Stroke and Traumatic Brain Injury

New Zealand researchers are finding new ways to reduce disability and casting the spotlight on the stroke epidemic in developing countries.

“Stroke is one of the most fearful disorders and imposes a huge physical, emotional and financial burden on stroke patients, their families and society.”

Professor Valery Feigin

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**Stroke**

*There are about 7,000 new strokes in New Zealand annually and some 45,000 New Zealanders live with the aftermath of stroke. One in four are younger than 65 years of age.*

Stroke costs $450 million yearly in direct costs but other costs include lost productivity, payment for medications and private rehabilitation. Three-quarters of stroke survivors are moderately to severely disabled and almost half require help in their everyday activities.

In New Zealand, it ranks second only to ischaemic heart disease in terms of total disability-adjusted life years lost and premature mortality.

**Traumatic Brain Injury**

*Traumatic Brain Injury (TBI) is also a significant health problem in New Zealand, costing the country $100 million a year in direct costs. About three-quarters of traumatic brain injuries are due to car accidents, while the remainder are due to falls, violence, sport and other causes.*

Preliminary findings of a recent study have shown that New Zealand is likely to have 50-60,000 traumatic brain injury patients every year, outnumbering stroke survivors.

Moderate to severe TBI patients have physical problems as well as an emotional and psychological burden. While the majority of them are considered mild, TBIs can lead to quite significant disability.
Professor Valery Feigin’s interest in stroke began after his father died from one 30 years ago. At that time, the World Health Organization was performing the first stroke epidemiological study. As a neurologist, he started developing his own research in the early 1980s.

Over the last 10 years he has been involved in twelve HRC-funded Projects in stroke, TBI and cardiovascular disease and now heads the National Institute for Stroke and Applied Neuroscience at AUT University.

His New Zealand stroke research began with the Auckland Regional Community Stroke Study (ARCOS) Group’s series of studies and the HRC-funded Project, Auckland Regional Stroke Outcomes (ASTRO). ASTRO was designed to follow-up all stroke survivors over five years, with the emphasis on neuropsychological outcomes – the largest population-based, follow up study of that kind ever done.

The latest HRC-funded ARCOS IV Programme, Measuring and Reducing Stroke Burden in New Zealand, began in 2010.

The ARCOS studies have shown that, while stroke incidence in New Zealand has declined over the last 20 years, the rate of decline (11 per cent) is over four times slower than in other developed countries. At the same time, stroke incidence for Māori and Pacific peoples increased.

The recently completed ASTRO also produced ground breaking findings that captured international attention. It was the first five-year population-based follow-up of 418 stroke survivors and spanned virtually all areas of functional outcomes – from neurological impairment to cognitive impairment and disability – and found that over 60 per cent of stroke survivors have a complete recovery by five years.

They also found that Māori and Pacific peoples have significantly worse outcomes in terms of cognitive impairment, including dementia and reduced economic self-sufficiency, when compared to European New Zealanders. At the same time, they identified that men do better than women in terms of outcomes post-stroke.

Importantly, they also found that cognitive rehabilitation may help influence all other functional outcomes, such as disability, handicap and quality of life. This finding could mean a significant change in the current practice of stroke management, by getting neuropsychologists involved earlier.

A rehabilitation technique called attention process training was also successful in stroke survivors who have attention deficit - the most prevalent cognitive deficit, accounting for about 50 to 90 per cent of all cognitive deficits from stroke. It has already been included in the current New Zealand guidelines as an evidence-based rehabilitation recommendation.

Internationally, they have also had an impact. In 2009 they published a systematic review of stroke epidemiology world-wide in The Lancet Neurology, using data from 56 different population-based studies. It showed that stroke incidence in developed countries has decreased by 42 per cent, but in developing countries it has actually increased by over 100 per cent.

Nobody expected such results and Professor Feigin predicts it will lead to a change in perspective on the importance of stroke in developing countries, leading them to put stroke on the government agenda and do something to stop the epidemic.

The stroke research has also led to some commercial developments, such as the world’s first stroke rehabilitation DVDs for people discharged from hospital, to improve their chances of recovery. They have been endorsed by the World Federation for NeuroRehabilitation and reviewed positively by leading medical journals.

Work in traumatic brain injury has also made significant progress through research, such as the Brain Injury Outcomes New Zealand in the Community study, designed to gauge the impact of head injury in New Zealand, which is the first population-based study of that kind here and the largest in the world.

They have already made two remarkable and unexpected findings. First, preliminary results suggest that TBI incidence here is far greater than anticipated and, significantly, a greater proportion of children are affected by TBI (30-35 per cent rather than the expected 25 per cent).
Professor Feigin says New Zealand has a good reputation internationally for carrying out top-quality, population-based epidemiological studies and many of these were pioneered 30 years ago by Professor Ruth Bonita, who is currently still involved in the ARCOS IV Programme as a named investigator. That international reputation is also underscored by his own role as editor in chief of Neuroepidemiology, a well-regarded international journal.

Looking ahead, Professor Feigin thinks it is time to do more research into understanding why there are differences in stroke burden – for example, between Māori, Pacific and European New Zealanders – and getting to grips with why Māori and Pacific are at greater risk.

What he hopes for is to use all this research to improve the outcomes and reduce the burden of stroke and TBI here, save lives, reduce the burden on families and contribute to international knowledge as well. To achieve this goal, his institute has established good collaborative links with key stakeholders, including the Ministry of Health, the Stroke Foundation and the Brain Injury Association of New Zealand.

CASE STUDY

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Rehabilitation after a stroke

Professor Winston Byblow and Dr Cathy Stinear

Professor Winston Byblow at The University of Auckland’s Centre for Brain Research has shown that combining magnetic brain stimulation with simple rehabilitation exercises can help people recover arm and hand function, even more than six months after a stroke.

Working with PhD student and physiotherapist Suzanne Ackerley he found that the stimulation appears to prime the brain to be more receptive to the rehabilitation exercises, helping it relearn how to control fine movement.

This research is part of an ongoing programme, led by Professor Byblow along with Professor Alan Barber and Dr Cathy Stinear in the Department of Medicine, that has led to the development of an inexpensive arm and hand rehabilitation device, that can be used by patients at home. They can make hundreds of arm movements in a few minutes with minimal effort and this repetitive movement boosts plasticity in motor areas of the brain.

Plasticity is the process through which the brain reorganises itself following damage, injury or exposure to new situations - including nerve cells sprouting new connections. For nerve cells to make beneficial connections, they need to be correctly stimulated.

In a recent HRC-funded clinical trial, patients who experienced stroke at least six months prior used the device immediately before self-directed therapy, three-times per day, for one month. They improved upper-limb function to a greater extent than patients who did therapy alone.

In a new trial, the team is working with Auckland District Health Board nurses and therapists to determine if their interventions enhance brain plasticity and improve outcomes for patients undergoing physical therapy in the weeks immediately following stroke.