that, while the recent survey found only one vacancy based on the above definition, there were two New South Wales' hospitals which reported a total of three additional temporary VMO vacancies. However, these positions did not fit the AMWAC definition of a vacancy because either recruitment action had not yet been undertaken (for two of the positions) and in the third case a suitable applicant had been selected although the position will not be filled for several months. In one of the cases where recruitment action had not yet been undertaken, it had been delayed because it was assumed that no suitable applicants were currently available and therefore the recruitment action would have more chance of success if it was undertaken after the current neurosurgery trainees had graduated.

Elective Surgery Waiting Times

As shown in Table 24, AIHW data show that in 1995-96, for neurosurgery, the median waiting time for urgent patients (category 1) was six days and for non-urgent patients (category 2 and 3) the median waiting time was 18 days. In comparison, the median waiting time for all surgery was 8 days for urgent (category 1) patients and 36 days for non-urgent (category 2 and 3) patients.

Table 24: Median waiting time (days) prior to admission, by urgency category and specialty of surgeon, 1995-96

Specialty of surgeon	Category 1 [(a)]	Category 2 [(b)]	Category 3 [(b)]	Categories 2 and 3 [(a)]	All patients [(a)]
Cardiothoracic	7	40	19	27	13
Ear, nose and throat	8	44	70	57	36
General	8	34	46	29	17
Gynaecology	8	33	36	31	19
Neurosurgery	**6**	**34**	**21**	**18**	**11**
Ophthalmology	10	47	58	60	46
Orthopaedic	7	63	75	55	34
Plastic	9	46	57	37	24
Urology	12	32	41	32	22
Vascular	6	23	14	25	11
Other	1	19	40	8	3
All patients	**8**	**39**	**50**	**36**	**21**

(a) For patients admitted in New South Wales, South Australia, and the Northern Territory
(b) For patients admitted in South Australia and the Northern Territory
Source: AIHW

Table 25 shows the clearance times for neurosurgery patients in all categories were comparatively low, at approximately half a month for urgent (category 1) patients and less than two months for non-urgent (category 2 and 3) patients. Clearance time is the theoretical time it would take to clear all patients from the waiting list at a point in time, ie., the time it would take to clear a list if no new patients were added to the list.

Table 25: Clearance time (months) by specialty of surgeon and urgency category, 1995 and 1995-96

Specialty of surgeon	1995 [a] Category 1	1995 [a] Categories 2 and 3	1995 [a] All patients	1995-96 Category 1 [b]	1995-96 Categories 2 and 3 [b]	1995-96 All patients [b]
Cardiothoracic	0.5	1.5	1.1	0.4	1.7	1.1
Ear, nose and throat	0.7	4.7	4.0	0.9	5.0	4.1
General	0.5	30.	2.2	0.6	2.7	1.9
Gynaecology	0.6	2.2	1.8	0.5	2.1	1.6
Neurosurgery	**0.4**	**1.9**	**1.3**	**0.5**	**1.4**	**1.0**
Ophthalmolog	0.5	4.2	3.6	0.5	3.6	3.1
Orthopaedic	0.8	5.2	4.2	0.8	5.6	4.4
Plastic	0.8	5.0	3.8	0.9	4.3	3.0
Urology	0.8	3.7	2.9	0.8	3.1	2.4
Vascular	0.5	3.9	2.5	0.5	2.9	1.7
Other	0.2	1.4	1.0	0.2	1.7	1.0
All patients	**0.6**	**3.5**	**2.7**	**0.6**	**3.4**	**2.5**

(a) January to June 1995. All States and Territories except Queensland.
(b) All States and Territories except Victoria and Queensland.
Source: AIHW

While the 1995-96 data summarised above are the most recently published national information on surgery waiting times by specialty, more current data are available for selected States, including New South Wales and Western Australia. New South Wales publishes average waiting times for elective surgery, by specialty and by hospital. Figures published for February 2000 show the average waiting times for neurosurgery in New South Wales' hospitals ranged from 0 to 1.3 months. A total of 27.8% of hospitals (5 out of 18) showed no waiting time, and the median of the average waiting times among the 18 hospitals was 0.7 months. Western Australia publishes median waiting times for elective surgery, by specialty and urgency category, across metropolitan area hospitals only. Figures published for March 2000 show the median waiting time to be 23 days for urgent (category 1) neurosurgery patients, 109 days for semi urgent (category 2) patients and 216 days for non-urgent (category 3) patients.

The Working Party would have liked to access more current national information on elective surgery waiting times, but the 1995-96 data are the most recent published figures available by specialty. Members of the Working Party noted that waiting times have changed considerably since 1995-96, and that the figures do not reflect the current situation. In particular, the Working Party felt it was important to note that the waiting times of category 2 and 3 neurosurgery patients, which comprise the majority of all neurosurgery patients, are considerably longer now than as shown by the 1995-96 data (Table 24).

Consultation Waiting Times

The AMWAC survey of neurosurgeons collected information on neurosurgery consultation waiting times. In considering these waiting times, one needs to be aware that patients who ultimately become neurosurgical patients have a spectrum of urgency and a variety of intermediate steps including investigations and consultations with other specialists. The various steps each apply judgement about urgency and each have their own waiting times, which may affect the overall waiting time for a patient to eventually see a neurosurgeon.

The results of the survey are shown below in Table 26. The data reveal that for a clinically urgent condition, the average waiting time to see a neurosurgeon in his/her private rooms is 2.4 days while a patient presenting to a public sector service would wait, on average, 7.4 days. For a standard first consultation with a neurosurgeon in his/her private rooms the average waiting time is 27.9 days while a patient presenting to a public sector service would wait much longer (62.6 days or approximately two months, on average).

Table 26: Average waiting time (days) for neurosurgery services for a clinically urgent condition and a standard first consultation, by type of service and State/Territory, 2000

State/Territory	Public Outpatient	Private Room
Clinically urgent condition		
NSW/ACT	11.5	2.2
Victoria/Tasmania	4.6	1.7
Queensland	7.3	2.3
South Australia	7.4	2.7
Western Australia	10.8	5.5
Total	**7.4**	**2.4**
Standard first consultation		
NSW/ACT	44.7	34.5
Victoria/Tasmania	54.4	31.4
Queensland	117.9	21.9
South Australia	44.2	15.6
Western Australia	70.0	14.0
Total	**62.6**	**27.9**

Source: AMWAC survey of neurosurgeons.

Neurosurgeons' Workload

Overall, 56.1% of neurosurgeons who responded to the AMWAC survey indicated that their workload was about right, 30.3% felt that their workload was too much and 13.6% felt that it was too little. In total, 38.5% of responding neurosurgeons felt that more neurosurgeons were required in their geographic area.

In response to the question on capacity to increase their workload, 41.5% indicated that they felt they had time available to increase their operating time, 31.1% felt they had time available to increase their consultative work and 29.0% felt they had time available to increase their hospital work.

Conclusions on Adequacy of the Current Neurosurgery Workforce

Overall, the Working Party concluded that the current neurosurgery workforce is adequately meeting current requirements. None of the indicators chosen by the Working Party pointed to any significant workforce shortage, although there are some factors which were of concern. In general, waiting times for public patients were quite high, particularly for a standard first consultation in Queensland and Western Australia. For Australia as a whole, the SPR was slightly below the NSA suggested benchmark. Some of the individual State/Territory SPRs were above the benchmark, although New South Wales / Australian Capital Territory, Queensland, and Western Australia showed SPRs which were slightly below the recommended benchmark, and the Northern Territory reported no neurosurgeons.

Public hospital vacancies were acceptably low, and there was a reasonable degree of satisfaction with workload level, although a fairly high proportion of neurosurgeons responding to the AMWAC survey (38.5%) indicated that they felt more neurosurgeons were needed in their geographic area. The Working Party considered these factors to be indicative of potential maldistribution problems within the workforce, both geographically and between the private and public sectors. Further, they considered that these problems may stem from other systemic factors such as inadequate and/or inefficient funding and facilities, rather than being due to any overall workforce shortage.

PROJECTIONS OF REQUIREMENTS

Population

Australia has a growing and an ageing population. The 1999 population was estimated at 18.9 million, and the population is estimated to increase to 20.2 million by 2006 and 21.0 million by 2011 (ABS 1998). Between 1999 and 2010, the projected growth rate of the total population is 0.9% per annum.

ABS estimates that the median age of the total population will rise from 34.3 years in 1997 to between 40.1 and 41.1 years in 2021. As a proportion of the total population, those aged 65 years and over represented 12.1% (2.2 million) in 1997, and this proportion is projected to increase to 12.9% (2.6 million) in 2006, 14.0% (3.0 million) in 2011, and 17.9% (4.0 million) in 2021. These changes represent a growth rate in the over 65 year age group of 2.0% between 1997 and 2011 and 3.1% between 2011 and 2021.

