Report of the
South Island Neurosurgery
Expert Panel

5 November 2010

Recommendations to the Acting Director-General of Health
for a safe, sustainable neurosurgical service
for the people of the South Island
Introduction

The South Island Neurosurgery Expert Panel was established by the Director-General of Health to provide him with expert advice on the future configuration of neurosurgical services to serve the whole of the South Island.

The Panel’s membership was established following advice from the Neurosurgical Society of Australasia (NSA).

It is particularly important in reading this report, to put it in the context of neurosurgery’s history in the South Island, which in turn, is inextricably linked to the history of New Zealand’s health service development and population trends.

The South Island’s first neurosurgical unit was established by Associate Professor Murray Falconer at Dunedin Hospital in 1943 and was linked with the University of Otago, School of Medicine. At that time Dunedin was still the major urban centre in the South Island. The development of health services at Dunedin Hospital has been historically associated with both that status and that of the University of Otago, School of Medicine, which until 1968 was New Zealand’s only medical school.

The second South Island neurosurgical service was established at Christchurch Hospital in 1981. As the result of changing demographics and referral patterns, the Christchurch unit has grown to be larger than the Dunedin unit. There has long been tension between Christchurch and Dunedin tertiary services as Christchurch has progressively supplanted Dunedin as the South Island’s major urban centre and the centre of population growth.

The starkest illustration of this tension was Christchurch’s very public battle in the 1990s to establish cardiac surgery, the only South Island centre for which up until then had been Dunedin. That conflict was frequently referred to in relation to this issue.

The Dunedin neurosurgical unit serves 300,3401 people in the sparsely populated lower South Island, south of the Waitaki River. In recent years it has struggled to maintain clinical viability and clinical staffing. While it has had an establishment of two neurosurgeons, for long periods of time it survived with just one permanent appointment.

Following the resignation of the sole neurosurgeon from the Dunedin unit in January 2009, an interim arrangement was put in place for the South Island. That initially involved three, and now four, neurosurgeons in Christchurch, with an inconsistent locum presence in Dunedin. This interim arrangement, instituted to allow development of a long-term plan, has been acknowledged by all parties as unsustainable.

In June 2009, under the chairmanship of Professor Spencer Beasley, a draft Neurosurgical Service Plan was delivered to South Island District Health Boards (DHBs). Following this, in August 2009 the DHBs agreed that there would be a single integrated service for the South Island, and that a single interim clinical director would be appointed to the service for 12 months to recommend the future configuration of the service.

Dr Ian Brown was appointed Interim Clinical Director and delivered a report in April 2010 which, building on the commitment of all South Island DHBs to a regional service, recommended one six-neurosurgeon service based in Christchurch, with a comprehensive outreach programme across the South Island. This recommendation was in line with Professor Beasley’s recommendations. Dr Brown noted that his decision was reached without agreed financial analysis or financial impact assessment of the status quo or his recommended configuration (this was principally because Canterbury and Otago DHBs were unable to reach agreed criteria for financial analysis).

Despite the two reviews reaching the same conclusions about a South Island neurosurgical service, there remains no united South Island DHB position. The Southern DHB, which serves Otago and

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1 Statistics NZ DHB population estimate update to Ministry of Health, October 2009
Southland, has steadfastly supported a two-site service with four neurosurgeons in Christchurch and two neurosurgeons in Dunedin. In the absence of consensus the DHBs escalated the issue for the Director General to resolve the impasse.

**Mandate**

The mandate of the Panel is to:

- provide the Director-General of Health with advice on the desired medium term service configuration and
- identify the development pathway that would best meet the requirement for a sustainable, high quality, affordable neurosurgical service, with consideration of financial sustainability.

The configuration and development pathway will be within the already agreed parameters of a single neurosurgical service for the South Island and:

- will have appropriate inpatient and outreach capacity
- include early action regarding recruitment to create the already agreed six neurosurgeon team
- must address Resident Medical Officer staffing
- recommend an appropriate governance structure for the single regional service.

The Panel’s Terms of Reference are attached to this document at Appendix 1.

**Approach**

The Panel took the approach that apart from the agreement that the South Island would have one service, how that was configured, governed, funded and managed was all to be determined.

It, therefore, approached its task with an open mind and sought to be able to make recommendations under the following categories:

- *Service to the community – in a relatively sparsely populated, geographically diverse island, how do we ensure safe access to a quality service for all South Islanders and what type of workforce, infrastructure and transport do we need to achieve that?*
- *A sustainable configuration for the service, which identifies location/locations, addresses delivery of acute services, sub-specialisation, linkages to other hospitals and health providers, provides adequate cover and staffing structures*
- *Linkages to other specialties, medical schools, and to training programmes*
- *Clinical leadership – How do we provide a clearly defined leadership structure in order to build the service, provide continuity and succession planning? (It should be noted that when the Panel refers to ‘clinicians’ it is referring to all disciplines, not only doctors.)*
- *The leadership and operation of a South Island service including funding arrangements – This will include details such as its management, leadership and employment arrangement, as well as how such a service is governed to provide maximum representation and involvement from across the island and minimum opportunity for conflict. What funding arrangements are required for the service to be equitable, sustainable and minimise conflict between regions?*
- *Implementation – The Panel needs to ensure that whatever its final recommendations are, they can be implemented and there is an understood timeframe for that to occur.*

In order to reach conclusions in each of these areas (Recommendations – Page 22) the Panel undertook an extensive process involving a combination of interviews, site visits, review of existing material, data verification and literature research. An outline of those with whom the Panel interacted is attached at Appendix 4.
As a result of our deliberations, outlined in this report is a set of recommendations which we believe represent a major opportunity to establish a high quality, clinically and financially sustainable neurosurgery service in the South Island.

In fact we have gone a step further, by recommending the establishment of the South Island Neurosurgical Service with an academic neurosurgical node, using the research strengths of the University of Otago. This will establish a New Zealand academic neurosurgical centre of excellence, which can provide a template for the rest of the country as it becomes more imbedded.

The wide brief we received has been the most important factor in allowing us to reach a workable conclusion which offers an immensely bright future for neurosurgery in the South Island and New Zealand, and addresses issues of recruitment, retention, education and career development.

It is important to note, though, that while we have looked at models from around the world, particularly Australia, Canada and Scotland, the model we have settled on is truly a New Zealand one, and, in particular, a South Island one.

A modern clinical service cannot be built in isolation – this solution recognises modern clinical trends and gives the clinicians in the service the opportunity to build a world-class, quality service, while at the same time recognising the South Island’s unique social, geographical and historical issues and opportunities.

Finally, the panel would like to thank all the many people and groups who have made a contribution to this report. We have been under no illusion as to the weight of responsibility on our shoulders to provide the people of the South Island with a workable solution and we greatly appreciate the contributions so many people have made, and the respectful way in which they have made them.

**The findings and recommendations contained in this report are unanimously supported by the members of the Panel.**

Anne Kolbe (Chair)
Glenn McCulloch
David Russell

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**Acknowledgements:** The Panel wishes to acknowledge the tireless, thoughtful, professional support provided to us initially by Siobhan Brown and then by Ms Claire Whelen, Ms Helen Galloway and Mr David Graham. Without your expert assistance we could not have completed our brief, thank you.
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Summary of Deliberations and Findings

This report lays out the key elements in meeting the Panel’s task as set out in its terms of reference of presenting to the Director General of Health recommendations which ‘identify the development pathway that would best meet the requirement for a sustainable, high quality neurosurgical service, with consideration of financial sustainability’.

This report recommends the establishment of the South Island Neurosurgical Service with two nodes – Christchurch and Dunedin – and for the Dunedin node to become New Zealand’s academic neurosurgical unit, using the strengths of the University of Otago, with research links to the major neurosurgical research centres of excellence around the world.

The Panel’s full set of recommendations is set out on Page 22. The preferred configuration is to build one South Island service with two nodes, at Christchurch and Dunedin, moving to seven, then eight neurosurgeons, with at least three of those in Dunedin.

Of the Dunedin-based neurosurgeons, one will be appointed at a Professorial level to the University of Otago Faculty of Medicine and one at a Senior Lecturer level, both within the Department of Surgery. These appointments will bolster the University’s already strong international reputation in neurosciences and the University has agreed to put in the physical, human and financial resources to support these appointments.

The University appointments are the basis of establishing Dunedin as an academic and research-based neurosurgical unit for the greater benefit of the entire South Island Neurosurgical Service.

This configuration also allows for the development of sub-specialisation, private sector work, the development of spinal neurosurgery and outreach to other hospitals in the South Island.

Critical to the Service’s success will be the establishment of an independent Governance Board chaired by Professor Andrew Kaye\(^2\), with the delegated authority and responsibility to implement the innovations outlined in this document.

The Panel believes that implementation of its recommendations will establish a world class academic neurosurgical service adapted to the particular issues facing the South Island, which will have a positive impact on the development of neurosurgery nationally. The proposed structure -

- meets clinical desires to develop the service for the future and give it the ability to sub-specialise
- meets community concerns over accessibility, particularly in emergency situations
- is fiscally responsible
- has strong governance and clinical leadership
- enhances recruitment and retention of clinicians
- sets a strong foundation for the national development of neurosurgical services
- establishes an academic neurosurgical element that will enhance the service’s clinical and research standing
- underpins and potentially enhances Otago University’s international research reputation
- supports other specialities and health care providers in the region
- provides an outreach model to the wider South Island which builds on existing templates already used by other specialities.

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\(^2\) James Stewart Professor of Surgery and Head of the Department of Surgery - University of Melbourne; Director of Neurosurgery, The Royal Melbourne Hospital
Background

When it began its deliberations, the Panel was confronted with an issue which had caused deep divisions in the South Island at a number of levels.

At the root of this had been the on-going attempts by South Island DHBs to establish a single-South Island neurosurgical service (Section 1.3).

This process had lead to two reports recommending that the South Island neurosurgical service should be sited solely in Christchurch and be staffed by six neurosurgeons with the corresponding closure of the Dunedin Hospital based service.

While this was accepted by the Chief Executive Officers (CEOs) and Chairs of the Canterbury, West Coast, South Canterbury and Nelson-Marlborough DHBs, it was vehemently opposed by the Southland and Otago DHBs (later amalgamated to become the Southern DHB), which wanted to retain two neurosurgeon positions in Dunedin.

These became known as the 6-0 and 4-2 options and argument raged about these two configurations for one service, although it was often not clear as to whether these figures referred to full-time equivalent (FTE) positions in the public sector, or to the number of actual neurosurgeons resident in each centre.

In the event, the Panel came to the conclusion that for varying reasons, neither was ideal and we have, therefore, recommended the alternative structure outlined above, and described in more detail below.

It needs to be noted here that the work of both Professor Spencer Beasley and Dr Ian Brown in their reviews of the existing service was of a high standard and, within the briefs they were given and the circumstances they faced, their conclusions were entirely appropriate. The Panel was privileged to have a much wider brief and it was only our ability to spend time looking very widely at this issue, which allowed us to come to the conclusions we have. The Panel is of the view that this, in itself, is an important lesson for the New Zealand health sector.

The Panel made it clear in correspondence and in public notices that it was looking at six areas in order to reach our conclusions and this Summary of Deliberations and Findings, therefore, addresses each of those areas:

Service to the community

The first question was - In a relatively sparsely populated, geographically diverse island, how do we ensure safe access to a quality service for all South Islanders and what type of workforce, infrastructure and transport do we need to achieve that?

The South Island has a population of 1,034,915 people3, and approximately 40% of those people live in Christchurch, with the other major urban centres being Invercargill, Dunedin, Timaru and Nelson. Therefore, the rest of the South Island has a sparse population spread across a land mass of 150,000 square kilometres (Section 1.5).

Access

Before we considered the question, it was important for the Panel to make sure it was understood that ‘access’ referred to the entire patient journey – that is, not just the neurosurgical event itself, but the events leading up to it and the process of recovery and rehabilitation after it.

3 Statistics NZ DHB population estimate update to Ministry of Health, October 2009
In that context it is important to acknowledge that distance becomes a significant issue for acute neurosurgery.

In acute situations and for time-critical conditions, time to expert assessment and treatment becomes important and retrieval, evacuation and transport arrangements are critical (Section 2.11). After the critical event, access to rehabilitation services, not only for the patient, but the family, becomes the important issue.

For planned and elective patients, access refers to highly specialised treatment which is best provided in a sub-speciality service and the issue becomes how to develop that sub-specialisation, while retaining access to acute services.

The Panel looked at access issues primarily as they relate to Otago and Southland, but we acknowledge that a South Island neurosurgical service will need to consider them for the whole island.

Acute neurosurgery and the recovery of patients was seen as perhaps the major issue for the Otago and Southland communities (Public Feedback - Section 1.6) with the general view that centralisation of the service in Christchurch would result in poorer outcomes for southern patients and more deaths.

In contrast, the Canterbury DHB and, in particular, a number of Canterbury-based clinicians felt that the Southern communities fundamentally misunderstood what constitutes neurosurgery (Neurosurgery Defined – Section 2.1) and did not understand that time-critical urgent neurosurgery, was according to them, a very small part of neurosurgical work. This is not a universally held view.

The contention was that the number of cases that required life-saving intervention could be as low as single figures in any given year (Mortality - Section 2.5) and that this could be dealt with by ‘up-skilling’ of general surgeons in other hospitals. The “Darwin model” was instanced as an example of this system working well.

There was acknowledgement that in a very small number of cases the outcome might be worse as the result of there being no acute neurosurgical service in Dunedin. However, the argument went, this was to be weighed up against the damage that could be done by an inappropriately resourced neurosurgical unit at Dunedin providing a potentially sub-standard service, and the desire to sub-specialise and to be able to really provide a world-class service for other neurosurgical patients, who made up the vast majority of people using neurosurgical services.

The Panel concluded that time-critical emergency surgery is in fact a significant component of neurosurgical practice.

The Panel also concluded that regardless of other benefits, service changes which knowingly resulted in increased deaths or less favourable patient outcomes would be difficult for the Panel to recommend, even if the number of cases was considered to be small.

This led the Panel to look closely at transport arrangements in the southern South Island (Section 2.11), and to consider the likelihood of up-skilling the general surgeons in Dunedin being successful and a robust solution.

**Transport**

We received very good information on the transport arrangements and were impressed by the work being done. But it quickly became clear that the terrain and weather in the South Island, combined with the demographics, create a unique environment, the impact of which cannot be underestimated.

It was emphasised, and illustrated with numerous examples, that the weather in the southern South Island is a big factor in emergency patient transfer (Section 2.11). This is seen as a major mitigating factor in moving critical emergency services further away. Road transport also offers challenges in South Island conditions, especially in the winter. However, as was pointed out by numerous
submitters to the Panel, if there is a need for air transfer to Dunedin which can’t occur because of weather conditions, there is a last-option alternative of road transport with a neurosurgery unit in Dunedin. That would not be the case if Christchurch was the neurosurgical base.

It is also worth noting that the Panel concluded that the number of patients requiring emergency air transport to Christchurch in the absence of a neurosurgery service in Dunedin was poorly understood by the Canterbury DHB and grossly underestimated.

It was emphasised, and we accepted, that the centralisation of neurosurgery in Christchurch would have a significant impact on air transport in general in the southern South Island and on its ability to meet demand. The cost of remedying this impact is likely to be considerable and is a serious issue in terms of overall financial sustainability of the Panel’s recommendations.

‘Up-skilling’ of General Surgeons

With regards to the up-skilling of general surgeons to provide emergency neurosurgery assessments and in extreme cases undertake neurosurgical operations, the Panel found very quickly that this was not a robust solution, given that it is asking the existing Dunedin general surgeons to work outside their established and current vocational scope of practice. This solution is not supported by international guidelines or practice.

As indicated earlier, much had been made of what has been called the “Darwin model”. This refers to the general surgeons of Darwin, who do not have a neurosurgical service on-site and who are geographically isolated. They have a history of undertaking emergency surgery to relieve pressure on the brain, whether from blood clot or other acute causes, with what have been described as good results.

Darwin once had a sole neurosurgeon, but many years ago. It has never had a fully developed neurosurgical service. It serves a vast area many times that of the South Island, which includes significantly deprived indigenous populations. The nearest neurosurgical centre is nearly 3,000 kilometres away and so transfer of patients in an acute situation has never been a viable option. The medical services have had to manage locally. As a result, Darwin has attracted a particular type of general surgeon over the years; a general surgeon with specific training and experience in the assessment and management, including operative procedures, of traumatic brain injury and chest trauma.

The Panel concluded that the “Darwin model” was not applicable to the South Island situation. The general surgeons who have gone to work in Darwin have done so knowing the type of work they will face and have essentially established a ‘generalist’ general surgery practice which involves the traditional abdominal general surgery but also surgery involving the head and the chest. This is a pattern of work quite unlike that done at other centres.

This is quite different from the South Island situation where there has been an established neurosurgical service in Dunedin for many years. The general surgeons have gone to Dunedin knowing that there was an established neurosurgical service. If an option similar to the “Darwin solution” was implemented we would be asking people who are midway through their careers and have established an expertise, to then undertake a type of surgery with which they are not familiar. That they have already indicated an unwillingness to be involved is understandable and, in fact, responsible. To force this solution on them, apart from being disrespectful, would be irresponsible and dangerous.

The Panel refers to the British Journal of Surgery 2007\(^4\) which while not specific to neurosurgery, indicated, as the result of a systematic review, that specialist surgeons had significantly better outcomes than general surgeons in 91% of studies.

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Infrastructure

The Panel spent some time examining and understanding the physical hospital infrastructure available at both Christchurch and Dunedin (Section 1.4).

Generally speaking, both facilities were well organised and well equipped for the services they are providing, although both sets of staff indicated that they were relying on promised capital developments for the longer term.

Dunedin Hospital has a 20 bed combined ward catering for neurosurgery, neurology, ORL, ophthalmology and maxillofacial patients, with a three bed high dependency unit.

It appears to have the appropriate equipment to support neurosurgery with the exception of the appropriate equipment for image guided surgery. Currently this equipment is hired on a case by case arrangement at a significant cost per case.

This is not a satisfactory situation in the long term and the capital cost of the equipment would be in the order of $600,000. Staff indicated that it would not be bought until there was confirmation that the service would continue in Dunedin. This is a fundamental piece of equipment for a functioning neurosurgical service and the Southern DHB would have to commit to purchasing it in order to attract surgeons.

Christchurch Hospital has a 26-bed combined neurosurgery/neurology ward which is shortly to be extended to 28 beds and it, too, has a four bed high dependency unit.

The Panel had significant concerns about the capacity of Christchurch Hospital to manage the increase in activity that would result from the disestablishment of neurosurgery in Dunedin. There was, in our view, a quite serious underestimation of the numbers involved (Volumes – Section 2.4).

Some consideration has been given to a rearrangement of wards, which would see neurology patients moving elsewhere, but there was no evidence that any serious planning had been done. The impact on staffing numbers and costs was not clear. There seemed to be limited operating theatre capacity and insufficient numbers of anaesthetists to cope with the increased volumes. The Panel’s biggest concern is around ICU and Radiology capacity (particularly MRI capacity). The ICU is already under serious pressure and MRI has a waiting list extending to approximately 1300 people. The neurosciences ward has high current occupancy and the neurosurgery and neurology could not exist in the same ward under the new arrangement, which would be a step backwards.

Canterbury DHB has indicated that they use spare private sector capacity to manage MRI demand. A review of “demand side management” over the last nine months had resulted in a change of service contracts with the private sector which had seen waiting times for routine MRI “balloon out”. It would shortly be back under control and, importantly, this was not a capacity issue.

That is not a view shared by a number of Canterbury DHB’s clinicians and the Panel remains concerned that an influx of patients from Southern DHB would put significant pressure on MRI facilities which already have a waiting list well beyond what can be considered as reasonable.

Additionally, the absence of a helipad on the hospital site is a major issue for patient transfer.

Many of these issues may be dealt with by the construction of the new hospital but the DHB is only in the process of presenting a business case and completion of construction is at least five years away.

Dunedin currently has significant rehabilitation capacity in the form of Wakari Hospital’s Physical Rehabilitation Service (ISIS) located a short distance away from Dunedin Hospital, while Christchurch has a neuro-rehabilitation facility attached to its Burwood spinal unit.

The ISIS team, voiced a concern that the centralisation of neurosurgery in Christchurch would lead to more people receiving their rehabilitation in Canterbury, leading to their unit either being down-

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5 Letter from Alister James, Chairman, Canterbury District Health Board, 18 October 2010
graded or uneconomic and having to close. However, the 6-nil proposal supports people to go back to their own communities as soon as possible, so the Panel did not believe that this was necessarily an impact of centralising the neurosurgical service.

It did note, however, that there appeared little interaction between the Christchurch and Dunedin-based services and there seemed considerable opportunity for strengthening of both centres and a South Island-wide approach to rehabilitation through that closer relationship.

**In summary**, the Panel concluded that the impact on patient outcomes because of transport factors, including the increased cost and complexity, seriously militated against centralisation of neurosurgical services.

Further, the Panel concluded that expecting general surgeons to routinely undertake emergency neurosurgery was not international best practice and would be inappropriate and unreasonable in the current South Island circumstances.

Finally, it also became clear that the real impact and capital cost of dealing with the infrastructural issues were yet to be fully considered and were likely to have a significant impact on a proposal to centralise services in Christchurch.

It became clear that the Panel needed to look at maintaining a resident neurosurgical service in Dunedin, as part of a two-node South Island-wide service. However, the Panel was reluctant to continue with the status quo, of two neurosurgeons being employed by the Southern DHB (formerly, in this case, the Otago DHB).

There was considerable evidence to support the assertion that this was unsustainable and that the service would quickly encounter similar problems to those it had encountered in the past, particularly around staff recruitment, retention and sustainable safe staffing levels (Section 3).

**Sustainable Configuration**

*The second question the Panel needed to answer was – How do we establish a sustainable configuration for the service, which identifies location/locations, addresses delivery of acute services, sub-specialisation, linkages to other hospitals and health providers, provides adequate cover and staffing structures?*

To establish a two-site South Island service which is clinically sustainable meant, in the Panel’s view, that we needed to look carefully at the numbers of neurosurgeons in relation to the South Island population demographics, allowing for the maintenance of skill levels.

Our deliberations on the numbers of neurosurgeons required for the South Island are outlined in Section 3.

