New Zealand Applied Neurosciences Conference

Auckland, New Zealand, November 24–26, 2016

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P.A. Barber, Auckland, New Zealand
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Neuroepidemiology

Recent data on the epidemiology, trends, and impact of stroke globally and in different regions are distinctly alarming. Significant geographical differences between countries and regions persist and have even increased. There is still no country in the world where the burden of stroke (in terms of absolute number of people affected by or died from stroke) has declined over the last two decades. The bulk of the stroke burden continues to be borne by low and middle income countries. Furthermore, the overall burden of stroke in younger adults is increasing globally, and now represents almost half of the total burden from stroke.

Tackling stroke is not only a clinical and public health issue but also an important challenge for global economic development. Stroke prevention has entered a new era, with stroke being identified as one of the prioritized non-communicable diseases (NCDs) in the WHO and UN actions on NCDs, including the landmark 2015 UN adoption of the Post-2015 Development Agenda.

Stroke is a prototype NCD disease in being highly preventable, probably to an extent that is not matched by any other NCD. More than 80% of all strokes are attributable to a limited number of risk factors that all are modifiable. At least half of all strokes should be possible to prevent. For primary prevention of stroke, governmental actions on lifestyle factors are important and constitute ‘best buys’. A high risk approach, identifying individuals with a substantial risk of stroke, constitutes an additional primary preventive action. However, to date progress has been achieved only in a limited number of high income countries, whereas unfavorable trends continue to be seen in low- and middle income countries. Strengthened actions are therefore warranted. Raising health awareness across all levels of risk through the use of mobile telephone apps constitute a most promising tool which is currently under scientific study.

One third of all strokes occur in persons who have already had a prior cerebrovascular event. Like first strokes, recurrent strokes are highly preventable and the full adoption of all therapies may reduce the recurrent stroke risk by three fourths or more. However, in low- and middle income countries the limited availability and affordability of essential stroke preventive drugs, have been recognized as major obstacles that require special efforts. Even in high income countries, lack of full implementation of therapies, and limited compliance and long term follow up constitute major problems in secondary stroke prevention.

Over only a few decades, visions of stroke have changed remarkably from nihilism, neglect and agnosia to optimism, realism and opportunities to act. However, with time also the many challenges have become better known. Preventive actions on stroke require the involvement and full support of stroke professionals, academics, non-governmental stroke organizations.

Epilepsy is a neurological disorder in which sudden, unpredictable, episodes of uncontrolled brain activity take over the normal function of the brain. Different parts of the brain, including the cerebral cortex and deep brain structures such as the thalamus, are involved in the generation of the uncontrolled epileptic activity. We are learning more and more about the specific neural circuits involved in epileptic seizures, and as a result we are able to develop experimental therapies designed to specifically disrupt brain activity in those affected regions. We have used optogenetics, an approach that makes neurons sensitive to light, and have shown that focal delivery of light to deep brain structures such as the thalamus can interrupt seizures very effectively and with few side effects. This neuro-engineering approach offers promise for the future treatment of brain disorders.
Not all of the stroke burden increase could be attributed to the ageing and growth of the population. For example, the proportional contribution of deaths from stroke to the total deaths from all causes has increased from about 10% to 12%. Where 5 years ago stroke disability was the third cause of disability out of disabilities from all diseases combined, in 2015 stroke became the second leading cause of disability worldwide. It also moved from a disease of the elderly, where >50% strokes happened in people of 75 years and older, to a disease of the middle-aged, with 60% of strokes happening in people younger than 65 years.

All these changes in stroke epidemiology suggest that currently used primary stroke prevention strategies are not sufficiently effective and need to be revised.
SS1 – Brain Research New Zealand – Dementia Prevention Research Clinics: A National Collaborative Research Effort to Delay the Onset and Progression of Dementia for the Ageing Population in New Zealand

SS1-01
Can We Really Prevent Alzheimer's Dementia? Examining the Evidence
Sachdev, P.
Centre for Healthy Brain Ageing, School of Psychiatry, University of New South Wales, Sydney, Australia

With the rapid increase in the health burden of dementia globally, there is an urgent need to develop and implement strategies to prevent dementia and/or postpone its onset. In the absence of effective pharmacological interventions for primary prevention, the focus has shifted to lifestyle and vascular risk factors. The modifiable risk factors identified in the literature include vascular factors (hypertension, diabetes, atherosclerosis, high cholesterol, mid-life obesity, smoking), low brain reserve (low education, complex mental activity or physical activity and poor social network), nutritional factors (low intake of antioxidants, high homocysteine, high alcohol use) and other (depression and head injury). The quality of evidence for these factors is varied, with most evidence being obtained from case control and observational cohort studies. Only some factors have been subjected to randomised control trials. The basic science evidence is not always consistent. There have been some recent large intervention trials for preventing cognitive decline. There is also emerging evidence that the incidence of dementia may be declining in some high income countries. This talk will examine some of the available evidence, identify the gaps in the literature and suggest a way forward. It will also ask the question whether observational evidence is sufficient to support large scale investment in interventions.

SS1-02
Introduction to Brain Research New Zealand – Dementia Prevention Research Clinics
Tippett, L.; Melzer, T.; Ilse, C.; Williams, J.

1University of Auckland, Auckland, New Zealand; 2University of Otago, Christchurch, New Zealand; 3University of Otago, Dunedin, New Zealand

The Brain Research New Zealand – Dementia Prevention Research Clinics (DPRC) are a network of clinics in Auckland, Christchurch and Dunedin, which aim to recruit a large New Zealand representative cohort of individuals with mild cognitive impairment (MCI) or the earliest stage of Alzheimer's disease (AD) and healthy older adults for longitudinal study. The aims are to collect clinical and lifestyle data, neuro-imaging data and tissue samples data, that will facilitate identification of biomarkers, or a 'biomarker signature', that predict progression from healthy aging to MCI and MCI to AD, and that affect rate of progression. A secondary aim is to generate and test a range of interventions (e.g. novel compounds, sensory, physical, lifestyle, social) that aim to delay progression of mild cognitive impairment to dementia, and to slow progression of early dementia.

Associate Professor Lynette Tippett is the Director of the Dementia Prevention Research Clinics (DPRC) and in this introduction will discuss the challenges and opportunities provided by the establishment of the Dementia Prevention Research Clinics.

Dr. Tracy Melzer is a medical physicist with subspecialty expertise in brain imaging techniques. As part of the DPRCs, eligible longitudinal study participants will have an advanced MRI session. Dr. Melzer's role in the DPRCs has been to help develop, implement, and in the future, analyse and interpret, the many images produced during the MRI session. In this introduction Dr. Melzer will discuss the different types of brain images that are acquired, what they can tell us about the brain, and plans for how we can leverage this information in the future.

Dr. Christina Ilse is a clinical neuropsychologist, specialising in assessment and diagnosis of dementia. As part of the DPRCs, eligible longitudinal study participants will have a comprehensive neuropsychological assessment. An explanation of how these measures contribute to a diagnosis being made of mild cognitive impairment or dementia, or normal cognitive functioning, and the challenges associated with this, will be provided. The neuropsychological domains assessed, and the use of this information as part of the longitudinal study into biomarkers for Alzheimer's disease, will also be discussed.