Trend in Neurosurgery Service Provision

The Medicare and the National Hospital Morbidity databases provide information regarding trends in neurosurgery service provision over recent years and are useful indicators of likely future demand.

Services Attracting Medicare Benefits

The Working Party analysed the available data on the growth rate in the number of Medicare services performed by neurosurgeons, excluding consultation items. Between 1994-95 and 1998-99, total Medicare services performed by neurosurgeons (excluding consultations) increased an average of 6.0% per annum, an increase of 26.5% in total. During the same period, the growth rate in the top ten Medicare items provided by neurosurgeons averaged 6.9% per annum (a 30.4% increase in total), and for the top 20 items the growth rate averaged 6.4% per annum (a 27.9% increase in total).

National Hospital Morbidity Database

The Working Party analysed hospital separations following neurosurgery procedures of public and private patients. Between 1995-96 and 1997-98 the average increase for all selected procedures in total was 3.1% (1.6% per annum).

The 1997-98 data on hospital separations following a neurosurgery procedure show that a large proportion of the patients are over the age of 55 years (Table 27). A total of 50.9% of the neurosurgery procedures related to patients aged 55 years or over, whereas this age group represents only 20.8% of the population. In contrast, only 7.6% of neurosurgery separations relate to patients under the age of 20 years, whereas this age group represents 27.9% of the population.

The incorporation of service trend data such as the National Hospital Morbidity data with future population projections has the potential to provide forecasts of future

service requirements. Forecasts of future neurosurgery procedures have been calculated by applying projections of the population to the hospital age utilisation data for 1997-98. These projections suggest that in total, across all age groups and gender, the demand for neurosurgery procedures over the next 20 years will continue to increase. Forecasts of neurosurgery procedures for the period 1997-98 to 2008 indicate a growth rate of 1.5% per annum, for all ages, and a per annum growth rate of 2.3% for patients aged 55 years or greater. For the period 1997-98 to 2018, the forecasts indicate a per annum growth rate of 1.6% for all age groups, and 2.5% for those aged 55 years or greater. Neurosurgery procedures for females are expected to increase at a slightly lower rate than for males (Table 28).

Table 27: Actual and projected population and hospital separations for neurosurgery related procedures, by age group and gender, 1997-98 to 2018

Age group	Population			Separations ('000)		
	Male	Female	Total	Male	Female	Total
			1997-98 (actual)			
0 – 19 yrs	2,683,882	2,549,482	5,233,364	9.7	6.7	16.4
20 – 34 yrs	2,131,892	2,105,761	4,237,653	15.9	12.7	28.6
35 – 54 yrs	2,689,891	2,671,368	5,361,259	30.9	30.0	61.0
55 – 64 yrs	815,029	801,306	1,616,335	15.8	13.3	29.1
65+ yrs	999,203	1,282,545	2,281,748	38.8	41.9	80.7
Total (all ages)	**9,319,897**	**9,410,462**	**18,730,359**	**111.2**	**104.6**	**215.8**
Total 55+ yrs	1,814,232	2,083,851	3,898,083	54.6	55.2	109.8
			2008 (projected)			
0 – 19 yrs	2,659,651	2,523,936	5,183,587	9.7	6.6	16.3
20 – 34 yrs	2,192,325	2,135,206	4,327,531	16.4	12.8	29.2
35 – 54 yrs	2,956,625	2,992,328	5,948,953	34.2	34.0	68.1
55 – 64 yrs	1,207,197	1,203,323	2,410,520	23.4	20.0	43.4
65+ yrs	1,230,363	1,502,349	2,732,712	48.6	49.7	98.3
Total (all ages)	**10,246,161**	**10,357,142**	**20,603,303**	**132.2**	**123.2**	**255.3**
Total 55+ yrs	2,437,560	2,705,672	5,143,232	72.0	69.8	141.7
			2018 (projected)			
0 – 19 yrs	2,555,144	2,422,938	4,978,082	9.3	6.4	15.7
20 – 34 yrs	2,304,921	2,237,201	4,542,122	17.2	13.5	30.7
35 – 54 yrs	3,034,599	3,051,296	6,085,895	35.1	34.7	69.9
55 – 64 yrs	1,419,474	1,452,358	2,871,832	27.5	24.2	51.7
65+ yrs	1,713,747	2,008,121	3,721,868	66.4	64.7	131.1
Total (all ages)	**11,027,885**	**11,171,914**	**22,199,799**	**155.6**	**143.5**	**299.1**
Total 55+ yrs	3,133,221	3,460,479	6,593,700	93.9	88.9	182.8

Note: It is assumed that the rate of hospital separations for each age group for 1997-98 will remain constant to 2008 and 2018, and, using this assumption, 1997-98 hospital separations have been projected using the ABS population projections.
Sources: AIHW hospital morbidity database and ABS Catalogue 3222.0.

Table 28: Percentage increase in projected population and hospital separations for neurosurgery related procedures, by age group and gender, 1997-98 to 2018

Total % increase

Age group	Population			Separations		
	Male	Female	Total	Male	Female	Total
			1997-98 to 2008			
0 – 19 yrs	-0.9	-1.0	-1.0	-0.9	-1.3	-1.0
20 – 34 yrs	2.8	1.4	2.1	2.8	1.4	2.2
35 – 54 yrs	9.9	12.0	11.0	10.5	13.0	11.8
55 – 64 yrs	48.1	50.2	49.1	48.1	50.2	49.1
65+ yrs	23.1	17.1	19.8	25.1	18.6	21.8
Total (all ages)	**9.9**	**10.1**	**10.0**	**18.9**	**17.7**	**18.3**
Total 55+ yrs	34.4	29.8	31.9	31.8	26.3	29.0
			1997-98 to 2018			
0 – 19 yrs	-4.8	-5.0	-4.9	-4.1	-4.5	-4.3
20 – 34 yrs	8.1	6.2	7.2	8.1	6.2	7.3
35 – 54 yrs	12.8	14.2	13.5	13.6	15.7	14.6
55 – 64 yrs	74.2	81.2	77.7	74.2	81.2	77.4
65+ yrs	71.5	56.6	63.1	71.2	54.3	62.4
Total (all ages)	**18.3**	**18.7**	**18.5**	**40.0**	**37.1**	**38.6**
Total 55+ yrs	72.7	66.1	69.2	72.1	60.8	66.4

Annual % increase*

Age group	Population			Separations		
	Male	Female	Total	Male	Female	Total
			1997-98 to 2008			
0 – 19 yrs	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
20 – 34 yrs	0.3	0.1	0.2	0.3	0.1	0.2
35 – 54 yrs	0.9	1.0	1.0	0.9	1.1	1.0
55 – 64 yrs	3.6	3.8	3.7	3.6	3.8	3.7
65+ yrs	1.9	1.4	1.7	2.1	1.6	1.8
Total (all ages)	**0.9**	**0.9**	**0.9**	**1.6**	**1.5**	**1.5**
Total 55+ yrs	2.7	2.4	2.6	2.5	2.1	2.3
			1997-98 to 2018			
0 – 19 yrs	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
20 – 34 yrs	0.4	0.3	0.3	0.4	0.3	0.3
35 – 54 yrs	0.6	0.6	0.6	0.6	0.7	0.7
55 – 64 yrs	2.7	2.9	2.8	2.7	2.9	2.8
65+ yrs	2.6	2.2	2.4	2.6	2.1	2.3
Total (all ages)	**0.8**	**0.8**	**0.8**	**1.6**	**1.5**	**1.6**
Total 55+ yrs	2.6	2.4	2.5	2.6	2.3	2.5

Note: Percentage changes are calculated based on data from Table 25
* compound annual increase
Sources: AIHW hospital morbidity database and ABS Catalogue 3222.0.

Impact of Technology

Technological advance will have an impact on the utilisation of neurosurgery services. The impact is, however, difficult to quantify. Generally, it is considered that technology has two long term impacts – boosting practitioner productivity and broadening both the types and sophistication of procedures and treatments that are available to the public. New technology may also allow other specialists to be able to perform some of the tasks which are currently referred to neurosurgeons. Recognition of the difficulty of quantifying this impact in advance is one of the reasons why the AMWAC process includes regular updating of the data and conclusions contained in the original reports, as this enables the prompt inclusion of new trends brought about by technological advance.

Some of the current major technological changes in neurosurgery include: endovascular treatments for cerebrovascular disease, biological therapies for cerebral tumours, improvement of stereotactic techniques, radiosurgery, and instrumental fusions for spinal conditions. Although these and other changes will have a major influence on the way neurosurgery is practised, the Working Party considered that it was unlikely that they will have a significant impact on workforce numbers.