Prior to the Panel’s involvement, there had been considerable discussion about ratios of neurosurgeons against populations and, in particular, quoting the Neurosurgical Society of Australasia\(^6\) which recommends a minimum population of 350,000 to sustain a viable neurosurgical service and that there ‘ideally be at least one consultant neurosurgeon per 175,000 population’.

As outlined in Section 3, the Panel considered this and other ratios of neurosurgeons from around the world, which vary widely\(^7\). Ratios are influenced greatly by many issues such as trends in neurosurgical practice, population demographics, local geography, scope of practice, the service outreach model, public and private mix, safe staffing models and involvement in education, research and clinical leadership and management. For instance, the Neurosurgical Society of Australasia’s recommended ratios referred to above (which are being reviewed) are rendered irrelevant in the New Zealand context, because, unlike their Australian colleagues, New Zealand neurosurgeons have less involvement in spinal surgery.

\(^6\) Neurosurgical Society of Australasia Inc – Guidelines for a Sustainable Neurosurgical Service (Updated 3 August 2009) – page two

The Panel came to the conclusion that to plan a regional or national service on the basis of ratios was simplistic and fraught. This was particularly the case in the New Zealand context, because it has been quite unclear whether the ratios refer to FTE positions in the public sector, or the actual number of neurosurgeons. If, for instance, there was significant development into complex spinal work, academic research or education there might need to be more neurosurgeons than there currently are, but the number of FTE worked in the public sector might increase only slightly.

The issues of current neurosurgeon numbers, future demand and succession planning are examined in Sections 3.1, 3.2 and 3.3. It became clear that there will be a number of retirements in the reasonably short term and that this country really needs to pay attention to succession, recruitment and retention, not only in the South Island, but nationally.

International trends would indicate that in terms of succession, recruitment and retention, we are not only talking about retaining the number of surgeons we already have in New Zealand, but increasing the number. Therefore, in planning a South Island service capable of meeting the South Island’s needs for at least the next 20 years, the Panel had to look at not only a bare minimum for the people for the south, but a service that was world class in terms of the mix of public and private work, opportunities for professional development and life-long learning, academic endeavours, contribution to education and training, sub-specialisation, clinical leadership, peer support and working conditions.

We accept that a two person service in Dunedin is unsustainable. Key issues include:

- frequent on-call requirements making the positions unsafe and unattractive
- difficulty in providing cover for annual leave, study leave and sick leave
- professional isolation
- difficulty to recruit
- inability to be part of the RACS neurosurgical training programme, making it difficult to recruit resident medical officers (RMOs).

However, the Panel had discussions with the University of Otago, Dunedin neurologists and orthopaedic surgeons in Christchurch, Dunedin and Invercargill, and with international experts in the field of academic neurosurgery in Canada and Australia. It became clear that a viable option was to establish an academic neurological unit in Dunedin.

Alongside that, but separate to the academic neurological opportunity, there was an additional opportunity for a greater involvement of neurosurgery in both basic and complex spinal work.

These in turn will have an impact on New Zealand neurosurgery as a whole, particularly in the areas of attracting and training more neurosurgeons.

**Academic Neurosurgery**

The definition of academic neurosurgery and the case for establishing an academic neurological unit in the South Island is explored in Section 4. An academic neurological unit established within the University of Otago would integrate the research and teaching activities of the academic neurosurgeons with the clinical services at the hospital. The research undertaken with those at the University would involve laboratory work, clinical trials and translational research and these research activities would complement the services undertaken within the South Island Neurosurgery service, and in particular at Dunedin Hospital. In this the University of Otago’s high quality facilities are crucial.

The Panel noted that the University of Otago has a highly regarded neurosciences division and that neuroscience is one of the fastest growing areas of research internationally.

We also noted the Canadian model of dispersed academic neurological units. Ontario has perhaps the best example of this, where the neurological units are organised in networks (often
encompassing a larger hospital and several smaller hospitals) bound together through their common involvement in academic neurosurgery through appointments to a significant university.

The Panel could see that there is an advantage for not only the South Island Neurosurgery Service, but for New Zealand neurosurgery as a whole, in pursuing this option. Eventually, the Panel sees the presence of a highly functional academic neurosurgical service underpinning a national neurosurgical clinical network. Given the Canadian example, the Panel believes there is the potential for the University of Auckland to consider establishing a strong academic neurosurgery presence in the North Island.

The Panel was conscious that a Dunedin node to a South Island Neurosurgical Service could not be just a two person service, nor could it be the bare minimum to meet the needs of the southern part of the South Island. If it was just the minimum it would struggle to attract the appropriate staff and would undoubtedly fail again.

However, an active academic neurosurgical presence in Dunedin as part of the South Island service makes both Dunedin and Christchurch appointments much more attractive. It supports training and post-graduate research positions; preserves and strengthens the University of Otago’s neurosciences departments and other research programmes. It has the potential to establish the South Island service as one with an international reputation for excellence.

The Panel also reached the conclusion that by strengthening training, research and post graduate positions, a better career path would develop for New Zealand trained neurosurgeons who often seek overseas positions in order to fulfil their ambitions.

The Panel met senior University of Otago representatives and subsequently received a proposal for an academic neurosurgery unit. Subsequent to receiving the written proposal, the Panel had further discussions with University of Otago representatives, along with Professor Andrew Kaye.

As a result of these discussions, the University of Otago agreed to appoint two clinicians – one at Professorial level and another at, at least, Senior Lecturer level, together with the necessary infrastructure and support. It was also agreed that advertising for the Professorial position should commence as soon as possible.

This appears to the Panel to be a realistic and strong commitment to establishing an academic presence in New Zealand, which we would see growing outwards in the future.

An academic neurosurgical unit is not simply about two positions. It requires a clear commitment from the parties involved to make it work and a strong understanding of how a vibrant and growing neurological service works. It is clear from history that neither the Southern nor the Canterbury DHB has the expertise to establish and support this service.

That is why the Panel has recommended Professor Kaye as the Chair of the South Island Neurosurgical Service. Professor Kaye is one of the world’s foremost neurosurgical researchers, has long experience in working across and managing academic and public hospital services and has links with the world neurological research network.

His positions as the current James Stewart Professor of Surgery and Head of the Department of Surgery at the University of Melbourne and Director of Neurosurgery at the Royal Melbourne Hospital make him ideally suited to lead the South Island Neurosurgery Service to becoming sustainable, well financed and internationally respected.

**Spinal Surgery**

Spinal surgery is often shared between neurosurgery and orthopaedic surgery. There is some variation around the world as to which speciality is best placed to advance certain types of spinal surgery. In some areas all traumatic spine and spinal cord injury is cared for by orthopaedic surgeons. In some areas there is significant neurosurgical contribution to the care of these patients.

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8 Letter from Don Robertson, Prov Vice Chancellor, Division of Health Sciences and Dean, Faculty of Medicine
In general all intradural spinal surgery (tumours, blood vessel abnormalities) is done by neurosurgeons (Section 2.1).

Overall, New Zealand neurosurgery is somewhat out of step with the rest of the world in that neurosurgery has a lesser involvement in spinal surgery.

The Panel was impressed by the positive attitude of South Island orthopaedic surgeons towards their neurosurgical colleagues and towards developing a cohesive approach to spinal surgery.

In particular, the Panel was impressed with the way the adolescent scoliosis service delivered a South Island service from Dunedin, including conducting surgery and clinics in Christchurch. There was strong support for a neurosurgeon with an interest in spinal work to collaborate with it in the delivery of scoliosis services and to further develop complex spinal work in both the public and private sectors in Dunedin.

We received a very strong signal that there was an opportunity to expand the volume of neurosurgical spinal work. There is, for instance, a considerable increase in spinal surgery for degenerative spinal disease with an ageing population. It was also noted that the one Invercargill orthopaedic surgeon with an interest in spinal surgery (Murray Fosbender, an esteemed surgeon with a long history of service to the Southland community) is approaching retirement and this provides further opportunities for both neurosurgery and orthopaedics to work together to support a sustainable and high quality service in Southland.

Putting all this together, the Panel is of the view that the South Island Neurosurgical Service is in a position, together with the South Island’s orthopaedic surgeons (particularly those in Dunedin, Invercargill and Christchurch) to develop a spinal service which sets a template for the way neurosurgery and orthopaedics can co-operate to develop a comprehensive spinal surgery service for the future.

This is an opportunity for clinical leadership across specialities to make a difference to the health status of South Islanders. As the service develops it will also be important to have clinical leadership in understanding and managing the costs, because complex spinal surgery is, generally speaking, high cost surgery.

This, in turn, has an impact on the volume of work available for a neurosurgical service in both Christchurch and Dunedin. It means that the South Island Neurosurgery Service can start immediately to build a Dunedin-based node comprising two neurosurgeons with academic appointments and a third with an interest in spinal surgery working across the public and private sectors.

There is potential for orthopaedics and neurosurgery to work together in developing better career pathways. This could be in the form of developing a combined orthopaedic and neurosurgical Fellowship in spinal surgery, which would also be advantageous to the University of Otago in developing its spinal research. If the first Fellow was a neurosurgeon, there is the potential for that person to assist on the consultant neurosurgical roster.

Additionally, the NSA has recently developed a Post-Fellowship programme in spinal surgery which is co-badged with the Royal Australasian College of Surgeons (RACS). The Australian and the New Zealand Orthopaedic Associations may well follow suit, which would mean the possibility of a one year programme available to FRACS graduates in orthopaedic surgery or neurosurgery. This programme could also be linked to the RACS combined FRACS/PhD (and Masters) pathway.

**Acute Services**

As outlined in ‘Service to the Community’, above, the Panel came to the view that to provide a South Island-wide acute neurosurgical service, there needed to be resident neurosurgeons in Dunedin.

However, the need to provide a 24-hour acute call service has been one of the major issues militating against that presence in Dunedin.
This is because in a two person service, each surgeon has to be on call one week in two (known as 1 in 2). A two consultant service is not sustainable in the long term, as an on-call roster of 1 in 2 becomes 1 in 1 when the other person is absent on recreational leave, sick leave or conference leave. In general each surgeon would be on a 1 in 1 roster for 6 to 8 weeks each year.

Because neurosurgery is a 24/7 service with a high emergency workload a 1:2 roster is particularly difficult to sustain, compared with some other specialties. In neurosurgery this type of roster is considered unsafe and contravenes RACS New Zealand National Board, Canadian and Australian Medical Association safe staffing and safe working guidelines and recommendations, and the European Working Time Directive.

The RACS 2009 Workforce Survey indicates surgical perceptions of the relative clinical safety of various roster schedules. The New Zealand National Board of the RACS is clear that minimal safe rostering is 1 in 3 and that a minimum of 1 in 4 is more desirable from a patient safety perspective.

A three person neurosurgical service is the minimum that could be considered safe and sustainable from a rostering perspective. The introduction of a three person node reduces the call rate to 1 in 3 and means it should not normally go below 1 in 2.

It also means that the service is less vulnerable to a resignation, which has been a major issue in the past and has meant one surgeon has faced indefinite periods of 1 in 1 call, which is not sustainable. International evidence on the number of neurosurgeons required is variable (Section 2.8.1), but there is general consensus that three neurosurgeons in one place is the minimum number.

There has been strong public comment from the Otago and Southland communities that those supporting a six-person service in Christchurch have simply been motivated by life-style reasons. This is unfair to the neurosurgeons in Christchurch; it is the Panel’s view that this option is being promoted as the best option to avoid the difficulties inherent in providing emergency cover in Dunedin in the last few years and also as an opportunity to expand safe, sustainable sub-specialisation in Christchurch. It is clear that the view that a two-person service in Dunedin is unsustainable is reasonable, given the evidence of the past. Organisations have to be conscious of the health of those providing the service, in order that those people are able to provide it in a safe and comprehensive way, for the benefit of their communities9.

In the case of Dunedin, it is clear that the neurosurgical service’s sustainability rested to a large degree for many years on the shoulders of Professor Bishara, whose outstanding dedication was acknowledged time and again during the Panel’s discussions with organisations and individuals. It is clear that Professor Bishara’s dedication in many ways protected the organisation from making the decisions required to build the service for the future. Clearly, while there is exceptional organisational commitment to the service now, that commitment has not always been evident.

The Christchurch clinicians, who themselves have shown considerable dedication to providing a service to the South Island, are right to look for a model which deals with this issue. It should be noted that the Clinical Head of the Christchurch service, Mr Martin MacFarlane, has been extraordinarily dedicated to the development of the Christchurch service, having started it up as the sole neurosurgeon in 1981. The Panel notes that Mr MacFarlane has championed the potential future for South Island neurosurgical services based on a justifiable belief that a two-person service in Dunedin is unsustainable. Although the Canterbury DHB senior management and Board seem to support his vision for the future, they do not appear to have done the necessary strategic work and business modelling that needs to accompany such a vision to ensure its successful implementation.

Therefore, the Panel came to the conclusion that the proposal to concentrate neurosurgical services in Christchurch was motivated by the wish to provide the best possible service for South Islanders, in the face of years of evidence that the service providers in Dunedin could not consistently sustain a viable service.

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The Panel was able to identify another, clinically and cost effective, model, but it fully understands the motivation behind the proposal to concentrate the service in Christchurch.

**Sub-specialisation**

The ability to sub-specialise is a major justification for the centralisation of relatively low-volume, highly complex and expensive tertiary neurosurgical services.

In the New Zealand context, and particularly with regards to the South Island, with a low and sparse population, centralisation in order to sub specialise is a significant issue. For specialities such as neurosurgery, where there is a time component for acute admissions, and therefore an accessibility component, centralisation becomes a problem.

The one site proposal was motivated, in part, to provide the ability to sub-specialise. The Panel came to the view that sub-specialisation was equally possible under a two-site academic neurosurgical service model.

Sub-specialisation can develop based on historical activity, teamwork and careful succession planning. Paediatric neurosurgery should, for instance, remain as a sub-speciality with Christchurch. The well established Christchurch based centre of expertise in endovascular neurosurgery should be supported and enhanced. Dunedin may develop a stronger interest and involvement in complex spinal surgery, including some involvement in the already well functioning adolescent scoliosis surgery. Dunedin would continue to provide the national stereotactic radiosurgery service.

**Out-Reach**

Out-reach is a significant component of any South Island-wide neurosurgical service. Section 5.3 sets out the Panel’s views on outreach.

It is important to define ‘outreach’ because the term can mean different things to different people. There were a number of different examples of services using varying models of outreach to which the Panel was exposed – these included Southern DHB’s blood and oncology service to Southland, the South Island paediatric surgical service, the paediatric oncology shared services model involving Canterbury and Capital and Coast DHBs and the scoliosis service which originated in Dunedin and has become, through the dedication of the multi-disciplinary team, a South Island-wide sub-speciality which takes services as close to the consumer as possible.

It was the Panel’s view that a two-node South Island Neurosurgical Service was more likely to provide a true outreach service to secondary hospitals and primary care, than a one-node service.

**Staffing Structures**

The discussion around the shape of an effective South Island Neurosurgical Service has become fixated on the numbers and location of neurosurgeons. While this is important, it fails to acknowledge that this must be a multi-disciplinary service which focuses on the full patient journey from the beginning to the end – not just the hospital-based neurosurgical intervention.

Therefore, the Panel considered the current staffing of both Dunedin and Christchurch Hospitals (Section 1.4), the likely shape of the new service and the appropriateness of these structures. The estimated cost of down-grading the Dunedin structures and building up the Christchurch staffing was also included in the financial considerations in Section 8.

Overall, it became clear that down-grading a skilled and long-standing workforce in Dunedin Hospital and attempting to expand the workforce at Christchurch Hospital was likely to be difficult and costly. The panel also considered the rehabilitation services in Christchurch and Dunedin (Section 1.4). While we did not consider these workforces in the same detail, we do consider that they have an important part to play in an effective service and maintaining and improving access to rehabilitation services is a significant issue in maintaining an effective neurosurgical service.
Linkages

…..to other specialities, medical schools, training programmes

One of the issues at the heart of the concerns raised by Otago and Southland clinicians, in particular, was the impact that having no Dunedin resident neurosurgeons would have on other specialities and their training programmes.

Equally important, from a Southern DHB perspective, was the impact on the University of Otago’s Faculty of Medicine and, in particular, the School of Medicine’s Dunedin Clinical School.

Neurosurgery is an integral part of those hospitals in which it is established. It’s interaction with neurology is obvious, of course, but it often overlaps with many other surgical and medical specialities. There are interfaces with orthopaedics in both trauma care and spinal work; with paediatric surgery for hydrocephalus and congenital abnormalities of the CNS; with plastic surgery for peripheral nerve work; with craniofacial surgery for skull and facial deformities and injury; with oto-rhino-laryngology for nasal tumours, skull base tumours, trauma with CSF leakage; with medical oncology for CNS tumours; with radiology for vascular abnormalities and aneurysms and stereotactic radiosurgery; with general medicine, and neurology, in the care of older patients with neurosurgical conditions such as chronic subdural haematoma and dementing illnesses.

With regards to the University of Otago’s Faculty of Medicine, it was clear that whether or not Dunedin had resident neurosurgery would have little impact on under-graduate medical education – a South Island service based in Christchurch could contribute adequately, as neurosurgery is a relatively small part of the undergraduate curriculum.

However, the Panel was more convinced that it would have an impact on the University’s post-graduate and research programmes, particularly neurosciences. Conversely, the linkages with the University have the potential to strengthen the whole South Island service and, ultimately neurosurgery throughout the country.

Leadership

Clinical leadership – How do we provide a clearly defined leadership structure in order to build the service, provide continuity and succession planning? (It should be noted that when the Panel refers to ‘clinicians’ it is referring to all disciplines, not only doctors.)

The clinical leadership within the newly constituted South Island Neurosurgery Service will be difficult at the beginning, at least from the point of view of the neurosurgeons themselves. Dunedin has no permanent staff and given the bad blood, it would be difficult for Christchurch’s clinicians to be responsible for the whole service at this point.

However, strong leadership is essential to the success of this service so in the initial stages it will have to come from outside. It is for that reason, amongst others, that the Panel has nominated Professor Kaye as the independent chair of the Governance Board. We also want to support him by having another neurosurgeon on the Board.

The Governance Board will also be urged to consider appointing a part time clinical director to provide day-to-day support to the locally-based neurosurgeons. As the service develops, and the Dunedin node begins to be staffed on a permanent basis, we expect a Clinical Director will be appointed from within the service, but that won’t happen over night.

Leadership and Operation of a South Island Service

The leadership and operation of a South Island service – This will include details such as its management, leadership and employment arrangement, as well as how such a service is governed to provide maximum representation and involvement from across the island and minimum opportunity for conflict.
Funding arrangements – What funding arrangements are required for the service to be equitable, sustainable and minimise conflict between regions?

These arrangements are outlined in Sections 7, 8 and 9. The Panel was conscious that it needed to change the leadership paradigm without setting up a whole new bureaucracy so we have gone for a pragmatic solution.

The proposed membership of the Governance Board is outlined in Section 7.3 and it ensures that there is representation from the Canterbury and Southern DHBs at the highest level, as well as representation from other South Island DHBs, and expert consumer input.

The fact it reports through the National Director of the National Health Board (NHB) gives confidence that there is guidance and momentum at a national level.

The employment arrangements set out in Section 6 are self-explanatory – it would be difficult to employ members of the clinical team outside their normal DHB arrangements, but the role of the Governance Board gives comfort that appointments will be dealt with appropriately and transparently.

It is also important, in the short term, to give the Governance Board some on-the-ground management support, hence the recommendation to appoint a manager, employed by the NHB to assist the DHBs to bring their teams and systems together. This is envisaged as a short-term arrangement.

With regards to funding, again the Panel has taken a pragmatic approach. As outlined in Section 9, we believe the current system which is reliant on inter-district flows (IDFs) has been unhelpful in providing the right signals for organisations to support their clinicians in making the right clinical decisions for their patients.

We have outlined a change to a population based funding arrangement which we expect the Governance Board to implement for the 2011/2012 financial year. We expect this to give the other DHBs’ communities and clinicians confidence that they are receiving a fair service in proportion with their population.

In terms of the financial sustainability of the service, we asked the National Health Board to look more closely at the previous financial projections and assumptions when the single service based in Christchurch was being developed as the preferred option. To do this, representatives of the Southern and Canterbury DHBs’ financial teams met with NHB officials to come to a common understanding of the financial assumptions being used. The NHB then used these assumptions to determine the likely savings or costs of centring the service in Christchurch. As outlined in Section 8, these figures showed that, conservatively, a Christchurch-only service is estimated to cost the health system as a whole, an extra $3.1 million in the first year.

It should be noted that this work was done after clinical and community issues had been considered.

Implementation

Implementation – The Panel needs to ensure that whatever its final recommendations are, they can be implemented and there is an understood timeframe for that to occur.

The Panel has been working on the basis that it will take two years for the South Island Neurosurgery Service to be fully functional with the Dunedin node becoming an academic neurosurgical unit, but the University of Otago has indicated it will begin advertising for a Professorial position immediately.

Likewise the Governance Board will need to begin work as soon as the Acting Director-General appoints it.

The Panel is under no illusion that the Boards and senior management of the Canterbury and Southern DHBs will need to work constructively and effectively together to ensure this South Island-
wide service works properly. All parties have a responsibility to the communities they serve to ensure the success of this service.

The Panel is of the opinion that this is the final opportunity for all parties to make this service work as a single regional all of South Island service. The Panel has provided them the vision, the framework, the guidelines, the tools and the support to establish and maintain a safe, high quality, internationally respected service; a service in which all South Islanders can have confidence and of which they can all be proud. If this opportunity is not taken, then we have recommended that the service be removed from the purview of the South Island DHBs and operated by another organisation, probably a North Island DHB.
Recommendations

The recommendations set out below are strongly supported by all three members of the South Island Neurosurgery Expert Panel.

The Panel recommends to the Acting Director General of Health that:

1. The South Island Neurosurgery Service is established as a regional, distributed service with nodes in Christchurch and Dunedin.

2. An independent Governance Board is established and given the delegated authority and support to lead the business and clinical development of the Service for the benefit of all South Islanders. This authority extends to all appointments and re-appointments of neurosurgeons and key clinical staff to the Christchurch and Dunedin nodes.