Dr. Joanna Williams is a co-principal investigator of the DPRC tissue bank which has been established to support research into biomarker studies that may predict progression from mild cognitive impairment (MCI) to early AD or other dementias, and rate of progression of cognitive decline and dementia. Participants will
be asked to consent for blood samples to be taken for blood based biomarker studies described for this study and also to consent for the storage of blood samples for future use in blood biomarker studies. Dr. Williams will discuss the types of components that will come from the blood donated as well as the types of biomarker studies that will be carried out with these samples.

SS2 – Focus on New Zealand

SS2-01

Prevalence of Genetic Muscle Disorders (MD-Prev) in New Zealand: A National, Population-Based Study

Roxburgh R., on behalf of the MD-Prev Research Group

Auckland District Health Board, Auckland, New Zealand

Prevalence data is essential for health care planning and understanding population differences. To date, most prevalence studies of muscle disorders have relied on health care services for case identification. A national, population-based study (MD-Prev) was conducted in New Zealand that aimed to identify all living cases, with a clinical and/or genetic confirmation of diagnosis, residing in New Zealand on the point prevalence date of 1st April 2015. Disorders included all muscular dystrophies, congenital myopathies, myotonic dystrophy, ion channel muscle disorders and Pompe disease. New Zealand 2013 Census data was used as the denominator (N = 4,242,048).

A total of 964 cases were identified, yielding an overall point prevalence of 22.72 per 100,000. Ages ranged between <1 to 90 years, with 16.4% of cases aged under 16 years. Prevalence was higher for males, 13.1 per 100,000, compared with females, 9.62 per 100,000. 91.1% of cases were identified through the NZ Neuromuscular Disease Registry, Neurologists records, NZ National Health Database, and the Genetics Service databases. An additional 7.8% were identified through the Muscular Dystrophy Association and 1.1% through self or family referral. The majority of cases were ascertained from multiple sources. The most common condition was Myotonic Dystrophy, with a prevalence of 8.09 per 100,000. Distal Muscular Dystrophy was the rarest conditions (0.21 per 100,000 respectively). Prevalence of Dystrophinopathies was 4.43 per 100,000.

Prevalence of Dystrophinopathies is lower in New Zealand compared to previous studies. This is likely to reflect potential under diagnosis and referral bias. Additionally, previous studies have focused on geographical areas surrounding centres of excellence in neuromuscular disorders, in contrast to this study which was conducted nationwide. Patient support organisations are an important source of cases for increasing the accuracy of prevalence data.

SS2-02

Traumatic Brain Injury in New Zealand – Findings from the BIONIC Study

Theadom, A., on behalf of the BIONIC Research Group

National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

Background: Previous epidemiological studies of TBI have restricted case ascertainment to medical records only. Whilst this approach provides good capture of moderate to severe injuries, many mild TBIs who attend primary care services or chose not to seek treatment may be missed, underestimating the disease burden. There has also been a lack of follow up of TBI incidence cohorts.

Methods: The Brain Injury Outcomes in the Community (BIONIC) study was a prospective population-based TBI incidence study conducted in the Hamilton and Waikato regions of New Zealand (173,205 residents). All new cases of TBI (in people of all ages) including hospitalised/non-hospitalised and fatal/non-fatal injuries that occurred over a 12-month period (2010–2011) were identified using multiple overlapping sources of case ascertainment. Participants completed assessments of physical psychological and social functioning at baseline, 1, 6, 12 and 48 months post-injury.

Results: A total of 1369 cases were identified (incidence rate of 790 per 100,000). 28% of cases did not seek medical attention following injury. Adults and children continued to experience persistent difficulties as a result of their injury up to four years later, even following a mild TBI. There was a high risk of recurrent injury in this sample with one in ten experiencing at least one further TBI in the subsequent year. This study has already resulted in 17 publications and the key incidence and outcomes findings will form the basis of this presentation.

Conclusions: Community based sources of case ascertainment are essential to inform accurate incidence rates. A high proportion of people even following a mild TBI experience persistent difficulties up to four years post-injury, contrary to previous research evidence.

SS2-03

E kīte a i ngā taonga o te moana me mākū koe (If You Seek the Treasures of the Ocean You Need to Get Wet) Māori Strategic Activities at the Centre of Research Excellence for the Ageing Brain, Rangahau Roro Aotearoa

Elder, H.

Te Whare Wānanga o Awanuiārangi, New Zealand

This paper will describe the key activities aimed at delivering on the contract with the Tertiary Education Commission and Brain Research NZ, the Centre of Research Excellence for the Ageing Brain.
The contract states that Brain Research New Zealand will produce world class collaborative research across the nation … will deliver new knowledge on brain ageing and associated neurological disorders, and, over time and in partnership with key stakeholders, including the MoH, DHBs and Māori, will translate this new knowledge into new treatments, therapies and interventions to provide innovative solutions for ageing-related brain disorders in New Zealand. The contract also specifies, ‘Improved Māori health and wellbeing during ageing by working with Māori communities to understand their needs and values and build equal relationships, incorporating mātauranga into innovative research and clinical methods, and by supporting Māori to determine their own pathways to brain health through training of Māori neuroscientists and clinicians’.

A survey of researchers was undertaken over the summer of 2015–2016 and a Māori Strategic Leader appointed in February 2016. Key survey findings provided direction including the need for more Māori researchers, visibility of these researchers, cultural competency development for all researchers and community partnership. A Māori researcher hui at the Annual conference and Māori keynote have been established as regular aspects of the annual calendar. Awareness of the existing research project funding model challenges to nurturing and maintaining relationships with Māori communities aligned with the need to develop relationships specific to the two main clusters of researchers in the first instance. The first wānanga with Māori communities in Tāmaki Makaurau (Auckland) and Ōtepoti (Dunedin) have occurred. Specific Māori project monies have been allocated and a contestable funding round completed with three projects to be funded commencing in March 2017. Three Māori researchers have been promoted to PI and AI roles. Development of mātauranga resources with the support of Te Reo Māori experts and Māori tikanga scholars is underway.

Within the first year of Māori strategic activities a significant number of critical positive changes have taken place. These establish the new platform from which ongoing momentum can develop. At the same time significant challenges have emerged in regard to the Māori workforce and career development as well as Māori cultural competency that require significant sustained efforts to meet the obligations of the contract and our duty to Māori communities throughout Aotearoa.
O1–01 Living Well with Mild Cognitive Impairment: Designing an Interactive Online Resource


Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; Centre for Person Centred Research, University of Otago, Dunedin, New Zealand; University of Auckland, Auckland, New Zealand; Centre for eHealth, Auckland District Health Board, New Zealand; Auckland University of Technology, Auckland, New Zealand

Mild cognitive impairment (MCI) refers to memory and thinking problems greater than those of normal ageing and is associated with a higher risk of dementia. While much is known about the cognitive deficits and symptoms that define the MCI category, relatively little is known about how people live with and respond to changes in their memory and thinking, or which strategies and supports people find most helpful from day to day.