Neurosurgeons' Perceptions of Factors Affecting Workforce Requirements

Respondents to the AMWAC survey of neurosurgeons were asked to indicate whether they believed particular factors would increase workforce requirements, decrease workforce requirements or whether requirements would stay the same.

Among the important issues that respondents considered would increase workforce requirements were: ageing of the population, patient expectations/knowledge, and increasing level of specialisation. Factors perceived as most likely to decrease workforce requirements were: public health resource allocation and the introduction of managed care. Factors which respondents thought were most likely to influence requirements to remain the same were lifestyle changes that improve population health, increased productivity in hospitals, expectations of other health professionals, and access to beds, nurses, theatres, etc. (Table B20)

PROJECTIONS OF SUPPLY

Additions and Losses to the Neurosurgery Workforce

Additions to the Neurosurgery Workforce

Between 1993 and 2000, an average of eight trainees per year have entered the advanced neurosurgery training program. During the same period the average number of neurosurgery Fellows admitted to the RACS each year has been approximately seven. The RACS estimates that during the next five years an average of five neurosurgeons per year will complete the training program. The expected number of graduates for the next five years are as follows: five in 2000, six in 2001, none in 2002 (due to a changeover from a four year to a five year training program), six in 2003, and nine in 2004. Excluding the changeover year, 2002, the expected average number of graduates between 2000 and 2004 would be 6.5 per year. The Working Party also estimates that, based on trends in recent years, approximately one overseas neurosurgeon per year enters the Australian neurosurgery workforce.

Retirements

The AMWAC survey of neurosurgeons asked respondents to provide details of their retirement intentions. The expected age of retirement ranged from 50 years to 75 years, with an average expected retirement age of 63.1 years (mode 65 years; median 65 years; standard deviation 4.1). The survey results indicate that 21 neurosurgeons (31.8% of respondents) intend to retire by 2010, with 9 planning to retire by 2005 and the remaining 12 planning to retire between 2005 and 2010. (Table B19)

If the planned average retirement age of respondents to the AMWAC survey (63.1 years) is indicative of the intentions of the workforce in general, a large proportion of neurosurgeons can be expected to leave the workforce over the next ten years. Overall, AIHW data indicate that 41.3% of the neurosurgery workforce (47 neurosurgeons) are aged 55 years or greater (Table 6). If all of these neurosurgeons retire over the next ten years, this would result in an average loss of approximately 5 neurosurgeons per year. Medicare data indicate that there are 27 neurosurgeons over 60 years of age. If all of these neurosurgeons retired over the next five years this would also represent a loss of about 5 neurosurgeons per year.

Female Participation in the Workforce

The representation of women in the workforce is approximately 3% to 4% (AIHW 4.4%; AMWAC survey 2.9%). It is expected that the proportion of women in the workforce may slowly increase, as the proportion of female trainee neurosurgeons (6.9% in 1999) is higher than that represented in the neurosurgery workforce. In addition, the female neurosurgeons currently in the workforce are relatively young, with no female neurosurgeons over the age of 65 years (three under 45 years of age and two between 55 and 64 years of age). The number of females entering the neurosurgery training program ranged from a high of three (out of seven trainees in total) in 1993 to a low of no female trainees in 1994 (seven trainees in total), 1996

(15 trainees in total), and 1999 (six trainees in total). In 2000, there was one female trainee (out of nine trainees in total). The number of female trainees can be expected to increase somewhat over the next decade given the general growth in the number of females entering medical schools. However, because the proportion of women in neurosurgery is so low to begin with, the impact of an increased proportion of women graduating from the neurosurgery training program on the workforce is expected to be minimal.

Expected Changes in Work Hours

In total, 54.5% of respondents to the AMWAC survey of neurosurgeons indicated that they anticipated a change in the hours that they work over the next ten years, with 36.4% anticipating a reduction in their hours and 18.2% planning to increase their hours worked (Table B16). Of the 24 responding neurosurgeons who expected their work hours to decrease over the next ten years, 54.2% were over 55 years of age. Of the 12 responding neurosurgeons who expected their work hours to increase, 83.3% were under the age of 45 years. Only a small percentage of respondents under the age of 45 planned to decrease their hours worked (10.7% of those in the 35 to 44 year age group). A large percentage of those in the 55 years and over categories planned to decrease their work hours (90.9% of those aged 55 to 64 years and 75.0% of those aged 65 years or greater) (Table B17).

Provision of Services in Rural and Remote Areas

All of the respondents to the AMWAC survey of neurosurgeons indicated that their primary practice was located in a metropolitan area. In total, five respondents (7.6%) to the AMWAC survey indicated that they had another practice where they do additional work on a regular basis, in a rural area. However, almost one-third of respondents indicated that they provide outreach services to rural areas (28.3% or 17 respondents). Based on 1997 AIHW data, more than 99% of neurosurgeons practise in metropolitan areas (87.7% in capital cities and 11.4% in other metropolitan areas).

Comparing the distribution of neurosurgeons to the population and the distribution of all surgeons and the population in each type of geographic location (Table 5), the non-metropolitan areas appear to be relatively poorly supplied with neurosurgeons. However, the data on neurosurgery patients (based on hospital separations following neurosurgery procedures) show that, despite the relatively low supply of neurosurgeons in non-metropolitan areas, the distribution of neurosurgery patients by geographic region is fairly consistent with the population. In total, 65.4% of neurosurgery patients are from metropolitan regions (58.0% from capital cities and 7.4% from other metropolitan areas), as compared with 71.3% of the population in metropolitan areas (63.8% in capital cities and 7.6% in other metropolitan areas).

It is important to note that a neurosurgery practice may not be sustainable within many rural areas, due to the infrastructure required to support a neurosurgery practice, including the availability of clinical support services, equipment and staff. In addition to infrastructure requirements, the population base required to sustain a viable neurosurgical practice may not be available in some rural areas.

The Working Party believes that the provision of neurosurgery services to non-metropolitan areas needs careful planning by State/Territory health departments and neurosurgeons, taking into account geography, demographics and the requirements for a sustainable neurosurgery service.

BALANCING SUPPLY AGAINST REQUIREMENTS

The standard AMWAC specialist medical workforce projection model has been used to project a neurosurgical supply and requirements scenario to 2010. On the supply side, the model takes into account expected entrants to the workforce and those leaving, converts the number of specialists to a full time equivalent (FTE) figure using the average hours worked per week by age and gender, and factors in the expected lower average lifetime workforce contribution of female specialists. On the requirements side, the likely trend in demand for neurosurgical services is included, based on the Working Party's assessment of the expected trend in requirements (Theile et al, 1998).

Both supply and requirements have been projected over a ten year period to 2010. It is recognised that a ten year projection period is a long time frame for assumptions to remain valid. However, this time frame was chosen because five years was considered to be too short for any impact on training numbers to move through, given that the neurosurgical training program is a minimum of five years.

Requirement Trends

The Working Party assessed various indicators as the basis for estimating future requirements for neurosurgeons. These indicators included population growth, trends in neurosurgery national hospital morbidity data and Medicare services data.

Each of the selected requirement indicators has been projected over the period 2000 to 2010 and the results are outlined in Table 29. The projections have been converted to FTE hours per week using the estimated average hours worked by neurosurgeons of 58.3 hours per week. For the projection modelling, the Working Party assumed one current vacancy, as identified by the public hospital vacancy survey. Conversion of the data to hours worked allows comparisons to be made with projected supply data, which has been similarly converted.

The Working Party concluded that the growth in hospital separations in recent years (1995-96 to 1997-98) best reflected the likely growth range for neurosurgery requirements. This indicator provides an annual requirements growth rate of 1.6% over the ten year projection period, which is slightly higher than the projected growth in population combined with the effects of ageing (1.3%) for the ten year period.

Table 29: Projected requirements for neurosurgery services (in FTE hours per week) for selected indicators , 2000 to 2010*

Projected requirements for neurosurgery services in FTE hours per week	% growth pa	2000	2002	2004	2006	2008	2010
Population growth (1997-2010)	0.9	6,124	6,236	6,351	6,467	6,586	6,706
Population growth and ageing (1997-2010)	1.3	6,124	6,286	6,452	6,622	6,797	6,977
Medicare service provision (1994-95 to 1998-99)	6.0	6,124	6,887	7,744	8,709	9,794	11,013
Hospital separations ICD-9-CM (1995-96 to 1997-98)	1.6	6,124	6,316	6,515	6,720	6,931	7,149

*Assumes an average of 58.3 hours worked per week
Source: AMWAC

Supply Trends

The supply of neurosurgeons was projected by ageing the estimated number of neurosurgeons through each year of age, subtracting expected retirements (estimated at approximately five per year) and adding expected new graduates (five in 2000, six in 2001, none in 2002, six in 2003 and nine in 2004). The expected number of graduates for the years 2000 to 2004 were provided by the RACS Board of Neurosurgery, based on the number of commencing students for the relevant years and historical trainee progression rates. The Working Party estimated that, based on trends in recent years, approximately one overseas neurosurgeon per year will enter the Australian neurosurgery workforce. From 2005 to 2010 the number of graduates has been estimated as averaging six per year.