3. The Governance Board be Chaired by Professor Andrew Kaye with the following additional membership:
   - an independent neurosurgeon
   - the Chair of Southern DHB
   - the Chair of Canterbury DHB
   - an expert consumer advisor
   - One of the Chairs of Nelson Marlborough DHB, South Canterbury DHB and West Coast DHB, on an annual rotational basis
   - a senior University of Otago nominee
   - a South Island Iwi nominee.

4. The Governance Board have an initial term of three years, with review after two years.

5. The Governance Board will be responsible to the National Health Board, through its National Director.

6. The Governance Board be supported by a clinical director and a manager, both employed by the National Health Board, which will also provide administrative support to the Board.

7. The Governance Board publish a six-monthly report. The report to be publicly available.

8. The South Island Neurosurgery Service develops an academic neurosurgical component in Dunedin, supported by the University of Otago and comprising, as a minimum, an appointment at Professorial level, an appointment at Senior Lecturer level, and appropriate infrastructural support.

9. Urgent attention be given to building the Dunedin node, in association with the University of Otago.

10. The South Island Neurosurgery Service is built to include seven, then eight neurosurgeons, with a minimum of three neurosurgeons in Dunedin. The numbers refer to people and not full time equivalent measures. Careful consideration be given to the prudent and integrated development of subspecialisation.

11. Employment arrangements to be with the resident DHBs, as outlined in Section 6.1 of this document.
12. The Service must ensure equitable patient access to neurosurgery by managing the available South Island-wide capacity. The Governance Board needs to develop a South Island-wide service delivery plan, the key elements of which are a single point of entry, contracted volumes for first specialist assessments inpatient case loads and, access to diagnostics such as MRI, neurophysiology and interventional neuro-radiology. Other key factors are the availability of intensive care, high dependency unit and neuro-rehabilitation beds.

13. The Service establish neurosurgical outreach services throughout the South Island as outlined in Section 5.3 of this document.

14. The Governance Board be charged with developing a population based funding model to ensure equitable access.

15. The Governance Board develop and utilise a combined clinical and corporate safety, risk management and quality improvement framework based on the “Plan, Do, Study, Act” (PDSA) cycle to drive the establishment and maintenance of a safe, quality, effective and resource efficient service.

16. The Governance Board, in conjunction with the Medical Council of New Zealand and the Royal Australasian College of Surgeons, review the current processes for the assessment of international medical graduates for registration in the vocational scope of practice of neurosurgery and ensure they are robust, timely and practical.

In support of the above recommendations, the Panel also recommends that:

a) a data set be developed to monitor the clinical, administrative and financial success of the service and to support sound strategic planning

b) patient recovery and related patient transport services be reviewed across the South Island

c) closer co-ordination is developed between the two South Island rehabilitation services

d) the requirements of neurosurgery are linked into the current review of South Island information technology systems

e) a review of the process used by this Panel occurs in order to capture the generic lessons for the wider New Zealand health sector.
1. Background

1.1. Development of Neurosurgery in the South Island

The first South Island neurosurgical unit was established in Dunedin in 1943. At that time, Dunedin Hospital remained the major tertiary hospital in the South Island and that status was inextricably linked to the presence of New Zealand’s only medical school at the University of Otago – a situation which continued until 1968 when the University of Auckland opened the country’s second medical school.

While the service has always been small, operating as a two to three neurosurgeon service up until the retirement of Professor Sam Bishara in October 1995 it had had a series of strong leaders, internationally recognised, involved in research and teaching, and dedicated to the southern region. The establishment of New Zealand’s only stereotactic surgery unit in Dunedin is an example of this.

The second neurosurgical service opened in Christchurch Hospital in 1981, with the current Clinical Head, Mr Martin MacFarlane, as its foundation neurosurgeon.

The opening of the Christchurch unit acknowledged the growing population needs in the upper South Island. It has grown to three and, in the last year, four neurosurgeons with three registrars and the unit is accredited by the Royal Australasian College of Surgeons (RACS) for the training of neurosurgical trainees in the SET programme (one SET 2 and one SET 1 trainee).

Conversely, since the retirement of Professor Bishara in 1995, the Dunedin unit has not been able to retain a clinical leader and has lost its accreditation as a RACS training unit in neurosurgery. It has struggled to maintain a complement of two neurosurgeons and its last permanent neurosurgeon left in January 2009 prompting the beginning of the review process described in Section 1.3.

The Southern DHB consistently submitted that it could have appointed replacement neurosurgeons in early 2009 and that the only reason it did not was in order to participate in the review with a view to forming one co-ordinated South Island service. The Southern position is that the delay in appointing replacement neurosurgeons, rather than being seen as a responsible commitment to a way forward has now been turned around to indicate a difficulty in recruitment where there was none. However, records\textsuperscript{10} show that there had been a reliance on locum cover from at least January 2008.

This cuts to the Canterbury clinician’s position that they have been propping up an unsustainable service, at the expense of the development of their own service. Indeed, as far back as 1996, Mr MacFarlane was writing to the Chair of Canterbury Health\textsuperscript{11} complaining that with the retirement of Professor Bishara the year before, Dunedin Hospital was having trouble appointing an appropriate replacement neurosurgeon.

Mr MacFarlane was basing his opinion on a number of reports which had indicated that there would eventually be only one neurosurgical service in the South Island, based in Christchurch.

Mr MacFarlane rightly points out, that in the late 1970s when it was decided to establish a new unit in Christchurch, the Minister of Health, George Gair, indicated that the Dunedin unit would not continue long term. The fact that it did continue, according to Professor Bishara\textsuperscript{12}, was due to two factors. The first was the advance in scanning technology which meant that a lot of intracranial

\textsuperscript{10} Southern DHB Cover Roster 2008 – October 2010
\textsuperscript{11} Letter M MacFarlane to Dr Brent Layton, 15 May 1996
\textsuperscript{12} Personal interview with panel, October 2010
tumours and aneurysms which had not been detected previously were now being discovered and treated. The second factor was the attention the Dunedin unit paid to outreach, which meant it received more referrals from other hospitals, particularly Invercargill.

There were other reports through the 1980s and 1990s indicating a move to a sole unit in Christchurch¹³ and until recently, there has been little development of facilities, equipment or staffing which would indicate a long term commitment to the service on the part of Otago DHB (now Southern DHB).

Indeed, it goes without saying that the collapse of an aged operating microscope¹⁴ while in use during 2009 is something that should never happen in a modern health facility and is something that is not designed to attract top quality staff, nor to protect patients. As a result of that collapse though, the Dunedin service now has an appropriately modern and high quality operating microscope.

So, it is with this background that we now come to the last quarter of 2010 when the Panel is being asked to make its own recommendations on the future direction of South Island neurosurgery.

With that in mind, it is important to note that a long established service such as neurosurgery does not exist in isolation. It becomes an integral part of a hospital’s activities and expertise. Many of the skill-sets within other departments develop as a result of the service being delivered.

For example the advances in endoscopic nasal surgery by ENT surgeons have had positive benefits in skull base surgery performed by neurosurgeons; the advances in radiological techniques have allowed the improvement of the treatment of aneurysms by endovascular means; the developing knowledge in the treatment of raised intra-cranial pressure has allowed better treatment of head injuries in co-operation with intensivists; the increased usage of spinal instrumentation has benefited both neurosurgically trained and orthopaedically trained spinal surgeons.

You would expect in a well-functioning hospital clear examples of this expertise, and of the passion of the people delivering neurosurgical and associated services. The Panel was delighted to find precisely this in both Christchurch and Dunedin hospitals. The process it undertook (Section 1.2) lead the Panel to interact with a wide range of health professionals throughout the South Island. We received, without exception, respectful, impassioned and knowledgeable submissions. Many showed a high level of leadership in their own fields.

It is, therefore, disappointing that somehow the same level of leadership; clinical, management and governance, has not been shown at a South Island-wide level.

A deep sense of parochialism undermines the development of this South Island-wide view. This relates not just to neurosurgery, but to all services and was demonstrated time and time again.

In Dunedin, rooted in its history as a leading tertiary and university centre within a static, and proportionately falling, population there is a deep paranoia that any change involving Canterbury is aimed at undermining the facility to the point where it is a shadow of what it once was.

In Canterbury there is a confidence that the greater population and growth of Christchurch must lead inevitably to it becoming the pre-eminent centre in the South Island.

With respect to neurosurgery, it is difficult to find a South Island-wide mind-set, one that sees the development of all the island’s strengths in all its regions as important. The South Island population

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¹³ MacFarlane – Neurosurgical Services for the South Island, 1 December 2008
¹⁴ Core equipment for a neurosurgical unit and worth in the order of $500,000
is too small to sustain this sort of parochialism in such a fundamental sector as publicly-funded health services. It deserves better.

The Panel sought to find a solution in neurosurgery that might set an example, in approach, if not in specific results, for the South Island health sectors’ leaders in the future.

1.2. Panel Terms of Reference and Process

The Panel’s terms of reference are attached at Appendix 1 and a list of the groups with which the Panel interacted is at Appendix 4.

Much of the information that the Panel gathered was through face to face interviews undertaken at various times over a period of 10 weeks.

Interviews with DHB staff were arranged through the Chief Executive’s office. The letters informing the South Island DHBs of the Panel’s intentions and seeking their assistance are at Appendix 5.

An extensive literature review was undertaken on the Panel’s behalf and the Panel sought the views of experts in Australia and Canada, as well as talking to neurosurgeons in each of the other New Zealand neurosurgery units – Auckland, Hamilton and Wellington.

A draft copy of this report, minus the Summary of Deliberations and Findings and Recommendations, was sent to all South Island DHBs for checking of fact and the Panel considered the responses in finalising the report.

1.3. Previous Reports on South Island Neurosurgery

In June 2009, under the chairmanship of Professor Spencer Beasley, a draft Neurosurgical Service Plan was delivered to South Island DHBs. Following this, in August 2009 the DHBs agreed that there would be a single integrated service for the South Island, and that a single interim clinical director would be appointed to the service for 12 months to recommend the future configuration of the service.

Dr Ian Brown was appointed Interim Clinical Director and delivered a report in April 2010 which, building on the commitment of all South Island DHBs to a regional service, recommended one six-neurosurgeon service based in Christchurch, with a comprehensive outreach programme across the South Island. This recommendation was in line with Professor Beasley’s recommendations. Dr Brown noted that his decision was reached without agreed financial analysis or financial impact assessment of the status quo or his recommended configuration.

1.4. Current Facilities

The tables below summarise the current staffing, resourcing, capacity, and IT interoperability of the South island’s two neurosurgical units. Data supplied and verified by Southern and Canterbury DHB’s respectively.
### 1.4.1. Dunedin Hospital

The data below represents information provided by Southern DHB.

<table>
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<tr>
<th>Ward</th>
<th>Bed numbers and description</th>
<th>20-bed combined neurosurgery, neurology, ENT and ophthalmology ward (Ward 5B)</th>
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</thead>
</table>
| High dependency | 3-bed high dependency unit | Nursing ratio: 1:2  
Intracranial pressure monitoring: yes  
CPAP: yes  
Arterial line: yes  
CVP monitoring: yes  
EVD: yes |

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<tr>
<th>Staffing (09/10)</th>
<th>FTEs</th>
<th>Number of people</th>
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<td></td>
</tr>
<tr>
<td>Consultant neurosurgeons</td>
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<td>3.0</td>
</tr>
<tr>
<td>(Figure supplied by Southern DHB, the Panels understanding is this currently represents two clinical full-time locums and an advisory non clinical position)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dedicated neurosurgical Fellows</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Accredited neurosurgical RACS SET trainees</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-RACS accredited registrars</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>House Officers (NS-specific)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Other/general staff on the same ward:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consultant - neurologists</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Consultants - other (please specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ophthalmologists</td>
<td>3.8</td>
<td>5</td>
</tr>
<tr>
<td>ENT</td>
<td>3.7</td>
<td>5</td>
</tr>
<tr>
<td>Accredited trainees - neurology</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Accredited trainees - other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ophthalmologists</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• ENT</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Non-accredited registrars - neurology</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Non-accredited registrars - other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ophthalmologists</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>• ENT</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>House Officers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Ophthalmologists</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>• ENT</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ward nurses</td>
<td>24.9</td>
<td>31</td>
</tr>
<tr>
<td>Allied Health (please specify if NS-specific, or if they cover several wards, if so, how many)</td>
<td>12.0 FTE across 3 wards and ICU</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total staff</strong></td>
<td>48.5</td>
<td>75</td>
</tr>
</tbody>
</table>
| Specialist nursing | Number of nurses that have undertaken a specialist neurosurgical nursing training programme: none  
Are there any nurse specialists in neuroscience? no  
Are there any nurse practitioners in neuroscience? no  
Comment on numbers/experience of neuroscience trained and experienced nursing staff: 9 very experienced nursing staff with plus 10 years experience each. All staff (24 nurses) have completed Neurosurgical HDU training |
|---|---|
| Occupancy rate | ![Ward 5B Occupancy Rate Graph](image)  
Note: the straight line shows recommended occupancy (85%), the other line shows actual occupancy. |
| Facilities for families | DHB Accommodation guide provided. |
| Theatre | Access | Number of elective operating sessions per week: 2.5  
Session time period: 0815-1600  
Access to emergency operating theatre time: yes |
| Equipment | Neurosurgical operating microscope: October 2009  
Ultrasonic aspirator: 2006  
Frameless stereotactic system: leased  
Intraoperative ultrasound equipment: no  
Micro-neurosurgical instruments: yes |
| Support | Facilities | ICU: 12 physical beds 8 resourced beds  
Radiology: please provide description/specs for:  
CT: Siemens 64 slice CT Scanner  
MRI: GE Signa 1.5T HDx MRI scanner  
Interventional radiology suite: MultiStar due for replacement with a Siemens ARTIS Zee |
| Personnel | Neuroanaesthesia: yes - 8  
Neuroanaesthesia: yes 24 hr availability  
Neuropathology: yes – full cover  
Neuroradiology: yes – full cover  
Interventional neuroradiology: yes – full cover  
Neurophysiology: yes – 2 |
Occupancy

<table>
<thead>
<tr>
<th>Month</th>
<th>ICU Occupancy</th>
<th>Total Hospital Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul-05</td>
<td>120%</td>
<td>100%</td>
</tr>
<tr>
<td>Jan-06</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Jul-06</td>
<td>120%</td>
<td>100%</td>
</tr>
<tr>
<td>Jan-07</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Jul-07</td>
<td>120%</td>
<td>100%</td>
</tr>
<tr>
<td>Jan-08</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Jul-08</td>
<td>120%</td>
<td>100%</td>
</tr>
<tr>
<td>Jan-09</td>
<td>100%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Note: the straight line shows recommended occupancy (85%), the other line shows actual occupancy.

**Retrieval**

**Staffing**
- 1 retrieval nurse rostered in ICU on each shift, usually accompanied by registrar
- Retrieval team is coordinated from ICU using ICU resource. A subset of ICU nurses is aeromedical trained. When required for transport their allocated tasks are absorbed by the team and they become part of the transport team

**Helipad**
- On roof of hospital

**Imaging**

**Interoperability**
- PACS environment since August 2008
- Interoperability with the following sites:
  - Invercargill PACS - includes all Queenstown Lakes District Hospital imaging
  - Balclutha and Dunstan Hospitals – all x-ray imaging is automatically sent to Dunedin PACS
  - Oamaru Hospital – all imaging is automatically sent to Dunedin PACS
  - Timaru Hospital – link via Christchurch for urgent only
  - Christchurch Hospital
  - Otago Radiology – includes all Gore Hospital imaging, Dunstan and Balclutha ultrasound, and Dunstan fluoroscopy
  - Christchurch Radiology Group (planned for next month)
## ISIS Rehabilitation Centre

Inpatient beds: 26 inpatient beds, 87% occupancy

### Links with Dunedin Hospital
- Links with Dunedin Hospital: twice a week, one of the consultants or registrars will go to the inpatient ward to do a preliminary assessment of cases that may be likely to go to ISIS; ISIS staff attend IDT meeting at Dunedin Hospital every Friday morning
- Urgent readmissions to Dunedin Hospital: since April last year 12 ISIS patients have needed urgent neurosurgical assistance (eg, SAH), at least 3 would have died – 20 min transfer time to hospital, good liaison with neuroradiology, immediate patient transfer to OR

### Patient profile
- All rehabilitation south of Timaru except spinal injuries
- Types of patients: majority are neurological, some are neurosurgical, some are trauma-related, maximum of 4 respite patients at any time
- Projected annual need to neurosurgical assistance to fit baclofen pumps: 1 per annum

### Staffing
- Consultants (Rehabilitation Medicine Specialists): 2
- RACP-accredited trainees: 1
- Registrars: 2
- Support: in and outpatient physiotherapists (6), SLTs (3), neuropsychologists (3), social workers (3), dietician, occupational therapists (4), palliative care and out-patient nurses
- Total staff: approximately 120

### Facilities for families
- Flats available for family to stay at ($18 per day – whole family/whanau is able to stay there)
- Flats on the outskirts of site for patients nearing discharge

### Christchurch Hospital

The data below represents information provided by Canterbury DHB

<table>
<thead>
<tr>
<th>Ward</th>
<th>Bed numbers and description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28-bed combined neurosurgery and neurology ward as of 9/8/10 (Ward 28)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-bed “special care room”</td>
</tr>
<tr>
<td>Nursing ratio: 1:3 or 1:4</td>
</tr>
<tr>
<td>Intracranial pressure monitoring: yes</td>
</tr>
<tr>
<td>CPAP: no</td>
</tr>
<tr>
<td>Arterial line: no</td>
</tr>
<tr>
<td>CVP monitoring: yes</td>
</tr>
<tr>
<td>EVD: yes</td>
</tr>
<tr>
<td>Lumbar Drains</td>
</tr>
<tr>
<td>Vasopressor Therapy</td>
</tr>
<tr>
<td>Staffing (09/10)</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>Neurosurgical-specific staff:</strong></td>
</tr>
<tr>
<td>Consultant neurosurgeons</td>
</tr>
<tr>
<td>(Note: the Panel received verbal information from the Christchurch neurosurgeons that one of the four surgeons works 0.2 in the private sector and another works 0.3)</td>
</tr>
<tr>
<td>Dedicated neurosurgical Fellows</td>
</tr>
<tr>
<td>Accredited neurosurgical RACS SET trainees</td>
</tr>
<tr>
<td>Non-RACS accredited registrars</td>
</tr>
<tr>
<td>House Officers (NS-specific)</td>
</tr>
<tr>
<td><strong>Other/general staff on the same ward:</strong></td>
</tr>
<tr>
<td>Consultant - neurologists</td>
</tr>
<tr>
<td>Consultants - other</td>
</tr>
<tr>
<td>Accredited trainees - neurology</td>
</tr>
<tr>
<td>Accredited trainees - other</td>
</tr>
<tr>
<td>Non-accredited registrars - neurology</td>
</tr>
<tr>
<td>Non-accredited registrars - other</td>
</tr>
<tr>
<td>House Officers Neurology</td>
</tr>
<tr>
<td>Ward nurses</td>
</tr>
<tr>
<td>Allied Health</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>Total staff</strong></td>
</tr>
</tbody>
</table>

Training Approval for:
- 1 x SET 2 or above registrar
- 1x SET 1 registrar

Subspeciality interests
- Martin MacFarlane: Paediatric neurosurgery, acoustic neuromas / skull base, pituitary tumours, neuromodulation, infusion pumps
- Nicholas Finnis: complex spine
- Ronald Boet: endovascular interventions
- Suzanne Jackson: complex spine
- All neurosurgeons cover: general neurosurgery (eg trauma, most brain tumours, spinal tumours, aneurysm clipping, CSF / shunts)
### Specialist nursing

Number of nurses that have undertaken a specialist neurosurgical nursing training programme: 3

Are there any nurse specialists in neuroscience? CNE 2 x .5FTE

Are there any nurse practitioners in neuroscience? no

Comment on numbers/experience of neuroscience trained and experienced nursing staff: 30 at least have 1 yr Neuroscience experience of which 19 have 3 yrs or more experience.

### Occupancy rate

Note: While the ward is combined, occupancy is shown separately below for neurosurgical and neurological patients.

![Neurosurgical Occupancy Chart](image1)

![Neurological Occupancy Chart](image2)
### Facilities for families

- Ranui House
- Gothic Heights
- Te Whare Mahana
- Ronald McDonald House

### Theatre

#### Access

Number of elective operating sessions per week: 9 designated plus 1 DSA for coils
- Session time period: 4 hours
- Access to emergency operating theatre time: as required based on priority

#### Equipment

- **Neurosurgical operating microscope**:
  - purchased: October 1999
  - cost: $170,000
  - supplier: Surgico Medical
- **Ultrasonic aspirator**:
  - purchased: July 2007
  - cost: $99,000
  - supplier: Integra Neurosciences
- **Image Guidance System**
  - purchased: January 2009
  - cost: $495,000
  - supplier: Medtronic
- **Intraoperative ultrasound equipment**:
  - purchased: October 2005
  - cost: $64,000
  - supplier: Sonosite
- **Micro-neurosurgical instruments**:
  - treated as consumables, ongoing purchasing

---

**Combined neurosurgical and neurological occupancy**

Note: CDHB uses Caplan to determine resource allocation and requirements NOT the traditional application of ward / unit occupancy. Patients are cared for in the most appropriate settings and should patients be managed in other areas, then the appropriate resourcing is then applied. Additional urology ward capacity has been created (July 2010) that has enabled the reconfiguration and establishment of medical home wards. All surgical wards will be reviewed over the next 12 months to achieve improved collocations.
### Support

<table>
<thead>
<tr>
<th>Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU: 18 bed unit</td>
</tr>
<tr>
<td>Radiology: please provide description/specs for:</td>
</tr>
<tr>
<td>- CT: x2 multi slice (64 slice), x1 multislice (16 slice), x1 Single slice and x1 multi slice (4 slice Ashburton), supplier is General Electric</td>
</tr>
<tr>
<td>- MRI: x1 (1.5 teslar), supplier is General Electric</td>
</tr>
<tr>
<td>- Interventional radiology suite: 2x suites, supplier is Phillips</td>
</tr>
</tbody>
</table>

In addition to the above the following additional radiology capacity exits within Canterbury and is used by CDHB to contract additional capacity to create / provide access for our community:

- MRI CMI x1 MRI
- CRG x3 MRI
- CT CMI x1 CT
- CRG x3 CT

In addition to the above MRI capacity, CDHB is planning a further MRI machine to be installed 2014.