Drawing on qualitative descriptive and interpretive approaches, this research aims to identify key issues of concern for people with MCI and their whānau, and investigate the strategies, supports, and resources people use to ‘live well’ within the context of possible cognitive decline. Preliminary findings from interviews with n = 14 individuals and n = 4 whānau highlight that changes to a person’s memory and thinking are managed within the context of profound uncertainty. In particular, individuals find it difficult to conceptualise the difference between normal age-related decline and early dementia, and do not know whether the changes they are experiencing will remain stable or worsen over time.

We are working in collaboration with the Design for Health and Wellbeing Lab to explore these findings through an iterative co-design process with individuals and significant others. This will inform the development of an interactive online resource.

O1–02 Factors Contributing to the Diagnosis of Mild Cognitive Impairment (MCI)

Fernandez, S.; Starkey, N.; Barber, C.

University of Waikato, Hamilton, New Zealand

Background: Mild Cognitive Impairment (MCI) has been recognized as a risk factor in developing dementia (Peterson et al., 1997). Some research has also shown that people have reverted back to normal cognition. The diagnosis of MCI is complex and different methods have been used based on neuropsychological testing. These methods differ among clinicians. The method of diagnosis of MCI would directly impact on people deserving of appropriate support and services causing either false diagnosis or some people missing out on help completely.

Aim: The study aims to compare four different methods of diagnosing MCI – liberal, comprehensive, conventional and conservative. It also aims to examine the use of premorbid intelligence in diagnosing MCI.

Methods: Ninety-four participants, recruited from the community, who met inclusion criteria (absence of dementia, other neurological conditions, alcohol abuse, or psychiatric disorder) were assessed on a wide range of neuropsychological tests and the Test of Premorbid Functioning (TOPF).

Findings: Seventy-five participants were diagnosed using the liberal method, 21 using the comprehensive method, 47 using the conventional method and 3 using the conservative method. There were significant differences in the number of people diagnosed with MCI with conventional methods and when their performance was based on their premorbid IQ.

Conclusions: There is a need for consensus on diagnosing MCI to improve the delivery of services for people who need them. The participants were predominantly from a healthy older population sample and data is now being collected from the Waikato District Health Board, details of which will be presented.
O1-03

Stroke and Dementia Awareness in the New Zealand Community

Krishnamurthi, R.; Barker-Collo, S.; Tippett, L.; Parmar, P.; Dalrymple-Alford, J.; Barber, P.A.; Feigin, V.

1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Auckland, Auckland, New Zealand; 3New Zealand Brain Research Institute, University of Canterbury, Christchurch, New Zealand

Background: Stroke and dementia share common risk factors. Awareness of their risk factors and symptoms in the community is not known but is required for effective prevention strategies.

Method: We conducted a national survey using ‘computer-assisted telephone interviewing’ to provide estimates of the awareness of stroke and dementia risk factors and symptoms in New Zealand (NZ). 100 people in each of four ethnic groups (Māori, Pacific, Asian and European) were contacted by random sampling from the telephone directory and electoral roll. We calculated the proportion within each ethnic group that correctly identified symptoms and risk factors of stroke and dementia without being prompted.

Results: Awareness of at least one stroke symptom was evident in only 19.5% Māori, 20% Pacific, 19.3% Asian and 29.5% Europeans. Only 5% or fewer across all ethnic groups correctly identified two or more stroke symptoms. Only 7% Māori, 3.8% Pacific, 7.5% Asian and 11.5% Europeans were able to identify two or more risk factors for stroke. For dementia awareness, 21.8% Māori, 19% Pacific, 20.5% Asian and 31% Europeans correctly identified one symptom of dementia, but less than 4% overall identified two or more symptoms. One risk factor of dementia was correctly identified by 17% Māori, 15.8% Pacific, 13.5% Asian and 24.5% Europeans and 10% or less correctly identified two or more symptoms. Further findings by age and sex will be presented.

Conclusion: The level of awareness of both stroke and dementia symptoms and their risk factors is low across all ethnic groups in NZ, particularly in non-Europeans.

O2 – Population and Health Economic Research of Neurological Disorders

O2-01

Online Interventions Show Potential to Help to Improve Sleep and Fatigue after TBI

Theadom, A.; Barker-Collo, S.; Jones, K.; Dudley, M.; Feigin, V.

1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Auckland, Auckland, New Zealand

Rationale: Poor sleep and daytime fatigue affect up to 70% of people for several years following a traumatic brain injury (TBI). Yet effective non-pharmacological interventions that do not require a specialist practitioner are limited. The aim of this study was to test the feasibility of an online cognitive-behaviour (CBT) sleep intervention compared to an online educational control for people post-TBI.

Methods: Participants aged 16–60 years, who had experienced a TBI within the last three years were randomised to receive either an interactive CBT sleep focussed intervention (intervention group) or an education based intervention including sleep hygiene principles (control group). All participants completed one 20–30 minute module online, each week for 6 weeks. Participants completed an online neuropsychological test, and sleep questionnaire pre and post-intervention. Additionally participants wore an actigraph as an objective measure of sleep quality for two weeks pre and post-intervention.

Results: Of the 34 participants approached, 24 (67%) participants were randomised. Seventeen (70.8%) participants completed the intervention and follow up assessments. Sample baseline characteristics and number of withdrawals were equal between the two groups. Reasons for withdrawal included external life stressors, and treatment for breathing difficulties. Two participants with visual disturbance found it difficult to use the online format. However those experiencing balance deficits, headaches, and other symptoms were able to complete the programmes with little support.

Discussion: Online interventions show potential to increase access to sleep interventions following a TBI although visual disturbance may need to be an exclusion criteria for such treatment.
O2-02
Ethnic Disparities in Stroke Presentations in Whanganui before and during the FAST Campaign
Badenoch, D.
Whanganui District Health Board, New Zealand

Background: Māori are 25% of the population of Whanganui, but only 13% of stroke presentations. Studies in Auckland (e.g. Feigin et al, 2015) suggest a higher incidence of stroke in Māori than non-Māori. Are Whanganui Māori reluctant to present to hospital stroke services?

Methods: We reviewed stroke presentations in Whanganui from 2014–2016, stratified by age, and compared these with data from the 2013 National Census. We then compared presentations in June and July 2016, the first two months of the national FAST awareness campaign, with the same period in the previous two years.

Results: In each age group, Māori were more likely than non-Māori to present with stroke, relative to their respective numbers in the general population. The FAST campaign doubled stroke presentations relative to previous years but the ratio of non-Māori to Māori was unchanged.

Conclusions: The ratio of non-Māori to Māori in hospital presentations with stroke in Whanganui is consistent with the previously reported higher individual risk of stroke in Māori and the small numbers of Whanganui Māori aged over 65. This ratio has been maintained during the FAST campaign, suggesting that failure to present to hospital stroke services is equally common in Māori and non-Māori.

O2-03
Developing a Comprehensive Framework of Community Integration in People with Acquired Brain Injury: A Conceptual Analysis
Shaikh, N.1; Theadom, A.1,2; Siegert, R.1
1Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Auckland, New Zealand

Purpose: Despite increasing emphasis on the importance of community integration as an outcome measure for acquired brain injury (ABI), there is still no consensus on the definition of community integration. The aim of this study was to complete concept analysis of community integration in people with acquired brain injury.