The number of neurosurgeons was converted to hours per week by applying the average number of hours worked to head counts in each major age cohort. In doing so the Working Party assumed that the pattern of workforce participation of the current workforce provides a suitable basis on which to project future workforce requirements. These supply projections show that, based on the current estimated intake of trainees of six per year, supply is projected to increase from the estimated 2000 level of approximately 6,066 FTE hours per week to an estimated 7,404 FTE hours per week in 2010 (Table 30).

Table 30: Projected supply of neurosurgery services (in FTE hours per week), 2000 to 2010[a]

Year	Expected graduates	Estimated FTE hours
2000	5	6,066
2001	6	6,099
2002	0	6,214
2003	6	6,115
2004	9	6,239
2005	6	6,504
2006	6	6,680
2007	6	6,858
2008	6	7,039
2009	6	7,221
2010	6	7,404

a – based on an average of 6 graduating neurosurgeons per year.
Source AMWAC

Projected Balance

Using the projected supply and requirements scenarios summarised in Tables 29 and 30, an indication of the expected shortage or oversupply within the workforce can be calculated. As outlined in Table 31, a slight undersupply is estimated until 2006, peaking at 4.9% in 2003. For 2007 and onwards, the projected workforce will be above the estimated neurosurgery service requirements level. Assuming growth in requirements of 1.6% per annum, the resulting notional oversupply is estimated to be 0.5% in 2007, rising steadily to an estimated 3.4% by 2010.

Table 31: Projected neurosurgery supply and requirements (in FTE hours per week), 2000 to 2010[a]

Year	Projected supply	Projected Requirements	Estimated (over)/under supply (%)
2000	6,066	6,124	1.0
2001	6,099	6,219	2.0
2002	6,214	6,316	1.7
2003	6,115	6,415	4.9
2004	6,239	6,515	4.4
2005	6,504	6,616	1.7
2006	6,680	6,720	0.6
2007	6,858	6,824	(0.5)
2008	7,039	6,931	(1.5)
2009	7,221	7,039	(2.5)
2010	7,404	7,149	(3.4)

a – based on a growth rate of 1.6%, average retirement rates (5 per year), average graduating neurosurgeons (6 per year), and a working week of 58.3 hours.
Source AMWAC

To balance the future neurosurgery requirement growth indicator of 1.6% per annum, a variety of scenarios showing different number of graduates per year between 2005 and 2010 were examined. 2005 is the first year in which the number of graduates can be changed, as the neurosurgery training program is five years, and those trainees who are expected to graduate up to the year 2004 would already have entered the training program. Table 32 shows three scenarios – five graduates per year, six graduates per year and seven graduates per year, between 2005 and 2010. The three scenarios in Table 32 assume neurosurgeons work an average of 58.3 hours per week (based on the 1997 AIHW medical labour force survey results).

Table 32 shows that the scenario of maintaining approximately five graduates per year results in a slight notional undersupply to 2008, reaching a balance in 2009, and a slight oversupply (0.2%) by 2010. For six graduates per year there is a slight notional undersupply to 2006, and a steadily increasing notional oversupply thereafter, peaking at 3.4% in 2010. With seven graduates per year the notional oversupply peaks at 6.4% in 2010. None of the scenarios impact on the projected slight undersupply in 2005, as the graduates from 2005 will not enter the workforce until 2006.

Table 32: Estimated neurosurgery graduate output required to move projected supply into balance with projected requirements (in FTE hours per week, assuming neurosurgeons work an average of 58.3 hours per week), by selected graduate output scenarios, 2005 to 2010

Year	Projected Supply	Projected Requirements	Estimated (over)/under supply (%)
Projected supply for 5 graduates per year, 2005 to 2010			
2005	6,504	6,616	1.7
2006	6,640	6,720	1.2
2007	6,773	6,824	0.8
2008	6,905	6,931	0.4
2009	7,036	7,039	0.0
2010	7,166	7,149	(0.2)
Projected supply for 6 graduates per year, 2005 to 2010			
2005	6,504	6,616	1.7
2006	6,680	6,720	0.6
2007	6,858	6,824	(0.5)
2008	7,039	6,931	(1.5)
2009	7,221	7,039	(2.5)
2010	7,404	7,149	(3.4)
Projected supply for 7 graduates per year, 2005 to 2010			
2005	6,504	6,616	1.7
2006	6,719	6,720	0.0
2007	6,943	6,824	(1.7)
2008	7,173	6,931	(3.4)
2009	7,406	7,039	(5.0)
2010	7,642	7,149	(6.4)

Based on a growth rate of 1.6%, average retirement rates (5 per year), and a working week of 58.3 hours.
Source: AMWAC

However, given that the average hours worked per week by neurosurgeons of 58.3 hours were among the highest of any medical specialist workforce, the Working Party considered that it would be useful to assess what the required intake of trainees would be if the average working hours of the neurosurgery workforce were more in line with the hours worked by other surgical workforces. In 1998 this was 56.7 hours per week. Accordingly, Table 33 shows the results of this modelling, which has assumed that neurosurgeons worked, on average, the same hours as other surgeons. In addition, three scenarios are summarised, based on varying the level of graduate output. The first scenario shows the likely outcome of maintaining approximately six graduates per year, and suggests a notional undersupply to 2009. The second scenario suggests that if output were seven graduates per year there would be a notional undersupply to 2007, and a slight oversupply thereafter, peaking at 3.8% in 2010. With eight graduates per year, the workforce achieves a balance by 2007 and thereafter there is a possibility of a steadily increasing excess. As in Table 32, none of the scenarios impact on the projected slight under supply in 2005, as the graduates from 2005 will not enter the workforce until 2006.

Table 33: Estimated neurosurgery graduate output required to move projected supply into balance with projected requirements (in FTE hours per week, assuming neurosurgeons work an average of 56.7 hours per week), by selected graduate output scenarios, 2005 to 2010

Year	Projected Supply	Projected Requirements	Estimated (over)/under supply (%)
Projected supply for 6 graduates per year, 2005 to 2010			
2005	6,326	6,616	4.6
2006	6,496	6,720	3.4
2007	6,670	6,824	2.3
2008	6,846	6,931	1.2
2009	7,023	7,039	0.2
2010	7,201	7,149	(0.7)
Projected supply for 7 graduates per year, 2005 to 2010			
2005	6,326	6,616	4.6
2006	6,535	6,720	2.8
2007	6,753	6,824	1.1
2008	6,976	6,931	(0.6)
2009	7,202	7,039	(2.3)
2010	7,432	7,149	(3.8)
Projected supply for 8 graduates per year, 2005 to 2010			
2005	6,326	6,616	4.6
2006	6,574	6,720	2.2
2007	6,835	6,824	(0.2)
2008	7,106	6,931	(2.5)
2009	7,382	7,039	(4.7)
2010	7,663	7,149	(6.7)

Based on a growth rate of 1.6%, average retirement rates (5 per year), and a working week of 56.7 hours.

Source: AMWAC

Based on the projection modelling results shown in Tables 32 and 33, the Working Party recommends that the number of graduates be maintained at between six and eight per year for the next few years (ie., ensuring that at least six trainees but preferably eight trainees enter the program each year, starting in 2001). It would seem appropriate that an update of this workforce review be undertaken in 2004-2005.

It should be noted that the projection model is sensitive to the chosen requirement indicator, number of retirements per year, average hours worked and the age and gender profile of the workforce. If the expected requirement growth for neurosurgery varies from the projected trend of 1.6% per annum, or if any of the other factors mentioned changes significantly, then the model will need to be updated. The neurosurgery workforce is particularly sensitive to changes in these factors due to its relatively small total size.

Placement of neurosurgery trainees is currently overseen by the RACS Board of Neurosurgery, which has a national selection policy to oversee the relatively small number of neurosurgery trainees across Australia. This is different to other surgical specialty training programs which may have larger trainee numbers and where the selection and placement is done mostly by State/Territory level committees. Although graduates from each State/Territory may train in their own State/Territory, it is not uncommon for trainees to move to different States/Territories, and no trainee can train entirely in one State/Territory, as they cannot spend more than two years in one particular training position. For these reasons, the Working Party feels that the placement of neurosurgery trainees should not be prescribed within this report, but that it continue to be regulated by the RACS Board of Neurosurgery, with consideration given to those States/Territories which are less well supplied with neurosurgeons.