### Personnel

- Neuroanaesthesia: Elective lists are covered by a core group of 10 anaesthetists, out-of-hours any of the 30 consultant anaesthetists who cover general call would be expected to manage a neurosurgical case
- Neuropathology: service provided by Canterbury Laboratory
- Neuroradiology: 2x specialists
- Interventional neuroradiology: 5x specialists
- Neurophysiology: 1x neurophysiologist 3x neurophysiology technicians

### Occupancy

15 July 2005 – 30 September 2010

Based on 18 Beds available

![Average Percentage Occupancy in ICU/CICU at Midnight by Month](image-url)

---

15 Occupancy graphics for ICU were supplied by Canterbury DHB – the Panel does not have the background data that it does for all other occupancy representations

16 This figure was provided by the DHB, however it differs from the publicly stated figure of 15 resourced beds in October 2010 (“Intensive care unit in crisis” The Press, 14 October 2010 http://www.stuff.co.nz/the-press/news/4230426/Intensive-care-unit-in-crisis)
In addition to the ICU unit there are a number of special care units that are supported by both speciality based teams and an ICU outreach team

- Orthopaedic Trauma Unit – 5 beds
- Surgical Progressive Care Unit – 6 beds
- Neurosurgical Progressive Care Unit – 4 beds
- Coronary Care Unit – 8 beds + 1 treatment room
- Paediatric High Dependency Unit – 8 beds in total & includes neurosurgical paeds

**Retrieval Staffing**

- Retrieval staff: 7.0FTE

**Helipad**

- Approximately 500m from the hospital, in Hagley Park (requires ambulance transfer)

**Imaging Interoperability**

- PACS system
  - Greymouth, Nelson, Wairau, Timaru – CT (able to push and pull)
  - Dunedin, Invercargill – CT, MRI (able to push only)
  - Moving to full interoperability with both CRG and CMI (private radiology providers)
<table>
<thead>
<tr>
<th>Rehab</th>
<th>Facility</th>
<th>Burwood Brain Injury Rehab Unit (all SI rehab north of Timaru):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Inpatient beds: 13 beds</td>
</tr>
<tr>
<td>Links with Christchurch Hospital</td>
<td></td>
<td>• Medical Officer and Consultant go to weekly meetings with Ward 28 staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Urgent readmissions to Christchurch Hospital: approximately 6 readmissions to Christchurch Hospital per year due to medical complications requiring further investigations in an acute facility. The transfer is generally arranged via consultant to consultant. If an emergency situation e.g. cardiac problems then would go through ED</td>
</tr>
<tr>
<td>Patient profile</td>
<td></td>
<td>Most are young strokes (including subarachnoid haemorrhage), plus traumatic brain injury</td>
</tr>
<tr>
<td>Staffing</td>
<td></td>
<td>• Consultants: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medical officer: 1.4FTE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Trainees: accredited to take trainees but none at present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Support: neuropsychologist (1), physiotherapists(2), occupational therapists (2), clinical psychologist (1.5), SLT (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Total staff: 10.9 (as above)</td>
</tr>
<tr>
<td>Facilities for families</td>
<td></td>
<td>• Special family room, which is well equipped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Family can stay in the former Nurses’ Home on the Hospital grounds, but this is not often used (shared with spinal patients’ families)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Motel unit on the hospital grounds – ‘half way house’ for patient and their family</td>
</tr>
</tbody>
</table>

### 1.5. South Island Demographics

In a country with a small population, the South Island is particularly sparsely populated.

The South Island contains 24% of the total population of New Zealand (1,034,915 inhabitants out of a total of 4,371,185 inhabitants), yet it covers 57% of the country’s land mass (150,771 square kilometres out of a total land mass of 264,243 square kilometres) 17.

Figure 1: New Zealand population and area by major island

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Area (sq km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Island</td>
<td>3,336,270</td>
<td>113,472</td>
</tr>
<tr>
<td>South Island</td>
<td>1,034,915</td>
<td>150,771</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4,371,185</td>
<td>264,243</td>
</tr>
</tbody>
</table>

Sources: Statistics New Zealand DHB population estimate update to Ministry of Health Oct 2009 (population), and Health and Disability Intelligence, Ministry of Health (area)

Out of every 100 inhabitants of the South Island, approximately 49 will live in Canterbury DHB, 29 in Southern DHB, 13 in Nelson Marlborough DHB, 6 in South Canterbury, and 3 in West Coast DHB.

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17 Statistics New Zealand DHB population estimate update to Ministry of Health Oct 2009
Several significant demographic features of the South Island population are pertinent to the configuration of neurosurgical services in the South Island: low population density; the fact that such a large proportion of the population lives outside the major urban areas; and a significantly ageing population.

In relation to **low population density:**

- There are 6.9 inhabitants per square kilometre in the South Island compared to 29.4 in the North Island.

In relation to a large proportion of the **population living outside major towns/cities:**

- In the South Island, 41% of inhabitants (425,615 of a total of 1,034,915 inhabitants) live outside primary urban areas, compared to 20% (678,620 of a total of 3,336,270 inhabitants) in the North Island.\(^{18}\)

---

The two cities with existing neurosurgical units (Christchurch City population 386,100, and Dunedin City population 115,700) – contain a combined 48% (501,800) of the South Island population. If the Dunedin neurosurgical unit closed, and services were centralised in Christchurch, this would mean that just 37% (386,100) of the South Island population would live in a city with a neurosurgical unit. This would be substantially lower than the current arrangements in the North Island, where a combined 58% (1,919,600) of the population live in cities with a neurosurgical unit (Auckland, Hamilton, or Wellington).

Rurality tends to be related to high risk activities and in the South Island’s case, this is exacerbated by the complicated geography and severe weather patterns, particularly in the southern and western regions.

Road crashes in rural areas are often at high speed and occur in poor driving conditions. Injuries are often severe and multiple. Traumatic brain injury is responsible for 70% of all road crash deaths and is the commonest cause of permanent disability after injury.

Table 1: Break-down of South Island population by DHB

<table>
<thead>
<tr>
<th>DHB</th>
<th>Major city/town</th>
<th>DHB population</th>
<th>DHB area</th>
<th>Major city/town population</th>
<th>Inhabitants per square kilometre</th>
<th>% of population outside the major city/town in the DHB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canterbury</td>
<td>Christchurch</td>
<td>507,820</td>
<td>26,886</td>
<td>386,100</td>
<td>18.9</td>
<td>24.0%</td>
</tr>
<tr>
<td>Southern</td>
<td>Dunedin</td>
<td>300,340</td>
<td>66,636</td>
<td>115,700</td>
<td>4.5</td>
<td>61.5%</td>
</tr>
<tr>
<td>Nelson Marlborough</td>
<td>Nelson</td>
<td>138,405</td>
<td>20,515</td>
<td>59,200</td>
<td>6.7</td>
<td>57.2%</td>
</tr>
<tr>
<td>South Canterbury</td>
<td>Timaru</td>
<td>55,655</td>
<td>13,448</td>
<td>27,500</td>
<td>4.1</td>
<td>50.6%</td>
</tr>
<tr>
<td>West Coast</td>
<td>Greytown</td>
<td>32,695</td>
<td>23,286</td>
<td>9,970</td>
<td>1.4</td>
<td>69.5%</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>1,034,915</td>
<td>150,771</td>
<td>598,470</td>
<td>6.9</td>
<td>42.2%</td>
</tr>
</tbody>
</table>


In relation to population ageing:

On raw figures, almost half (49%) of all neurosurgical patients are aged in the 40-69 year age range.

Figure 4: Average annual national neurosurgical discharges in the period 2006/07 to 2008/09, by age group, as a percentage of total neurosurgical discharges (Average annual total neurosurgical discharges = 4141)

Source: NMDS

• On a population basis, those aged 40 years or above have higher rates of neurosurgical discharge than those aged under 40 years.

Figure 5: Average annual national neurosurgical discharges by age group, per 100,000 population within that age group

Source: NMDS, national data, annual average 2006/07 – 2008/09; Statistics New Zealand population estimates, annual average 2006-2009

• The proportion of those aged 40 years and above is currently higher in the South Island than in the North Island. This trend is predicted to continue.

Figure 6: Projections of population aged 40 years and above as a percentage of the total population

Source: Statistics New Zealand DHB population estimate update to Ministry of Health Oct 2009
- Population projections for the South Island show marked increases in the two age groups that currently have the highest number of neurosurgical discharges on a population basis (60-69 years, 70-79 years).

Figure 7: Projection of number of South Island inhabitants aged 60-69, 2006-2026

The two other factors which are significant in this conversation are the numbers of tourists utilising the South Island and the significant pockets of deprivation, particularly in the southern and western parts of the island.

With regards to the tourist activity much of this occurs in the Central Otago/Lakes District area. In the 12 months to the end of August 2010, there were 5,524,081 guest nights in the Otago/Southland region\(^{20}\), of which 58% (3,239,455 guest nights) were spent in Queenstown, Fiordland or Central Otago. As the Mayors of Otago and Southland pointed out when they met the Panel, much of this visitor traffic involves high risk activities.

The West Coast also has high visitor numbers relative to its population – 1,215,282 guest nights in the 12 months to the end of August 2010.

Dunn, Henry and Brand\(^{21}\) concluded that areas of socio economic deprivation are associated with increased use of alcohol and increased incidences of assault and inter personal violence.

In the southern part of the South Island the areas of lower socio economic status are often outside major metropolitan areas, which compounds the issue in terms of distance and access to definitive expert assessment. This is a global issue for the South Island – the most isolated part of the island geographically, the West Coast, has the highest levels of deprivation.

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These factors together, support the need for a distributed service in the South Island, provided it can be provided on a clinically and financially sustainable basis.

1.6. Public Feedback

During its process the Panel considered public feedback from a number of different channels. These included public meetings in Dunedin and Invercargill (with approximately 1,000 people at each), meetings with representatives of the ‘Keep Neurosurgery in Dunedin’ Facebook page and analysis of 2,256 submissions from 2,193 members of the public addressed to either the Minister of Health, the Director-General of Health or the Panel itself.

There was a view promulgated that the public activity in Otago and Southland was ‘political’, emotional and ill-informed.

The Panel acknowledges that in any event such as this there are always a number of agendas at play but, public health providers ignore the community view at their peril. Further, far from being ill-informed, much of the public comment was, to the contrary, well informed and thoughtful.

Having said that, much of the emotion could have been avoided if the South Island health authorities had handled this issue better and sought community feedback in a more structured way. It is important to have real community involvement in our planning processes.

The analysis of written submissions (either by letter or email) is attached at Appendix 3. The analysis did not include approximately 21,332 newspaper coupons supporting retention of neurosurgery in Dunedin, which were of limited value in terms of informing the Panel’s deliberations – however each of these was logged by the National Health Board.

The vast majority of submissions came from people located in the area served by the Southern DHB, and the majority of those from Dunedin or its surrounding suburbs.

Most submissions came from individuals or groups of individuals. Many submissions came from people with some level of direct involvement with the health sector.

The common themes in submissions were:

Patients will be more at risk:
- the travel time needed to get to Christchurch will mean that patients will have worse outcomes, including more deaths
- it also means that it will cost the system more overall – as those who do get to Christchurch and survive will be in worse condition – so they will need longer time in hospital and more ongoing rehabilitation

The travel time to Christchurch is problematic:
- neurosurgical procedures are often time-critical (for example strokes, aneurysms, brain injury)
- transport can be unreliable/unavailable (due to poor weather, icy roads or air transport already in use)
- it will make things even more difficult for the friends and family involved, during an already stressful time
- additional costs to the patient and friends/family of being in Christchurch – for example, needing to take time off work – many people are not able to do this
- increased stress; being away from support of their friends and family

It isn’t fair that people who live in the Southern DHB area should have more risk than those who live in other parts of the country:
- they pay the same taxes
they contribute significantly to the economy (for example, through farming and tourism)
• it will result in inequitable outcomes at a population level
• the government often makes decisions that ignore the needs of or discriminate against people who live in the South

This proposal could have flow on effects:
• loss of more health services, as other services may be more likely to be centralised in Christchurch as a result of Dunedin losing neurosurgery
• downgrading of status of the medical school, and limitations on clinical placements
• resultant impacts on the university
• economic impacts on Dunedin

This was generally in line with the feedback the Panel received in public forums and face-face conversations.

It is also in line with the response of communities in Scotland when faced with similar discussions around the rationalisation of neurosurgical services in that country.22

As is noted in the summary, a significant number of the submissions noted the “political consequences” around this issue. These comments were viewed by the Panel as a symptom of the various agendas at play in an issue like this, and did not influence deliberations.

2. Service to the Community

2.1. Neurosurgery Defined

Neurosurgery, also known as neurological surgery, is a specialised area of medicine that uses surgery and non-surgical care – such as prevention, evaluation (including on-going evaluation), diagnosis, treatment, critical care and rehabilitation – to manage disorders of the nervous system. These disorders include those of the brain and its blood supply, the meninges (membranes surrounding the brain and spinal cord) and skull; disorders of the pituitary gland; disorders of the spinal cord and vertebral column and disorders of the cranial (skull), spinal, peripheral and autonomic nerves.

Neurosurgical care covers the entire spectrum of the continuum of patient care from prevention through to rehabilitation. It is therefore very important to have a regional, all of South Island plan that takes a systems approach to ensure equity of access and safe high quality outcomes for all patients using this highly specialised service.

Figure 9: Continuum of neurosurgical care

<table>
<thead>
<tr>
<th>Primary and community care</th>
<th>Hospital care</th>
<th>Rehabilitation</th>
<th>Complex continuing care</th>
<th>Primary and community care</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emergency room</td>
<td>2. Neurosurgical care</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In New Zealand neurosurgery is a specific vocational scope of surgical practice.

Neurosurgery is a complex, technology dependent and resource expensive specialty with a large emergency care component.

Conditions requiring acute neurosurgical assessment and care include; neurotrauma, subarachnoid haemorrhage, acute hydrocephalus, blocked CSF shunts, acute spinal cord compression and intracranial tumours. All emergency and urgent neurosurgical care is time critical; the longer the time to expert assessment and management the greater the chance of patient death or significant long term disability. Clinicians talk of the “golden hour”, the optimal time period from incident to definitive care. In 2001 Schuhmann et al23 indicated that the minimum incidence of patients requiring acute neurosurgical care in Germany was estimated at 75-115/100,000 inhabitants/year. James Rutka in the introductory section of the Report of the Neurosurgery Expert Panel in Ontario comments that “two out of every three neurosurgical cases is an emergency/urgent case”24.

Therefore, for optimal patient safety and care a neurosurgical service should provide 24 hours a day, seven days a week cover on a distributed regional basis. A distributed regional network minimises the time to definitive assessment and care for the maximum number of inhabitants.

Pickard, Bailey et al25 showed that early expert neurosurgical intervention in acute conditions not only improves patient outcomes by reducing the rates of mortality and of severe disability; it also saves money. They found that the “cost of long term care for severely disabled survivors is at least 18-fold greater than the cost of neurosurgical intervention to avert such disability”.

Therefore, taking into account patient needs, population distribution, geography and weather, the “ideal” configuration for an “emergency care” neurosurgical service for the South Island would be a distributed regional network. The network would include acute neurosurgery nodes in Dunedin, Christchurch and Nelson Marlborough (Wellington), supported by a single point of entry, a well organised and resourced transport network, and clear triage and referral pathways.

The neurosurgery scope of practise is made up of two broad areas; “generalist” (core) neurosurgery and the subspecialties that include:

- **Paediatric neurosurgery**
  The New Zealand public sector defines paediatric as children and adolescents <15 years of age. The neurosurgical conditions occurring in this age group are specific pathologies found only in children, including specific types of tumours, congenital abnormalities (including hydrocephalus) and cranio-facial abnormalities. All of these conditions require special skills and knowledge; all FRACS neurosurgeons have at least three months of paediatric neurosurgical training and have the basic skills needed for many of these conditions but further training is needed to be very competent in this area.

- **Cerebro-vascular and endovascular neurosurgery**
  This includes the assessment and treatment of aneurysms, AVMs, carotid cavernous sinus fistulae, vasospastic arteries, arterial stenosis, and cerebral re-vascularisation problems. All FRACS neurosurgeons will have training in the treatment of these conditions but the more complex procedures need further post-fellowship training.

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• Complex spinal surgery
This includes the assessment and treatment of congenital and degenerative spinal conditions which may involve extensive decompressive procedures, vertebrectomy, the use of disc implants, the use of various hardware devices to achieve fixation and fusion of spinal deformities, conditions affecting the skull base-cervical spine junction and intra-dural procedures involving the spinal cord and its nerve roots. The more common procedures such as a discectomy or a cervical nerve root decompression are an essential part of “core” neurosurgery. However an increasing number of trainees have extensive experience in the more complex procedures, depending to some degree on their training.

• Skull base surgery
This includes the assessment and treatment of acoustic neuromas, skull base tumours such as meningiomas and chordomata, head and neck tumours invading the skull, trans-sphenoidal resection of pituitary tumours. Some of this work is done with oto-rhino-laryngology (ORL) surgeons.

• Functional neurosurgery and stereotactic functional
This includes the assessment and treatment of Parkinson’s disease, tremors, pain and psychiatric conditions and some cases of epilepsy by surgical means. It is a highly specialised area with limited cover during neurosurgical training.

• Epilepsy surgery
This includes the assessment and treatment of patients with intractable epilepsy by surgical means. The most common procedure is a temporal lobectomy but other procedures include lesionectomy (removal of the abnormal electrical focus) and surface EEG recordings. It is a highly specialised area with limited exposure during neurosurgical training and requires an extensive team of support persons.

• Pituitary neurosurgery
This includes the assessment and treatment of patients with tumours of the pituitary gland. Most trainees reach a level of competence during training but the complex cases require extra training.

• Neuro-oncology
This includes the assessment and treatment of brain tumours by surgery, radiation therapy and chemotherapy. Often surgeons with a strong interest in this area will also have laboratory-based research interests.

• Radiosurgery
This includes the treatment by radio-surgery of some types of tumours: small acoustic neuromas, small critically placed meningiomas, AVM’s and some metastatic tumours.

Generalist neurosurgery includes the management of neurotrauma, spinal surgery, cerebrovascular disease, brain and spinal cord tumours. All Australasian neurosurgical trainees exiting the RACS Neurosurgery programme do so with a strong foundation of expertise in all of these aspects of general neurosurgery. Some may have expertise in sub-specialty areas depending on their training and background.

As neurosurgeons progress through their careers many choose to further sub-specialise in one or more areas, often undertaking a specific fellowship or targeted training in a specific area thereby developing sub-specialist expertise. The literature clearly shows reduction in complications and improved clinical outcomes when low volume, high acuity sub-specialty cases are clustered in the hands of a small subset of neurosurgeons and the expert teams that surround them.
2.2. **Volumes and Outcomes**

As indicated above, neurosurgeons progress through their careers many choose to further sub-specialise in one or more areas.

It must be stressed that there is a learning curve for the acquisition of surgical competencies that is reflected in workplace expert performance and the delivery of safe, high quality care. Competence and performance are complex constructs and relate to all aspects of patient care not simply to the performance of technical skills. The competence and performance of an individual is also influenced by case mix and by the nature of the support team and the working environment.

Surgical educational theory clearly demonstrates that exposure to a larger number of cases (vs. procedures) is required to learn how to perform competently in, for example, a new sub-speciality area, than is subsequently required to maintain that safe, quality performance over time. The learning curve for endovascular neurosurgery vs the number of cases required for maintenance of competence is a good example of these educational principles.

In terms of sub-specialisation the literature is complex, varied and contains a limited amount of hard evidence. It does show that the greatest gains in enhanced patient outcomes can be achieved by clustering very uncommon, complex and high risk procedures in the hands of one team.

However, provided the team has received the necessary prerequisite training, the actual increments in the number of cases managed to achieve enhanced patient outcomes is probably fairly small, especially for very specific sub-speciality procedures. For example, if a team moves from managing less than 10 cases per year to volumes of greater than 20 cases per year, patient outcomes are significantly enhanced – but, beyond 20 there may be little difference.

The most recent systematic review of the relationship between volume and outcomes has suggested that "high surgeon volume and specialisation are associated with improved patient outcome, while high hospital volume is of limited benefit". The review found that specialist surgeons had significantly better outcomes than generalist surgeons in 91% of the studies.

Figure 10: Histogram illustrating the effect of hospital volume on overall outcome, mortality, length of hospital stay and complication rate.

Figure 11: Histogram illustrating the effect of surgeon volume on overall outcome, mortality, length of hospital stay and complication rate.

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27 Ibid

28 Ibid. p147

29 Ibid. p149
It must be emphasised that neurosurgeons do not work in isolation, rather they work with teams of highly skilled neurosurgical nurses, neurologists, interventional neuro-radiologists, neuropathologists, neuro-oncologists, intensive care specialists, orthopaedic surgeons, anaesthetists, neurophysiologists, rehabilitation medicine specialists and specialist allied health staff. In New Zealand neurosurgeons also work with general practitioners, primary health care providers and health care colleagues in other hospitals.

Neurosurgical conditions are a major cause of morbidity and mortality that result in high costs to individuals, their families and society. Neurological diseases, disorders and injuries are among the leading causes of disability in the New Zealand population and these conditions impact negatively on a person’s quality of life and the lives of their families and caregivers, and are an economic burden on individuals and society. In Canada in 2000/01 the estimated total direct costs for only three neurosurgical conditions – brain tumours, head injuries and spinal injuries – was $311.7 million. Since the incidence of many neurological conditions increases with age, the burden of these conditions on individuals, their families and society may increase.

2.3. Current neurosurgical volumes

National volumes

Total volumes of neurosurgical discharges nationally remained static between 2006/07 and 2008/09.

Volumes by neurosurgical unit

Auckland is the largest neurosurgical unit in New Zealand, followed by Wellington, Christchurch and Waikato, each approximately half the total volumes of the Auckland unit, followed by Dunedin, approximately half the volume of Wellington or Christchurch unit.

It is noted that the Waikato unit opened in 2006.