Materials and Methods: The method of Concept Clarification was used to guide concept analysis of community integration based on a literature review. Articles were included if they explored community integration in people with acquired brain injury. Data extraction was performed by the initial coding of (i) the definition of community integration used in the articles, (ii) attributes of community integration recognized in the articles’ findings, (iii) the process of community integration, and (iv) outcomes related to community integration.

Results: Twenty articles were identified that met the inclusion criteria. The construct of community integration was found to encompass six components: being physically independent, being involved in the community, having a place to live, being socially and psychologically integrated into the community, and involved in meaningful occupational activity.

Conclusion: The findings of this concept analysis enabled the development of a proposed conceptual model of community integration that provides a basis for the development of a new outcome measure to assess community integration in people with ABI.

O2-04
10-Year Trends in Incidence of Stroke Subtypes – Findings from the Auckland Regional Community Stroke Study 2002–2011
Krishnamurthi, R.1; Barker-Collo, S.2; McPherson, K.3; Parag, V.2; Parmar, P.1; Anderson, C.4; Bonita, R.2; Barber, A.2; Feigin, V.1
1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Auckland, New Zealand; 3Health Research Council of New Zealand, New Zealand; 4The George Institute for Global Health, Sydney, Australia

Risk factors, and outcomes of stroke differ according to its major pathological types and subtypes within ischemic stroke. We report 10 year trends in the incidence of major stroke types and ischaemic stroke subtypes from the population-based registers of all new stroke cases in the greater Auckland region; Auckland Regional Community Stroke Studies; ARCOS III (2002–2003) and ARCOS IV (2011–2012). Strokes were classified into pathological types (ischaemic stroke [IS], primary intracerebral haemorrhage [ICH], subarachnoid haemorrhage [SAH], and stroke of undetermined type [UND]). IS strokes were classified into subtypes according to the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) criteria: large-artery atherosclerosis [LAA]; cardioembolism [CE]; small-vessel occlusion [SVO]; stroke of other determined aetiology [OA]; and stroke of undetermined aetiology [UND]. Rate ratios [RR] were calculated to evaluate differences in age-adjusted incidence rates between the two study periods. There was a significant decrease in the age-standardised incidence rate of first ever stroke in 2011 compared to 2002 (RR 0.86, 95% CI 0.80, 0.93). There was a significant overall decrease in SAH (RR 0.73, 95% CI 0.54,0.99) and UND (RR 0.14, 95% CI 0.09,0.22) incidence rates in 2011 compared to 2002, but no change in incidence rates of IS and ICH. Among IS subtypes, significant increases were seen in incidence rates of LAA and SVO. The overall decline in first-ever stroke incidence rates mirrors improved stroke care in that time period. Continued surveillance of stroke subtypes is necessary to gauge the effectiveness of health services and inform primary prevention.
Prevalence of TBI in a NZ Prison Population

Mitchell, T.¹; Theadom, A.¹,²
¹Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; ²National Institute for Stroke and Applied Neurosciences

Guidelines recommend that acute stroke patients seek immediate assistance from the Emergency Ambulance Service (EAS). However, researchers typically report ambulance usage as the mode of transport and not as the first medical contact (FMC). There is no New Zealand data identifying the actual referral pathway to hospital. This study establishes the FMC in acute stroke and transient ischaemic attacks (TIA) using population level data from Auckland.

Methods: All new prisoners arriving at an Auckland corrections facility over a 6 month period (18 May, 18 November 2015) were asked whether they had ever experienced a hit to their head in their lifetime, and if so, on how many occasions. Details of the each incident were recorded. Demographic information such as age, ethnicity, most serious offence category, security classification and sentence length was extracted from the prison database. Results: TBI histories were available for 1054 prisoners (99.3% consent rate). Of those screened, 63.7% had sustained at least one TBI in their lifetime, with more than half (51.1) experiencing two or more. The most common causes of injuries were assaults (41.8%) and accidentally being hit by an object such as a sports related injury (21.25%). Males imprisoned for burglary (70.0%), violence (64%) and sex offenders (69.0%) had the highest prevalence of TBI.

Conclusion: High TBI prevalence in the NZ prison population is comparable to international levels. Interventions designed to both prevent further injury and help prisoners to understand and manage any persistent symptoms from TBI may help to reduce recidivism rates.
Huntington’s Disease – New Perspectives Correlating the Variable Symptomatology with Striatal and Cortical Pathology in the Human Brain

Faull, R.1,2; Tippett, L.1,3; Thu, D.1,2; Nana, A.1,2; Kim, E.1,2; Mehrabi, N.1,2; Hogg, V.1,3; Waldvogel, H.1,2

1Centre for Brain Research, 2Departments of Anatomy and Medical Imaging, 3Department of Psychology, University of Auckland, Auckland, New Zealand

Huntington’s disease (HD) is an autosomal dominant neurodegenerative disorder distinguished by a variable clinical symptomatology (choreiform involuntary movements, mood and psychological change) and a variable neuronal loss in the striatum and cerebral cortex. We have used tissue from over 40 HD brains in our Human Brain Bank and clinical data together with neuropathological, neurochemical and stereological cell counting techniques to compare and contrast the clinical symptomatology with the pattern of neuropathology and cell loss in the striatum and cerebral cortex. The results of these multidisciplinary studies show that in HD the pattern of symptomatology correlates with: (i) the variable pattern of neurochemical changes and neuronal loss in the compartments of the striatum; and (ii) the variable pattern of projection and interneuron cell loss in the different functional regions of the cerebral cortex. These studies show that there is a correlation between the symptomatology in HD and the heterogeneous pattern of cell death in the striatum and cerebral cortex which provides new perspectives showing that the clinical heterogeneity in HD is reflected by the pattern of neurodegeneration in the human forebrain.

An essential biological sensor for acetylcholine (ACh) detection is constructed by immobilizing enzymes, acetylcholinesterase (AChE) and choline oxidase (ChO), on the surface of iron oxide nanoparticles (Fe2O3NPs), poly(3,4-ethylenedioxythiophene) (PEDOT)-reduced graphene oxide (rGO) nanocomposite modified fluorine doped tin oxide (FTO).

The qualitative and quantitative measurements of nanocomposites properties were accomplished by scanning electron microscope (SEM), electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). This prepared biological sensor delineated a wide linear range of 4.0 nM to 800 μM with a response time less than 4 s and detection limit (based on S/N ratio) of 4.0 nM. The sensor showed perfect sensitivity, excessive selectivity and stability for longer period of time during storage. Besides its very high-sensitivity, the biosensor has displayed a low detection limit which is reported for the first time in comparison to previously reported ACh sensors. By fabricating Fe2O3NPs/rGO/PEDOT modified FTO electrode for determining ACh level in serum samples, the applicability of biosensor has increased immensely as the detection of the level neurotransmitter is first priority for patients suffering from memory loss or Alzheimer’s disease (AD).

Spinal Cord Stimulation of the Dorsal Root Ganglion for Chronic Pain: A Retrospective Study

Hadidi, S.

University Hospital Southampton NHS Foundation Trust, United Kingdom

Introduction and Aims: The primary aim of this study is to evaluate the efficacy of Dorsal Root Ganglion (DRG) SCS in reducing pain in patients afflicted with chronic pain. Our secondary aim is to assess how much of an impact DRG SCS has on the patients’ quality of life.