The Working Party would like to note its concern with the working conditions of neurosurgeons, particularly within public hospitals. The AMWAC survey results showed that some neurosurgeons are frustrated with the public system, and that the environment of public hospital practice is, in some cases, inadequate. While the Working Party acknowledges that the survey results are based on perception rather than trends and statistics, they felt that this point had sufficient merit, such that it is important to note its potential impact on workforce planning and recruitment. The Working Party would like to highlight their concern that difficult working conditions in public hospitals may contribute to neurosurgeons leaving the public sector and moving into the private sector, although this movement may not have an impact on overall workforce balance and adequacy. In the initial instance, the issue of public hospital working conditions needs to be pursued by the RACS and the NSA directly with the relevant State/Territory health authorities.

The recruitment of neurosurgery trainees is also of concern to the Working Party. The number of qualified applicants to the neurosurgery training program has recently decreased to the point where there were seven unfilled training positions in 2000. If

this continues to be the case in future years then ultimately too few trainees will be graduating from the program and this will lead to a developing shortage of neurosurgeons. Based on the survey of the workforce, the key reasons for this may be related to the nature of neurosurgery practice (demands of a neurosurgery practice and hours of work), the cost of medical indemnity insurance and working conditions. Comments also focused on the fact that neurosurgery does not appear as an attractive vocation to medical graduates. Both the RACS and the NSA have indicated to the Working Party that they intend to consider strategies to ensure unfilled training positions does not become a common occurrence.

Monitoring of these two issues will be an important part of the regular monitoring of the workforce that will be undertaken by AMWAC.

RECOMMENDATIONS

The Working Party recommends:

1. To achieve an appropriate supply of neurosurgeons the annual average intake to the neurosurgery training program should be maintained at between six and eight trainees per year from 2001 onwards. (There were five trainees entering in 1998, six in 1999, and nine in 2000.)

   The aim of maintaining first year advanced trainee numbers within this range is to match workforce supply with an expected future growth in neurosurgery requirements of 1.6% per annum.

2. That the coordination of these neurosurgery trainee placements continue to be overseen by the Royal Australasian College of Surgeons (RACS) Board of Neurosurgery, in consultation with State/Territory health departments.

   That, subject to feasibility, the Board consider placing trainees in States/Territories which are less well supplied with neurosurgeons, including Queensland, New South Wales/Australian Capital Territory, and Western Australia.

3. That the RACS and the Neurosurgical Society of Australasia, in conjunction with State/Territory health departments, form a national working group to cooperatively develop strategies to overcome concerns regarding recruitment of an adequate number of neurosurgery trainees, facilities and working conditions for neurosurgeons and neurosurgical trainees in public hospitals, and provision of neurosurgery services to non-metropolitan areas.

4. That neurosurgery requirements and supply projections continue to be monitored regularly so that they can be amended if new trends in any of the workforce characteristics emerge or projection assumptions change. That this monitoring be coordinated by the RACS and AMWAC and the results incorporated into the AMWAC annual report to AHMAC. AMWAC will provide all necessary support.

5. That an update of this review of the neurosurgery workforce be undertaken in 2004-2005.

APPENDIX A: RURAL, REMOTE AND METROPOLITAN AREAS CLASSIFICATION

The Rural, Remote and Metropolitan Areas classification, developed in 1994 by the then Commonwealth Department of Health and Family Services and the Commonwealth Department of Primary Industries and Energy, has been used to classify the geographic location of the job of responding medical practitioners in the following seven categories. The data used in determining these categories are based on the 1991 population census.

Metropolitan areas:

1. *Capital cities* consist of the State and Territory capital cities of Sydney, Melbourne, Brisbane, Perth, Adelaide, Hobart, Darwin and Canberra.

2. *Other metropolitan centres* consist of one or more statistical subdivisions which have an urban centre of population of 100,000 or more in size. These centres are: Newcastle, Wollongong, Queanbeyan (part of Canberra-Queanbeyan), Geelong, Gold Coast-Tweed Heads, Townsville-Thuringowa.

Rural zones:

3. *Large rural centres* are statistical local areas where most of the population reside in urban centres of population of 25,000 to 99,999. These centres are: Albury-Wodonga, Dubbo, Lismore, Orange, Port Macquarie, Tamworth, Wagga Wagga (NSW); Ballarat, Bendigo, Shepparton-Mooroopna (Vic); Bundaberg, Cairns, Mackay, Maroochydore-Mooloolaba, Rockhampton, Toowoomba (Qld), Whyalla (SA); and Launceston (Tas).

4. *Small rural centres* are statistical local areas in rural zones containing urban centres of population between 10,000 and 24,999. These centres are: Armidale, Ballina, Bathurst, Broken Hill, Casino, Coffs Harbour, Forster-Tuncurry, Goulburn, Grafton, Griffith, Lithgow, Moree Plains, Muswellbrook, Nowra-Bombaderry, Singleton, Taree (NSW); Bairnsdale, Colac, Echuca-Moama, Horsham, Mildura, Moe-Yallourn, Morwell, Ocean Grove-Barwon Heads, Portland, Sale, Traralgon, Wangaratta, Warrnambool (Vic); Caloundra, Gladstone, Gympie, Hervey Bay, Maryborough, Tewantin-Noosa, Warwick (Qld); Mount Gambier, Murray Bridge, Port Augusta, Port Lincoln, Port Pirie (SA); Albany, Bunbury, Geraldton, Mandurah (WA); Burnie-Somerset, Devonport (Tas).

5. *Other rural areas* are the remaining statistical areas within the rural zone. Examples are Cowra Shire, Temora Shire, Guyra Shire (NSW); Ararat Shire, Cobram Shire (Vic); Cardwell Shire, Whitsunday Shire (Qld); Barossa, Pinnaroo (SA); Moora Shire, York Shire (WA); George Town, Ross (Tas); Coomalie, Litchfield (NT).

Remote zones:
These are generally less densely populated than rural statistical local areas and hundreds of kilometres from a major urban centre.

6. *Remote centres* are statistical local areas in the remote zone containing urban centres of population of 5,000 or more. These centres are: Blackwater, Bowen, Emerald, Mareeba, Moranbah, Mount Isa, Roma (Qld); Broome, Carnarvon, East Pilbara, Esperance, Kalgoorlie/Boulder, Port Hedland, Karratha (WA); Alice Springs, Katherine (NT).

7. *Other remote areas* are the remaining areas within the remote zone. Examples are: Balranald, Bourke, Cobar, Lord Howe Island (NSW); French Island, Orbost, Walpeup (Vic); Aurukun, Longreach, Quilpie (Qld); Coober Pedy, Murat Bay, Roxby Downs (SA); Coolgardie, Exmouth, Laverton, Shark Bay (WA); King Island, Strahan (Tas); Daly, Jabiru, Nhulunbuy (NT).

APPENDIX B: AMWAC SURVEY OF NEUROSURGEONS, 2000

METHODOLOGY

To assist with the establishment of a profile of the neurosurgery workforce in Australia, a confidential mailed survey of all neurosurgeons who were Fellows of the RACS was conducted in February/March 2000. The survey was administered by AMWAC in consultation with the RACS. In total, 122 questionnaires were distributed and 75 Fellows responded, which is a response rate of 61.5%.

RESULTS

The results of this survey are presented in the following sequence:

- An analysis of the survey response rate, which includes a description of the profile of respondents;
- A description of the work profile of responding neurosurgeons including type of practice, work setting, hours worked, practice activities, waiting times, provision of services to rural areas, and professional satisfaction;
- An examination of factors influencing future workforce participation and requirements, including plans to change hours worked, retirement expectations, respondents' perceptions of factors affecting workforce requirements, and recruitment of trainees.

Response rate analysis

Distribution

Table B1 shows that the State/Territory distribution of survey respondents was similar to the distribution of neurosurgeons who are Fellows of the RACS. Respondents from Victoria/Tasmania show a higher representation than indicated by their share of Fellows.

Table B1: Distribution of survey respondents (2000) compared with the distribution of all neurosurgeons who are Fellows of the RACS (2000), by State/Territory

	NSW / ACT	Vic/ Tas	Qld	SA	WA	NT	Aust
AMWAC survey respondents (n=66)							
% respondents	30.3	37.9	15.2	10.6	9.1	-	100.0
Neurosurgeons who are Fellows of the RACS (n=104)							
% of members	33.7	29.8	17.3	9.6	9.6	-	100.0

Source: RACS and AMWAC survey of neurosurgeons.

All survey respondents who indicated the location of their primary practice were located in a metropolitan area. The AIHW 1997 survey data showed an almost identical distribution, with 99.1% of neurosurgeons located in a metropolitan region.