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31 Direct costs include hospital and physician care and drugs. Canadian Institute for Health Information. 2007. The Burden of Neurological Diseases, Disorders and Injuries in Canada. Ottawa: CIHI
Access to neurosurgical services

Current levels of access to neurosurgical care show considerable variation across the country. Table 1a shows a standardised neurosurgical discharge rates by DHB of domicile. Canterbury and Otago both have higher than average overall levels of access to neurosurgery, compared to the expected level of access based on their respective demographic profiles.

Table 1a: Standardised discharge rate analysis of total neurosurgery activity 2009/10 financial year

<table>
<thead>
<tr>
<th>DHB of Domicile</th>
<th>Discharges</th>
<th>Expected Discharges</th>
<th>Standardised Discharge Rate*</th>
<th>Population estimate</th>
<th>Lower Confidence Level</th>
<th>Upper Confidence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canterbury</td>
<td>1,101</td>
<td>589</td>
<td>1.868</td>
<td>504,700</td>
<td>1.695</td>
<td>2.052</td>
</tr>
<tr>
<td>Otago</td>
<td>282</td>
<td>224</td>
<td>1.258</td>
<td>188,160</td>
<td>1.034</td>
<td>1.512</td>
</tr>
<tr>
<td>Wairarapa</td>
<td>57</td>
<td>52</td>
<td>1.090</td>
<td>39,875</td>
<td>0.685</td>
<td>1.625</td>
</tr>
<tr>
<td>Capital and Coast</td>
<td>319</td>
<td>294</td>
<td>1.086</td>
<td>289,070</td>
<td>0.904</td>
<td>1.291</td>
</tr>
<tr>
<td>Auckland</td>
<td>471</td>
<td>454</td>
<td>1.037</td>
<td>448,465</td>
<td>0.893</td>
<td>1.197</td>
</tr>
<tr>
<td>Counties Manukau</td>
<td>463</td>
<td>450</td>
<td>1.028</td>
<td>487,950</td>
<td>0.884</td>
<td>1.188</td>
</tr>
<tr>
<td>Hutt Valley</td>
<td>148</td>
<td>161</td>
<td>0.922</td>
<td>142,745</td>
<td>0.700</td>
<td>1.186</td>
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<tr>
<td>South Canterbury</td>
<td>65</td>
<td>71</td>
<td>0.910</td>
<td>55,598</td>
<td>0.592</td>
<td>1.325</td>
</tr>
<tr>
<td>Waitemata</td>
<td>503</td>
<td>557</td>
<td>0.902</td>
<td>535,095</td>
<td>0.780</td>
<td>1.036</td>
</tr>
<tr>
<td>Waikato</td>
<td>389</td>
<td>446</td>
<td>0.873</td>
<td>361,965</td>
<td>0.740</td>
<td>1.022</td>
</tr>
<tr>
<td>Hawke’s Bay</td>
<td>167</td>
<td>194</td>
<td>0.861</td>
<td>154,580</td>
<td>0.665</td>
<td>1.092</td>
</tr>
<tr>
<td>West Coast</td>
<td>36</td>
<td>44</td>
<td>0.809</td>
<td>32,605</td>
<td>0.443</td>
<td>1.330</td>
</tr>
<tr>
<td>Tairawhiti</td>
<td>48</td>
<td>60</td>
<td>0.798</td>
<td>46,187</td>
<td>0.479</td>
<td>1.231</td>
</tr>
<tr>
<td>Bay of Plenty</td>
<td>213</td>
<td>271</td>
<td>0.787</td>
<td>209,520</td>
<td>0.627</td>
<td>0.971</td>
</tr>
<tr>
<td>Whanganui</td>
<td>63</td>
<td>87</td>
<td>0.728</td>
<td>63,432</td>
<td>0.469</td>
<td>1.065</td>
</tr>
<tr>
<td>Southland</td>
<td>93</td>
<td>131</td>
<td>0.710</td>
<td>111,468</td>
<td>0.498</td>
<td>0.973</td>
</tr>
<tr>
<td>Lakes</td>
<td>87</td>
<td>127</td>
<td>0.688</td>
<td>102,575</td>
<td>0.476</td>
<td>0.953</td>
</tr>
<tr>
<td>Northland</td>
<td>145</td>
<td>213</td>
<td>0.681</td>
<td>156,535</td>
<td>0.515</td>
<td>0.878</td>
</tr>
<tr>
<td>Nelson-Marlborough</td>
<td>103</td>
<td>170</td>
<td>0.604</td>
<td>137,702</td>
<td>0.432</td>
<td>0.816</td>
</tr>
<tr>
<td>MidCentral</td>
<td>126</td>
<td>209</td>
<td>0.602</td>
<td>166,615</td>
<td>0.446</td>
<td>0.791</td>
</tr>
<tr>
<td>Taranaki</td>
<td>65</td>
<td>139</td>
<td>0.468</td>
<td>108,428</td>
<td>0.304</td>
<td>0.681</td>
</tr>
</tbody>
</table>

Key:
Grey cell indicates a rate that is above the national rate and is statistically significant.
Black cell indicates a rate that is below the national rate and is statistically significant.

Source: National Minimum Data Set

The table illustrates discharges where patients have had a procedure and is based on each patient discharged from the neurosurgery specialty S35. The National Minimum Data Set (NMDS) contains information on all publicly funded and provided activity and publicly funded and privately provided activity. Privately provided and privately funded data is not included. It is not compulsory for private providers to submit data to the NMDS.
The expected discharge figure for each DHB of domicile region reflects the national intervention rate for the specific population mix of that DHB.

Appendix 7 also shows the New Zealand national intervention rates for various specific areas of neurosurgery by DHB of Domicile.

As can be seen in Appendix 7 we tried to compare New Zealand intervention rates against Scottish intervention rates in an attempt to establish the level of unmet need in specific areas of neurosurgical practice in New Zealand. However it is difficult to establish an accurate and verifiable comparison and the figures in the Appendix need to be viewed with caution.

We also looked to compare New Zealand and Australian neurosurgical intervention rates via the Health Round Table, but Health Round Table data is only available on the specific request of a member organisation. The Panel strongly suggests that this data is obtained for the use of the Governance Board.

We had considerable discussions with the NHB Analysis Team who were very helpful but this is one area that the Panel found difficult, and it is one of the reasons we believe that the South Island Neurosurgery Service must establish a minimum data set.

Table 2: Breakdown of Canterbury neurosurgical unit discharges by DHB of domicile and admission type 2004/05 – 2008/09

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelson-Marlborough - Acute</td>
<td>15</td>
<td>12</td>
<td>9</td>
<td>16</td>
<td>11</td>
<td>12.6</td>
<td>1.5%</td>
</tr>
<tr>
<td>Nelson-Marlborough - Arranged</td>
<td>8</td>
<td>12</td>
<td>8</td>
<td>11</td>
<td>7</td>
<td>9.2</td>
<td>1.1%</td>
</tr>
<tr>
<td>Nelson-Marlborough - Elective</td>
<td>9</td>
<td>39</td>
<td>34</td>
<td>50</td>
<td>36</td>
<td>33.6</td>
<td>4.0%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>32</td>
<td>63</td>
<td>51</td>
<td>77</td>
<td>54</td>
<td>55.4</td>
<td>6.6%</td>
</tr>
<tr>
<td>Otago - Acute</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>0.4%</td>
</tr>
<tr>
<td>Otago - Arranged</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>2.2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Otago - Elective</td>
<td>7</td>
<td>12</td>
<td>13</td>
<td>24</td>
<td>23</td>
<td>15.8</td>
<td>1.9%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>11</td>
<td>15</td>
<td>17</td>
<td>32</td>
<td>30</td>
<td>21</td>
<td>2.5%</td>
</tr>
<tr>
<td>South Canterbury - Acute</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>12</td>
<td>7</td>
<td>10.4</td>
<td>1.2%</td>
</tr>
<tr>
<td>South Canterbury - Arranged</td>
<td>1</td>
<td>11</td>
<td>8</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>1.2%</td>
</tr>
<tr>
<td>South Canterbury - Elective</td>
<td>19</td>
<td>27</td>
<td>28</td>
<td>31</td>
<td>27</td>
<td>26.4</td>
<td>3.2%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>30</td>
<td>49</td>
<td>48</td>
<td>60</td>
<td>47</td>
<td>46.8</td>
<td>5.6%</td>
</tr>
<tr>
<td>Southland - Acute</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>2.8</td>
<td>0.3%</td>
</tr>
<tr>
<td>Southland - Arranged</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>2.2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Southland - Elective</td>
<td>9</td>
<td>10</td>
<td>7</td>
<td>13</td>
<td>18</td>
<td>11.4</td>
<td>1.4%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>12</td>
<td>13</td>
<td>10</td>
<td>17</td>
<td>30</td>
<td>16.4</td>
<td>2.0%</td>
</tr>
<tr>
<td>West Coast - Acute</td>
<td>7</td>
<td>13</td>
<td>4</td>
<td>13</td>
<td>5</td>
<td>8.4</td>
<td>1.0%</td>
</tr>
<tr>
<td>West Coast - Arranged</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>4.8</td>
<td>0.6%</td>
</tr>
<tr>
<td>West Coast - Elective</td>
<td>12</td>
<td>15</td>
<td>21</td>
<td>11</td>
<td>17</td>
<td>15.2</td>
<td>1.8%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>22</td>
<td>32</td>
<td>30</td>
<td>31</td>
<td>27</td>
<td>28.4</td>
<td>3.4%</td>
</tr>
<tr>
<td>Canterbury - Acute</td>
<td>235</td>
<td>328</td>
<td>341</td>
<td>360</td>
<td>266</td>
<td>306</td>
<td>36.6%</td>
</tr>
<tr>
<td>Canterbury - Arranged</td>
<td>21</td>
<td>55</td>
<td>61</td>
<td>47</td>
<td>49</td>
<td>46.6</td>
<td>5.6%</td>
</tr>
<tr>
<td>Canterbury - Elective</td>
<td>239</td>
<td>309</td>
<td>342</td>
<td>388</td>
<td>300</td>
<td>315.6</td>
<td>37.7%</td>
</tr>
<tr>
<td>Sub-total</td>
<td>495</td>
<td>692</td>
<td>744</td>
<td>795</td>
<td>615</td>
<td>668.2</td>
<td>79.9%</td>
</tr>
</tbody>
</table>

Source: NMDS
2.4. **Estimate of likely volumes that would move to Canterbury under a 6:nil model**

Table 3: Part A: Inpatient and daycases

<table>
<thead>
<tr>
<th></th>
<th>Canterbury</th>
<th>Otago</th>
<th>Canterbury + Otago</th>
<th>% increase of total volumes for Canterbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>594</td>
<td>185</td>
<td>779</td>
<td>31%</td>
</tr>
<tr>
<td>Arranged</td>
<td>98</td>
<td>35</td>
<td>133</td>
<td>36%</td>
</tr>
<tr>
<td>Elective</td>
<td>573</td>
<td>96</td>
<td>669</td>
<td>17%</td>
</tr>
<tr>
<td>Total</td>
<td>1265</td>
<td>316</td>
<td>1581</td>
<td>25%</td>
</tr>
</tbody>
</table>

Note: Acute, arranged and elective numbers are an average of the number of discharges for the five years from 2004/05 to 2008/09.

The table below shows the number of first specialist and subsequent outpatients appointments which it is estimated would transfer to Canterbury DHB under the 6:nil model. The Panel understands that under this proposal it was intended that much of this volume would be seen in Dunedin.

Table 4: Part B: Outpatients

<table>
<thead>
<tr>
<th></th>
<th>Canterbury</th>
<th>Otago</th>
<th>Canterbury + Otago</th>
<th>% increase of total volumes for Canterbury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurosurgery - 1st attendance</td>
<td>624</td>
<td>233</td>
<td>857</td>
<td>37%</td>
</tr>
<tr>
<td>Neurosurgery - Subsequent attendance</td>
<td>1573</td>
<td>482</td>
<td>2056</td>
<td>31%</td>
</tr>
<tr>
<td>Total</td>
<td>2197</td>
<td>716</td>
<td>2913</td>
<td>33%</td>
</tr>
</tbody>
</table>

Note: Volumes are based on the average annual volumes for the three years from 2007/08 to 2009/10.

**Trauma**

International guidelines for the management of traumatic brain injury indicate that all patients with moderate (GCS 9-12) and severe (GCS 3-8) head injury and in addition that all patients with multiple trauma and a head injury should be assessed by a neurosurgeon.

The data below was kindly provided by the Trauma Service at Auckland City Hospital from the Adult Trauma Registry. Auckland City Hospital serves a catchment area of approximately 1.6 million people. This data indicates that the approximate incidence of moderate and severe head injury as measured by GCS ≤12 or AIS ≥3, is between 5 and 11/100,000 inhabitants per year. This equates to approximately 15 – 30 such cases in the Southern DHB catchment area per year.

**Total admissions - GCS ranges**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Average</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS 3-8 -severe</td>
<td>45</td>
<td>47</td>
<td>37</td>
<td>43</td>
<td>3.6</td>
</tr>
<tr>
<td>GCS 9-12 - moderate</td>
<td>32</td>
<td>41</td>
<td>29</td>
<td>34</td>
<td>2.9</td>
</tr>
<tr>
<td>GCS 13-15</td>
<td>1033</td>
<td>1099</td>
<td>1093</td>
<td>1075</td>
<td>91.2</td>
</tr>
<tr>
<td>n/v</td>
<td>21</td>
<td>30</td>
<td>31</td>
<td>27</td>
<td>2.3</td>
</tr>
</tbody>
</table>

|               | 1131 | 1217 | 1190 | **1179** |

**AIS score to head**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS 3 or above to head</td>
<td>213</td>
<td>265</td>
<td>212</td>
</tr>
</tbody>
</table>

**AIS score to head and ISS**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS 3 or above to head &amp; ISS&gt;15</td>
<td>162</td>
<td>214</td>
<td>173</td>
</tr>
</tbody>
</table>
In addition the Auckland data shows an incidence of 14/100,000 inhabitants per year multiple trauma presentations as measured by AIS ≥3 and ISS >15. These patients all require assessment by a neurosurgeon. Therefore Dunedin Hospital might expect approximately 42 such presentations per year from the Southern DHB catchment area. These groups of patients would need to be transferred to Christchurch for neurosurgical assessment and management under a 6:nil model.

**Explanation of Trauma Scores** - Glasgow coma scale (GCS): is a neurological scale used to assess the level of consciousness after head injury. The scale tests eye, verbal and motor responses with a maximum score of 15.

GCS in the 3 – 8 range – denotes severe head injury

GCS in the 9 – 12 range – denotes moderate head injury

GCS in the 13 – 15 range – mild to normal score.

Abbreviated injury score (AIS) is a method for scoring severity of injury. The AIS describes the severity of injury to one body region: 1 Minor, 2 Moderate, 3 Serious, 4 Severe, 5 Critical, 6 Maximal (Currently untreatable). The data extract AIS score to the head counts the number of patients admitted to Auckland Hospital who had an AIS (3 – 6) injury to the head.

Injury severity score (ISS) is a method of scoring injury severity in a person with multiple injuries. The ISS is a calculation using the sum of the squares of the highest AIS score of the three most injured body regions (of which there are 6 regions). The maximum possible score is 75. An ISS of 15 and above is classified as major trauma.

The AIS score to head and ISS data extract counts the number of patients with major trauma including a severe or critical head injury. This is the group which would need neurosurgical input.

### 2.5. Mortality

The argument that has been raised by people in the southern half of the South Island that people will die if there is no neurosurgical unit in Dunedin. This claim needs evaluation.

During discussion it became evident that Canterbury clinicians had an alternative view, namely that centralisation of neurosurgical services in Christchurch would have minimal effect on the mortality of patients with neurosurgical conditions in the southern part of the South Island. The table below shows the number of conditions treated in Dunedin in the three years from 2005 to 2008 for which an adverse outcome is either likely or possible if there was a significant time delay to treatment.

If there were no person available to provide surgical treatment of the patients with extra-dural and acute sub-dural haematoma it is highly likely that many would die or have a poorer outcome.

The same is possibly true of the other conditions listed but the nexus is not as strong as the outcome would depend on the clinical setting. One southern clinician expressed the view that a loss of neurosurgical services to Dunedin would result in 5-10 additional deaths per year and a similar number of persons with an increased disability. The data available suggests that his figure is a reasonable estimate.
2.6. Estimate of likely future and unmet neurosurgical need

Raymont and Simpson\textsuperscript{33} have estimated the projected increase in both future surgical need and unmet surgical need:

- The projected increase in future surgical need (based on demographic projections from 2001 to 2026) was estimated as being between 23 and 48% of current volume (weighted across both the public and private sectors’ discharges) with a central estimate of an increase of 40% between 2001 and 2026.
- The unmet need for neurosurgery, as a percentage of the national average, was estimated at 15%.

2.7. Current equity of access

Equity of access needs to be one of the aims of the future South Island Neurosurgery Service, particularly as it continues to sub-specialise. As mentioned previously, the literature clearly shows reduction in complications and improved clinical outcomes when low volume, high acuity sub-speciality cases are clustered in the hands of a small subset of neurosurgeons and the expert teams that surround them. Such clustering also maximises the return on investment with respect to scarce, expert human resource and expensive capital items. It also promotes peer support, safe working hours and assists succession planning.

At the moment only Canterbury DHB provides “coil” and “stent” services for the South Island and as can be seen from the table below, the number of operations being provided to South Island residents varies widely by DHB.

Figure 14: Number of patients with operations involving use of coils and/or stents at Canterbury DHB March 2004 – August 2010

<table>
<thead>
<tr>
<th>Number of cases where “coil” and/or “stent” mentioned in operation description</th>
<th>DHB population (2010 est.)</th>
<th>Rate per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast</td>
<td>11</td>
<td>32,695</td>
</tr>
<tr>
<td>South Canterbury</td>
<td>13</td>
<td>55,655</td>
</tr>
<tr>
<td>Canterbury</td>
<td>113</td>
<td>507,820</td>
</tr>
<tr>
<td>Southern</td>
<td>33</td>
<td>300,340</td>
</tr>
<tr>
<td>Nelson</td>
<td>11</td>
<td>138,405</td>
</tr>
<tr>
<td>Marlborough</td>
<td>11</td>
<td>1,034,915</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data supplied by Canterbury DHB (address provided assumed to refer to DHB of domicile)

Note: As most acute neurosurgical patients from Nelson Marlborough DHB are treated in Wellington, the actual population rate is likely to be higher than stated above.

\textsuperscript{32} Dunedin Hospital Neurosurgery Department Annual Reports 2005/06 to 2007/08 provided by Dr. S Jackson
\textsuperscript{33} Raymont A, Simpson J. Projections of surgical need in New Zealand; Estimates of the need for surgery and surgeons to 2026. Journal NZMA, 06-June-2008, Vol 121 No. 1275
2.8. **Recommended population ratios**

The use of metrics such as population ratios and minimum catchment size have become popular methods for estimating the number of neurosurgeons required for a particular population. Table 3 below shows the most recent recommended ratios in use in Australia, and the United Kingdom from the Neurosurgical Society of Australasia and the Society of British Neurological Surgeons respectively.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Australasia</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of neurosurgeons per 100,000 population</td>
<td>“at least one consultant neurosurgeon per 175,000 population”</td>
<td>(not specifically mentioned)</td>
</tr>
<tr>
<td>Minimum population catchment per neurosurgical unit</td>
<td>“recommends a minimum population catchment size of 350,000 to sustain a viable neurosurgical unit”</td>
<td>“whilst this must be reconciled with equity of access a 1 million catchment population should be the minimum”</td>
</tr>
<tr>
<td>Minimum number of neurosurgeons per unit</td>
<td>“recommends a minimum of two surgically active full time consultant neurosurgeons”</td>
<td>“a minimum of 6 whole time equivalent (WTE) consultant surgeons”</td>
</tr>
<tr>
<td>Minimum surgeon volumes</td>
<td>“minimum of 135 major neurosurgical cases per year per neurosurgeon would be preferable”</td>
<td>“the ideal number of cases a consultant should have is 180-250 per year”</td>
</tr>
<tr>
<td>Exceptions</td>
<td>“In instances where the population catchment is less than 350,000 a service may only be established if patient access is compromised and where there are sufficient infrastructure and support services”</td>
<td>“Equity of access suggests a maximum surface journey time of two hours to a neurosurgical unit. This criterion indicates there may need to be a very small number of units serving populations less than 1million.”</td>
</tr>
</tbody>
</table>

In the J Rutka, Report of the Neurosurgery Expert Panel that evaluated the delivery of neurosurgical care in Ontario, that expert panel recommends that a Level 3 neurosurgical service requires a minimum of three full-time staff neurosurgeons to provide 24/7 cover and a level 4 neurosurgical service needs a minimum of four full-time staff neurosurgeons to provide the same cover.

It is clear that in many areas, there are significant differences between what is recommended in Australasia, the United Kingdom and Canada. This is entirely appropriate, as geography and demography of the populations referred to are also very different: Australia, New Zealand and Canada cover a large land masses, with some areas densely populated and others sparsely populated; whereas the United Kingdom covers a relatively small and generally quite densely populated land mass.

2.8.1. **Actual population ratios**

Comparisons of actual population to neurosurgeon and discharge ratios show similar differences. This can be understood as resulting from different neurosurgical scopes of practice, and different geographic and demographic profiles.

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Table 7: actual ratio of population to neurosurgeon (including paediatric neurosurgeons) for selected countries based on a survey of members of the World Federation of Neurological Surgeons. 36 (Note: New Zealand data was not included in the survey, but figures have been added based on 4.36 million population and 20 neurosurgeons.)

Figure 15: Comparison of total annual neurosurgical discharges, by region/country

<table>
<thead>
<tr>
<th>Country/region</th>
<th>Annual neurosurgical discharges</th>
<th>Population</th>
<th>Annual neurosurgical discharges per million population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario, Canada 37</td>
<td>30,749</td>
<td>12,160,000</td>
<td>2,529</td>
</tr>
<tr>
<td>Scotland 38</td>
<td>7,704</td>
<td>5,100,000</td>
<td>1511</td>
</tr>
<tr>
<td>New Zealand 39</td>
<td>4,195</td>
<td>4,315,355</td>
<td>972</td>
</tr>
<tr>
<td>Ireland 40</td>
<td>2130</td>
<td>3,885,283</td>
<td>548</td>
</tr>
</tbody>
</table>

2.9. Population ratios for the South Island

The Panel was conscious that previous work, and much of the argument, around establishing the number of neurosurgeons to work in the South Island Neurosurgery Service had relied upon population ratios.