Methods: Pre-op and post-op pain scores were measured using a Visual Analogue Scale (VAS) and the EQ5D-3L questionnaires were used to obtain information of patients’ quality of life (QoL) before and after DRG-SCS implantation.

Results: The mean reduction in VAS pain scores was 45.1%, a decrease of 37.65 mm on the VAS scale (95% Confidence Interval [CI] = 19.5–55.8, p < 0.01). Using the TTO (Time Trade-Off) index scores 45% of the patients had an increase in overall quality of life scores, and four had a decrease in overall quality of life post-operatively. Individual TTO scores are shown below. The greatest increase in score was +1.175, whereas the greatest decrease in score was –0.395. The mean TTO score for QoL pre- and post-DRG SCS implantation were –0.087 and 0.460 respectively. There was a significant increase in scores, with a mean increase of 0.55 (CI: 0.27–0.82, p < 0.01).

Conclusion: There is a statistically significant reduction in pain and a statistically significant increase in QoL in patient undergoing DRG SCS. This study, therefore, shows that DRG SCS is effective in treating chronic neuropathic pain, especially those caused by trauma. Further research is needed to study the cost-effectiveness of this modality.
The Effect of Emergency Ambulance Service versus Primary Care Doctor as First Medical Contact on Symptom Onset-to-Door Time in Acute Ischaemic Stroke

Tunnage, B., Krishnamurthi, R., Swain, A., Taylor, S., Feigin, V.

Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; National Institute for Stroke and Applied Neurosciences, Auckland University of Technology, Auckland, New Zealand

In ischaemic stroke, the benefits of reperfusion therapy are strongly time-dependent. Pre-hospital delays are a major factor limiting treatment eligibility. This population-based study of ischaemic stroke is set in Auckland, New Zealand. Emergency ambulance service (EAS) records for patients transported to hospital by ambulance are used to compare referral by EAS to referral by primary care doctor. Onset-to-door (O2D) time and total EAS contact duration are established for both referral routes. The association between referral route and administration of a thrombolytic agent is investigated. 1,046 ischaemic stroke events were identified over a one-year period. An O2D time could be determined for 61% (n = 638) of events. A Mann-Whitney Test revealed a significant (p < 0.001) difference in the O2D time when referral was by EAS (median = 134 minutes, n = 528) compared to a doctor (median = 1,145 minutes, n = 110). The duration of the overall EAS contact time was equivalent for both referral routes (EAS median = 48 minutes; doctor median = 49.5 minutes), (p = 0.09 using the Mann-Whitney Test). However, component intervals differed significantly. There was insufficient data to examine the effect of first medical contact on rates of thrombolysis.

These provisional findings confirm that in cases of acute ischaemic stroke, arrival at hospital is more expeditious when the EAS is the first medical contact and not a primary care doctor. Further research is needed to establish whether EAS referral translates to improved rates of thrombolysis.

Molecular Diagnosis of Genetic Muscle Disorders in New Zealand


Auckland City Hospital, Auckland, New Zealand; Capital and Coast District Health Board, Wellington, New Zealand; Auckland District Health Board, Auckland, New Zealand; University of Auckland, Auckland, New Zealand; National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

Rationale: Molecular diagnosis is important to confirm clinical diagnosis and provide crucial information about the inheritance pattern of genetic muscle disorders, yet it is not always easily available for some disorders.

Methods: This study drew upon data collected as part of a population-based incidence and outcomes study, MD-Prev. This study aimed to identify all living cases with a clinical and or genetic diagnosis on the point prevalence date of the 1st April 2015 using multiple and overlapping sources of case ascertainment in New Zealand. The Kaplan Gene Table Classification, June 2016, www.musclegenetable.fr/ was used to populate a database of disorders. Laboratory reports of molecular genetic tests, both positive and uninformative, for all eligible cases were obtained.

Results: Overall, 55% of individuals with a genetic muscle disorder have a molecular diagnosis in New Zealand. The proportion of individuals with a molecular diagnosis varied according to several factors, the main one being subtype of muscle disorder. Geographical distribution of people with a molecular diagnosis shows that some regions are disadvantaged.

Discussion: The type of genetic muscle disorder has a significant impact on the likelihood of having a confirmed molecular diagnosis. The majority with single gene disorders such as Duchenne, Becker and myotonic dystrophy have a molecular diagnosis while the majority of people with limb girdle muscular dystrophy do not. This is likely to reflect the lack of commercially available testing for heterogeneous disorders and a perceived lack of benefit for testing for disorders where no effective treatment is available.
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Worldwide Prevalence of Poliomyelitis: A Systematic Review

Balalla, S.; Jones, K.; Theadom, A.; Jackman, G.; Feigin, V.

1Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2National Institute for Stroke and Applied Neurosciences, 3Polio New Zealand Inc., New Plymouth, New Zealand

Poliomyelitis is a highly infectious and incurable disease and it estimated that 12–20 million individuals are currently affected by polio. However there are no current reliable studies internationally that have examined the prevalence of polio in the general population. The aim of this systematic review is to synthesise the literature on the prevalence of polio worldwide. A literature search was undertaken in relevant electronic databases from inception to May 2016. Inclusion criteria were: Peer reviewed studies reporting on the prevalence of polio, including population-based approach with a defined denominator and some form of diagnostic or clinical verification of polio. Studies in which prevalence data were unable to be extracted or calculated or reported incidence rates were excluded. Average crude prevalence rates were used to calculate worldwide estimates. Thirty-one studies met the criteria with 90% of studies conducted in low-to-lower middle income countries. Lameness surveys of children predominated, with wide variation in case definition and assessment criteria. There was significant variability in the prevalence of polio between low-to-lower middle income (15 per 100,000 in Nigeria to 1,733 in India) and high-income countries (24 per 100,000 in Japan to 380 in Brazil). The total combined prevalence of polio ranged from 165 in high-income countries to 425 per 100,000 person-years in low-to-lower middle income countries. Future epidemiological studies of polio need to examine nationally representative samples (including all ages), using population-based approaches and focus on high-income countries to provide more reliable and robust estimates of polio prevalence.

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Epidemiology of Atrial Fibrillation in Ischaemic Stroke Patients: A Population-Based Study in Auckland, New Zealand

Zagreanu, C.

Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

Background: Atrial fibrillation (AF) is a major independent risk factor for stroke. Patients with AF have worse outcomes than those without. Large population-based studies are important to accurately estimate the prevalence and characteristics of stroke associated with AF. We investigated AF-associated stroke within the Auckland Regional Community Stroke (ARCOS) IV study.

Methods: Ascertainment was conducted over 12 months to identify all cases of stroke. Ischaemic stroke patients' electrocardiograms (ECG) were reviewed to identify the characteristic changes seen in AF. Medical records were searched to determine if the AF diagnosis was known prior to stroke. The demographic data was collected from hospital electronic records.

Results: Over the 12-month ascertainment period, 1718 patients with new stroke events were included. Of these, 1345 had first-ever and 373 had prior stroke. Of 1680 ECGs reviewed, 554 (32.2%) showed AF. AF was incidentally found in 92/1680 patients (5.4%) and previously diagnosed in 462/1680 (26.8%) patients. Using the classification of subtype by the TOAST system, 507 (29.5%) were classified as cardio-embolic and 530 (30.8%) as undetermined etiology (where 2 or more etiologies are demonstrated). CHA2DS2-VASc score was high (≥2) in 96.1% previously diagnosed AF patients. Only 21.8% of those at high risk were on Warfarin.