Table B2: Geographic distribution of neurosurgeons, AMWAC 2000 survey and AIHW 1997 survey

	Metropolitan	Rural	Australia
AMWAC survey respondents (n=66)			
% respondents	100.0	0.0	100.0
AIHW medical labour force data (n=113)			
% of neurosurgery workforce	99.1	0.9	100.0

Source: AIHW and AMWAC survey of neurosurgeons.

Age profile

The age range of survey respondents was from 33 years to 83 years with an average age of 50.2 years, while the AIHW 1997 survey data show the average age of neurosurgeons was 51.1 years. Table B3 shows the distribution of respondents by age group varied from the age profile of the workforce, as indicated by the 1997 AIHW medical labour force survey. For some age groups the proportion of respondents was reasonably consistent with the AIHW labour force survey but for others the distribution was quite different. In both surveys the majority of respondents are between the ages of 35 and 54 (63.5% according to the AMWAC survey and 55.2% according to the AIHW survey). Those in the 55 to 64 year age category appear to be under-represented in the AMWAC survey, while those in the 35 to 44 year age group and the 65 years and greater age category appear to be over-represented. The AIHW data show 32.5% of neurosurgeons in the 55 to 64 year age group while the AMWAC survey data show only 16.2% in the same age category.

Table B3: Age profile of neurosurgeons, AMWAC 2000 survey, and AIHW 1997 medical labour force survey

	<35 yrs	35-44 yrs	45-54 yrs	55-64 yrs	65+ yrs
AMWAC survey respondents (n=74)					
% respondents	5.4	37.8	25.7	16.2	14.9
AIHW medical labour force data (n=113)					
% neurosurgery workforce	3.5	29.8	25.4	32.5	8.8

Source: AIHW and AMWAC survey of neurosurgeons.

Gender profile

In total, of the respondents who answered this question 97.1% were male and 2.9% were female. This gender profile is similar to the profile indicated by the AIHW 1997 labour force data, which show 95.6% of neurosurgeons are male and 4.4% are female. Of the 75 total respondents to the survey, 69 answered this question and six did not.

Workforce status

In total, 88.0% (66) of survey respondents indicated they were currently working in the field of neurosurgery, of whom 97.0% indicated they were working full-time and 3.0% indicated they were working part-time. A further nine respondents did not complete the body of the questionnaire because they were not currently practising in neurosurgery. Of these, four indicated they were working in a medicolegal practice; three were retired; and the remainder did not indicate the reason for not currently practising in neurosurgery. The age of respondents who indicated that they were not currently practising in neurosurgery ranged from 63 years to 83 years, with an average age of 75 years.

The remainder of this report focuses on the information provided by the 66 respondents who were currently active in the workforce.

Response rate conclusions

The Working Party concluded that a response rate of 61.5%, whilst somewhat disappointing for a small workforce, was acceptable. Furthermore, it was concluded that the profile of respondents was sufficiently consistent with the RACS and AIHW profiles of the neurosurgery workforce to provide representative data of the neurosurgery workforce.

Qualifications

All respondents indicated that they hold a Fellowship of the RACS.

Type of Neurosurgery Practice

Respondents were asked to indicate the proportion of their professional effort spent in various neurosurgery practice areas. On average, respondents spent the largest proportion of their time on spinal surgery (41.2%), followed by tumour surgery (20.5%), intracranial vascular surgery (11.5%), and with less than 10.0% of their professional time spent in any of each of the other specified areas of practice (Table B4).

Table B4: Average percentage of professional time spent in neurosurgery practice areas, 2000

Area of neurosurgery practice	Average percentage of time spent in area of neurosurgery practice
Spinal surgery	41.2
Tumour surgery	20.5
Intracranial vascular surgery	11.5
Head injury	9.0
Paediatric neurosurgery	7.8
Peripheral nerve	5.8
Pain procedures*	1.7
Stereotactic functional surgery	1.6
Extracranial vascular surgery	0.9
Total	**100.0**

* also includes other areas not listed.
Source: AMWAC survey of neurosurgeons.

There was some variation among States/Territories with respect to the proportion of time spent in each area of neurosurgery practice (Table B5). For example, while all States/Territories showed that the largest proportion of a neurosurgeon's time was spent on spinal surgery as compared with the other specified areas of practice, the percentages ranged from a high of 62.0% in Western Australia to a low of 35.3% in New South Wales/Australian Capital Territory. Also of note is the variation in the percentage of time spent in paediatric neurosurgery, which ranged from a high of 12.9% in South Australia to a low of 1.5% in Western Australia.

Table B5: Average percentage of professional time spent in neurosurgery practice areas, by State/Territory, 2000

Area of neurosurgery practice	NSW / ACT	Vic /Tas	Qld	SA	WA	Aust.
Spinal surgery	35.3	39.9	38.3	50.0	62.0	41.2
Tumour surgery	21.8	23.0	19.4	16.1	14.4	20.5
Intracranial vascular surgery	13.6	11.6	15.0	4.4	6.2	11.5
Head injury	8.5	9.7	8.9	10.3	6.2	9.0
Paediatric neurosurgery	9.5	5.4	8.7	12.9	1.5	7.8
Peripheral nerve	5.8	6.4	5.6	5.1	5.5	5.8
Pain procedures[a]	1.2	1.9	3.4	1.2	-	1.7
Steroetactic functional surgery	1.8	2.1	0.7	-	3.0	1.6
Extracranial vascular surgery	2.4	0.1	-	-	1.2	0.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a] also includes any other areas of neurosurgery practice not listed.
Source: AMWAC survey of neurosurgeons.

Work Setting

Respondents to the survey were asked to indicate where they practised neurosurgery. On average, respondents indicated that 41.6% of their time was spent in the public sector in a salaried position and 58.4% of their time was spent in private practice. A total of 28.8% of respondents indicated that all of their time was spent in private practice, 7.6% indicated that all of their time was spent in a salaried position, and the remaining 63.6% indicated that they worked in both a public position and in a private position (Table B6). Of the respondents who indicated they worked in both the private and public sectors, 53.5% of total time was spent in a salaried position and 46.5% of total time was spent in private practice.

Table B6: Average percentage of neurosurgery workforce by work setting, 2000

Work Setting	Average % of neurosurgeons by work setting
Salaried position only	7.6
Private practice only	28.8
Salaried position and private practice	63.6
Total	**100.0**

Source: AMWAC survey of neurosurgeons.

As shown in Table B7, of the respondents who indicated they worked some or all of their time in a salaried position and reported their source of salary, the main source of salary indicated was a public hospital (87.0%). The remainder of respondents were equally divided among the following salary sources: university; public hospital and university; and other sources. No respondents indicated research/institute as a source of salary.

Table B7: Source of salary of neurosurgeons employed in the public sector in neurosurgery, 2000

Source of Salary	Percent
Public Hospital	87.0
University	4.3
Public Hospital & University	4.3
Other	4.3
Total	**100.0**

Source: AMWAC survey of neurosurgeons.

As shown in Table B8, of the respondents who indicated they worked some or all of their time in a private practice, and reported their source of salary, the majority had a public hospital appointment (81.1%). A further 9.4% indicated they had a private hospital appointment and 7.5% indicated both public and private hospital appointments.

Table B8: Appointment in private practice in neurosurgery, 2000

Appointment in Private Practice	Percent
Public hospital appointment	81.1
Private hospital appointment only	9.4
Public hospital and private hospital appointments	7.5
No hospital appointment	1.9
Total	**100.0**

Source: AMWAC survey of neurosurgeons.

Hours Worked

On average, respondents worked a total of 63.7 hours per week (minimum 6 hours; maximum 120 hours; mode 50 hours; median 63.0 hours; standard deviation 17.4). Table B9 shows that the average hours worked per week ranged from a low of 50.5 hours in Western Australia to a high of 69.0 hours in New South Wales/Australian Capital Territory.

Table B9: Average hours worked per week by neurosurgeons, by State/Territory, 2000

	NSW / ACT	Vic/ Tas	Qld	SA	WA	Aust.
Average hours worked	69.0	65.7	60.3	59.0	50.5	63.7

Source: AMWAC survey of neurosurgeons.

As shown in Table B10, the survey responses indicated that only 3.1% of the neurosurgery workforce worked an average of less than 35 hours per week. A total of 90.7% of the workforce worked more than 50 hours per week, with 16.9% of the workforce working more than 80 hours per week.

Table B10: Percentage of neurosurgeons, average total hours worked per week, by State/Territory, 2000

Hours worked	NSW / ACT	Vic/ Tas	Qld	SA	WA	Aust.
Less than 35 hours	-	4.3	-	-	16.7	3.1
35 to 49 hours	-	4.3	10.0	14.3	16.7	6.2
50 to 64 hours	31.6	39.1	50.0	42.9	66.7	41.5
65 to 79 hours	36.8	30.5	40.0	42.9	-	32.3
80 hours or more	31.6	21.7	-	-	-	16.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: AMWAC survey of neurosurgeons.