While population ratios may appear useful ways to determine the appropriate number of neurosurgeons for a specific population, there are several significant issues with their use. Specifically, they fail to account for a number of key factors that are known to affect the likely level of population need for neurosurgical care:

- Ratios do not account for different scopes of neurosurgical practice in different countries. Neurosurgeons in different countries have developed different scopes of practice, which means that the volume of work will differ from country to country – for example, in Australia neurosurgeons carry out a considerable level of spinal work, whereas in New Zealand the level is much lower than orthopaedic surgeons have tended to work in this area. In Japan, neurosurgeons treat patients who would be treated by neurologists in either Australia or New Zealand. As a result of different scopes of practice in different countries, there is considerable difference in the volume of work available for neurosurgeons. This is emphasised by the variation in actual population to neurosurgeon ratios, as described in Section 2.8.1 above

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37 Rutka report (based on volume data from 2005/06, population data from 2006) p18
38 Scottish report (based on data from 1998/99) p6
39 NMDS data from 2008/09, Statistics New Zealand population estimate for 2009
40 Irish report p58
• Ratios do not account for different demographic and employment profiles in different countries or regions. Almost half of all neurosurgical discharges in New Zealand currently relate to those aged 40-69 years, and those aged 60-79 years have the highest rates of neurosurgical discharges on a population basis.

This means that populations with larger proportions of people in this age range are likely to have a much greater demand for neurosurgical services than those with a greater proportion of young adults. Populations with significant proportions of inhabitants involved in heavy industry are likely to have greater need to neurosurgeons, due to increased levels of head and spinal injuries.

• Ratios do not account for different population densities – many of the ratios commonly cited relate to countries with much greater population density than New Zealand. A significant proportion of neurosurgical care relates to urgent or acute patients, where delay to care is likely to lead to poorer outcomes.

In other words, if there are two countries of equal population size but different population densities, the country with the lower population density is likely to require more neurosurgeons than the country with higher population density, if it is to ensure equitable access.

• The numerator of the ratio is not always clearly defined in terms of full-time equivalents (FTEs), WTEs or the number of individual neurosurgeons.

• Some ratios are designed to indicate the maximum safe upper limit of population numbers per neurosurgeon that allow for safe provision of care. Others are designed to indicate the minimum safe lower limit of population numbers per neurosurgeon in order to maintain neurosurgeon competence and therefore ensure patient safety.

• Ratios are artificial predictions and as shown in Figure 15 may not reflect the state of the market place.

The Panel, therefore, concluded that it could not rely on ratios alone, and needed to consider some of the other factors at play in the South Island situation in order to provide safe, quality care. These included:

• The geography, weather and transport arrangements in the region as they affect the time to definitive care.

• The needs of the particular population for neurosurgical care and how best to configure the service to meet those needs. In the case of the South Island relevant factors become the age (and ageing) of the population, the low population density, the prevalence of manual occupations and high risk leisure activities, and the significant tourist population, which is also frequently involved in high-risk leisure activities.

• The level of unmet need for neurosurgical care in the region – and here, we tended to look most closely at Scotland and Canada for some level of comparison.

• The actual number of FTEs dedicated to the provision of direct clinical care in the public sector. Two broad sets of general factors are relevant; the split of public and private sector clinical work and the split of each surgeon’s timetabled work across the domains of surgical competence and performance. Those domains are; professionalism, scholar/teacher, health advocate, management and leadership, collaboration, communication, medical expertise, judgement and clinical decision making and technical expertise. Communities and patients, rightly, have an expectation that surgeons will demonstrate competent performance across each of these domains and employers should be expected to ensure that each surgeon has some degree (major or minor) of involvement in and responsibility for activities in each of the domains.
• The nature of the service delivery model. For a variety of valid reasons neurosurgery services usually operate a “consultant led” model of service delivery. This is especially true for the New Zealand neurosurgery services with few, if any, senior RACS SET trainees and/or Fellows. A “consultant led” model of service delivery, of necessity, requires a high level of specialist neurosurgeon “hands on” clinical care; patient assessment and management including operations and on a 24/7 basis.

• The need to run a safe 24 hour, seven-day-a-week roster, (safe for both the people receiving care, and those providing it), which requires a minimum of 3 neurosurgeons and preferably 4 neurosurgeons.

• The need for collegial support and opportunities for collective reflection, learning and Continuing Professional Development (CPD).

• The need for sub specialisation which is best done in pairs.

• The need for succession planning, better career paths, greater focus on training programmes and building up the New Zealand workforce.

Better patient outcomes result when acute neurosurgical patients are treated by neurosurgeons, as opposed to by general surgeons.

In an English study of trauma patients between 1989 and 2003, patients with head injuries were found to have significantly worse outcomes if they were treated at a non-neurosurgical facility. “2305 (33%) of patients with severe head injury were treated at non-neurosurgical centres; this group had a 26% increase in mortality and a 2.15-fold increase (95%CI 1.77-2.60) in the odds of death adjusted for case mix compared with patients treated at a neurological centre”.

If we look at the existing actual Canadian, Australian and Scottish neurosurgeon workforces (as opposed to recommended ratios), we see they all have in the order of one neurosurgeon (that’s a person, as opposed to an FTE) to every 100,000 to 125,000 people.

Translating that to the South Island would equate to 8 – 10 neurosurgeons for the entire population, which starts to make sense if you look at Scotland and Canada, in particular, grappling with similar issues to New Zealand.

This is bearing in mind that New Zealand’s neurosurgeon population is ageing, is small and therefore the service could be considered fragile – any change in the current situation has the potential to upset the equilibrium. The workforce is not yet self-sustaining, we are exporting our New Zealand trainees mostly to Australia and we have a higher than New Zealand average reliance on international medical graduates (IMGs).

The international market for neurosurgeons is small and they are scarce – locum recruitment is difficult and expensive.

We have heard that the Medical Council of New Zealand (MCNZ) and Branch Advisory process is difficult and prolonged for IMG neurosurgeons especially for those from the Indian sub-continent and from Europe.

We need to grow our own and retain them and to do that we need a vibrant high performing training programme. Building a seven person, and ultimately an eight person South Island Neurosurgery Service, with increasing sub-specialisation, an academic node focusing on research and teaching and a real focus on outreach and the multi-disciplinary team, is an opportunity to revitalise neurosurgery in this country and prepare for the future.

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2.10. Relationship with primary care

Given the importance of early identification and treatment of neurosurgical conditions and the trends in neurosurgical care (Section 3.2) the relationship with primary care and community providers is important.

The Panel received a lot of information on the organisation of primary care in the southern half of the South Island and were impressed with the adaptations made to cope with distance and isolation.

The systems for dealing with trauma in country areas were sophisticated and well supported and there were strong messages that the South Island Neurosurgery Service of the future needed to:

- have clear protocols for triaging patients
- have good communications and the ability to consult a neurosurgeon by phone
- ensure access to acute care when required and avoid delays
- have clear and efficient referral pathways for acute, planned and effective care
- have good post-discharge links and ensure appropriate referrals to rehabilitation
- avoid inappropriate use of emergency air transportation – issue of early transfer from tertiary facility to secondary facility requiring costly air transport (eg, “if patient able to be kept there for a few more days, then able to return via commercial transport – significant extra costs to Vote Health if the patient is transferred non-commercially”).

2.11. Transport

The effective and early treatment by an expert neurosurgical team is seen internationally as being a major factor in improving outcomes for people with moderate to severe head injury – Section 3.2 explains.

“A balance has to be struck between providing neurosurgical services which are close to the population served and ensuring that the units concerned are well resourced and able to deliver services of consistently high quality."

The Accident Compensation Corporation estimates that effective trauma management of one person’s brain injury, resulting in the outcome being moderate rather than severe, would mean, on average, a saving of $1.32 million in that person’s claim liability.

Patient transport, therefore, becomes a key consideration for the shape of South Island Neurosurgical Service in the future. In the South Island this is complicated by the sparseness of the population, the difficult terrain and the difficult weather conditions.

Both the Beasley and Brown reports, in recommending a centralised Christchurch neurosurgical service, noted that patient transport services would need to be strengthened, and Canterbury DHB management representatives also indicated this as a vital issue, which needed to be dealt with on a national basis. However, the Panel came to the view that this was not simple, quick or inexpensive.

The maps below give an effective illustration of the difference between the Auckland region and the Otago/Southland region in terms of the populations which can be reached quickly, in this case by helicopter.

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42 Review of Neurosurgical Services in Scotland – Sir David Carter, Chief Medical Officer, Chairman of Working Group
43 Report of the Air Ambulance Reference Group to the ACC and Health Ministers, February 2008
In the southern South Island, not only is the population sparse, but a large proportion of it lives outside the major city (refer Table 1). The situation is further complicated by the Queenstown/Lakes District areas, which have high levels of visitor numbers, many of whom are engaged in high risk activities (refer Section 1.5).

The PRIME (Primary Response In Medical Emergency) system has been developed in New Zealand to deal with this isolation and there was some pride expressed amongst practitioners in Otago and Southland at the way this worked, and its linkages with the trauma team and neurosurgery at Dunedin Hospital. The need for maintenance of these relationships was emphasised.

Equally, both Christchurch and Dunedin hospitals were able to explain appropriate systems for activating and determining modes of transport and whether or not to send a retrieval team.

Much of the focus was on air transport and in this area a number of issues emerged:

- Difficult flying conditions in the southern South Island
- The distance of the airport from Dunedin Hospital for fixed wing aircraft
- Inappropriate facilities for helicopter landing at Christchurch, with the helipad in Hagley Park, requiring a further ambulance transfer
- Difficulty with the retrieval of children by fixed wing aircraft from Invercargill to Christchurch or Auckland because of the weather
- The impact of increased usage on helicopter availability
- Funding of rescue helicopter trusts

### 2.11.1. Weather and Terrain

The Panel met with the Otago Rescue Helicopter Trust representatives who explained the issues concerning weather and terrain in the southern South Island and how their service was adapted to deal with those.

The Trust, like many around the country has been developed locally and has very low overheads and a high level of local input and loyalty. Indeed, the Otago Regional Council funds it to the tune of $250,000 per annum – 10% of its general rate intake – on behalf of the Otago community. It is the Trust’s biggest single contributor. The rescue helicopter is run as an adjunct to a commercial operation, which makes the operation feasible and cost-effective. It
also means that there is a second helicopter available if necessary, although this is not a dedicated machine.

The Trust explained the various issues relating to weather and the impact on its ability to fly. This meant that road ambulance transport was the final option available; occasionally even this option was not available due to severe conditions. If the neurosurgical service was transferred to Christchurch road transport reliability and time would be significant issues.

All flying is done under VFR (Visual Flight Rules). Although the helicopters are capable and certified for IFR (Instrument Flight Rules) they fly under VFR-NVG (Visual Flight Rules – Night Vision Goggles) because of the freezing level and to avoid cloud. The south of the South Island has a low freezing level which often below the IFR minimum altitude level. None of the EMS helicopters in New Zealand are equipped with full de-icing equipment. It was indicated that the purchase of such a helicopter would make the machine uneconomic for the Trust to operate.

Fixed wing aircraft suffer from similar issues – the cost of the type of aircraft required to be able to fly in the more inclement southern conditions would require a national commitment. With regards to neurosurgery, the use of fixed wing aircraft is further complicated by the distance of hospitals in Christchurch and in particular Dunedin from their respective airports.

The Invercargill paediatricians rely on fixed wing aircraft to transfer their patients to Christchurch, and sometimes, Auckland. They instanced occasions when they needed to hold patients in difficult circumstances because aircraft were either not available or unable to fly, because of conditions. While this did not occur often, when it did, it put the patients at serious risk and placed significant stress on Southland Hospital staff.

They pointed out, not unreasonably, that the removal of neurosurgery services from Dunedin Hospital would make Otago people similarly vulnerable, under the current transport arrangements.

2.11.2. Impact of Transfer to Christchurch on Aircraft Availability

The Panel was not able to look at all the issues surrounding transport but looked at it enough to see that there were a number of serious complications, which would need to be dealt with, in terms of increasing the amount of patient transfer to Christchurch, particularly by air.

It is also reasonable to assume that much of the increased traffic will be by air, because the majority of patients, particularly trauma patients are not from Dunedin, but Central Otago or Southland.

The increased usage of helicopter retrieval, regardless of the neurosurgical situation is worthy of greater examination, because it represents a significant cost to the New Zealand health sector.

As an example the Otago Rescue Helicopter Trust presented the Panel with its figures for machine usage for the last eight years. They showed a steady increase and, more importantly, in the last four years, a sharp increase in the amount of time a second machine was required.
One point they made was that an increase in the total time the first helicopter was in use to transport neurosurgical patients to Christchurch rather than to Dunedin could have a significant impact on its availability in the Otago/Southland region. Another related point was that a flight from Dunedin (home base) to the Queenstown snow fields for retrieval to Christchurch (rather than Dunedin) was not possible with the current helicopters without a refuelling stop which would take additional time. Long range tanks were an option in this situation but at the expense of a lower passenger load (for example the ICU nurse could not come as well as the retrieval doctor). A helicopter with this long range and load capacity would be a very large capital expense.

Source: Otago Rescue Helicopter Trust

Source: Reproduced from original as supplied by Otago Rescue Helicopter Trust
From the Panel’s perspective, this all indicated that the likely transport costs involved with transferring all additional patients requiring neurosurgical assessment to Christchurch in the event that there was no neurosurgical service in Dunedin had been severely underestimated (Section 8 – Financial analysis).

2.12. Rehabilitation

Neurosurgical illnesses and injuries often result in a loss of neurological function. Any high quality service must have as an essential part of its programme a well resourced, well run and highly co-ordinated rehabilitation service. The Panel was impressed with the quality of the two South Island services provided at ISIS Rehabilitation Service in the case of Dunedin and at the Brain Injury Rehabilitation Service at Burwood Hospital, Christchurch. Both of these services should continue as a minimum at their current levels. Both services indicated a good working relationship with the two neurosurgical services and a commitment to continue this relationship. We did observe that there was very little cross pollination between these two excellent services; both could possibly benefit from consideration of more interaction.

In the case of ISIS the view was expressed that a transfer of all the neurosurgical patients to Christchurch could result in patients “falling through the cracks”. Instances were quoted where a return of an Otago/Southland patient to the South from initial treatment in Canterbury had resulted in a disappearance of the patient from the system. They feared that these instances could increase with a move of neurosurgical services to Christchurch. They also expressed the view that there were a few instances where patients had deteriorated whilst in rehabilitation and needed an urgent neurosurgical re-assessment. This would have been difficult if the treating team were in Christchurch.

The Panel was also made aware of the difficulties for families to perform a useful supporting role if the rehabilitation was taking place at a considerable distance from home. Neurological rehabilitation often extends over many months. The Panel reached the conclusion that rehabilitation as close as possible to the patient’s residence was highly desirable.

2.13. Impact on Families

An important but often overlooked element in neurosurgical patient care is the role families play. A family presence before and after an operation or care intervention can help the psychological wellbeing of a patient, which in turn is likely to assist in a less stressful and quicker recovery.

The greater the distance a family has to travel the more difficult it will become for some families to provide this practical social contact and support. Work commitments, competing family obligations such as childcare and cost will all play a part in reducing or in some cases preclude completely, family contact with patients.

The following Air New Zealand return ticket prices between Dunedin and Christchurch give an indication of the travel costs in October 2010.

Flexiplus $350.00
Smartsaver $226.00

Limited, subsidised family accommodation is available in Christchurch for people visiting patients. However, most families will be faced with the paying to stay at motels charging nightly rates of between $85 to $120.00.

These costs are going to be unaffordable for people on low incomes or benefits. The Panel noted that the National Travel Assistance Policy provides for families to receive limited financial support,
including for a support person, but this is poorly understood within the community and does not compensate for the lack of access to wider family support.

A large number of submissions to the Panel (20%) mentioned the benefit to patients of being able to have the support of family at a traumatic and stressful time. Many submissions felt that having family able to visit regularly was likely to help with better and quicker patient recovery. Conversely, other submitters were concerned that the additional difficulty family members from the southern areas faced in travelling to Christchurch could lead to slower recovery and worse outcomes.

A number of submissions noted that where children were patients, at least one parent needed to remain close to the hospital. Where stays are long, it could be difficult for partners and other family members to visit, causing lengthy separation of the family.

Several elderly submitters noted that they lived alone, and as such would experience a greater level of anxiety if, in the event of needing neurosurgical treatment, they would need to travel further away from their homes to receive it. Some noted that their support networks tended to be based on friendships rather than family members and felt that they couldn’t expect friends to travel to Christchurch for support. Other issues of concern were the security of their homes and the care of their pets.

The panel was not able to accurately measure the total cost to the community, either in money or social terms, of family separation from patients. However, it is confident that there is a link between physical family support and patient wellbeing. The shifting of neurosurgery from Dunedin to Christchurch would undermine that synergy.

3. Workforce

Neurosurgery in New Zealand is a small speciality but one which is likely to grow through future demand (3.2 below). In considering the issues around the South Island neurosurgical workforce, the Panel also looked at the wider New Zealand workforce, and international trends.

3.1. Current Demographics of the Workforce

The neurosurgical workforce in New Zealand, in Australia and indeed internationally is small.

There are currently 20 vocationally registered neurosurgeons across the country, working in five neurosurgical units – Auckland, Hamilton, Wellington, Christchurch and Dunedin

According to RACS Australasian data there are 207 active neurosurgeons in Australasia; 187 in Australia and 20 in New Zealand. Twenty-five FRACS neurosurgeons reside and work outside of New Zealand and Australia.

The MCNZ definition of an international medical graduate in neurosurgery (IMG) is a vocationally registered neurosurgeon whose primary undergraduate medical qualification was obtained outside of New Zealand. Using this definition, 60% of the New Zealand neurosurgical workforce are IMGs’. The New Zealand national average of IMGs in the MCNZ 2009 workforce survey was 40.6%. The majority of the overseas primary undergraduate qualifications were obtained in, Australia, South Africa, the Indian Sub-continent and the United Kingdom and Ireland.

The RACS definition of an IMG is a medical practitioner who obtained his/her primary undergraduate medical qualification outside New Zealand or Australia. Using this definition, 40% of the New Zealand neurosurgical workforce are international medical graduates. The RACS Surgical Workforce 2009 data shows that only 14.3% of all RACS Fellows across nine specialties obtained their undergraduate medical degree outside of Australia and New Zealand.

New Zealand, therefore, has a very significant reliance on the IMG neurosurgical workforce – a scarce resource and an unpredictable market.

RACS neurosurgical training figures show that New Zealand is not self sufficient in terms of neurosurgical training outputs.

These factors together mean that the New Zealand neurosurgeon workforce fits a very specific scope of service delivery, is small in number, scarce internationally and difficult to both recruit and retain. This workforce requires very careful strategic planning.

Another interesting issue facing the speciality is the age of the neurosurgeons in the country. Approximately 35% of New Zealand’s neurosurgeons are approaching or beyond retirement age (with four of the 20 neurosurgeons over the age of 65 years). Note that the RACS Surgical Workforce 2009 data shows that the average age of the Australasian neurosurgical workforce is 51.8 years and that 35% of the workforce are over the age of 55 years.

This means that the speciality as a whole is going to see a considerable turnover in the next few years. Increasing demand as a result of technical advances and the aging population will only exacerbate the situation.

It is, therefore, vitally important that the solution to the South Island situation, supports the development of a national neurosurgical workforce.

In addition, not all New Zealand neurosurgeons work full time in the public health sector. At least one neurosurgeon works only in the private sector. Some neurosurgeons on the vocational register no longer deliver clinical care.

The data below was provided by the Medical Council of New Zealand. It attempts to determine the New Zealand neurosurgical FTEs devoted to public sector work. While it is self reported and incomplete, it is the best New Zealand data we have at the moment. This 2009 data indicates a significant issue, in the number of clinical hours being delivered each week by surgeons aged 60 or above – 278.

**Figure 19**

![Clinical hours by age group](source: Medical Council of New Zealand)
Below are two tables of data from the 2009 Census of the Surgical Workforce – Extract for Neurosurgeons (RACS) that are provided for comparison.

Table 2.1 Average Hours Worked per Week Over a 4 Weeks Period in the Public Sector by Active Neurosurgeons by Region.

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Public Hours</th>
<th>Public Work</th>
<th>Public Procedural</th>
<th>Public Administration</th>
<th>Public Private</th>
<th>Mean</th>
</tr>
</thead>
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<td>ACT</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NSW</td>
<td>7</td>
<td>6.3</td>
<td>9</td>
<td>16.8</td>
<td>27</td>
<td>7.1</td>
</tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>QLD</td>
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<td>7.4</td>
<td>17</td>
<td>16.2</td>
<td>12</td>
<td>4.7</td>
</tr>
<tr>
<td>SA</td>
<td>9</td>
<td>6.9</td>
<td>9</td>
<td>11.3</td>
<td>10</td>
<td>9.3</td>
</tr>
<tr>
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<td>2</td>
<td>2</td>
<td>1</td>
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</tr>
<tr>
<td>NZ '01</td>
<td>16</td>
<td>12.1</td>
<td>16</td>
<td>21.1</td>
<td>15</td>
<td>8.7</td>
</tr>
</tbody>
</table>

NB: areas were there are five or less fellows responding to the question are excluded by an asterisk ***

For surgeons participating in these activities and thus reporting a response, the n value represents the number of respondents in each category. If a surgeon of this specialty is involved in this area of work, the average time spent is shown.

Source: 2009 Census of the Surgical Workforce – Extract for Neurosurgeons (RACS)
Neurosurgery

Table 2.2: Average Hours Worked per Week Over a 4 Week Period in the Private Sector by Active Neurosurgeons by Region.

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consulting</td>
<td>Ward</td>
<td>Procedural</td>
<td>Administration</td>
<td>Teaching</td>
<td></td>
</tr>
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<tr>
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<td>2</td>
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<tr>
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<tr>
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<td>22</td>
<td>44</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>NZ 17</td>
<td>17</td>
<td>34</td>
<td>17</td>
<td>34</td>
<td>17</td>
<td>34</td>
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</tbody>
</table>

As indicated in the data table below, the workload of a neurosurgeon can be split into a number of categories. It is important to take this construct into account in developing a strategic neurosurgical workforce plan for the South Island and indeed the whole of New Zealand.