Discussion: The prevalence of AF-associated stroke in our study is higher than that reported in previous studies. There is a low implementation rate of warfarin therapy for high risk patients in clinical practice.
Stroke is the second biggest killer in the world today. However, research suggests that 8 out of 10 strokes could have been prevented. A lack of awareness about stroke and associated risk factors, and the lack of an easy method of calculating their individual risk means that the general population is not motivated to maintain a lifestyle that minimises their stroke risk. The Stroke Riskometer was developed as an easy to use app aimed at addressing these issues. Users can calculate their risk of stroke by answering a series of validated questions. The app provides the user with their risk of stroke, the factors affecting their risk and how to manage them, and their relative risk compared to someone their age and sex with no risk factors. In addition, the app has a research component that allows data collection for the RIBURST study, which aims to determine the prevalence of stroke risk factors on a global level. The app has been downloaded over 70,000 times globally, and the RIBURST study has over 7,000 participants. Preliminary demographic information and descriptive analyses of risk factor prevalence collected since the start of the study will be presented. The use of the Stroke Riskometer app, combined with its research capability has the potential to reduce the burden of stroke worldwide. The app could also provide a platform for similar products aimed at other non-communicable diseases.

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**P2 – Basic Neuroscience Research**

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**Plant Natural Product Puerarin Ameliorates Depressive Behaviors and Chronic Pain in Mice with Spared Nerve Injury (SNI)**

**Zhao, J.**

The University of Hong Kong, Hong Kong

Pain and depression are common health problems and closely related. Current therapies have not been validated for simultaneous relief of the pain from body and brain. We recently discovered that plant natural product puerarin not only coordinated nerve growth factor to promote neurite outgrowth but also induced arginase-2 to protect neurons against oxidative injury. These results stimulated us to further investigate the effects of puerarin on depressive behaviors and pain in mice with spared nerve injury (SNI). C57BL6/N mice were divided into 8 different groups (n = 6). On day 8 after surgery, SNI mice were treated with puerarin, Citalopram and Ibuprofen, alone or in combination, for 8 to 14 days. Animals in Sham group and one SNI group were treated with vehicle. Depressive behaviors were assessed by forced swim test and tail suspension test. Pain responses were assessed by the von Frey filaments. It was found that puerarin ameliorated depression and pain in SNI mice as effectively as the existing antidepressant drug Citalopram. Anti-inflammatory drug Ibuprofen attenuated the pain response to a lesser extent and did not show any activity against SNI-induced depression. The mechanisms were different. Collectively, our results suggest that puerarin may ameliorate the SNI-induced depression and pain via activating ERK, CREB and BDNF pathways. These results may be transferrable for the development of novel therapeutics for depression and pain comorbidity.

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**Reducing the Risk of Stroke Using Mobile Technology: An Update on the RIBURST Study**

**Bhattacharjee, R.1; Krishnamurthi, R.1; Hussein, T.2; Feigin, V.1**

1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2Auckland University of Technology, Auckland, New Zealand

Stroke is the second biggest killer in the world today. However, research suggests that 8 out of 10 strokes could have been prevented. A lack of awareness about stroke and associated risk factors, and the lack of an easy method of calculating their individual risk means that the general population is not motivated to maintain a lifestyle that minimises their stroke risk. The Stroke Riskometer was developed as an easy to use app aimed at addressing these issues. Users can calculate their risk of stroke by answering a series of validated questions. The app provides the user with their risk of stroke, the factors affecting their risk and how to manage them, and their relative risk compared to someone their age and sex with no risk factors. In addition, the app has a research component that allows data collection for the RIBURST study, which aims to determine the prevalence of stroke risk factors on a global level. The app has been downloaded over 70,000 times globally, and the RIBURST study has over 7,000 participants. Preliminary demographic information and descriptive analyses of risk factor prevalence collected since the start of the study will be presented. The use of the Stroke Riskometer app, combined with its research capability has the potential to reduce the burden of stroke worldwide. The app could also provide a platform for similar products aimed at other non-communicable diseases.

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**450**

**Changes in Pentylenetetrazole-Induced Convulsion Threshold Following Chronic Caffeine and Taurine Administration to Rats**

**Sarkhough, M.; Mubarak, M.; Algherbal, M.; Almahrezi, A.; Abdulnabi, H.; Naisar, M.; Kamal, A.**

Arabian Gulf University, Manama, Bahrain

Moderate consumption of caffeine, a xanthine alkaloid, is sufficient to induce behavioral stimulation, which is mainly due to antagonism of all adenosine receptors that function as neurotransmitter and neuronal excitability modulators. In contrast, taurine, a neurotransmitter, has a more regulatory effect on the CNS by reducing spontaneous neuronal firing, hyperpolarizing the resting membrane potential and increasing the membrane’s conductance for Cl-. The effect of caffeine and taurine on PTZ-induced convulsion parameters was measured following a one-month treatment of caffeine (0.2 g/L, Caf) and taurine (1000 mg/kg, Taurine) dissolved in the rats’ (n = 136) drinking water, as the only source of water available. Furthermore, the probability, latency and type of convulsions were recorded following the administration of the intraperitoneal PTZ doses. The caffeine treated group showed a significant change in convulsion latency in contrast to the taurine treated group, mainly with the two highest doses of PTZ: 50 mg/kg (control 376.7 63.7 s, Caf 132.4 21.1 s, P < 0.05. Taurine 368.4 88.4 s, P > 0.05) and 80 mg/kg (control 281.9 63.2 s, Caf 127.9 44 s, P < 0.05. Taurine 368.4 88.4 s, P > 0.05) and 80 mg/kg (control 281.9 44 s, P < 0.05). Furthermore, caffeine treated group also showed a higher probability of convulsion when given the aforementioned doses of PTZ: 50 mg/kg (control 50%, Caf 100%, Taurine 56%) and 80 mg/kg (control 67%, Caf 100%, Taurine 67%). Chronic administration of caffeine has a significant effect on the PTZ-induced convulsion threshold. It also shows a higher susceptibility to PTZ than both the control and chronic taurine groups. On the other hand, the chronic administration of taurine seems to have no significant effect on the PTZ-induced convulsion threshold.
Oculomotor Dysfunction in Children with Attention Deficit Hyperactivity Disorder (ADHD)

Cade, A.1; Jones, K.2; Holt, K.; Haavik, H.1
1New Zealand College of Chiropractic, Auckland, New Zealand; 2National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand

Objectives: This paper aims to provide: 1) a systematic review of literature on oculomotor control (OC) in children (8–15 years) with ADHD, specifically describing effects on reading ability (RA); and 2) an overview of potential links between chiropractic and OC.

Data Sources: Electronic databases (i.e., Scopus, PubMed, ChiroAccess) were searched from June–October, 2015, using terms including ‘oculomotor’, ‘ADHD’, ‘reading-difficulties’. Inclusion criteria were: English language; experimental design; peer-reviewed; computer-based oculomotor; attentional or visual-attention training.