Table B11 shows a variation in the profile of hours worked by age group. In total, 54.0% of respondents under the age of 55 years indicated that they worked more

than 65 hours per week on average, with 22.0% indicating that they worked more than 80 hours per week. In comparison, 33.3% of respondents aged 55 years or more indicated that they worked 65 hours per week or more, with none indicating that they worked more than 80 hours per week.

Table B11: Percentage of neurosurgeons, average total hours worked per week, by age group, 2000

Age group	Less than 35 hours	35 to 49 hours	50 to 64 hours	65 to 79 hours	80 hours or more	Total
Under 55 years	2.0	2.0	42.0	32.0	22.0	100.0
55 years and over	6.7	20.0	40.0	33.3	0.0	100.0

Source: AMWAC survey of neurosurgeons.

Practice Activities

Respondents were asked to indicate the percentage of their time spent in various activities over a typical week. The responses showed that the majority of their time was spent on clinical activities (75.1%), with responses ranging from 30% to 100% of time spent on clinical activities. The majority of respondents indicated that they spent at least 75% of their time on clinical activities (57.9%). Respondents indicated that their remaining time was fairly evenly divided among the other specified activities (administration, teaching, research and continuing medical education (CME)) listed on the survey questionnaire. Four respondents indicated that they spent some of their working hours on 'other' activities, with two of these respondents noting that they spent 10% and 15% of their time, respectively, on medicolegal work.

Table B12: Percentage of hours worked by neurosurgeons, by type of activity, 2000

Type of activity	Percentage of total hours worked in a typical week %
Clinical	75.1
Administration	7.8
Teaching	5.8
Research	5.5
CME	5.2
Other	0.6
Total	**100.0**

Source: AMWAC survey of neurosurgeons.

Consultation Waiting Times

Table B13 shows that patients with a clinically urgent condition wait less time, on average (2.4 days), to see a neurosurgeon in his/her private rooms than do patients in public outpatient departments (7.4 days). The data also show that there is wide variation in average waiting times among the States/Territories. Waiting time for a

patient with a clinically urgent condition presenting to a public sector service ranged from 4.6 days in Victoria/Tasmania to 11.5 days in New South Wales/Australian Capital Territory. Similarly, waiting times for patients with a clinically urgent condition presenting to a private sector service ranged from 1.7 days in Victoria to 5.5 days in Western Australia. Within State/Territory, New South Wales/Australian Capital Territory showed the most variation in average waiting time for patients presenting with a clinically urgent condition. In New South Wales/Australian Capital Territory, the average waiting time within the State/Territory ranged from 2.2 days for a patient presenting to a private sector service to 11.5 days for a patient presenting to a public sector service.

The survey results show the disparity between the private and public systems with respect to waiting time for a standard first consultation with a neurosurgeon is much greater than for a clinically urgent condition. The average waiting time for a patient to see a neurosurgeon in his/her private rooms for a standard first consultation was 27.9 days, while for a patient presenting to a public sector service the average waiting time was 62.6 days (approximately two months). Among the States/Territories, patients in Queensland had the longest average waiting time for a standard first consultation with a neurosurgeon when presenting to a public sector service (117.9 days or almost four months), while those in South Australia had the shortest average waiting time of 44.2 days.

Table B13: Average waiting time (days) for neurosurgery services for a clinically urgent condition and a standard first consultation, by type of service and State/Territory, 2000

State/Territory	Public Outpatient	Private Room
	Clinically urgent condition	
NSW/ACT	11.5	2.2
Victoria/Tasmania	4.6	1.7
Queensland	7.3	2.3
South Australia	7.4	2.7
Western Australia	10.8	5.5
Total	**7.4**	**2.4**
	Standard first consultation	
NSW/ACT	44.7	34.5
Victoria/Tasmania	54.4	31.4
Queensland	117.9	21.9
South Australia	44.2	15.6
Western Australia	70.0	14.0
Total	**62.6**	**27.9**

Source: AMWAC survey of neurosurgeons.

Provision of Services to Rural Areas

All of the survey respondents indicated that their primary practice was located in a metropolitan area. In total, five respondents (7.6%) indicated that they had another practice where they do additional work on a regular basis, in a rural area. Two of those with a secondary practice in a rural area were located in Queensland, and the other three were located in Victoria, South Australia and New South Wales, respectively.

Respondents were also asked to indicate if they work in the city but provide services in the country. As shown in Table B14, almost one-third of respondents to this question reported that they provide services in the country (28.3% or 17 respondents). Of these, the largest proportion were located in New South Wales/Australian Capital Territory (seven respondents), followed by Victoria/Tasmania (five respondents), and South Australia (three respondents), and one in each of Western Australia and Queensland. Among the States/Territories, South Australia had the highest proportion of respondents who indicated that they provide services in rural areas (42.9%), while Queensland had the lowest with 12.5% of respondents indicating that they provide services in rural areas.

Of those respondents who indicated that they spend some of their time providing services in country areas, the average time spent working in the country was 1.9 days per month, and all services provided in country areas were consultations only

(ie., no operative work). Among the States/Territories, responding neurosurgeons from Queensland indicated that they spent the most number of days per month in country areas (three days per month, on average). Those from New South Wales/Australian Capital Territory indicated the least number of days per month spent working in the country (1.5 days per month, on average).

Table B14: Provision of rural services by neurosurgeons, by State/Territory, 2000

Location of service provision	NSW / ACT	Vic/ Tas	Qld	SA	WA	Aust.
Metropolitan only	58.8	77.3	87.5	57.1	83.3	71.7
Metropolitan providing rural services	41.2	22.7	12.5	42.9	16.7	28.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: AMWAC survey of neurosurgeons.

Professional Satisfaction of Neurosurgeons

Workload Level

Overall, 56.1% of respondents indicated that they felt their current workload was about right, 30.3% felt that their workload was too much and 13.6% felt that their workload was too little. Reasons given for having a workload that was too heavy included: too few neurosurgeons, being on call, too much time spent on administrative or non patient work, and too many (sometimes inappropriate) referrals. Reasons given for having a workload that was too little included: establishing a practice, no public hospital appointment, and too many neurosurgeons. A total of 38.5% felt that more neurosurgeons were required in their geographic area.

Capacity to Increase Practice Activity

In response to a question on capacity to increase workload, 41.5% of responding neurosurgeons indicated that they felt they had time available to increase their operating time, 31.1% felt they had time available to increase their consultative work and 29.0% felt they had time available to increase their hospital work. A total of 15 responding neurosurgeons provided details of the conditions under which they could increase their practice activity. A common response was that they would increase their practice activity if required, i.e., if there was an increase in demand or on an as-needed basis; however, some noted that this would be difficult, and in some cases would require re-balancing time spent in other areas, such as research. Others noted that additional beds and theatre time would have to be made available, particularly in public hospitals.

Adequacy of Access to Neurosurgery Facilities

In terms of adequacy of access to neurosurgery facilities, 91.8% of responding neurosurgeons indicated that they have adequate access to private facilities, while 77.0% indicated that they have adequate access to public facilities (Table B15). In total, 25 respondents provided comments about the adequacy of access to private and public facilities. Some of the more frequent comments noted a cut back and/or deterioration of public facilities and equipment; not enough beds available; and

difficulty accessing public facilities, particularly outside of set times (*ie.*, for emergency cases at night).

Table B15: Adequacy of access to neurosurgery facilities, 2000

Type of facility/time of access	Adequate %	Inadequate %	Total %
Private facilities			
Generally	91.8	8.2	100.0
During regular working hours (8am to 5pm)	85.2	14.8	100.0
Public facilities			
Generally	77.0	23.0	100.0
During regular working hours (8am to 5pm)	70.2	29.8	100.0

Source: AMWAC survey of neurosurgeons.

Factors Affecting Work Performance

Responding neurosurgeons were asked to indicate if they were ever required to perform surgery when they felt they were too tired, and a total of 65.2% (43) respondents answered yes. Of these, 46.5% stated that this happens less than once a month, 23.3% stated it happens about once a month, 27.9% stated it happens more than once a month, and 2.3% did not specify how often it happens. A large proportion of respondents indicated that the reasons for this happening were that facilities are only available at unreasonable hours (25.6%), their workload is too heavy (23.3%) or a combination of these two factors (34.9%), with the remaining 16.2% specifying other reasons. Some of the other reasons noted were urgent cases late at night, being on call and normal variation in workload.