Table 2.3: Average Hours Worked per Week Over a 4 Week Period in Other Activities by Active Neurosurgeons by Region.

<table>
<thead>
<tr>
<th>Specialty</th>
<th>CPD</th>
<th>Medico/Legal</th>
<th>Research Work</th>
<th>Prep-Bone Work RACS</th>
<th>Prep-Bone Work Specialty</th>
<th>On-Call Work (all types)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NSW 10</td>
<td>10</td>
<td>20</td>
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<td>20</td>
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<td>20</td>
</tr>
<tr>
<td>NT 1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
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<td>QLD 10</td>
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<tr>
<td>VIC 17</td>
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</tr>
<tr>
<td>NZ 17</td>
<td>17</td>
<td>34</td>
<td>17</td>
<td>34</td>
<td>17</td>
<td>34</td>
</tr>
</tbody>
</table>

As indicated by Canadian, Report of the Neurosurgery Expert Panel, December 2007 and in the data table below, when planning the neurosurgical workforce for South Island, it is crucially important to take into account the appropriate number of neurosurgeons required to run a safe, sustainable, 24/7 stand-alone roster. International guidelines indicate an absolute minimum of 3 neurosurgeons, preferably 4, is needed to run such a roster.

Source: 2009 Census of the Surgical Workforce – Extract for Neurosurgeons (RACS)
During our deliberations the Panel became aware that the workforce in the vocational speciality of Rehabilitation Medicine is in urgent need of critical evaluation and careful workforce planning. This Royal Australasian College of Physicians (RACP) speciality workforce in New Zealand is extremely small in number in comparison to its Australian counterpart.

As a result of our research and discussions with respect to neurosurgeon workforce, the Panel also became aware of a number of workforce data issues. In particular there are numerous different workforce data sets and data bases, held by various bodies. The databases vary significantly with respect to data set, accuracy and validity.

The most accurate and useful seem to be the Medical Council of New Zealand’s, The New Zealand Medical Workforce reports and the Surgical Workforce of Australia and New Zealand reports published by the Royal Australasian College of Surgeons.

The Panel is of the opinion that consideration should be given to developing and maintaining a single, up-to-date New Zealand workforce data base that employs the principles and data sets currently utilised by the MCNZ and the RACS. This will require appropriate resourcing.

3.2. Future Trends

There is sufficient international literature to give us a clear view of trends and new technologies in neurosurgery in order for us to form a view on the type of capacity and workforce we will need in the future, and how we might use them.

3.2.1. Future trends in head injury management

The international literature indicates that the outcome after traumatic brain injury has not significantly improved since the 1990s. RACS, the NHS National Institute for Health and Clinical Excellence (NICE)48 and the Scottish Intercollegiate Guidelines Network (SIGN)49 all recommend that all moderate and severe head injured patients should be assessed by a neurosurgeon and admitted to neurosurgical specialist centres that have the full range of expertise.

50 Moderate head injury = GCS 9 – 13; Severe head injury = GCS less than 9
In terms of neurosurgery, volumes of head injury are high and the time to definitive neurosurgical assessment is important in terms of mortality, morbidity and the success of long-term rehabilitation.

The National Neurosurgery Needs Assessment For Scotland report of 2007 (Foster/Gibson) states - “Therefore the potential for improving the outcome of patients with severe head injury by expanding the number of UK neurosurgical centres is much greater than any other potential new intervention or treatment under investigation”.

It goes on to say that the movement towards increased and quicker neurosurgical management of head injury would put pressure on neurosurgery beds and was also a strong argument against centralising “general neurosurgery services”.

3.2.2. Future trends in subarachnoid haemorrhage and endovascular therapy

The approximate incidence of aneurysmal subarachnoid haemorrhage in the South Island can be expected to be 9/100,000 population per year, 90 incidences per year\(^{51}\) and as the population ages we would expect this incidence to increase.

This condition is associated with a 40% mortality rate at one week post bleed and a 50% mortality rate at six months. Approximately 40% of all survivors have major, long term neurological deficits. In the USA it has been estimated that SAH is associated with an annual cost of $1.75 billion\(^{52}\).

Given the incidence of subarachnoid haemorrhage in New Zealand and the ageing population in the South Island, early diagnosis and management of unruptured cerebral aneurysms and AVMs and of spontaneous SAH is likely to have a significant impact on outcome, reducing the long term costs of permanent disability. Given the high costs of long term care, an early and accurate intervention that produces even a modest reduction in disability is often cost effective when lifetime impacts are considered. Therefore early expert assessment and diagnosis of SAH together with early neurosurgical intervention; clipping or where appropriate endovascular intervention could reduce mortality, morbidity and subsequent costs\(^{53}\).

Early diagnosis is dependent on the availability of an expert assessment team (neurologist, neurosurgeon and neuro-radiologist).

Of cases admitted to hospital most (85%) are treated by surgical or endo-vascular means. Historically the only means of treatment was clipping of the aneurysm or ligation of the feeding artery. The latter treatment is no longer practised due to the improvement of operative techniques. An increasing number of aneurysms are now treated by endovascular coiling and stenting techniques. This is an expensive and highly specialised procedure; in New Zealand it should probably be limited to the number of centres at which it is currently done.

As a subset of that, in the South Island context, coiling is already undertaken at Christchurch by one neurosurgeon and one interventional neuro-radiologist. The South Island Neurosurgical Service will need to examine how best to support that service as a centre of excellence.

\(^{51}\) Rooij NK, Linn FHH et al. Incidence of subarchnoid haemorrhage: a systematic review with emphasis on region, age, gender and time trends. Neurol Neurosurg Psychiatry 2007;78:1365-1372


3.2.3. Future trends in stroke management

The on-going cost of stroke to health services and the community is significant. In the United Kingdom it is estimated that for every patient who experiences stroke the cost to the National Health Service (NHS) is approximately £15,000 over five years. With informal care costs included this figure is estimated to increase to £29,00054.

Internationally it is being recognised that there are significant benefits to be gained from more intensive early management of stroke patients, including early access to a CT scan and a “brain attack” team.

The principle is that a “brain attack” is as time critical as a heart attack55. Therefore intensive early management of a stroke involves early referral to an expert assessment team, early diagnosis with CT within four hours of admission to differentiate ischemic from haemorrhagic stroke and identify patients for thrombolytic therapy and management of vasospasm.

The treatment of acute stroke is primarily an area for neurology but aggressive management with thrombolytic therapy carries a risk of intra-cerebral haemorrhage requiring neurosurgical intervention.

In the South Island context this again means rapid access to a general neurosurgery services team is important to providing the population with world-class care. It also fits in with the concept of Outreach (Section 5.3) that a more dispersed neurosurgical service will develop better networks with clinical teams in the other smaller hospitals across the region.

3.2.4. Future trends in stereotactic radio surgery

The international literature cites clear evidence of the benefits of stereotactic radio surgery in the management of AVMs, small acoustic nerve tumours and some brain metastases.

The SBNS guidelines indicate a catchment population of 5 million is appropriate to support a regional stereotactic surgery service. This indicates that New Zealand should have just one site and that there is no reason in the foreseeable future to expand beyond that.

Historically the national centre for stereotactic radio surgery has been at Dunedin Hospital and the contract for the number of procedures has just been increased to meet New Zealand’s demand levels.

Such a service is synergistic with the delivery of a stereotactic radiotherapy service and both require a team including neurosurgeons and neuro oncologists.

It would be logical in a distributed South Island service for the stereotactic sub-speciality to continue developing at the Dunedin node.

There was the view that in the case of all resident neurosurgeons being placed in Christchurch, the stereotactic service could remain in Dunedin and be served by Christchurch neurosurgeons undertaking their weekly outreach service to Dunedin. That is not the Panel’s view. If there were to be only one resident site at Christchurch, then in order to nurture the stereotactic service and develop it for the benefit of New Zealand people, it would have to shift as well, as the wider team’s expertise in this sub-speciality would inevitably wane over time.

However, there are a number of extremely expensive devices associated with stereotactic surgery, such as the Gamma Knife ® or Cyberknife ® which would have to be looked at very carefully on a national basis before they were purchased.

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3.2.5. Future trends in the management of movement disorders

Movement disorders, such as Parkinson’s disease, are common in the elderly and, as in other countries, New Zealand’s elderly population is growing, so we can expect an increased incidence of Parkinson’s disease and dementia in the future.

Pharmacological treatment has historically been the main way to treat Parkinson’s disease sufferers, but it is expensive and may have significant side-effects. There have been huge advances in the surgical treatment in the last 10 years, with similar levels of advance expected in the next 10 years.56

Chronic deep brain stimulation has become increasingly common internationally and in New Zealand, Auckland City Hospital has begun undertaking some of these procedures. Therefore, given that the New Zealand population is ageing, we would be wise to plan carefully for the future and consider the cost-effectiveness of managing Parkinson’s disease using neurosurgical intervention.

Both pharmacological and neurosurgical interventions have the potential to realise major quality of life benefits for the New Zealand population. It would be logical to think of establishing the neurosurgical treatment of Parkinson’s disease in the South Island some time in the future as a developing sub-speciality at one of the nodes.

3.2.6. Cost implications of new technologies and treatments

The Panel will also recommend that the Governance Board takes responsibility for planning the introduction of new technologies to prevent unnecessary duplication. This can be supported through PHARMAC’s increased responsibilities around the purchasing of devices and equipment.

The Governance Board will also need to manage the South Island Neurosurgical Service budget for high cost interventions, implants and high cost consumables.

3.2.7. Effects on workforce planning

The list above is not exhaustive. The Panel simply looked at the international literature57 with a view to establishing the general direction of a South Island Neurosurgical Service, in terms of workforce development and sub-specialisation.

What it tells us is that in terms of head injury and indeed for all aspects of core neurosurgery, there will be a greater need for a distributed network of neurosurgical expert teams. However at the same time there is widespread development of sub-specialty interventions which, while often low volume and high cost, have the potential to improve patient outcomes and reduce on-going costs to the sector and the community; this is especially true if the developing expertise is clustered in the hands of a small subset of neurosurgeons.

In that context, a two-node South Island service with the development of sub-specialities at either node, seems not only justifiable but imperative.

In this way, it can develop as a service which is attractive to work in and provides the potential to support and expand some of the current relatively vulnerable sub-specialisation.

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It also provides the critical mass for SET trainees and Fellows, which will be necessary in order to foster the development and expansion of the neurosurgical workforce in this country.

3.3. Attraction and Retention

The interest in neurosurgery as a career has increased over the last five years. The Royal Australasian College of Surgeons education database shows that an increasing number of young New Zealand and Australian doctors are applying for SET in neurosurgery (Section 3.4.1). Attracting suitable young doctors into neurosurgery is not the problem.

It is also important to state that the Fellowship of the Royal Australasian College of Surgeons in Neurosurgery is a qualification that is held in high regard internationally.

The most significant issue facing New Zealand neurosurgery is the retention of New Zealand trained neurosurgeons in our own health system. On completion of training many young neurosurgeons are attracted to overseas positions, often in Australia. There are a number of reasons for this;

• insufficient opportunities for, and guidance and assistance with, post Fellowship training and subspecialisation
• lack of clearly defined career pathways and opportunities for career development and progression in New Zealand
• lack of job certainty
• family commitments in other countries; the 6 year SET programme in neurosurgery is an Australasian programme and trainees frequently rotate across the Tasman
• a perception, rightly or wrongly, that the opportunities for appropriate work-life balance for a neurosurgeon in New Zealand may be more limited than in some other countries
• perceived enhanced academic opportunities including education and research in other countries
• enhanced employment packages and monetary rewards in many overseas centres

The Panel believes that it is imperative and urgent that these issues are addressed.

3.4. Education and training programmes

3.4.1. RACS training

In Australia and New Zealand training in neurosurgery is provided by a six year programme run by the RACS Board of Surgical Education and Training in Neurosurgery (SET). Entry is by a competitive process involving a mixture of CV, referee reports and interview. In 2010 there were 56 people interviewed for 12 positions. Prospective trainees may apply in the second post graduate year.

SET 1 is a general introductory year; SET 2, 3, 5 and 6 are clinical neurosurgery years with increasing responsibility and increasing difficulty of operative cases. SET 4 is a year of research or an elective year in a related area or an area of special interest. There are currently 63 trainees in the 6 years but a small number have been allowed time out of training to complete higher degrees (PhD, MD). Eleven trainees were identified as being of New Zealand origin.

There are currently 29 approved training units and 47 approved training positions in Australia and New Zealand for SET 2, 3, 5 and 6 (a very small number of these 47 positions are vacant). This results in about 10 trainees for each year. There are 9 trainees in research and 4 trainees on interruption (for family and personal reasons). Of the 63 trainees 16 are in SET1 (but 3 of these have deferred for a year).

Any hospital that has an accredited SET 2 + position automatically has approval for a SET 1 position. As the number of approved units is 29 the number of potential SET 1 positions is also 29. However the number entering into SET 1 is defined not by the number of SET 1 positions
but by the number of likely positions in SET 2. This varies a little from year to year depending on resignations, progression of trainees and the number taking extra time to do a higher degree such as a PhD or MD. Consequently not all of the SET 1 positions are filled (or will be filled in any year).

In New Zealand there are accredited training positions for SET 2 + in Auckland (two positions), Wellington and Christchurch (one position each). Each of these units has a SET 1 position approved (but not necessarily filled) making a total of 3 SET 1 positions and 4 SET 2+ positions in New Zealand.

A purely NZ training programme would have as a maximum one trainee graduating each year as the determining number is the number of SET 2+ positions; the current numbers suggest that there are double that number of trainees in the programme at present. An enhanced Dunedin unit as a part of a South Island integrated service and a further developed Waikato unit could see accredited training positions at both of these units, making a total of five SET 1 positions and six SET 2+ positions in New Zealand.

This may go some way to dealing with the current issue which is that the RACS training system does not ensure a New Zealand neurosurgical workforce as the New Zealand candidates are competing with Australians for positions on the training programme and for accreditation positions at New Zealand hospitals. Mechanisms need to be explored to ensure an adequate number of New Zealand applicants get selected onto the programme and are able to train.

3.5. Staffing

After careful consideration of the available information and research\textsuperscript{58} the Panel recommends that the Governance Board take into account the following principles in developing the Resident Medical Officer (RMO) workforce plan for the South Island Neurosurgery Service. The Service:

- should be consultant driven
- must ensure a good balance between high quality service delivery and high quality education opportunities
- needs to develop a strong, vibrant RACS Neurosurgery SET programme
- needs to develop Fellowship programmes based on areas of sub-specialisation, education, research and post graduate qualifications at Masters and PhD levels
- must develop an excellent, well resourced education programme that provides opportunities for; SET trainees from other specialties, other RMOs and medical students as well as colleagues from general practice and primary care and other interested health professionals, to learn about various aspects of neurosurgery care
- must follow the principles of safe work practices and has a responsibility to ensure the health and wellbeing of all professionals within the service
- should consider appointing only “interested” RMOs to positions in the service and providing additional neurosurgical workforce through the use of trained neurosurgical nurse practitioners and/or physician assistants trained in neurosurgery.

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4. **Academic Neurosurgery**

4.1. **Definition of Academic Neurosurgery**

Academic Neurosurgery can be defined in a number of ways. However, it is generally accepted that an academic programme is one in which personal research and teaching directly informs clinical practice.

It involves the establishment of research programmes which preferably should be both laboratory and clinically based, as well as translational clinical trials based on personal and/or international collaborative research programmes.

An academic neurosurgeon would be expected to be involved in both undergraduate and postgraduate teaching, and the teaching should essentially be research based.

An academic neurosurgical service would establish research programmes in one or more subspecialty areas and supervise postgraduate students (at Honours, Masters or Doctorate level). The members of an academic neurosurgical unit would be expected to have collaborations with their international peers, and participate in national and international collaborative research programmes as well as clinical trials.

Academic neurosurgery influences the practice of neurosurgery by ensuring there is a critical scientific focus to clinical activities.

There are numerous examples of international neurosurgical academic centres, including the University of Toronto, the neurosurgery service at Cambridge University, Harvard University (Brigham and Women’s Hospital), University of California, San Francisco, University of California, Los Angeles, Hebrew University Jerusalem (Hadassah Hospital), and The University of Melbourne (The Royal Melbourne Hospital).

5. **Leadership**

Health services exist to serve the needs of citizens, communities and patients and their families.

Professionalism encompasses four ethical principles; beneficence, autonomy, non-malfeasance and justice. For all health professionals (clinicians, governors and managers) professionalism is based on the values and principles of honesty, integrity, compassion, altruism and social justice.

“Professional skill or professionalism covers a wide range of elements, including communication skills, knowledge of medical ethics, personal and professional development, awareness of relevant laws pertaining to medical *(health care)* practice and cultural awareness in our multi-cultural society ... positive attitudes to all the roles of being a doctor *(health care professional)*”. Kerry J Breen, FRACP, Australian Medical Council.

The establishment and maintenance of a high quality, effective, flourishing South Island Neurosurgery Service will require strong and sustained facilitative leadership from clinicians, health governors, managers and communities.

The leaders will need to be true professionals. They will need to be open and honest in their dealings with others. They will need to exercise diligence, perseverance, humility and courage. They will need to be committed and resilient.
The success of this endeavour depends on strong leadership facilitating the development of excellent, open, multi-directional communication and strong, reliable and trusted relationships both within the Service and with other professional and service groups and patients and communities.

The key leadership challenge and indeed opportunity will be to develop and nurture a vibrant, committed, cohesive, high functioning, whole of South Island Neurosurgery Service TEAM; governors, managers and clinicians. A team able and willing to work collaboratively to deliver a safe, high quality, sustainable regional neurosurgery service across the whole South Island - a service that the team and all South Islanders can be justly proud of.

5.1 Teamwork and Teams

Currently health care faces a number of significant challenges in terms of the system’s ability and capacity to continue to deliver health care in the way it has traditional done in the past. Many believe that health needs to look to new paradigms if it is to continue to effectively meet community needs. In Canada teamwork is being proposed as one of the solutions to help stabilise and sustain the health care system.

A team can be defined as a “collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves, and who are seen by others, as an intact social entity embedded in one or more larger social systems and who manage their relationships across organizational borders” 59. Put another way, in health, collaborative patient-centred practice “is designed to promote the active participation of each discipline in patient care. It enhances patient and family centred goals and values, provides mechanisms for continuous communication among care givers, optimizes staff participation in clinical decision making within and across disciplines and fosters respect for disciplinary contributions all professionals”.

Health care teams are very fluid and varied. Health professionals may think and appear to work in and across a variety of defined teams however that does not necessarily mean they are engaging in teamwork.

Teamwork or collaboration is a health care professional competency. It can be taught, learned and assessed.

Competent teamwork has clearly demonstrable benefits for safety, quality of care and enhanced patient outcomes. Safe care is resource efficient and cost effective.

The Panel suggests that the Governance Board develop a formal strategy for developing and sustaining professional competence and performance in the domains of collaboration, teamwork and relationships for the South Island Neurosurgical team. The Royal College of Physicians and Surgeons of Canada, The CanMEDS Train-the-trainer Collaborator Faculty Development Program is an excellent resource 60.

5.2 Quality Improvement

All citizens, communities, patients and families have a right to care that is safe and is of a high standard.

60 Richardson D, Glover TS et al. The CanMEDS Train-the-trainer Collaborator Faculty Development Program. Ottawa. The Royal College of Physicians and Surgeons of Canada: 2007
A number of authors have suggested “that policies aimed at increasing cooperation rather than competition among health service providers have a positive impact on quality of care.” Nobilio, Fortuna, et al, 2004.\(^{61}\)

The South Island Neurosurgery Service should operate within a broad, combined clinical and corporate safety, risk management and quality improvement framework.

In general terms a safety, risk management and quality improvement framework should have strong community engagement. It should enable; respectful challenges to existing behaviours, practises and systems and the provision of relevant information, knowledge, tools, expertise and support to where they are needed. It should provide opportunities to nurture innovation and local solutions, encourage sharing, teamwork and collaboration and foster self-reflection and scientific evaluation. As such, it can be a very effective tool for facilitating a culture of safe practice and quality service delivery across the entire Service.

High level data management; accurate collection, informed critical analysis and timely feedback of information and data is central to any effective quality improvement programme. The measurement of relevant parameters drives change through the quality improvement cycle – assessment, planning, implementation, evaluation. Data will enable the Service to accurately identify problems, prioritise quality improvement interventions and evaluate the outcomes of those interventions.

The Governance Board should facilitate the development of a minimum data set for the Service.

A safety, risk management and quality improvement framework for the South Island Neurosurgery Service would include a number of domains;

- delivery against community and patient expectations
- clinical performance and development
- service performance and development, including teamwork and relationships
- research and innovation
- education
- business performance
- compliance and legislative requirements.

On an annual basis the Governance Board may wish to define a small number of inputs under each domain. Each input should be “connected” through into a relevant output that directly reflects patient outcomes across the entire patient journey. Safety, quality and risk reporting should be included in the Governance Board’s annual agenda.

In addition there are a number of specific safety and quality items that should ideally be constant inclusions in the framework;

- Clinical audit - the Panel recommends that a single centralised clinical audit is implemented across the whole South Island Neurosurgery Service. The audit should adopt the principles of the Australian and New Zealand Audit of Surgical Mortality (ANZASM)\(^{62}\) that are:
  - it is independent
  - it is external
  - it is peer-review

\(^{61}\) Nobilio L, Fortuna D et al. Impact of regionalisation of cardiac surgery in Emilia-Romagna, Italy. J Epidemiol Community Health 2004; 58: 97-102 doi: 10.1136/jech. 58.2.97
- it is systematic
- it is routine
- it is objective
- it is confidential (all audits are covered by qualified privilege at a Commonwealth level)

- The service should apply to the Minister for Protected Quality Assurance (PQA) status. It should be aligned with the RACS Surgical Audit and Peer Review Guide. The audit discussions may be facilitated through the use of video-conferencing. This audit needs to be based on the national neurosurgery audit minimum data set and should be connected into the national neurosurgery processes
- Critical incidents or significant variances, both clinical and corporate including; SAC 1 and 2, coronial findings, Health and Disability Commissioner investigations and findings, professional competence and disciplinary findings
- Facilities and programme accreditations
- Neurosurgeons annual performance review and development plans

The review and development plan should cover the RACS domains of surgical competence that are:

- Professionalism
- Scholar/Teacher
- Health Advocacy
- Management and Leadership
- Collaboration
- Communication
- Medical Expertise
- Judgement – Clinical Decision Making
- Technical Expertise

The process should be aligned with the RACS; Surgical Competence and Performance Guide, the Maintenance of Professional Standards Information Manual and the College, Continuing Professional Development Information Manual 2010-2012, the Code of Conduct and the brochure about the recognition, avoidance and management of bullying and harassment

It should also take account of safe working practices and the health and well-being of the workforce

It should be noted that the RACS Surgical Competence and Performance Guide is recognised internationally as the “gold standard” guide for assessing and developing surgical performance and for guiding the remediation of sub standard performance

- Neurosurgeon and neurosurgical service credentialing

The RACS Appointments and Credentialing Committees that Define Scope of Practice is an important resource.