Results: Of 20+ studies identified, consensus processes determined four met inclusion criteria. However, bias review revealed 100% had significant methodological flaws. Studies were limited by small experimental groups, poor randomisation, selection bias and restricted interventions. Nonetheless, neurological linkages between ADHD, OC and reading ability suggest sensorimotor processing/control and OC. Further, more robust experimental studies are required to investigate any effects of chiropractic on OC and RA in children with ADHD.

Hyperpolarization of CA2 Neurons During Hippocampal High-Frequency Oscillation States in vivo

Matsumoto, N.; Okamoto, K.; Takagi, Y.; Ikegaya, Y.
University of Tokyo, Japan

The CA2 region is unique in the hippocampus; it receives direct synaptic innervations from several hypothalamic nuclei and expresses various receptors of neuromodulators, including adenosine, vasopressin, and oxytocin. Furthermore, the CA2 region may have distinct brain functions, such as the control of instinctive and social behaviors. In pathological aspects it is resistant against epileptic damage. Because the dynamics of the subthreshold membrane potentials of CA2 neurons in vivo is ill-defined, we conducted whole-cell current-clamp recordings from CA2 pyramidal cells in urethane-anesthetized mice and monitored the intrinsic fluctuations in their membrane potentials. The CA2 pyramidal cells emitted spontaneous action potentials at mean firing rates of approximately 0.8 Hz. In approximately half of the neurons, the subthreshold membrane potential oscillated at approximately 3 Hz. In 2 neurons, we obtained simultaneous recordings of CA1 local field potentials and demonstrated that the 3-Hz oscillations of CA2 neurons were not correlated with CA1 field potentials. Moreover, the CA2 pyramidal neurons were hyperpolarized during high-frequency oscillations, which are initiated in the CA3 region and may contribute to epileptiform discharges under pathological conditions. In tetrodotoxin-perfused acute hippocampal slices, the membrane potentials of CA2 pyramidal cells were not preferentially entrained to 3-Hz sinusoidal current inputs. These data suggest that the CA2 region is unique in terms of the membrane potential dynamics and the resistance of the CA2 to epileptic damage may result from the hyperpolarization during high-frequency oscillations.

Predictors of Long-Term Health-Related Quality of Life in Stroke Survivors

Jones, A.1; Krishnamurthi, R.1; Theadom, A.1; Barker-Collo, S.2; McPherson, K.1; Feigin, V.1
1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Auckland, Auckland, New Zealand

Background: Stroke is a major health concern in New Zealand, associated with huge financial cost and burden. Predictors of health-related quality of life (HRQoL) can help provide important information about relevant rehabilitation targets.

Aim: This study will present data on HRQoL derived from the Auckland Regional Community Stroke Study (ARCOS IV), a population-based stroke incidence and outcomes study.

Method: Prospective and retrospective surveillance methods were used to identify both hospitalised and non-hospitalised, and fatal and non-fatal strokes occurring in the total population of the greater Auckland region over one-year (2011–2012). Consenting participants were followed-up for one-year post-stroke to assess a range of outcomes at baseline, 28-days, 6 and 12 months. HRQoL was measured using the EuroQOL five dimensions questionnaire (EQ-5D) and visual analogue scale (EQVAS), and Medical Outcomes Study 36-Item Short-Form (SF-36) Health Survey.

Results: For the 435 consenting stroke survivors, a multi-variate linear regression model was fit for main outcomes adjusting for co-variants (age, sex, ethnicity, stroke subtype and baseline HADS (anxiety & depression), mRS (disability), and NIHSS (stroke severity)) and time/assessment type.

Discussion: Predictors of poorer HRQoL outcomes at 12 m post-stroke included: stroke severity, greater disability, being female, and worse anxiety and depression scores at baseline. To help improve HRQoL outcomes for stroke survivors, emphasis should be placed on early interventions aiming to improve patients’ emotional wellbeing.
P3 – Clinical Neuroscience and Neurorehabilitation Research

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The Role of GH/IGF-I Axis and Neurorehabilitation in the Functional Improvement after Acquired Brain Injuries: FOLTRA’s Method
Devesa, P.; Devesa, J.
Fundación FOLTRA, Teo, Spain

Currently it is well known that adult neurogenesis continuously occurs along life in any animal species, including humankind. Adult neurogenesis mainly takes place in two brain regions: Subgranular Zone of Dentate Gyrus (SGZ) and Subventricular Zone of the lateral ventricle (SVZ); other cerebral areas may produce differentiated neurons though. A number of different Growth Factors interact in these neurogenic niches regulating the proliferation-differentiation-migration and survival of neural precursors to repair brain injuries or for the acquisition of recent memory. Among these factors, the GH/IGF-I axis seems to play a key role, both acting directly or by inducing the expression of other neurotrophic factors. When damage occurs in the brain, the subsequent loss of neurons and astrocytes amounts to a number of functional impairments, but also to an attempt of self-repair, that is usually not sufficient due to the severity of the injury. Previous studies from our group and others indicate that the exogenous administration of GH or IGF-I strongly helps neurorehabilitation therapies by increasing adult neurogenesis and brain plasticity. In this presentation we will show the results obtained with this therapeutic strategy in patients suffering from Cerebral Palsy (CP), Traumatic Brain Injury (TBI) and Stroke. Our data indicate that GH administration is safe and effective, regardless of whether the patient is GH-deficient or GH secretion is normal. Moreover, our results also indicate that the time elapsed since the injury occurred is not a negative conditioning factor, except when joint deformations exist.

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Measuring Pulse Wave Velocity: Developing a New Approach
Dahiya, E.; Krishnamurthi, R.; Lowe, A.; Feigin, V.
1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2Institute for Stroke and Applied Neurosciences, 3Midland Trauma System, Hamilton, New Zealand; 4Department of Biostatistics and Epidemiology, University of Technology, Auckland, New Zealand

Pulse wave velocity (PWV) is a gold-standard measure of arterial stiffness (AS) and has been acknowledged as an independent diagnostic marker of stroke and cardiovascular risk. PWV is defined as the rate at which a pulse travels between two sites along an arterial segment. The purpose of this study is to review existing methodologies and validate a new non-invasive monitor against Doppler Ultrasound. The normal and reference PWV ranges will be estimated for the New Zealand (NZ) population, overall and by major ethnic groups. Carotid and femoral arteries, being superficially located are commonly used sites to track regional pulse waves. Local assessment of stiffness in a short arterial segment is done by MRI or ultrasound. Invasive methods using catheterisation, though more accurate, are not routinely practiced. Commercially available non-invasive monitors are less expensive and easier to use. The majority of these monitors detect arterial pulse wave using applanation tonometry (e.g. Complior, SphygmoCor, Pulse Pen, Doppler Ultrasound) and record pulses either simultaneously or sequentially by gating using the R-wave of the ECG. Despite practical advantages of these non-invasive monitors, assessment of PWV still needs a controlled environment and trained personnel, and current devices don’t allow continuous monitoring. The development of a new non-invasive monitor with wearable patch sensors would enable PWV and 24-hour ambulatory arterial stiffness index (AASI) measurement. Establishing a link between AS and cardio-cerebral-vascular risk factors using normative values for the NZ population will assist in developing more accurate risk assessment and management strategies.