Respondents were also asked whether there were any other factors affecting their performance at work and of the 61 respondents who answered this question, 42.6% (26) answered yes. Other factors affecting work performance, as specified by respondents, included:

- Unavailable and/or inadequate nursing staff and junior staff;
- Demands of the profession (excessive on call hours, high concentration required for prolonged periods, high expectations of patients, heavy emotional stress);
- Inadequate and/or insufficient facilities and equipment;
- Bureaucracy, and interference in clinical management by admin. in public sector;
- Concern about litigation; and
- Remuneration (concern about making an adequate income).

Plans to Change Hours Worked

In total, 54.5% of responding neurosurgeons indicated that they anticipated a change in the hours that they work over the next ten years, with 36.4% anticipating a

reduction in their hours and 18.2% planning to increase their hours worked (Table B16).

Table B16: Neurosurgeons' plans to change hours worked, by State/Territory, 2000

State/Territory	Reduce hours	Increase hours	Remain the same	Total
NSW/ACT	30.0	5.0	65.0	100.0
Vic/Tas	43.5	26.1	30.4	100.0
Qld	30.0	30.0	40.0	100.0
SA	28.6	14.3	57.1	100.0
WA	50.0	16.7	33.3	100.0
Australia	**36.4**	**18.2**	**45.5**	**100.0**

Source: AMWAC survey of neurosurgeons.

Of the 24 responding neurosurgeons who expected their work hours to decrease over the next ten years, 54.2% were over 55 years of age. Of the 12 responding neurosurgeons who expected their work hours to increase, 83.3% were under the age of 45 years. As shown in Table B17, only a small percentage of respondents under the age of 45 planned to decrease their hours worked (10.7% of those in the 35 to 44 year age group). A large percentage of those in the 55 years and over categories planned to decrease their work hours (90.9% of those aged 55 to 64 years and 75% of those aged 65 years or greater).

Table B17: Neurosurgeons' plans to change hours worked by age group, 2000

Age group	Reduce hours	Increase hours	Remain the same	Total
Less than 35 years	0.0	75.0	25.0	100.0
35 to 44 years	10.7	25.0	64.3	100.0
45 to 54 years	42.1	10.5	47.4	100.0
55 to 64 years	90.9	0.0	9.1	100.0
65+ years	75.0	0.0	25.0	100.0
Total	**35.0**	**16.7**	**48.3**	**100.0**

Source: AMWAC survey of neurosurgeons.

Reasons given by respondents who planned to increase their work hours over the next ten years, in order of frequency, were:

- changed practice numbers;
- to build practice/income;
- impact of changes in clinical practice;
- lifestyle preference; and
- family considerations.

Reasons given by respondents who planned to decrease their work hours over the next ten years, in order of frequency, were:

- lifestyle preference;
- family considerations;
- personal health considerations;
- retirement;
- work place change;
- impact of changes in clinical practice; and
- developments in medical technology.

Table B18 shows by how much, on average, respondents expect to change the hours they work over the next ten years. Respondents who anticipated their work hours to increase expected an increase, on average, of 28.8% of total hours they worked, while respondents who anticipated their work hours to decrease expected a change, on average, of 41.3% of total hours worked. Respondents in South Australia who anticipated a reduction in hours worked expected a reduction, on average, of 60.0% of total hours worked. Similarly, respondents in Queensland who anticipated a reduction in hours worked in the next ten years expected to reduce their total hours worked, on average, by 58.3%.

Table B18: Average expected change in hours worked, 2000

State/Territory	Reduce hours %	Increase hours %
NSW/ACT	35.0	15.0
Victoria/Tasmania	38.5	25.0
Queensland	58.3	43.3
South Australia	60.0	30.0
Western Australia	33.3	20.0
Total	**41.3**	**28.8**

Source: AMWAC survey of neurosurgeons.

Retirement

Respondents were asked at what age they intend to retire from the neurosurgery workforce. The expected age of retirement ranged from 50 years to 75 years, with an average expected retirement age of 63.1 years (mode 65 years; median 65 years; standard deviation 4.1). Among the States/Territories, the average planned retirement age did not vary much, ranging from 61.3 years in Queensland to 65 years in South Australia.

Table B19 shows that 13.6% (9) of responding neurosurgeons intend to retire in the next five years and a further 18.2% (12) plan to retire in the next ten years, for a total of 31.8% (21) neurosurgeons indicating that they plan to retire by 2010. Of practitioners aged 55 years and over, 60.0% (9) plan to retire in the next five years and the remaining 40.0% (6) plan to retire within the next ten years.

Table B19: Number of neurosurgeons who intend to retire in selected years, 2000

to 2005	2006-10	2011-15	2016-2020	2021-2025	2026-2030	2031-2035
9	12	8	15	12	8	2

Source: AMWAC survey of neurosurgeons.

Neurosurgeons' Perceptions of Factors Affecting Workforce Requirements

Respondents were asked to indicate whether they believe particular factors will increase workforce requirements, decrease workforce requirements or whether requirements would stay the same.

As shown in Table B20, the most important factors that respondents considered would increase neurosurgery workforce requirements were ageing of the population (87.9%), patient expectations/knowledge (64.6%), and increasing level of specialisation (53.0%). There were no factors which a majority of respondents (more than 50%) felt would decrease workforce requirements, although more than one third of respondents thought that the following factors would decrease requirements: public health resource allocation (37.5%) and the introduction of managed care (37.5%).

Table B20: Neurosurgeons' perceptions of factors that could influence requirements for neurosurgeons over the next ten years, 2000

Factors likely to influence requirements for neurosurgeons over the next ten years	Decrease %	Stay the same %	Increase %
Disease patterns	7.8	53.1	39.0
Ageing of the population	-	12.1	87.9
Lifestyle changes that improve population health	18.2	72.7	9.1
Patient expectations/knowledge	3.1	32.3	64.6
Access to beds, nurses, theatres, etc	27.0	58.7	14.3
More defensive medicine	18.5	32.3	49.2
Increasing level of specialisation	6.1	40.9	53.0
Safer procedural practice	6.1	53.0	40.9
Increased productivity in hospitals	14.3	61.9	23.8
Technology	15.2	47.0	37.9
Expectations of other health professionals	6.3	60.9	32.8
Multi-disciplinary team provision	7.6	54.5	37.9
Geographic distribution of population	4.6	55.4	40.0
Health outcomes/quality assurance	1.5	49.2	49.2
Public health resource allocation	37.5	46.9	15.6
Increasing emphasis on hospital efficiency	19.7	51.5	28.8
The introduction of managed care	37.5	40.6	21.9

Source: AMWAC survey of neurosurgeons.

Recruitment of Trainees

Respondents were asked what they thought the reasons were for the recent decrease in qualified applicants to the neurosurgery training program. Many respondents to this question indicated several reasons for the decrease in qualified applicants. Table B21 shows each reason listed on the survey questionnaire and the percentage of respondents who indicated that they thought that particular reason was relevant to the decrease in applicants. Based on the responses the top three reasons for the decrease in qualified applicants were demands of neurosurgery practice (71.2% of respondents felt this was at least one of the reasons for the decrease), followed by hours of work (68.2%) and cost of malpractice insurance (66.7%).

For those respondents indicating that poor working conditions was a reason for the decrease (42.4%), many specifically noted the long working hours, high stress, relatively poor remuneration and poor public sector conditions. For those indicating other issues related to practising as a neurosurgeon (30.3%), the majority of

respondents considered poor remuneration (in relation to other surgical specialties and other specialties in general, and in relation to the stress, skill level and responsibility involved in being a neurosurgeon) to be the key issue for the decrease in qualified applicants.

For those respondents specifying other issues related to the training program (15.2%), issues noted included lack of support and long hours.

Respondents who specified other reasons to be responsible for the decrease in applicants (16.7%) indicated poor remuneration, poor role models, lack of substantial public hospital appointment and significant number of sad cases as reasons for the decrease. In addition, they suggested that neurosurgery is too far removed from the mainstream and does not appear as an attractive vocation to medical graduates, and there is bad publicity of treatment of colleagues and trainees.

Table B21: Reasons for decrease in qualified applicants to the neurosurgery trainee program, 2000

Reason	% of neurosurgeons who thought this was a reason for the decrease in qualified applicants
Issues related to practising as a neurosurgeon	
Hours of work	68.2
Demands of neurosurgery practice	71.2
Lack of support	
From other neurosurgeons	22.7
From other specialists	7.6
Other	12.1
Cost of malpractice insurance	66.7
Fear of malpractice litigation	59.1
Poor working conditions	42.4
Other issues (related to practicing as a neurosurgeon)	30.3
Issues related to the training program	
Training program too long	15.2
Other issues (related to the training program)	15.2
Other reasons	16.7

Source: AMWAC survey of neurosurgeons.

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A full copy of the report can be obtained by contacting amwac@doh.health.nsw.gov.au