The Acta Neurochirurgica Supplementum publication may be of use in customising the safety, risk management and quality improvement framework to best meet the needs of the South Island Neurosurgery Service.

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64 Appointments and Credentialing Committees that Define Scope of Practice (2009)
5.2.1. Evaluation

The setting up of this service needs to be evaluated as we go through the process. It will be important to undertake a continuous evaluation to adjust the development process where appropriate and ensure that the generic learnings are harvested and used appropriately.

The Panel suggests that the Governance Board develop a 2-3 year strategic plan and a formal evaluation strategy for the South Island Neurosurgery Service.

5.3. Outreach Service

There are various models for the delivery of surgical care across populations and geographic areas. The main tenet of surgical outreach is to, where possible, “take the surgeon to the patient rather than the patient, and family travelling to the surgeon”. So it involves providing care as close to the person’s home as possible.

Neurosurgery has a clear and specific scope of practice – it is a low volume, complex, technology dependent and expensive specialty with a large emergency or acute care component.

This last aspect, the proportion of emergency or acute care, separates neurosurgery from many other super, or tertiary specialties. Very few other high level specialties have the time dependency as a critical aspect of care, in the way that neurosurgery does.

The delivery of safe, quality neurosurgical care is dependent on the presence of expert medical and non medical staff working collaboratively in teams to provide a 24 hour service in a fit for purpose, well resourced environment.

Therefore neurosurgical outreach is by definition ambulatory neurosurgical care. It involves consultations, assessments, and some investigations, but not usually operative procedures.

In planning a regional neurosurgical service the inclusion of a robust model for the sustainable and affordable delivery of outreach care is crucial.

The planning for the South Island Neurosurgery Service needs to carefully consider and balance the resources necessary to sustain safe, quality care in both the Christchurch and Dunedin nodes while maintaining a South Island wide outreach programme. In other words, it is no use sending valuable and highly trained neurosurgical staff out to other cities and towns, if the ability to maintain a 24-hour roster at the two nodes is compromised.

But it was the Panel’s considered view that safe and appropriate outreach was much more likely to be possible with a two node service than it would be with one centralised service based in Christchurch. While the centralised model66 did include a proposal to provide weekly visits to Dunedin by a neurosurgeon and registrar, backed up by a monthly visit to Invercargill, this did not, in the Panel’s opinion constitute an effective outreach programme.

The panel considered that an effective outreach programme would involve the following principles:

1. Care to be provided as close to the patient’s home as possible: this is better for the patient and family and more cost effective

2. Outreach involves a patient: surgeon face to face encounter

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66 Brown Report – Appendix 2
3. It involves first specialist assessments (FSAs) and follow-ups (FUs). Good neurosurgical practice indicates that all patients should have at least one FU consultation as part of the treatment for a significant illness, after an investigation (neurophysiology, radiology) and after an operative intervention. This practice provides safe, quality care for the patient and enhances surgeon learning and continuous professional development.

4. Requires the development and publication of a clear calendar for outreach visits; venues and frequency. This should be done in conjunction with the services receiving the outreach to ensure the plan meets local needs. This calendar should be reviewed regularly.

5. Ensures that the same surgeon is assigned to the same venue for six to twelve months. This facilitates patient: surgeon relationships, surgeon: local staff relationships and surgeon familiarity with the local service environment. It forms the basis for excellent communication, allows the formation of effective clinical relationships and a shared understanding of various service delivery environments. It facilitates mutual clinical trust. The Panel heard repeatedly about the importance of robust, stable clinical relationships and mutual clinical trust. The Panel was told that clinicians outside the two nodes need to have a sustained and predictable relationship with a neurosurgeon from whom they can seek expert advice.

6. Ensures that each outreach clinic is well set up and runs efficiently so valuable expert time is not wasted.

7. Ensures that the visiting team has easy access to all paper and electronic data/records at the local site and the nodes, including, local computer logins, patient records, radiology and laboratory information.

8. Ensures that the visiting surgeon is allocated time in order to meet with local colleagues, including general practitioners.

9. Ensures that the visiting surgeon is allocated time to provide educational input for primary care and local hospital clinicians especially in the areas of patient diagnosis, stabilisation and triage.

10. Ensures that careful consideration is given to the composition of the outreach team, this may vary according to circumstances and place; neurosurgeon, SET trainee, neurosurgery Fellow, rehabilitation medicine physician and/or trainee, neurosurgery nurse practitioner, neurosurgery physician assistant.

11. Requires careful determination of the neurosurgical FTEs required to deliver and effective an efficient whole of South Island regional neurosurgical outreach service and the incorporation of this into the neurosurgery workforce plan.

The reason the Panel is being prescriptive around the principles of outreach is two-fold. Firstly we found varying commitment to the principles of outreach (and its meaning) as we undertook our deliberations. For instance, amongst the Wellington neurosurgeons, we found an impressive commitment to the sort of practice outlined above, and a real understanding of its effectiveness in delivering patient-centred care. That contrasted with the view expressed elsewhere that the telephone was effective outreach.

The second reason for being so specific about what is meant by outreach is that the Panel believes that it is one of the areas where the South Island can become a model for New Zealand, as we increasingly grapple with the implications of future trends (Section 3.2), changing practice, super-specialisation and an ageing, but still very sparse population. It fits very well into the current work being done nationally around clinical networking and regional planning, and provides an avenue for clinicians to lead that process.
That stated, the Panel recommends that the Governance Board give consideration to:

- the appointment of an outreach coordinator for the South Island Neurosurgery Service
- the development of quality measures and key performance indicators (KPIs) for the outreach service. The Board should be held responsible and accountable for ensuring equity of access to the outreach service and the for the implementation and maintenance of an integrated clinical and business quality improvement framework for the outreach programme
- the role of telemedicine in the provision of outreach

In time the Governance Board may also wish to consider:

- the provision of selected spinal surgery and peripheral nerve surgery as an outreach service in centres other than Christchurch and Dunedin. This should be planned in conjunction with local surgeons and in line with the RACS Position Statement on Outreach Surgery, June 2007, review date June 2010
- acute outreach care; in a very small number of emergency cases it may be appropriate to send a neurosurgeon with the retrieval team to a local hospital to provide “on the spot” acute neurosurgical intervention. This practice is occasionally used to benefit patients in the North Island.

6. Employment Arrangements

Once the Panel had come to the conclusion that one South Island neurosurgical service needed to encompass neurosurgeons at both Christchurch and Dunedin, a number of employment options were considered:

- each DHB employing its own neurosurgeons with a joint administration
- a separate entity employing the neurosurgeons and providing the service under contract to the South Island DHBs
- one or other of the provider DHBs employing all the neurosurgeons
- a third party entity employing the neurosurgeons.

6.1. Each DHB employing surgeons

The simplest employment arrangement would be for each provider DHB to continue to employ staff, including surgeons, located at each hospital as part of one ‘virtual’ combined unit.

This may have some issues in terms of staff working under different conditions for the same service.

However, from a practical perspective, this is probably the best way forward in the short term, with the proviso that the South Island Neurosurgical Service’s Governance Board (Section 7) is responsible for all appointments and reappointments of neurosurgeons.

This is to avoid the current position, where Southern DHB has made two appointments without any input from Canterbury DHB. This has proven to be a significant bone of contention for the Canterbury Board, management and clinicians, who believe an agreement has been broken.

The involvement of a third party, in the form of the Governance Board would be critical to this arrangement being successful.

It also means that the Panel would anticipate the Governance Board examining the current Southern appointments before they proceed.

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6.2. **Separate Entity**

It would be possible for a new entity such as a company, to employ the neurosurgeons and enter into contracts with both ‘host’ DHBs.

A similar arrangement was in fact used by Otago and Canterbury DHBs to run the South Island Cardiac Surgery Service in the late 1990s. However, there was, in that case, an existing private company owned by the clinicians which already contracted with the DHBs.

The drawback to this concept is the complexity, both in setting it up and in its operation. There would be significant time lags going through the legal and bureaucratic processes to set up a new entity, there would be further complexity with the appointment and functioning of the directors and in needing to comply with company law obligations and there would be yet further complexity with the financial and contractual arrangements with the providing DHBs.

The Panel, therefore, did not favour this option.

6.3. **Employment by one DHB**

This option would be relatively simple, with regards to neurosurgeon employment, but in the current circumstances could be difficult to implement.

The difficulty arises around the question of which DHB would employ the surgeons as it could be seen that the employing DHB would have control of the service. As the DHB employing the larger number of neurosurgeons, Canterbury would be the obvious one to undertake the employment. However, the history between the two DHBs, and the current level of distrust, make this option very difficult at this point.

6.4. **Third Party Provider**

There is the potential for a third party from within the health sector to employ the neurosurgeons. This could be, for instance another DHB which already has an involvement in neurosurgery.

This model does create complexity, but it is an option which could be developed further if the Canterbury and Southern DHBs continued to be unable to co-operate.

7. **Governance**

The Panel came to the view that a strong governance structure is the key to the South Island Neurosurgical Service being successful and having a sustainable future.

7.1. **Role**

As outlined in Section 6 the Panel believes that the employment arrangements can be quite straightforward. However, given the history of animosity between the DHBs over this issue, there needs to be some independence in the governance of the implementation and operation of the service to ensure that there can be universal confidence amongst all health authorities that the service is truly a South Island one.

It is also important to note that neither DHB has a history in supporting and managing a high performance, academic neurosurgical service. They will, therefore, need strong support and guidance.

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68 Richard Bunton submission to Panel
Thirdly, the South Island’s various communities need reassurance that the service is being developed in the way that the Panel is recommending. Whether or not it is justified, as a result of recent developments, there is deep distrust within the communities of the lower South Island and that needs to be acknowledged in the composition of the governance group (Section 7.3).

The Governance Board should function as a traditional board, not as a constituent representational board.

The members of the Board should exercise full fiduciary responsibilities; therefore they should act in the best interests of the collective, not demonstrate sectional interests, maintain confidentiality (apart from official board reports and communications) and assume collective responsibility for all decisions.

7.2. Responsibilities

The Governance Board will need to be given full responsibility to oversee the service and it will be responsible for:

- Appointing a clinical director
- Appointing a manager
- Making all neurosurgeon appointments and reappointments, and undertaking annual performance reviews for each neurosurgeon
- Making all appointments at Fellow, neurosurgery Nurse Practitioner and neurosurgery Physicians Assistant level
- Implementation of the regional service
- Urgently developing the Dunedin-based node
- Establishing one point of entry to the service
- Developing sub-specialisation across two nodes
- Ensuring the service follows an effective outreach model
- Ensuring appropriate linkages with other services and inter-professional groups, especially nursing and management at both “host” DHBs and the other South Island DHBs
- Ensuring the academic element of the service is supported by both the DHBs and the University of Otago
- Supporting the development of, and providing oversight for, the South Island Neurosurgery Service RACS SET training programme
- Ensuring appropriate facilities, support services and equipment are in place
- Ensuring appropriate quality and monitoring systems, both corporate and clinical, are in place, including those related to risk management and compliance matters
- Developing the funding model for the service
- Reporting to the National Health Board (NHB) on the implementation and performance of the service.

If the Governance Board feels it is not able to appropriately advance the service because of a lack of co-operation from the DHBs, the service and employment arrangements will need to be transferred out of the DHBs to a third party, such as a non-South Island DHB or other appropriate entity.
7.3. **Membership**

The Governance Board will need to comprise:

- an independent Chair (Professor Andrew Kaye)
- an independent New Zealand-based neurosurgeon
- the Chair of Southern DHB
- the Chair of Canterbury DHB
- an expert Community Advisor (from outside Canterbury and Otago)
- the Chair of Nelson Marlborough DHB, South Canterbury DHB or West Coast DHB (rotate annually)
- a senior nominee of the University of Otago
- an Iwi nominee.

The Panel believes that in addition to the membership above, all South Island Neurosurgery Service meetings should be attended by the CEOs of both the Southern and Canterbury DHBs as they will be responsible for giving effect to the Governance Board’s deliberations.

The Panel has already spoken to Professor Kaye about his willingness to Chair the Board. Professor Kaye is the James Stewart Professor of Surgery and Head of the Department of Surgery, University of Melbourne and Director of Neurosurgery at the Royal Melbourne Hospital. He is an eminent neurosurgeon, researcher and educator and has an international reputation for his work. He understands the elements of an effective academic neurosurgical service and his involvement will also be important in identifying and attracting the right people to the service.

7.4. **Support Structure**

It will be important that the Governance Board is appropriately resourced if it is to be able to effect change and, the ultimate goal, a truly world-class service for the whole of the South Island, which is both clinically and financially sustainable.

The Panel was conscious to avoid unnecessary bureaucracy, while at the same time providing the service with the tools for success. Therefore, we believe it is necessary to appoint both a South Island Neurosurgical Service Clinical Director and a Manager to provide more hands-on day to day support to the Governance Board.

The Clinical Director should be a neurosurgeon and preferably from within New Zealand. This has the added value of linking the South Island service to a national approach to neurosurgery. However, this appointment may not be able to be realised in the first instance, it may take time to source an appropriate appointee.

Alongside the Clinical Director, there initially needs to be a South Island Manager, able to co-ordinate the required initiatives.

These positions should be fixed term, for a period of up to two years. These are likely to initially require a fulltime commitment. However, at the discretion of the Governance Board, this arrangement can be varied. As the service matures and gains momentum it should be able to identify and sustain both positions from within.

To avoid further argument from the DHBs as to who should employ these people, they should be employed by the National Health Board (NHB) for a fixed term. That fits in with the proposed reporting structure for the Governance Board. The NHB will also need to provide appropriate administration support for the Governance Board.
7.5. **Reporting Structure**

The Panel recommends that the Governance Board needs to be responsible to the National Health Board, through its National Director.

The Board will provide regular reports to the National Health Board on its progress against its activities. This will give the various interest groups from around the South Island the confidence, that an impartial and nationally responsible organisation is supporting the Governance Board and has oversight of it.

The same reports should also be distributed to the South Island DHB Chairs and CEOs groups as a matter of course, and it would be expected that they are made available to the public.

7.6. **Appointment Process**

The Panel recommends that the Acting Director General be responsible for appointing the members of the Governance Board and the Panel believes this should be done at the time, or shortly after, the release of his decision. The Panel would hope that the Acting Director General consults Professor Kaye in the process of making the appointments. This Board is the key to getting the South Island Service on track and must commence its work as quickly as possible.

8. **Financial Analysis**

One of the issues that afflicted the previous processes around establishing one South Island service was a lack of agreement on the cost of the various options.

This was a major failing and one which allowed the Canterbury and Southern DHBs further ground for argument.

To avoid this, the Panel asked the National Health Board to host discussions between the financial representatives of the two DHBs to come to a common framework for evaluating the costs of the previous 6:0 and 4:2 models. This was done and the outcomes are explained below.

8.1. **Cost to Sector**

Previous attempts at establishing a cost analysis for either a one site (based in Christchurch) or a two site service model had a number of areas of disagreement and failings.

The two major areas of failing were the assumption around the type of patients who would transfer to Christchurch in the 6:0 model, and the associated transport costs.

The previous projections had been calculated on the basis that only patients who had a length of stay of three days or more would be transferred to Christchurch. This presumed a far greater input from general surgeons than the Panel has determined is realistic.

We, therefore, determined that the financial cost formula should presume that neurosurgical volumes currently being undertaken at Dunedin would, in the future, be undertaken in Christchurch.

The second area that seemed out of line was the allocation for the costs of air transport, which was not realistic. The time and cost of transport is discussed in Section 2.11 but it is clear that previous financial calculations underestimated the time required for transport which, of course, involves the return of the vehicle and crew to its base.

The updated financial calculations on the previously proposed 6-0 (Christchurch based neurosurgeons only) and 4-2 (4 neurosurgeons in Christchurch and 2 in Dunedin) are attached at Appendix 6.
They indicate that the Christchurch-only option is calculated as being in the first year at least $3.1 million more expensive than having the service available at both centres.

These are conservative costings as they do not include any capital allowance for increasing theatre, ward, ICU, or radiology capacity in Christchurch, nor do they include any additional first specialist assessment or follow-up costs associated with practitioners travelling to Dunedin.

8.2. Cost to Individuals
The cost to individuals and families, because it is so difficult to quantify, is often ignored in costing the development of health services. Certainly the Panel has not had the time nor resources to undertake an in-depth cost analysis from a patient and family perspective, but we can make some observations, based on the experience of the Panel members, representations by the community, and international observations in the same area. These are contained in Section 2.13.

9. Future Funding Arrangements
The Panel has looked at potential funding models for the service in order to support a whole of South Island approach.

It was important for us to look at this because throughout the process, one of the recurring themes in our deliberations was the negative impact that Inter-district Flows (IDFs) have on co-operation between DHBs.

IDFs are the mechanism that the New Zealand public health system uses to recognise services DHBs deliver to people from outside their region. At the end of each year it is calculated on an historical basis, what each DHB will receive for services they have delivered to people whose domicile is outside their area. Equally each DHB pays other DHBs for services members of its population have received elsewhere. Typically, DHBs which operate a tertiary hospital are net-receivers of IDF funding and the smaller DHBs are net-payers of IDFs.

This leads to claims from net-paying DHBs that they are being forced into financial hardship by IDFs and the larger DHBs nearly always claim they do not receive enough from other DHBs through the IDF system to compensate them for the high cost, low volume services they provide.

It also provides an incentive for DHBs to find ways to manipulate their IDF income, and leads them to encourage sometimes unhelpful referral patterns.

An example of how this might be a concern in the South Island Neurosurgical Service is coiling, an expensive procedure only done in Christchurch. A perception that IDFs did not cover the cost of this intervention, could provide an incentive for Canterbury DHB to concentrate more on providing this procedure for their own population in preference to people from the rest of the South Island who also need it.

The Panel uses coiling as a hypothetical example only and is not making any claims about this or any other procedure. However, we are aware that IDFs do make life difficult for DHBs and encourage them to put pressure on their clinicians.

For a whole of South Island service which is being established and which needs to overcome parochialism and bad-feeling from the past, the IDF system is not helpful.

It is difficult to pull one service out of the current funding system, but the Panel has looked at how best to fund the South Island Neurosurgical Service in order to ensure that each of the South Island’s five DHBs is paying its fair share for the service it receives.
The Panel considers that a population based funding (PBF) model is a better way of ensuring the service is fairly funded and of removing any issues which could affect referral patterns.

PBF would be relatively simple to budget on the basis of predicted discharges (both cases and CWDs), first specialist assessments and follow-ups. The predicted discharges by ICD code to be determined by a formula combining the actual South Island figures for the preceding 12 months, the predicted figures based on average incidences and the expected unmet need. An annual wash up based on either actual costs or PBF against budget could be done to ensure that real costs are being reflected appropriately.

In addition the Panel suggests that the Governance Board give strong consideration to managing the high cost items budget for the Service. This budget would include; equipment, coils and stents, implants and neurosurgery specific consumables. It would be useful to use the PHARMAC cost benefit business modelling methodology to manage this budget.

Finally, as the Service develops, the Board will need to ensure that the activities of the Service provide value for money for all South Islanders.

### 10. Enablers

Telemedicine is often mentioned as an enabler of health services of the future and could have significant benefit for the South Island’s health services in the future. The world’s most advanced user of telemedicine is, arguably, the Dalhousie University in Halifax, Nova Scotia, which has a Division of Telemedicine. It is also the centre of a distributed academic neurosurgical service which includes three hospitals, the smallest of which has three neurosurgeons.

Telemedicine does have great potential in the South Island, and New Zealand generally, but international experience shows that it is not necessarily an inexpensive option either to develop or operate, it requires sufficient bandwidth to get the required level of detail, and it requires very strict and thoughtful operational guidelines. Additionally, and crucially, with regards to neurosurgical services, it is less useful in the diagnosis and treatment of acute patients.

With regards to the South Island Neurosurgery Service, the Panel is of the view that there are some basic issues that need to be dealt with in order for it to be able to develop as one service and the implementation of the South Island Information Technology strategic plan over the next two years is very important in this.

There needs to be a single patient record across the service, connected radiology, laboratory and patient information systems that talk to each other.

IT needs to be able to support an integrated referral and FSA process and efficient clinics in an outreach model.

Other key enablers will be
- a single point of entry for the service
- common waiting lists for FSA, essential investigations including radiology and neurophysiology, and for surgical procedures
- the uniform use of a standard system of prioritisation
- clear published agreed common guidelines and clinical pathways for referrals and for the management of common clinical problems.
11. Implementation: Timeline and pathway

The Panel expects that it will take up to two years for the South Island Neurosurgical Service to be truly operational as one service.

The key initial steps are for the Governance Board to be appointed and provided with the appropriate support to enable it to prepare a work programme.

Important in that will be an early focus on stabilising and developing the Dunedin node and the most important part of that is for the University of Otago to immediately commence the advertising and recruitment process for a Professor of Neurosurgery.

12. Appendices

Appendix 1
South Island Neurosurgical Service Expert Panel Terms of Reference, August 2010

Appendix 2
Draft South Island Neurosurgical Services Report by Dr Ian Brown
Draft South Island Neurosurgical Service Planning Report by Professor Spencer Beasley

Appendix 3
Analysis of written submissions

Appendix 4
Groups and individuals the Panel met

Appendix 5
Letters informing the South Island District Health Boards of the Panel’s intentions and seeking their assistance

Appendix 6
Updated financial calculations

Appendix 7
Explanation of data analysis