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Risk of Medical Comorbidities after Traumatic Brain Injury – Methods for a Case-Control Study
Balalla, S.; Theadom, A.; Jones, K.; Christey, G.; Holmes, S.; Feigin, V.; Rohan, M.
1Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2National Institute for Stroke and Applied Neurosciences, 3Midland Trauma System, Hamilton, New Zealand; 4Department of Biostatistics and Epidemiology

Traumatic Brain Injury (TBI) has been found to affect up to 790 people per 100,000 in New Zealand every year. Previous research has highlighted a wide array of poor physical, emotional, cognitive and behavioural outcomes associated with TBI. It remains poorly understood as to whether people who have experienced a TBI have an increased risk of developing subsequent comorbidities. A greater understanding of the risk of developing comorbidities post TBI will therefore assist in intervention planning post-TBI. This age- and sex-matched case-control study aims to investigate the onset of post-injury medical comorbidities in the 1–4 years following injury. Eligible participants will be recruited retrospectively from the Waikato Trauma Registry. All TBI admissions (including mild, moderate and severe TBI) and orthopaedic admissions at Waikato Hospital that occurred between Jan 1st 2012 and Dec 31st 2014 will be contacted. An estimated 400 TBI and 400 orthopaedic participants are expected to be recruited. Information on the injury sustained will be collected from the registry. A brief telephone assessment on self-reported pre- and post-injury medical comorbidities will be conducted using the Cumulative Illness Rating Scale. This study will address
the limitations in current TBI research, highlighting the imperative to study the long-term medical risks in the wider TBI population, inclusive of mild, moderate and severe TBI groups.

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Effects of Acute Caffeine and Taurine Administration on Pentylenetetrazole-Induced Convulsion Parameters in Rats

Mubarak, M.; Algherbal, M.; Sarkhoud, M.; Almahrezi, A.; Abdulnabi, H.; Naisar, M.; Kamal, A.
Arabian Gulf University, Manama, Bahrain

Primarily, caffeine's behavioral stimulation is related to its antagonizing effect on the adenosine receptors that modulate neurotransmitter release and neuronal excitability. Taurine, on the other hand, acts as a neuroprotector against glutamate-induced neurotoxicity and increases the membrane conductance of Cl−, thus reducing the spontaneous firing of neurons.

In this study we measured the pentylenetetrazole-induced convulsion threshold in 140 rats after acute administration of caffeine (0.2 g/L of water for two days, Acute Caf) and taurine (1000 mg/kg/day for two days, Acute T). The probability, type, latency and duration of the convulsions were recorded after the administration of five different doses of pentylenetetrazole intraperitoneally.

The results showed significantly lower latencies for convulsions in the acute caffeine groups, especially with the 50 mg/kg dose of PTZ (control latency 376.7 ± 63.7 s, Acute Caf 296.9 ± 88.9 s, Acute T 269 ± 86.2 s P < 0.05, ANOVA) and 80 mg/kg of body weight dose of PTZ (control latency 281.9 ± 63.2 s, Acute Caf 152.4 ± 51.7 s P < 0.05, ANOVA, Acute T 281.4 ± 97.1 s P > 0.05, ANOVA).

By comparing the durations of the convulsions, the results showed the same pattern response, whereas the convulsion duration was significantly higher in caffeine treated animals. No significant responses were recorded in the acute taurine group when compared to the control or acute caffeine group. Acute administration of caffeine has shown to increase the PTZ-induced convolution threshold, which suggests an increased level of neuronal excitability. In contrast, acute administration of taurine has a non-significant to minimal effect on the PTZ-induced convolution threshold.

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Children’s Participation at 4 Years Following Mild Traumatic Brain Injury (TBI)

Jones, K.; Starkey, N.; Theadom, A.; Feign, V.

1National Institute for Stroke and Applied Neurosciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand; 2University of Waikato, Hamilton, New Zealand

Background: Participation in activities during childhood helps to foster overall well-being across the lifespan. Paediatric research following mild TBI has primarily focused on cognitive and behavioural outcomes, with less emphasis on children’s capacity to take part in age-appropriate activities.

Method: As part of a longitudinal observational study, this analysis examines 93 children (aged <16 years at injury) who were identified during a TBI incidence and outcomes study in Waikato, New Zealand and who agreed to on-going follow-up. At 4-years following mild TBI parents completed the 20-item Child and Adolescent Scale of Participation to describe their child’s participation in home, school, and community settings compared to same-aged peers. All responses were recorded on a 4-point Likert scale (1 = Unable to 4 = Full participation). Factors associated with participation were also examined.

Results: Participation restrictions were more prevalent in the community (M = 95.43, SD = 10.79) than at home (M = 96.24, SD = 8.16) or school (M = 98.18, SD = 5.19). Children were less likely to participate in family chores and decisions (21.5%), structured events and activities in the community (18.3%), and self-care activities (16.1%). Children were least restricted moving in...
around at home (3.2%) and school (2.2%). Following control for socio-economic status, multivariate linear regression analyses revealed significant main effects for child overall neurocognitive function and parental depression on school and community participation, with significant interaction effects between the two.

**Conclusion:** This research describes patterns of children's participation following mild TBI, with greater restrictions evident in community-based activities, and provides useful information to consider when supporting children following mild TBI.

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**Exploring the World: Gaze Analysis during Visual Search Tasks in Parkinson’s Disease**

Alamri, Y.¹; MacAskill, M.¹; Dalrymple-Alford, J.²; Anderson, T.¹

¹New Zealand Brain Research Institute and University of Otago, Christchurch, New Zealand; ²New Zealand Brain Research Institute and University of Canterbury, Christchurch, New Zealand

**Introduction:** Parkinson’s disease (PD) patients exhibit motor (including ocular movement) and non-motor (including cognitive decline) symptoms. Prominent among deficient cognitive domains in PD patients is visuospatial dysfunction. Not only does this impair patients’ performance of activities of daily living, but it can also complicate motor symptoms leading to gait freezing and falls. We examined the differences in oculomotor behaviour in PD patients and healthy controls in an attempt to better understand each group’s patterns of performance and impairment.

**Methods:** A total of 48 participants divided equally between PD-normal cognition (PD-N), PD-mild cognitive impairment (PD-MCI) and matched controls (NC) were recruited. Eye movements were studied while participants were shown visual search tasks on a screen (Where’s Wally?™ puzzles and locating petrol stations on a map).

**Results:** Quantitative analyses revealed that PD-MCI participants scored lower than NC participants on the Where’s Wally?™ tasks (mean percent correct answers 13.6% vs. 30.9%, p = 0.01). Additionally, analysis of microsaccade direction revealed significantly larger deviations from the horizontal made by PD-MCI participants (39.7° ± 8.5), compared with NC (33.2° ± 3.3) and PD-N (31.4° ± 3.2) participants (p = 0.03). Eye-tracking analyses of the map search task, on the other hand, revealed no significant differences between the study groups.

**Discussion:** Artificial search tasks, such as Where’s Wally?™ puzzles, may be more cognitively demanding than map searching. This could account for the differences observed in our study. Examining a group with Parkinson’s dementia would yield a fuller picture of visual search patterns in this disorder.
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